DEPARTMENT OF TRANSPORTATION

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REMARKS PREPARED FOR DELIVERY BY WILLIAM M. MAGRUDER, DIRECTOR, OFFICE OF SUPERSONIC TRANSPORT DEVELOPMENT, U.S. DEPARTMENT OF TRANSPORTATION, TO THE IRON GATE CHAPTER, AIR FORCE ASSOCIATION, NEW YORK, NEW YORK, FEBRUARY 23, 1971

It is indeed a privilege to be the guest of this, the Iron Gate Chapter of the Air Force Association. A few weeks ago, I was talking with Ken Ellington, and he told me the story of the beginning of this chapter ... where Mac Kriendler with the original 21 ex-Air Force chaps met to form what was aptly named the Iron Gate Chapter of the Air Force Association. With Mac as founder and first president for all of 30 seconds before he resigned and Ken Ellington was elected second president to serve a one year term, the organization has grown to reflect great credit on all of you ... for your intelligent, effective support of the aerospace industry in both military and commercial progress, to your worthy annual charity affair, the Air Force Ball, to raise money for the Air Force Aid Society, the Aerospace Education Foundation and the Air Force Village Foundation. My wife, Barbara, and I will make every effort to attend and do thank you for your kind invitation.

As you know, we are right in the middle of committee action on the U.S. SST program by the 92nd Congress. You also are aware that the program has been continued on continuing resolution funds by the 91st Congress in a political quagmire that has had no precedent in our nation's history.

Today I will talk to you about the effect the SST can have on our economy and business, if we proceed on schedule as the President wishes, or if we are forced to slow down, or cancel the program.

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I noted recently a speech Mr. Henry Ford made in Chicago. "It seems clear," he said, "that neither business in general nor the auto business in particular will survive in its present form. Never before has American business been under such great pressure to change. The real question is whether the changes will be good or bad for the country."

He also made another observation that I found very apt. "American politics and journalism," he suggested, "are better at exposing problems than they are at understanding them and helping the public to understand them."

These comments by Mr. Ford touched a nerve, because ever since last April I have been at the helm of a program buffeted by controversy, assailed by allegations, and charged with nearly every environmental and economic ill conceivable to mankind. I refer to the National understanding to develop a prototype supersonic transport to be built in the United States and sold on the world market.

Despite exhaustive examinations by the lawmakers of our land -- and I would like to point out that 24 Congressional committees have studied and endorsed the SST program over the years -- and in spite of extensive coverage by the press, the letters I receive and some of the editorials I read make it quite apparent that there is a great misunderstanding at large with regard to the conduct and the objectives of the SST program. There is reason to believe that unless the SST program can be seen in its proper perspective, in light of its importance to the Nation, and unless its development is allowed to proceed, the American aerospace industry in its present form and with its proven leadership capacities, may not survive.

In the midst of the debate raging in Washington last month, when I was trying to assure those Senators who sought my advice that the SST really was a white hat program, I stopped by my doctor's office for some routine maintenance ... and ended up flat on my back. After several days of tests and a more or less full systems check, the medics were persuaded I wasn't quite ready for Medicare or the rocking chair. As my doctor told me: "Contrary to what some senators are saying, I assure you your heart is in the right place."

I was delighted to know that. I have always felt my heart really is in three places -- with my family, of course, with my country, and with the aviation industry. The SST is vital to the welfare of the industry, and productive to the economic vitality of the Nation. If I didn't believe that, I never would have accepted Secretary Volpe's invitation to leave sunny California for "Fun City on the Potomac."

A few days ago I had occasion to be on a television program with Al Capp. I asked him what single incident impressed him most out of all the experiences he has had as a lecturer on college campuses. He told me about a student who came up to him after one of his talks and said, "Mr. Capp, it took courage to tell an audience of students that you love America." He said this persuaded him that young people want to hear the truth (and I was glad to hear him say that because personally I have great faith in the sincerity of most of our young people). But Al Capp went on to say that what makes America great is not something we found here, but something we created here -- the freedom we have to forever repair and renew America, not by hate or hysteria, but -- in his words -- "by the way of patience and persuasion, the way of thinking men."

What Al Capp is suggesting is that the tenor of criticism today needs to be more constructive, less destructive. Too often we seem ready to discard principles with practices, as though our institutions -- like our commodities -- come packaged in disposable and expendable containers. I tell you it takes courage today to defend some of the principles and institutions that stand at the foundation of our society ... at the cornerstone of our economy.

I offer three examples: technology, profits, and progress.

A few words, first, about the stance of technology today.

The Senate vote against the SST last December was hailed by some as the "first time this country has deliberately turned its back on technology." If that were the case -- and I don't happen to interpret the Senate vote that way -- it would be a sad day for our Nation.

The function of technology is to sustain man. Rejecting technology out of hand and turning aside from opportunities that beckon in the direction of progress will neither feather our nest or make it more livable. Properly directed and controlled, technology can help restore balance to the planet and correct the abuses of its resources. Selectively applied, it can fuel the forces of social and environmental reform as well as economic prosperity.

I thought Mr. Charles M. Kearns, Vice President for Research at United Aircraft Corporation, made some very cogent remarks on this subject in a recent speech. "Consider," he said, "that the single most important characteristic which has brought man to his unique position among animals has been his ability to use the natural resources around him to his own advantage. The history of technology traces the gradual evolution of this capability, which has found its most fruitful flowering in the United States. The benefits of this technology are the envy, and the ultimate objective, of the rest of the world."

There is another attribute of technology: it is the source of the increasing productivity in industry which enables us to keep pace with growth. Without periodic improvements in productivity, for example, the auto industry would need 500,000 more workers to produce today's volume of motor vehicles with 1960's capital equipment and methods. Every woman in the labor force today would have to work for the telephone company if today's volume of telephone communications had to be handled with yesterday's technologies. The air transport industry is perhaps the best example of how improvements in productivity benefit the average citizen. With the larger and faster planes the industry has provided, the air carriers have been able to achieve a fivefold gain in operating revenues, to nearly $10 billion, with a labor force less than double what it was in 1960. One result is better service and lower fares for the traveling public. Even those who don't travel by air benefit indirectly through the improved postal and cargo services air transportation provides

I might say something at this point about how important efficient and economically productive airplanes are to the air transportation industry. Suppose we had never graduated from the good old DC-3, which was the number one airliner 30 to 40 years ago. To do what the airline industry is doing today -- to fly the revenue passenger miles logged in one year -- the airlines would need something like 50,000 planes of the DC-3's capabilities.

I have no idea what the airline payroll might be under such circumstances. Incidentally, the economic headwinds many of the airlines are encountering today are not due entirely to the low pressure area that has developed temporarily in the traffic growth pattern. There are at the moment, as Mr. Secor Browne has so graphically phrased it, "more seats than there are bottoms to fill them," but the airlines are compensating to some degree by making adjustments in the number and frequency of flights. More significantly, perhaps, air transportation is a labor-intensive -- and labor sensitive -- industry. The average airline salary last year increased 11 per cent. Wages account for 47 per cent of the airlines' operating expenses, and have been escalating at a rate higher than the national average. One obvious offsetting factor to bigger payrolls is layoffs. According to the Air Transport Association, some 6,000 jobs were lost in the airline industry last year, representing nearly $64 million in wages.

It is neither possible nor practical for the airlines to economize their way to prosperity. Perhaps one answer to the airlines' pressing needs is a reassessment of fare and route structures. The improvements under way in the nation's airport and airway facilities, to reduce congestion and prevent delays, will also help. But the return of the airlines to good health depends on a reassertion of the proven formula of greater productivity matched to growth. The industry thrives on aircraft of higher per unit earning power. The SST, with nearly three times the speed of today's subsonic jets plus a greater schedule flexibility, will be twice as productive as the 747, and do the work of four-and-a-half 707s. For every SST we don't build and put into commercial service, the airlines will need three trijets of the DC-10 or L-1011 class to meet the air traffic levels forecast in the mid-1980s.

Before we are too quick to give a bad name to technology, we should also consider what effect cutbacks in research and development -- in the exploration and exploitation of technology -- has on employment. It is reliably reported that 50,000 to 60,000 engineers are unemployed on the West Coast. In Seattle alone, one out of every five in the work force is said to be job-hunting. Reports of highly trained technicians and aero specialists working as taxi drivers, insurance salesmen, and even grave diggers appear on the pages of our newspapers. Seventy-two dollar a week unemployment checks are poor substitutes for $15,000 a year salaries, and represent a waste of resources and a drain on the economy.

The prospect of a National retraining program for engineers is not a pleasant one. America's reservoir of technical talent is nothing less than a National resource of great value. This is not to say that skills bred in aerospace pursuits should not be applied to other challenges, but there is a limit to diversification and the transfer of talents and technologies.

I am sure I do not need to point out to a Detroit audience that we have no monopoly on technology in America, or any copyright on its use. Industrial competition today is increasingly a contest between nations as well as between companies. Grant Hansen, the Assistant Secretary of the Air Force for Research and Development, puts it this way: "People of the United States are inherently no more capable than the peoples of Japan, Germany, the Soviet Union, Britain, or other modern nations. The past combination of our government and social systems, our industrial organizations, and our technological know-how has enabled us to create in this country what is truly a land of milk and honey. As our technological lead diminishes, and to the degree that we lose our National resolve to support high technology programs such as modern defense equipment, the exploration of space, and the development of the SST, we will find that the areas where we are able to compete successfully with other nations of the world will diminish." Inevitably, Secretary Hansen says, "this will have an attendant impact upon our employment and our standard of living." End of quote.

The growing thrust of other nations into markets where the United States used to lead is visible in a variety of areas -- autos, textiles, steel, electronics, shipping, etc. This in itself is not bad; competition is the sparkplug of private enterprise, and has always brought out the best in Yankee ingenuity. But we have to be willing to compete. Throwing in the towel before you have even taken the measure of the opposition is no way to win a fight. The SST prototype development program represents the willingness of the United States to compete against the nationalized efforts of other countries to unseat us from the position of civil aviation leadership. Behind the Concorde development program is a less-publicized but no less determined drive to provide a European product for every segment of the aviation market -- STOL, VSTOL, airbus, executive jet, trijet, and advanced fighters. It's no accident that French aerospace exports in 1970 exceeded $1 billion, more than double the 1969 figure; or that non-military aircraft orders in the year just ended nearly equalled France's total aerospace business -- military and civilian -- in 1969.

Then, secondly, a few words, if I may, on profits, which is another American institution under siege today.

I don't know where the idea originated that the industry makes huge profits at the expense of the taxpayer. I have been associated with the aviation industry most of my life, and I assure you the risks greatly exceed the returns. In fact, I don't know of another industry that literally challenges the state of the art every time a new product or a new model is developed. Considering the lead times involved, the fragility of forecasts, and the economic gamble at stake, the profits the companies realize (when there are profits) are indeed modest. Profits such as they are (and even in their absence) must feed research and development and capital equipment investments, which take precedence over stockholder dividends and corporate profit sharing. Maybe this is a reason why aerospace stocks are seldom among the "high flyers."

The kinship between technology and profits is an obvious one. Since there has always been a wage difference between the United States and other countries, we have depended on our superior technology to overcome that difference through productivity gains. Technology, then, is an essential ingredient in all of our profit ventures -- and profits are indispensable if we are to stay in business.

Myron Tribus is a former Assistant Secretary of Commerce who, a few months ago, agreed to serve as Chairman of our SST Environmental Advisory Committee. Dr. Tribus has this to say about profits: "It is the profit from our activities which supports our efforts for social advance. The funds for poverty programs, health programs, educational programs, urban-renewal programs, defense programs -- all come from the economy. And if we falter technologically, the funds for these programs will begin to evaporate."

This is the key to fuller public understanding of the SST program. Our nation's economic base must be preserved and nurtured if it is to continue to support the many social programs sure to confront us in the years ahead. Bob Hotz, the very perceptive editor of Aviation Week, has wondered out loud about the logic of those who, in his words, "would turn this Nation into a welfare state without any thought of where the money to pay the welfare bill is produced." As you and I know, it's produced in large part in Detroit, and in Flint, and in Saginaw -- in Seattle, Los Angeles and Cincinnati. It's produced out of the corporate and personal income taxes of the builders of U. S. products, and from the export revenues on the sale of those products around the world.

The understanding that we cannot relax our production vigor is at the root of President Nixon's goal of a full employment economy. His proposal for a Department of Economic Development underlines a National conviction that our country must have economic as well as social incentives -- that the provision for human resources and the management of natural resources cannot be accomplished in an economic vacuum. The SST development program is an incentive -- seed money toward a future harvest of profits of direct benefit to the Nation.

Competition between nations, as between companies, begins with research and development. It is still true that if you build a better mousetrap the world will beat a path to your door. The automobile companies have recognized this anew and are going all-out to fight the imports -- not by banning them, but by bettering them. Success means profits, not just for the industry involved, but for the country as well.

Third, there is the matter of progress which is a perfectly noble objective that somehow or other has been twisted out of shape by the notion that technical developments and the quality of life are unavoidably in opposition.

I am frequently challenged by the opponents of the SST program who ask how I can advocate a new airplane when there are so many "human needs" going unmet. I'm not sure how stopping the SST program would do anything to advance the cause of health or education or urban problems but I would like to submit that aviation also serves uniquely "human" needs. The airplane transports medicines and missionaries; it carries bereaved relatives as well as businessmen; it speeds that mail and provides mobility for the masses. Overall, the aerospace industry has been a significant contributor to the quality of life and -- given a chance -- it can make even greater contributions in the times ahead.

Dixon Speas, President of R. Dixon Speas Associates of Long Island, has put his finger on the issue when he observes that air transportation has done a great deal in the past for people; it must now cope more effectively with the challenges of what it does to people. He's talking specifically about pollution and noise, and these are the areas where progress is being made most notably and where greater progress can be anticipated in the years immediately ahead.

We no longer question the wisdom of technology assessment in political and scientific judgments on what constitutes progress in our society. But it is clearly better to recruit technology as an ally than to dismiss it as an intractable enemy. In the fight against deterioration of the environment, we had better have technology on our side if we expect to make progress.

The aviation industry is currently engaged in a crash retrofit program which by 1972 will erase the smoke trails from most of the aircraft in the commercial jet fleet. The new burner cans being installed do not elimate all the exhaust emissions, but they do get rid of the soot and the smoke residents around airports find offensive. The 747 and the new trijets are equipped with "smokeless"engines, which will also be a feature of the SST. In the total pollution picture, airplanes are minor offenders. Less than one per cent of the fuel consumed by turbine engines is converted to pollutants. Nevertheless, a "zero pollution" engine is as earnest an objective of the aviation industry as it is for autos. On a passenger mile basis, air travel is unquestionably the "cleanest" form of transportation available today.

Probably the noisiest objections to the SST program come from the people and the organizations concerned about noise in our environment. What I have been trying to say, without adding to the decible count or the pitch of the frequencies, is that noise suppression is not the insoluble problem some people think. Take the 747. For all of its size and its larger engines, the 747 is not noticeably noisier than the 707 it replaces. When the DC-10 and L-1011 trijets go into service, I think you will find them significantly quieter than today's jets. So industry is on the right track.

Actually, the airport builders were on the right track years ago when airports were built away from population centers. If we had persisted in that trend--insulating airports from the encroachment of residential communities--most of the public animosity toward airplanes could have been avoided. Be that as it may, airplanes have to make peace with the community today if air commerce is to survive, and the SST is no exception.

If what Walt Kelly's Pogo says is true, that "we have met the enemy and he is us," then we must take steps to correct what is unacceptable in our attitudes and actions. I only caution, though, against any tendency to jump to quick solutions or even quicker conclusions.

The quick solution favored by some concerned citizens today is to legislate against the airplane. This, in effect, is what is happening in New York where no agreement can be reached on a location for the badly-needed fourth jetport. In 1967 it was estimated that if additional airport capacity was not obtained, the community would suffer economic consequences of approximately $54 million by 1970, $205 million by 1975, and $589 million by 1980. While the loss in wages and other income to the city resulting from under capacity in air transportation services has gone uncorrected, analyses show that the forecast has thus far proved conservative. Instead of $54 million, the loss to New York in 1969 was on the order of $80 million, not counting the unmeasured losses resulting from a migration of industries from the City in search of better air transportation service.

Neither are there legitimate grounds for adopting as gospel what some critics are saying today -- that the supersonic should be prohibited from major airports because they will be intolerably noisy. In the case of the U.S. SST in particular -- eight years away from commercial use -- any ban against its operation at specific airports would constitute what I would consider to be a hasty conclusion.

What are the facts about the SST and noise?

First, noise control has been a constraint since the inception of the program.

Second, the SST is specifically designed to create less noise over the community, on approach or takeoff, than the jets we are accustomed to today.

Third, our noise objectives are becoming more stringent. A few years ago, a sideline noise level of about 124 EPNdB -- which is just about what the biggest conventional jet (a 707-320B, for example) makes today on takeoff -- looked like about the best we could expect. As our engine development program moved along, and as we spent more time and money on engine research, we discovered we could reduce that sideline noise factor substantially -- to 112 EPNdB. Now with that capability in sight, we're setting an even tougher objective, and betting we can meet it.

So, fourth, we are saying today that prior to production commitments, the capability of the commercial SST to achieve noise levels consistent with those required for certification of new, four-engine intercontinental subsonic aircraft, will be demonstrated. One of the leading acoustic consulting firms in the country -- Bolt, Beranek and Newman -- will certify that one-and-a-half miles away from the runway the noise contours of the SST will be approximately equivalent to those of typical street levels.

I believe there is no doubt that left to its own resourcefulness, the aero industry can prove equal to the challenges from within -- the pressures for noise and emission controls. Dealing with the challenges from without -- and by that I mean the resurgence of aviation abroad, financed by the governments involved -- is where our industry is in trouble and needs the helping hand of the Government which has always been available in the past.

The employment of production workers in the industry dropped 26 per cent in 1970. The total industry payroll declined from $14 billion in 1969 to $11.9 billion. Overall sales were down nearly five per cent.

Much of the drop is due to reduced military procurements and expenditures. But there is another factor perhaps less obvious but more insidious. I refer to the "offset" agreements which are becoming a way of life in the aircraft business. When the U.S. technology is matched by the civil aviation industry abroad, it becomes difficult for the U.S. manufacturers to bargain for sales without agreeing to share the production dollars with customer countries. For example, for McDonnell-Douglas to make a Canadian airline sale, they may have to put the wing and tail manufacture into a Canadian plant. Or, when Lockheed wants to sell to British airlines, a Rolls-Royce engine may be the price. For a McDonnell-Douglas jet to be eligible for Alitalia markings may require that the fuselage panels be built in Italy.

The ultimate extension of this practice could be a U.S. airplane built everywhere but in the United States. In such a situation, our aircraft manufacturers could become little more than managers or licensing agents for airplanes built elsewhere, and civil aircraft would move from the plus to the minus side of our balance of trade ledger -- as have so many other traditionally American products.

The SST program affords a hedge against such an eventuality. No other nation has a commercial titanium capability, and the overall jump in technology the SST represents is a strong defense against the spread of offset agreements. But unless we can remain innovative and inventive, technically superior and aggressively competitive, our aviation industry may continue to be a National resource in trouble.

To conclude: we stand at a crossroads that involves more than a live or die decision on the SST. The future of a vibrant American enterprise may hang in the balance. Three other countries have made production commitments for supersonic transport aircraft -- the assembly lines are moving, based on the successful flight tests of prototypes and a clearly discernible and economically attractive market.

There is no reason why we cannot or should not meet and beat the competition.

We have a better airplane in the 2707-300: larger, faster, more productive, with greater long term growth potential, and therefore potentially more attractive to the airlines.

We are nine years deep into a 12-year development program, with a substantial National investment at stake. The prototype program is more than 50 per cent complete.

The airplane is going together better than any previous experimental aircraft in Boeing's experience.

More than 2,000 pieces of prototype hardware for the titanium aircraft have been completed.

Nagging concerns such as flutter control and noise suppression, imponderables a few months ago, are clearly being overcome and are off the "critical list."

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On the environmental front, responsible scientists are conceding that many of the fears expressed earlier -- about the possible effects of increased water vapor and carbon dioxide on the upper atmosphere -- were exaggerations or simply don't exist. The MIT-sponsored study of critical environmental problems last summer dismissed ozone depletion as a possible problem, and noted that there was "little likelihood" of any temperature or climatic changes as a result of SST operations. Other unknowns or uncertainties are being brought under the scrutiny of an expanded and intensive environmental research program, monitored by advisory committees whose members hold impressive credentials in the scientific and technical communities.

The SST prototype program is in a "go" condition. We who are responsible for that program are the first to recognize and respect our obligation to the American people. It is a dual obligation -- on the one hand, to guard against any degradation of the environment we all share. On the other hand, we also have a responsibility to provide for the common good, not only by progressive improvements in the various modes of transportation, but by shoring up the economy against the due bills for social and environmental reforms which must not be ignored.

The aviation industry need not be a National resource in trouble if we accept the premise that environmental concerns and technological developments are not mutually exclusive; that profits and progress need not be sacrificed in the interests of human welfare. Such agonizing as there has been over the merits of the SST program is proof that we do have a National conscience -- that it is alive and functioning. Guided by our conscience, and sustained by our competence, we need not feign or forfeit America's aviation leadership . . . or suffer the economic pangs of its loss.

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STATEMENT BY WILLIAM M. MAGRUDER
DIRECTOR, SUPERSONIC TRANSPORT DEVELOPMENT
DEPARTMENT OF TRANSPORTATION
BEFORE THE
HOUSE SUBCOMMITTEE ON TRANSPORTATION
MARCH 1, 1971

Mr. Chairman, gentlemen of the committee, it is a pleasure to appear before you today and to have the opportunity to present the case for the United States program to develop and flight test two experimental prototype SSTs.

Since this is my first appearance as a witness before this Committee, I would like to describe the extensive SST personal review that I had made before accepting Secretary Volpe's invitation to head up the SST Program for the Government last year.

This review included discussions with industry, NASA, Air Force, airlines, financial and Concorde key personnel to ascertain their feelings, interest, and general evaluation of the overall SST programs. I don't think I need to tell you that I was convinced as to the strong merits of the SST and the need for this country to undertake this advanced program of far-reaching implications for the future well being of our citizens. I would not have assumed this task if I had any doubts on this score.

There seems to be public confusion about the U.S. Government role in this program on the following accounts:

- The program is to develop and flight test two experimental aircraft in order to keep our options open in the international competition.
- There will be no commitment to production unless the airplane is economically viable and will have been shown to be not harmful to the environment.

- o No government commitments have been made for production appropriations for U.S. SSTs.
- o All government participation will be repaid by means of a sales royalty plan.

Today, I feel even more strongly that my decision on the merits of the U.S. SST program was correct. We are in our tenth year of research and development of a 13-year program. I have attempted to check and analyze every piece of "so called" evidence produced on possible detrimental environmental effects and have found none that are supported by recognized scientific authorities as being of sufficient concern to curtail the program - likewise in other crucial areas such as economic benefits. I will speak to all of these points in some detail. First, I would like to describe the status of the program and highlight the extensive progress that has been made since last summer.

PROGRESS

I am pleased to report that in spite of tight funding restrictions, the Boeing and General Electric Companies are essentially on schedule.

Funding

As of March 30, 1971, a total of $1,009 billion has been invested in the program since 1961. The government's share of this has been $864 million of which $708 million has been appropriated and $156 million authorized under the FY 1971 Joint Resolution. Industry's share has been $144 million of which $85 million was provided by the manufacturers and $59 million contributed by the airlines. In addition, the manufacturers have also invested $54 million in new facilities and $25 million in nonallowable commercial expenses for a total of $864 million by the government or 79 percent and $223 million by industry or 21 percent.

Schedule and Management

During this fiscal year, the program has advanced well into the final hard design, fabrication, and procurement phase. We are basically on schedule, within budget, and the configuration has remained essentially stable throughout. If anything it appears to be better than predicted.

Engineering manpower peaked in the fall of 1970 with the factory peak scheduled for 1971. Seventy percent of the total manpower required to complete the prototype program will have been expended by the end of FY '71. Presently 17,000 people are working on the prototype program at the Boeing Company, General Electric, major subcontractors and at the suppliers. Through the multiplier factor it safely can be stated that at least 50,000 jobs will result from the SST prototype program.

Monthly DOT/Boeing and DOT/GE management reviews are continuing as well as joint Boeing/GE meetings to ensure that current information is available at all times. Program visibility is good and all program controls appear to be operating effectively.

Reacting to the admonishment by Congress to assure optimum management controls, the Director decided to employ two line Deputies. This was deemed advisable in view of the increasing program tempo and the flexibility that it would provide in the day-to-day management of internal and external SST office activities.

One deputy, R. E. Parsons, will assist in handling those activities directly related to project management, dealing with the contractors and evaluating project performance and rendering timely direction. The other Deputy, B. J. Vierling, will assist in conducting the necessary staff work and formulating policy recommendations necessary to convert the program to private sector when the present prototype phase is completed.

The office staffing is still considerably under authorization and currently recruiting is underway to strengthen the following areas: financial management and economic forecasting, on-site field representation, environmental specialist, and data handling and processing specialist. While we have doubled the size of our field representation, we have not been able to staff the on-site field organization with the types or numbers of personnel I feel are required for optimum management, due to the present uncertain nature of the program.

Airplane Progress

The full-scale metal mockup duplicating the prototype design was completed and unveiled in June 1970 on schedule and below budget. Since that time, it has been continuously in use progressively verifying the structural design of the prototype aircraft and the optimum location of ducts, tubing, wiring and equipment and checking functional installation of systems within the structure.

A steady flow of drawings has continued from the design tables to the factories and shops across the nation. Over half of the detail design has been released for manufacturing with the 75% point scheduled by the end of FY 1971. Detail parts fabrication is underway both at The Boeing Company and the seven major subcontractors.

The major subcontractors were all placed under contract last year. The team consists of major companies across the country - Aeronca, Fairchild Hiller, North American Rockwell, Northrop, Rohr, Cleveland Pneumatic and Heath Tecna. Each firm has invested its own capital in special facilities and equipment to accommodate use of the latest manufacturing technologies and has agreed to share the costs of the prototype phase. The first major airplane section will start assembly in March 1971 at Northrop.

Contracts have been awarded for the majority of the airplane systems and substantial orders have been placed for titanium raw materials. There are approximately 550 Boeing first tier suppliers involved, located in 40 states. Raw materials began arriving at Boeing in June 1970 in support of the detail parts fabrication. Finished parts are accumulating in storage as required for the wing major assembly start scheduled for June 1971.

Supersonic, transonic, and low-speed wind tunnel testing is essentially complete. Approximately 39,000 hours of wind tunnel testing have been conducted.

Boeing Facilities

Substantially all of Boeing's new facilities (representing a 30 million dollar Boeing investment) are in place or on order including the most modern titanium processing plant in the aerospace industry covering some 87,000 square feet of space.

Engine Progress

General Electric has made steady advances in the development of the prototype engines for the U.S. SST. The engines continue to demonstrate their ability to meet thrust and fuel consumption values equal to or better than those required. The engine program remains on schedule and within budget.

Significant program accomplishments have been numerous; however, the following are particularly noteworthy:

One engine successfully operated for more than 80 hours at simulated 1,800 mph cruise conditions and established a new world's thrust record of 69,900 lbs. for aircraft gas turbine engines.

One engine successfully operated for 150 hours at rated turbine inlet temperature or above.

In December 1970 the first of the actual flight test configured engines became available and testing was initiated. During the first half of FY '71, some 400 hours of testing were accomplished bringing the total to over 1,500 hours for the Phase III program.

With the design of the flight test engine completed, material procurement and manufacturing are proceeding as scheduled. General Electric's first tier suppliers number approximately 2,000 and are situated in 38 states. General Electric has placed 118 million dollars worth of orders out of an estimated Phase III total of 170 million dollars.

Noise Suppression Progress

The Boeing Company is working closely with the engine company, members of industry, and the Government on a coordinated aggressive noise technology program. Recent testing has revealed three significant breakthroughs in noise improvement which have dramatically improved the SST noise posture.

1. Actual ground tests on the prototype engine and detailed flight performance analysis have revealed significantly less effective perceived noise than was estimated initially.
2. Wing flap tests in the NASA wind tunnel showed an improvement in lift and drag and a marked beneficial effect on takeoff thereby improving the altitude of the airplane over the community during climbout.
3. Recent testing of advanced suppressors are encouraging in their acoustic and performance characteristics.

The combination of these features, characteristics and suppressor developments will result in achieving a marked reduction in SST noise.

Prior to production commitment, the capability of the commercial SST to achieve noise levels consistent with those required for certification of new four-engined intercontinental subsonic transport aircraft will be demonstrated.

Airline Reviews

The Airline/SST Committee completed a review of the Prototype and Production design status in November 1970 and continue to be actively engaged in all phases of the program. In March this year a major review of the engine and noise suppressor studies and experimental work for the eventual production aircraft will be held.

Environmental Effects Progress

Scientific authorities who have counseled the government over the past five years have voiced the considered opinion that in the light of existing data there is no evidence of likelihood that SST operations will cause significant adverse effects on our atmosphere or our environment. Nevertheless, the desired degree of certainty about these matters has not been attained. Therefore, the Environmental Advisory Committee was formed in July 1970 and is composed of some of the most knowledgeable atmospheric, radiation and noise specialists in the United States. This committee will advise me on these matters and recommend and plan research in any areas where uncertainties may exist.

Likewise, a Community Noise Advisory Committee has been established and will counsel us in this very important area.

Comprehensive research programs in the key areas of climatic effects, cosmic radiation and noise reduction have been defined and are being undertaken. Already, as I have mentioned, dramatic improvements in the community noise reduction area have been achieved.

FUNDING OPTIONS

Last April I reported to the Committee that the original funding request for FY-71 was reduced from $315 million to $290 million and the DOT estimated cost for Phase III was $1,283 million.

Judicious replanning of schedules, deferral of work to subsequent phases, and general belt tightening allowed us to gain the assurances of the two prime contractors that with timely and adequate future funding there was still a high probability of holding the original schedule and total cost estimate (November 1972 and $1,207) even with the reduced funding in FY-70 and FY-71. We are currently trying to control to this plan by utilizing all in-house Boeing and General Electric management pressure and maintaining the major subcontractors as originally planned.

If we receive the funding as originally requested, i.e., $290 million for FY-71 and $235 million for FY-72, I believe we will be able to recover the schedule time lost under the continuing resolution and still meet the March 1973 first flight date within our Phase III estimate of $1,283 million. This will permit sufficient funds early in FY-72 to support the rapid buildup and schedule acceleration necessary to effect the transition from the continuing resolution to the $290 million level. The risk of schedule slippage is obviously higher now than if we had been able to proceed on a timely basis but we believe it is no higher than that assumed by the contractors when they previously gave us assurance that they could maintain the November 1972 flight date within the $1,207 million cost figure.

The costly option would be to remain at the level of the continuing resolution, i.e., $210 million for FY-71. This would result in a schedule impact of at least five months (March 1973 to August 1973) and would require renegotiation of both prime and major subcontracts with an associated unfavorable loss to the Government of the existing cost overrun points. It should be noted that, while the cumulative FY-71/FY-72 funding would be less due to our inability to recover schedule time in FY-72, the total Phase III cost impact would be appreciably higher. Preliminary estimates range from $95 to $115 million depending on our ability to negotiate the prime contracts and, in turn, the prime contractors' ability to negotiate with the major subcontractors. The element of fiscal doubt introduced by such a drastic program change does not enhance the Government's chances of controlling costs or schedule.

THE INTERNATIONAL THREAT

The great potential for a major breakthrough in the speed of commercial transportation has been recognized by aeronautical engineers and scientists for well over the past decade. Now SST programs by three nations are well into the final stage of proof by flight test. DOT information indicates that both the British/French Concorde and the Russian TU-144 have performed satisfactorily at all speeds, including the design supersonic cruise, and are well on the way to demonstrating that the SST age has definitely arrived and cannot be ignored.

As of the end of 1970, the Concorde prototype airplanes (001 and 002) have completed a total of 376 hours of development flying. Of these total hours, 86 have been at supersonic speeds and approximately 12 have been at supersonic cruise speed. The total number of flights is 188 with 98 of these invovlving supersonic flight. The highest Mach number achieved to date is 2.07 (1,360 mph) and the highest altitude is 58,000 feet. The TU-144 is estimated to have flown over 400 hours with the highest Mach number being about 2.2 (1,450 mph).

Comparative characteristics and status of the competing SSTs are shown in the charts. E-4
E-5

Next I would like to discuss the Concorde and its economic potential in some detail.

Concorde E-1

The British/French supersonic transport is a pure delta wing airplane. This differs from the U.S. SST, which features a conventional horizontal tail, allowing the use of high-lift devices on the wing for better low-speed performances. As a result, the U.S. plane has shorter takeoff distances and higher rates of climb over the community, thereby resulting in lower community noise and better subsonic performance. The Concorde is smaller and shorter, about the length of a Boeing 707, and carries about half the payload of the SST. It is also slower, being constructed of aluminum, which loses strength at the higher speeds which produce higher skin temperatures. By employing a more advanced technology and using titanium, the Boeing 2707 is being designed to cruise at just under 1,800 mph. It should have advanced model structural growth capability to speeds over 2,000 mph. Approval has been given for construction of six production Concorde models, in addition to the two flying prototypes and two pre-production models currently under construction. Model specifications and performance guarantee negotiations appear to be complete at BOAC and Air France. Sales agreements could occur as early as March 1971. Reportedly, an advanced model Concorde is also being considered which would be larger and therefore more competitive with the American SST and the State Department has indicated Germany may join in the financing of this advanced model.

Skepticism regarding the economic viability of the Concorde has been heard. When compared with the jumbo jets on the basis of seat mile costs alone, we could draw this conclusion. However, a quick review of the Concorde performance to date versus what the engineers had laid out in their test plans, gives us good reason to believe that the Concorde program will perform as designed. When one reviews the first 707 original range and payload, there is no basis at this time to question the adequacy of the Concorde's range/payload, since all indications are that the first Concorde will carry its design payload across the Atlantic and will have better range than the first 707 in service which had a range of about 3,300 statute miles with full payload.

The results of the Concorde test program will go a long way toward answering the question, "how profitable will the first supersonic transports be?" The Concorde has performed better than predicted in many areas. Both prototypes are flying at their supersonic cruise speed and have not encountered insurmountable difficulties. The specific fuel consumption and vital aircraft operating characteristics have been generally established for the speed regime through Mach 2.0 (about 1,350 mph) and have confirmed engineering estimates.

In any event, one must recognize that the Concorde introduces a new class of transportation. It will be the queen of the international commercial aircraft fleet as the first of a new generation transport and because of its much shorter trip times. History has shown that speed has value, and that the name of the game in transportation is to reduce travel time. This value could offer airline revenue in several ways. The most obvious are higher load factors and the willingness of passengers to pay a rather modest premium fare for speed.

The Concorde may have a surcharge, not because it is needed, but to protect the slower subsonic jets flying the same routes from early obsolescence. Even with a small 15% surcharge above economy fare which is much less than the present difference between the economy and first class fares, the Concorde can return 12.8% after taxes at a nominal 55% load factor. However, at a 70% load factor (equivalent to only 84 passengers) the Concorde could earn over 20% E-8
after taxes. It is reasonable to expect this to be achieved during the first several years of operation, because the Concorde will have a monopoly of

supersonic operations, and the potential demand for the higher speed will far exceed the number of Concordes available.

The Concorde manufacturers have been emphasizing the desirability of the Concorde as a single-class airplane, with a probable fare level 15% below jet first class, catering to travelers who are sensitive to the value of time savings. With the advent of the U.S. SST, however, in a likely mixed-class configuration, the Concorde would probably be changed accordingly. Furthermore, rather than be used in a head-on competition with the more economical U.S. SST, the Concorde would be more likely shifted to long-range routes with low traffic density, where frequency and load factor considerations would favor a smaller airplane with lower airplane mile costs. On this basis, the initial Concorde would probably continue in service until improved models became available.

Depending on the test program and on the performance of the production Concordes, the British and French Governments could decide to partially subsidize production costs. Since sales price and airline return on investment are directly coupled, a decrease of 20% in the selling price of the Concorde through subsidization could make the aircraft one-third more profitable to the world's airlines, even at a relatively moderate load factor of 55%.

Chart E-8A illustrates the relationship of load factors and the sales price on airlines rate of return. E-8A

The Concorde breakeven load factor for the New York - Paris route at a 15% surcharge is only 7½% higher than the 747 at the current fares and only 2½% higher than the 707. Because of the potential for high load factors, the Concorde should have a good opportunity to earn as much as the advanced subsonic jets, particularly on the high-density routes where it will first be introduced. The U.S. SST's breakeven load factor is about 9 percentage points less than the Concorde and at surcharge fares would be less than both the 747 and 707. E-9

Another way of looking at the effect of load factors on profit is to measure the effect on gross operating profit for the aircraft that will be competing in the supersonic era. Chart E-10 shows that the Concorde at a 15% surcharge will earn a higher annual profit than the E-10
long-range DC-10-30 at load factors above 55%, as well as more than the current long-range jets. It is interesting to note that the Concorde without any surcharge will earn as much profit at 75% load factor as the stretched DC-8. The U.S. SST, as might be expected because of its much greater productivity, will earn substantially more annual operating profit than any other aircraft, and at 55% load factor will earn E-10A
about 50% more than the 747 on long-haul routes in transatlantic and transpacific operations.

Russian TU-144 E-2

Unfortunately, we do not have anything like the depth of information on the TU-144 that we have on the Concorde. However, representatives of Pan American and Boeing have inspected the aircraft at Moscow.

The aircraft is a delta wing supersonic transport quite similar in planform to the Concorde. Its range equals that of the Concorde. It is reportedly designed to fly somewhat faster, the higher speed capability being dependent upon the application of titanium in certain critical temperature areas. The payload is slightly less than the Concorde at 120 all-tourist passengers. The TU-144 is the first commercial supersonic transport to have flown and the first to be flown at supersonic speeds. It could be in airline service as early as 1972 or 1973.

In their June 26 issue, the publication Interavia stated:
"According to a Pravda report, preparatory work for series production of the TU-144 SST is almost completed. Aeroflot has announced its intention to operate the TU-144 on the route between Moscow and Khabarovsk, a journey time of 3 hrs. Aeroflot also envisages the creation of a route for the SST linking Moscow-Delhi-Singapore-Tokyo."

FAMILY OF AIRCRAFT

I have just expressed to you my conviction that foreign governments do have promising SST developments that are much further along than ours. These aircraft represent a distinct threat to our present position of superiority in the air transport and aviation industry, and further to our ability as a nation to continue to maintain a favorable balance of trade. This threat does not concern the U.S. SST alone but reaches out to cover the whole family of aircraft that the United States is now able to offer the nations of the world for any and all missions or transport needs. Before going further into the "family" concept and its effect on the aviation world market, I would like to discuss some key aspects of balance of trade, which is, after all, the prime index of whether or not this country is maintaining economic viability and prosperity on an international basis.

The balance of payments problem is amazingly complex. It is virtually impossible to accurately relate one account like aircraft exports to the total balance of payments. Our payments' balance depends upon many interrelated aspects of the financial and economic fibers of our economy and for that reason the U.S. SST Program analyses are in terms of the balance of trade considerations. Historically, this country has had a strong position in its balance of trade that has enabled it to help other countries of the world and in so doing still maintain equilibrium in the total balance of payments picture.

It is very significant that estimates of the magnitude of the SST impact upon our U.S. balance of trade, made in 1969, were to a large extent, influenced by cables from our overseas embassies indicating the Concorde program would probably not reach the commercially-viable production stage. In 1970, most of the government agencies having concern with SST development, including the State Department, concluded that the Concorde flight test program to date was going better than originally anticipated. It appears that their SST is headed for commercial service in early 1974. United Kingdom and French officials indicate initial sales announcements are expected early this year. The airlines while not completely satisfied with the capacity of the first Concorde nonetheless continue to support the program and both the French and British Governments have made sizable financial investments to get the initial production Concordes underway, in their determined bid to overcome the U.S. lead in air transport sales. If a supersonic transport of British-French design appears on the world airways within three years, a few essential facts and factors related directly to trade balance are worth considering.

In the earlier balance of payments studies there was serious concern that the U.S. SST through its speed would generate increased tourism and that this tourism would have an adverse effect on our total balance of payments picture and negate the advantages the U.S. would obtain in the trade account from selling 500 SSTs. Underlying these studies was a general consensus by those departments having such concern that the Concorde program would not be viable.

However, if there is a viable Concorde this oft-described "speed-induced travel" factor almost disappears since only the difference between the Mach 2.2 design speed Concorde and Mach 2.7 SST is relevant. The speed-induced travel concept, if accepted, was used to illustrate a potential negative services account impact from travelers' expenditures abroad, port expenditures, and the like that would all be charged to the U.S. SST. Under the assumption of no Concorde, the amount could be sizable. But with the Concorde in airline service, as all responsible agencies now indicate, then the induced U.S. expenditures abroad over the SST time period to 1990 are roughly estimated at about \$3 to \$4 billion as compared to a roughly estimated favorable trade swing of between \$17 and \$22 billion in 1967 dollars. Also, there is considerable difference of opinion as to the validity of speed-induced travel and for this reason we did not include this input in our charts. Additionally, no weight has been given, either in the past or in our present computations, to the positive effects on exports or on overseas investment income from increasing the producitivity of business air travelers, a further conservatism.

The trade balance computations used prior to last year did not adequately reflect the "real world" of airline equipment purchases. The assumption that the free world airlines will continue to buy about 84% of American made civil subsonic jets regardless of our action on the U.S. SST is not a valid premise. Airline executives make their purchases only after careful examination of the manufacturer's "family of aircraft." If the United States restricts itself to the jumbo jets and the tri-jets for the 1980s, then the foreign family of civil transports -- the Concorde for "blue ribbon" overwater routes, the A-300 twin engine 250-passenger low-cost airbus (Figure G-6) and the French Mercure replacement for the DC-9/Boeing 737 G-6
(Figure G-7) -- may well, and probably will, induce many airlines, G-7

especially nationally-owned foreign airlines, to purchase their "family" outside the U.S., in fact, "closer to home." In addition to pressure on foreign flag airlines to re-equip with home-manufactured airplanes, there are many inducements that can make purchase of non-U.S. transports attractive. These include price discounting, trade-in allowances, purchase loans, low interest rates, favorable warranties, and low-cost spare parts and servicing arrangements. The efforts of the Soviets to develop their own family of aircraft for export is shown here in the recent advertisement of E-12 Aviaexport.

When the U.S. technology is matched by the civil aviation industry abroad, the U.S. airplane manufacturers begin to encounter a business arrangement commonly referred to as the "offset agreement." For example, for McDonnell-Douglas to make a Canadian airline sale, they may have to put the wing and tail manufacture into a Canadian plant, or when Lockheed wants to sell to British airlines, a Rolls-Royce engine may be required, and for the McDonnell-Douglas jet to be eligible for Alitalia markings may require fuselage panels built in Italy. These are actual occurrences! The significant impact of this fact (which reaches billion-dollar levels) upon balance of trade was not considered in prior trade balance studies. However, when our technology takes a big jump ahead of foreign technology, this negative offset disappears. We already have an advantage in technology in the U.S.A. The labor and material to build the all-titanium U.S. SST will be all American, an added safeguard to our trade balance and national economy, for no other free nation has the titanium manufacturing technology of the United States.

One thing is clear in the balance of payments area: it is extremely difficult to predict with much precision future developments of the major nations and aircraft companies of the world. We do know that the continuing high GNP growth rate of the developed nations will increase the air travel of foreign nationals and the need for greater capacity and productivity. Note the North Atlantic travel growth in 1970 in spite of domestic travel level off with the business recession. It is questionable that comparison of the U.S. SST versus the Concorde should be done on an all-black or all-white premise. Nevertheless, in order to simplify the presentation of potential trade swings, it is necessary to make assumptions that there would or would not be a U.S. SST competing with the foreign-built supersonic transports. To the best of our ability, our trade balance studies consider real life factors, but, at best, these projections only convey possibilities of what could happen.

A summary of the results of DOT studies shows that if there is a viable Concorde and no U.S. SST, we suffer a trade imbalance from 200 Concordes imported worth \$7.0 billion and lose by not building an SST, \$10.1 billion from sales abroad, for an unfavorable swing in trade balance of \$17.1 billion. (Figure G-8). If a more airline-economical Concorde II G-8
appears, this unfavorable trade impact would grow to \$22.1 billion. This represents our conservative or base estimate and is due to a greater impact upon the jumbo tri-jet market from a more commercially attractive Concorde II. However, taking into account the effect on import sales of a more favorable "family of civil aircraft," this impact G-9
could grow to \$27.1 billion and, when the real world offset agreements

are accounted for, then this trade impact could reach almost $30 billion, all computed in 1967 dollars, over a 12-year period (1978-1990). (Figure G-9).

When we apply a conservative escalation of 3% per year to current dollars through 1985, only half the life of the production program, the trade impact numbers can rise dramatically from a minimum of $17.1 billion to $45.6 billion over a 12-year period, or $3.5 billion per year. (Figure G-10). G-10

Finally, when aircraft are sold over a time period such as the U.S. SST 1978-to-1990 time span, the spare parts for airframe and engine support can add exports with a value of 50% of the initial sales price. This factor has also been largely ignored in our previous trade balance assessments. If we add this to the above highest estimate, over $50 billion trade swing can be projected. This does not include U.S. servicing activities worldwide that employ U.S. people and bring revenue into the U.S.A.

Export business of this magnitude is no longer easily attained or duplicated in other product fields. An examination of Commerce Department statistics shows a steady erosion of our export markets and a migration of our technology abroad. Automobiles, for example, passed from a favorable to an unfavorable balance of trade in 1968 and in 1970 we imported $2.3 billion more than we exported. G-12

Unfortunately this trend is continuing and information recently available indicates that imported car sales set a new high in July 1970 up 25% from the year ago figure. Imports of iron and steel products are up 145% over a 10-year period. Consumer goods, excluding automobiles, has shown more than a 297% import rise in the same period. Exports associated with our electrical and electronics industries also represent a disturbing situation. Since the mid-1960s, our electronics exports have been growing approximately 15% per year. However, during this same period, imports have been increasing at the rate of 40% per year. Should these trends continue, it appears that by the end of 1972, our imports will exceed our exports in a field in which we originally excelled in technology. On the other hand, the products of American civil aircraft technology have been near the top of the export list for the past 10 years. This is a strong technology base that we cannot afford to default.

It is a significant fact that our exports of civil aircraft are being converted to favorable trade balances at a ratio in excess of 90%. In other words, 9 of every 10 dollars of civil aircraft exports contribute to our favorable trade balance. This point has not been lost in the deliberations of Sir George Edwards, Managing Director of British Aircraft Corporation, who recently said that the economic future of Great Britain is largely dependent upon the advance of aerospace and related technologies, mainly due to the high conversion ratio of exports against imports for high technology items. Quite clearly the $2.7 billion of civilian aircraft engines and parts which the U.S. exported in 1970 would have a much greater impact on the British economy where the total Gross National Product is less than one-eighth of that of the U.S., should the British be able to achieve this level of aircraft exports.

A high technology base by means of an advanced competitive aerospace industry, provides an advanced technology spillover to other areas such as titanium usage in the chemical industry. The maintenance of an advanced technology base serves to enhance the position of the United States in its dealings with the other nations of the world. Civil aviation leadership means advanced technology unmatched outside the U.S. and promotes a stable trade balance. These attributes work together toward a common end - a sound U.S. economy. Without a sound economy, we can never honor our commitments to better education, better housing, better health, better law enforcement, better transportation, and, to improve our environment, a better quality of life for all.

PRODUCTIVITY

Aside from the need for an SST as an overall U.S. national transportation requirement, there is the very important consideration of the attactiveness of the U.S. SST to the airlines, both U.S. and international, based on its speed and productivity.

Productivity refers to the ability to do work efficiently. In air transportation terms, one measure of productivity is available seats per airplane times the speed. Analyses in these terms show the U.S. SST to be:

- Three times as productive as the Concorde and the jumbo tri-jets.
- Almost twice as productive as the 747.
- Four times as productive as a 707.
- Sixteen times as productive as a DC-6.
- About one hundred times as productive as the DC-3.

New productivity levels provide the basis for the airlines to:

- Accommodate the normal travel growth requirements coincident with attractive service in terms of departure and arrival schedules.
- Maintain a reasonable financial return in spite of cost escalation.
- Provide the traveling public with reasonable fares, and
- Maintain reasonable worldwide civil air transport fleet sizes.

The impact of productivity increases in the light of these factors, is to facilitate international revenue passenger miles' growth, conservatively projected by Boeing, to be such that by 1985, the SST traffic alone will equal the entire free world traffic of today. This means 260 billion revenue passenger miles or 100 million people traveling by SST -- and this with no supersonic overland flights. Almost 75% of all intercontinental flights are projected to be in SSTs. This would require about 720 additional 747s or about 1,200 Concordes to do the job of 423 U.S. SSTs. As a means of showing how important it is for aviation to plan ahead, and to underscore why we must go ahead now, examine what would have transpired had the aviation industry not been ready, capable and willing to offer the needed advances in aircraft technology, reflected in improved productivity per dollar, through improved models about every 5 to 8 years.

- Only 345 pre-war DC-3s were built to serve the airlines of the entire world. By 1947 the DC-3/4 and Constellation fleet had grown to 2,000 civil aircraft.
- At the end of the piston engine airplane era, a total of some 4,500 DC-6s, DC-7s, Constellations and other piston airplanes were in use by the airlines of the world.

Today the airline fleets of the free world number about 3,500 subsonic jets, and these aircraft carry about 3½ times more traffic than the airline fleet at the end of the 1950s. Had the industry not pressed ahead with the jet age, in spite of all the outcry of the critics of progress of the early Fifties, we would today be choking the airways and airports with piston aircraft and be causing significant environmental degradation.

Looking forward to the 1980s and 1990s, if the U.S. aircraft industry does not continue to move ahead with its advanced generations of more productive, more comfortable, safer, more reliable and cleaner air transportation, then it must fall behind -- there is no standing still. The economic benefits resulting from meeting the increased demand will be reaped by countries currently planning and aggressively pursuing this lucrative market.

Some critics of the U.S. SST contend that international air travel is limited to an insignificant segment of the U.S. population. Consider the composition and magnitude of air transportation projected for the 1980s. It appears this next advance in travel - communication - cultural exchange - business will be of service to a significant segment of our U.S. population. Examination of present day travel and that predicted for the 1980s shows that:

- o Today, some 44.7 million separate Americans (22% of our population) travel by air domestically and over 6 million internationally (3% of our population).
- o By 1985, which is only the mid-life of the first generation of SSTs, 50% of our population, 126.4 million Americans will travel by air domestically and 25 million, or 10% of our population, internationally. This is hardly a "jet set."
- o 62.3% of international air passengers between the U.S. and foreign countries are U.S. citizens.
- o The business/pleasure split of international air passengers is 26%/74% for the North Atlantic and 24%/76% worldwide. Passengers in the Pacific area are split about 50-50, business and pleasure.
- o The North Atlantic routes represent the most lucrative airline route system in the world, carrying over 6 million people in 1969 between North America and Europe and projected to carry 28 million in 1985. About 2 million Americans or 1% of our population flew this route

in 1969, and about 9 million are expected to fly in 1985. During the 1960s, 19 North Atlantic carriers flew 31.3 million passengers. Passenger volume increased 243% from 1960 - 1968. This air communications system links the two most powerful economic communities in world history - Europe and the United States. By shrinking distances on the entire globe to 12 hours or less, the U.S. SST will open up similar traffic in other directions from the U.S. The forecast growth rates shown in Chart H-14 indicate that the Pacific area H-14 including Australia and New Zealand will grow at higher rates in the period to 1980 than the North America-Europe traffic. The 1975-1980 period should reflect the initial impact of Concorde and SST operations, yet the growth rate indicates about one-third reduction from the preceding period. This indicates the conservative nature of the SST forecast. It is very significant that although 1970 was a bad year for domestic airline travel, with a growth of only 2%, international traffic on U.S. airlines was up about 19%.

- From a profit standpoint, the SST clearly aims at the prime market. Long-haul routes are traditionally more profitable than short haul. Most SST flights will be "long distance." International operations have been shown from CAB statistics to be consistently 60% higher in rate of return than domestic operations, returning 9.6% internationally versus 5.9% on total investment, based on the 10-year average through 1969. This is important to the SST program and fleets of the future in terms of:
  - Repayment of the government cost share.
  - A healthy airline industry.

A more rapid payoff of the new equipment directly for a greater return on investment.

Greater productivity is also the way the airlines generate the funds to pay back the loans required for new equipment. Much has been said about the potential price of a U. S. SST escalating from a 1970 estimate of $37 million per airplane to the order of $50 million in 1978. Historically, new equipment has produced sufficient revenue to pay back its cost in about 5-6 years. The SST is not expected to be an exception in this respect because of its expected very high productivity -- the ability of the airplane to produce revenue. This is strikingly illustrated in Chart H-15, showing that the SST can earn H-15 annually over 2½ times as many dollars per installed seat as the 747, and an even greater margin over the Concorde and other long-range subsonic jets. This comparison assumes no supersonic surcharge and 55% passenger load factor.

There still remains the question of what the U. S. SST productivity will H-10 H-11 do for the average traveling citizen, (all 25 million of us) in 1985. An examination of cost history and projections to 1985 shows a steady rise in costs for all aspects of airline operations -- except for fuel. In spite of this all too familiar trend, airline fares, compared to the Department of Labor Consumer Price Indices, have actually decreased since 1947. The ability of the airplane manufacturing industry, combined with progressive airline management, enables nearly 45 million Americans or about 22% of our population today, to enjoy the phenomenon of one of the few remaining 5 cent cigars in the form of lower air fares while other prices have risen an average of 50%! The U. S. SST will be available to the 25 million Americans who will fly internationally or 10% of our population to further enjoy these beneifts in the 1980s.

In summary, productivity has made it possible for the airline industry to accomplish the following:

- o Hold fleet sizes to manageable levels and offset cost escalation.
- o Maintain a low fare level, enabling more people to fly.
- o Accommodate known travel growth trends with adequate service and constantly improving level of comfort and safety.
- o Provide airlines with earnings generally adequate for solvency and continued growth.
- o Keep airway and airport congestion from reaching impractical levels.

THE ENVIRONMENT and the SST

The Administration's position, Secretary of Transportation Volpe's position, and certainly my own position on the SST in relation to the environment is that the U. S. Supersonic Transport must be demonstrated to be acceptable under the terms of the Nation's commitment to higher environmental standards. We do not intend to allow supersonic air transportation to further blemish what astronaut Frank Borman so aptly described as "the good earth -- an oasis in space".

Secretary Volpe made the Administration's position quite clear when he said in a speech last month "that the production program will not proceed if tests of the prototypes indicate serious damage to the fabric of the natural world, or social problems that we can't treat and assimilate".

The apprehensions that have thrust environmental aspects of SST operations into public prominence are based on theory, conjecture or scientific speculation. While many of these concerns are sincere, and while I consider it entirely proper that we examine the potential environmental consequences of our actions, I suggest we should differentiate between fear and fact, and not confuse possibility with probability.

On that basis, I would like to summarize for the members of the Committee the circumstances pertaining to the SST and the environment, as they now stand.

First, the program never has sought to avoid environmental issues or evade environmental responsibilities. For example, the SST contract was the first transportation development program to contain noise objectives, acknowledging that noise has been a common concern and lower noise levels a goal of our efforts.

Similarly, smokeless engines for the airplane have long been a production requirement.

For nearly five years, the Government has acknowledged that flights of civil supersonic aircraft will not be allowed over the United States at speeds that would cause a sonic boom to reach the ground.

Every possible environmental effect — radiation on passengers and crew, sonic boom,noise pollution, atmospheric effects - all of these concerns were subjected to inquiry or investigation even before "environment" and "ecology" became household words. Further research in all of these areas is continuing.

Secondly, there is no evidence or likelihood that supersonic aircraft operations will cause any significant adverse effects on our atmosphere or the global environment. That is the consensus of the scientific community at this point in time, based on existing data. Further, there is general agreement that two prototype aircraft will in no way endanger the environment. Mr. Russell Train, Chairman of the President's Council on Environmental Quality, has so testified before the Senate Joint Economic Committee.

The question that concerns all of us is what effects, if any, will large-scale operations by supersonic aircraft have on the environment we all share -- bearing in mind that whether or not the U. S. SST goes into commercial service, the British-French and Russian supersonic transports will be flying in some numbers, in addition to the countless military aircraft operating at supersonic speeds or altitudes. We cannot answer the question completely or absolutely today, but there are certain facts -- presently available -- which provide insight into the problem and indicate to me that the more conclusive answers we all seek are within reach.

First, there are the findings of the MIT-sponsored Study of Critical Environmental Problems (SCEP), a month-long seminar held on the campus of Williams College during the summer of 1970. A portion of the study was given over to the possible impact of the SST on world climate. F-38

Not surprisingly, the SCEP advocated more research. But equally important, I velieve, the chairman of this scientific working group made it clear that there is no reason to halt or delay work on the U.S. SST prototype program. This fact, unfortunately, did not always emerge in the press reports and commentary on the SCEP findings. The misleading accounts of the SCEP's position led the Chairman of the Working Group, Dr. William Kellogg*, to issue a subsequent statement, saying in part:

> "I am very much distrubed over recent gross exaggerations and scientific mis-statements regarding the SST's potentially harmful effects upon the atmosphere and man's environment. Last August a group of scientists at the MIT Summer Study stated that there are indeed environmental uncertainties, caused in no little part by gaps in available information, which require additional research in order that they may be resolved. I pointed out at that time and want to strongly reaffirm that there is no environmental reason to delay construction of the two prototype SST's.
>
> "It is my profound hope that the U.S. Congress will not be mislead by these exaggerations or by scientific mis-statements. Dr. Ed David's** statement, which Dr. Walter Roberts*** and I strongly endorse, says it well: 'Let's not suppress technological advances but through research, development and experimentation make sure that those advances are obtained without undesirable side effects.' I support a vigorous environmental research program in parallel with prototype SST construction. Don't downgrade the ability of American scientists and engineers to apply their genius to the successful resolution of uncertainty."

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* Associate Director of the National Center for Atmospheric Research, Boulder, Colorado.

** Dr. Edward E. David, Jr., the President's Science Adviser, in a statement issued December 5, 1970.

***Director, National Center for Atmospheric Research.

Without going into detail, let me enumerate the principal findings of the SCEP group as they relate to the SST and the environment.

1. The additional carbon dioxide from SST operations at 60,000 feet to 70,000 feet altitudes will cause no problem.

2. The water vapor content of the stratosphere will probably be increased, but the significance of this change is not known. The SCEP group did express opinions on several possibilities:

-- One, that increased winter cloudiness in the polar region might occur.

-- Two, the added water vapor may increase the thickness and extent of stratospheric clouds already observed in the polar region at night. However, the direct radiation effects would result in warming of air at ground level in regional areas of peak moisture concentrations by less than 0.1 degree centigrade on a world-wide basis and cooling in the stratosphere by a few degrees centigrade.

-- Three, the reduction of ozone due to water vapor interaction would lie well within the present day-to-day and geographical variability of total ozone.

3. The group noted that reduced ozone could admit more ultraviolet radiation to the lower atmosphere. Predicted ozone changes, however, would be insignificant.

4. With regard to particulates, the direct role of quantities of CO, CO_2, NO, NO_2, SO_2, and hydrocarbons in altering the heat budget is small. It is also likely that their involvement in ozone photochemistry is even less significant than water vapor.

5. The Group found that SST operations will introduce particles into the stratosphere in proportion to the sulphur content of fuels and the amount of hydrocarbons and soot contained in the exhaust products. We know, however, that tomorrow's aviation fuels will contain much less sulphur than today's fuels, which contain about 0.05 percent sulphur by weight. Sulphur in fuel serves no practical purpose, and its reduction will result in a significant decrease in the generation of particulates by aircraft engines. In fact, use of jet fuel with a 0.01 percent sulphur content (instead of 0.05 percent) would reduce emissions by 80 percent.

The overall conclusion reached by the scientists who participated in the MIT Summer Study is one of uncertainty as to the extent of effects from supersonic aircraft operations. The course they recommended is very likely the one you and I would propose -- the obtaining of more information on which a factual, well-reasoned, objective decision can be made.

An American Geophysical Union Symposium on environmental effects of supersonic aircraft was held in San Francisco in December 1970. The papers and panel discussions featured during that symposium were in general agreement with the conclusions reached by the MIT study group.

The SCEP and the AGU did not deal with cosmic radiation, but facts are available which show that SST passengers and crew will actually experience less radiation exposure than subsonic jet travelers because of the shorter time duration of travel in supersonic transports.

It is known, for example, that radiation exposure at different geographical locations on the surface of the earth vary from 35mrem to 200mrem per year, showing that human beings are continually exposed to radiation F-15 of varying intensities. In some parts of the world people in their normal environment receive greater annual exposure than encountered in SST or in subsonic jet travel.

A flight crew of the SST, based on an assumed 200 flights a year, will be exposed to approximately the same radiation as crews of subsonic jets -- generally less than 10 percent of the 5.0 rem per year exposures allowable by the International Commission on Radiobiological Protection as permissible. (Normal international jet flight crews today average about 120 flights per year.) F-14

To evaluate and apply the facts that are known, and to investigate, analyze and advise on the concerns that do not yet have full or final answers, we have -- first -- established the SST Environmental and Noise Advisory Committees, and -- secondly -- assembled a comprehensive research program encompassing all of the areas where more information and data are necessary.

The members of the SST Environmental Research Committee are identified on this chart. The Committee is chaired by Dr. S. Fred Singer of the Department of Interior. Dr. Singer is a former Dean of the School of Environmental Sciences of the University of Miami, and is Chairman of the American Geophysical Union's Committee on Environmental Quality. His committee includes the most knowledgeable and highly respected professionals in the atmospheric and radiation fields. F-2

I asked Secretary of Commerce Stans to request the Commerce Technical Advisory Board (CTAB), a body of distinguished, non-governmental scientists, to convene a panel on SST Environmental Research. CTAB agreed and the panel is now conducting an independent analysis of SST environmental concerns. It is reviewing the environmental research program to insure that it is correctly structured to resolve environmental uncertainties. Their findings and recommendations will be most helpful in support of our environmental research effort. CTAB, as you probably know, recently tackled the issue of removing lead from automotive fuels.

Dr. Fredrick Henriques, a photochemist, and CTAB member, chairs its F-2A SST panel. The other panelists are listed on this chart. They represent a range of environmental interests and expertise. The CTAB Panel has available to it, government liaison representatives from every concerned agency, including EPA, HEW, CEQ, NOAA, HUD, STATE, DOD, DOT, and INTERIOR.

Also, in cooperation with other departments and agencies of the Government, we have defined and have underway a program of research into many of the areas where concerned groups, like the SCEP, have indicated research is needed. In the SST Climatic Impact Assessment program, for example, the Government will conduct research to improve our knowledge of engine exhaust emissions, atmospheric monitoring, chemical dynamics, atmospheric modeling, and contrails and polar cloudiness. As information becomes available it will be communicated to the Congress and to the agencies charged with responsibilities for environmental preservation and protection.

Let me turn now to the subject of noise, which has long been a major concern in the development of the SST.

The members of the SST Community Noise Advisory Committee are identified F-3 F-3A on this chart. The representation is diverse, and includes some of the outstanding authorities in the propulsion and acoustic fields. It is not only very gratifying to me that these gentlemen have agreed to serve in this important capacity, but I believe their presence indicates the intense desire of people in Government and the private sector alike to overcome the excessive noise which has been detrimental to the broader acceptance and greater progress of air transportation.

The noise characteristics associated with the SST have been perhaps the most misunderstood and generally confused aspect of the various SST environmental concerns. Some apprehension is certainly understandable, but the facts do not support the degrees of concern and emotion that have been expressed.

These are the facts:

First, the SST will be quieter over the community than the typical jet in the present intercontinental fleet. The noise level, at the designated measuring point -- one-and-a-half miles from the end of the runway, approximately -- will be within the limits of the FAA rule for subsonic jets. This means the SST can be expected to relieve, not aggravate, the present noise situation over the community, where people live or work.

Secondly, the approach noise of the SST over the community will also be lower than the present-day 707 and DC-8 jets. The high-pitched "whine" of the compressor of today's jets will not be heard from the SST because of the unique supersonic engine inlet. This inlet prevents the whine from propagating forward, thus reducing annoyance to the people on the ground.

Now, thirdly, we have the question of noise on the airport itself, or what is referred to as "sideline" noise.

In most communities this is not a serious concern with present aircraft, simply because airports are not expected to be quiet places and the people who work there or frequent airports understand and accept this. In fact, the operators of a major international airport have told me they have never had a public complaint attributable to sideline noise.

With the SST, however, because of the size and power of the engines, sideline noise has been a major technical challenge. Based on the propulsion and acoustic technologies then in hand, the sideline noise levels from the SST appeared in the past to be greater than we preferred. We have, however, had intensive and aggressive noise reduction programs under way for a number of years, and these programs are yielding results. F-41
Recent testing has revealed significant breakthroughs which have dramatically improved the SST noise posture.

Last month I received a letter from Dr. Leo L. Beranek, Chairman of the SST Community Noise Advisory Committee, informing me of his Committee's latest findings on the noise characteristics for the production U. S. SST. Because of the importance of Dr. Beranek's conclusions, I would like to present the letter in its entirety for the record.

> "We are pleased to submit this interim report on the activities of the SST Community Noise Advisory Committee, which you appointed in July 1970. Our initial step was to review the SST noise objectives in relation to the noise situations currently prevailing at the Nation's airports together with the projected improvements resulting from the introduction of new, quieter subsonic

airplanes meeting certification requirements of FAR 36 (Federal Aviation Regulation - Noise Standards: Aircraft Type Certification). This review also included meetings with the airlines, airport operators, Boeing, General Electric and representatives of Government agencies active in aircraft noise.

"On September 11, 1970, I reported the first conclusions of the Committee to you as follows:

1. The noise levels for the production SST should be the same as those imposed by FAR 36 for new 4-engine, intercontinental, subsonic transport aircraft.

2. To meet the above objective, added emphasis should be given by Boeing and General Electric in their respective noise programs.

"Since that oral report, the Committee has kept abreast of progress on the program relative to reduction of the noise levels projected for the production SST. On February 4, 1971, we reviewed in detail with Boeing and General Electric the status of engine and aircraft design of the production SST with respect to noise. This review included results of recent tests on a number of jet noise suppressors, aircraft and engine performance, and the adequacy of engineering methods in predicting the noise levels for the production SST.

"We conclude that the level of technology demonstrated by Boeing and General Electric is sufficient to achieve the noise level objectives we recommended. We are available to discuss our findings with you and other concerned parties, as you deem appropriate."

We have discussed these findings with Dr. Beranek, and with Boeing and General Electric. On the basis of the analyses now available, we are confident that prior to production commitment, the capability of the commercial SST to achieve noise levels consistent with those required for F-9
certification of new four-engined, intercontinental subsonic transport aircraft will be demonstrated.

The Airport Operators Council International has been sufficiently impressed with the projected SST noise levels to write a letter of endorsement of the SST program to the President. In this letter the

Council says, and I quote: "We see the SST program as a unique opportunity to reduce community noise, air pollution, and congestion while improving air transportation service through an orderly, well-planned program involving international coordination between airport and airline operators, manufacturers, and governments."

There is one other environmental factor that remains to be discussed, and that is sonic boom. Here there is little to say, except that no one I have any acquaintance with advocates flights at boom-producing speeds over the United States, and everyone involved in any way with the program is agreed that restrictions on overland flight are appropriate. The proposed Federal Air Regulation specifically prohibits flights over the United States at speeds that would create a boom on the ground. A law to that effect has been proposed, and the Department of Transportation poses no objection if a law is the desire of the people and the Congress.

I would point out, however, that flights over land area are not, and never have been considered necessary in order for SST operations to be profitable. The economics of the SST are based on the fact that 70 percent of the surface of the globe is water, and that 89 percent of all international airline route mileage (over 700 miles) is over water.

To conclude this portion of my statement, let me summarize by saying that the Department has complied with the terms of the National Environmental Policy Act (Section 102) requiring that new technical developments be demonstrated as being compatible with sound environmental practices. Our SST Environmental Impact Statement was submitted, along with the comments of the reviewing agencies, on December 7, 1970, to the Council on Environmental Quality. We have discussed the environmental issues with members of the Counciland with the Administrator of the Environmental

Protection Agency and his staff. We have considered carefully the findings and opinions of qualified environmental authorities, such as those engaged in the SCEP, and all concerns are being given the close attention of our Advisory Committees. We are continuing the research necessary to enable us to determine the environmental acceptability of the SST before any commitments are made for commercial production.

As I mentioned earlier, the question that concerns us all pertains only to large-scale operations. The prototype program, rather than a threat, is a means by which environmental questions can be better answered and unknowns resolved.

EMPLOYMENT

Gentlemen, as we are all painfully aware, aerospace employment and more specifically commercial transport aircraft development and manufacturing employment has been experiencing a sharp downtrend since its mid-1968 peak. Elements contributing to this include declining sales of large civilian transport aircraft as well as reduced expenditures for military aircraft, missiles and space programs and the civilian space program.

Aside from the international balance of trade implications of the U.S. SST Program, I would like to emphasize the very important consideration of the domestic economic impacts. Certain sections of the country are already experiencing significant economic problems and without increased employment stability, these can be expected to multiply. Inherent in employment losses, of course, are other material considerations, such as personal hardships including severe relocation expenses and increased burdens on state and local governments which tend to compound rather than alleviate the problems.

The foregoing factors should be considered in evaluating the U.S. SST's contribution to the overall good of this country. During the production phase, the SST Program will provide a direct labor force of 50,000 jobs. Through the multiplier factor, the impact more reasonably can be expected to concern 150,000 jobs in the next 15 years if we fail to respond to the foreign SST challenge which is being posed. In this way, we will contribute to a "brain drain" on the aerospace industry specifically and on the technological expertise inventory of the U.S. in general.

Foreign Impacts

We have already experienced some labor impacts growing out of the business arrangements commonly referred to as "offset agreements." Basically, these come about when U.S. technology is matched by the civil aviation industry abroad and in order for U.S. aircraft manufacturers to sell their export products, a portion of the plane is required to be manufactured in the purchaser country, as I have already pointed out.

Quite obviously in these circumstances, U.S. aircraft manufacturers were placed in a position of having to adopt a "half a loaf" approach in dealing with these agreements. However, in the SST program we are now dealing with the whole loaf, since we alone possess the necessary titanium technology.

As opposed to the feeling which has persisted in some quarters that the Concorde would never be a viable product, there is ever increasing evidence that this program is for real. Given the opportunity to extend the initial Concorde effort into a second-generation aircraft which could be more competitive with the U.S. SST, it is wishful thinking to assume that the British and French will not do so.

SST Employment Potential

The significance of the SST upon our aircraft employment, is shown J-5
in this chart. This indicates a loss of 28% of all jobs available at the end of 1979 if we do not have the U.S. SST Program. If we have a less favorable family of civil airplanes to offer to the airlines of the world and if, as a consequence, future subsonic sales are filled by foreign aircraft such as the A-300B and the French Mercure, then the 28% can be much larger and represent a material employment loss.

Current Aerospace Employment Downtrend

Perhaps the present condition of aerospace employment in the United States can be used as a mirror of the future. In current perspective, as shown in the chart, employment in the aerospace industry is already J-6 suffering from declining sales of large civilian transport aircraft coupled with reduced expenditures for military aircraft and missiles and space programs, because of the conversion from stepped-up production for the Vietnam war to essentially a peacetime basis, and because of the end of hardware development and production for the Space Program. For the year ending September 1970, employment will have dropped by 12½% from a year ago -- a loss of 168,000 jobs or one out of every 8.

Contrary to popular misconceptions that the aerospace industry employs only white collar workers, I would like to point out that this job loss is not restricted to any particular type of employee but rather has an across-the-board application. Scientists and engineers who comprise only 15% of the work force will lose 28,000 jobs, down 13.8% from the year-ago level, production workers representing 51% of the force will lose 89,000 jobs, a drop of 12.8% and technicians representing 5% will lose 10,000 jobs, a drop of 14.1%.

Accompanying Consequences

Impressive as these statistics appear in totality, they tend not to convey the true import of the situation. For example, the 168,000 jobs comes more into perspective when viewed in light of the fact that this is roughly comparable to the population of Arlington County, Va.

which according to the 1960 census was slightly more than 163,000 persons. Quite obviously, the loss of this number of tax-paying Americans, if even for a limited time, must have repercussions in various segments of the economy.

Present Mirrors Future

The present aerospace employment picture, depressing as it is to all of us can be useful in that it can be a mirror of the future, if we experience the loss of employment from having exported one of our best national resources -- which is what will happen if we fail to answer this foreign SST challenge. I feel that there is a very important message for us here, that our aircraft industry is an essential force in our overall economy and a substantial contributor to our well being.

Program Support

That this fact has been recognized by others is evident in the following sections of a "Statement by the AFL-CIO Executive Council on SST." At their meeting on August 3, 1970 in Chicago, the Council in supporting this program said in part..."Today, the USSR and the French and British are developing airliners that will fly at supersonic speeds on trans-oceanic flights. These nations, using government funds, have produced prototypes and are now well along in their testing programs.

"Without an SST, the American aerospace industry will be unable to maintain its leadership in world aviation, losing most of the market for trans-oceanic airliners.

"American aerospace workers will also lose sorely needed employment.

"We urge the United States Senate to vote funds for the development of an American SST. The age of supersonic travel over water will soon be here. The United States cannot afford to be left in the lurch."

BENEFITS FOR THE NATION

I have discussed at some length how the SST vitally affects our national aerospace industry and how essential a successful SST program is to the health of this major United States industry, with major effects on future balance of trade and employment.

Now I would like to concentrate on the government-industry partnership involved here and show that a most beneficial result should be expected, both for the government and for the aerospace industry.

The American SST Program is a unique government-industry partnership more in the nature of an investment than a direct Federal subsidy. This is, of course, the American way of doing business, for the U.S. SST is a civil transport in the business sense and the Government is most certainly not to be involved in competing with private industry for profit. The contract arrangements provide for both parties to realize a reasonable return as follows:

- The Government's prototype investment will be returned by the time the 300th airplane is delivered.
- When the 500th airplane is delivered, the Government's investment will have been recovered along with a projected additional billion dollars. None of this, of course, includes any consideration of the tax revenues which will accrue. Inclusion of taxes calculated from SST employment (50,000 direct jobs and 150,000 total jobs, including indirect) would add an additional \$6 to \$7 billion to be returned by 1990.
- Returns to the manufacturers are sufficient to cause them to actively pursue the program's objectives.

The planning for financing of the production phase has not assumed Government participation nor was it, nor is it, intended to do so. A finance plan is evolving with discussions already in progress with financial organizations, industry, labor, CAB, etc. The present timing for a plan is June 30, 1972. It is hoped that this year an outline of the plan can be developed; however, the success of the prototype design and the associated research and development are the keys to attracting the private financial community to this program. As one leading financial expert put it, "with a proven successful prototype flying and the prospect of more than $25 billion worth of business, someone will find the cash to promote this business."

The industrial financing of a program as large and with such national economic impact is a truly U.S.-wide project. Labor, the airlines, the manufacturing industry, the lending institutions, the government fare-route regulating authorities and the international fare-route regulating authorities will all be directly involved in developing the necessary actions to assure:

- o A healthy airline-industry economy.
- o An attractive economical design.
- o A well-managed, imaginative total transportation system to accommodate the SST.

Two important factors, normally representing the only requirements for private financing assurance, are implicit in the SST Program --

- o A willing buyer (10 airlines have invested nearly $60 million of risk money to show their support for the program).
- o A proven vehicle which this prototype program is designed to demonstrate.

From a study of previous commercial transport development, it is apparent that commercial aircraft development has been Government supported one way or another many times. Government participation in the U.S. SST prototype program should not, therefore, be considered either extraordinary or as a detriment. The $1.7 billion required to develop the U.S. SST prototype is simply too large a price tag to expect contractors and financial concerns to underwrite, particularly in view of the long "dry spell" before return on investment is realized. Government financing of other transportation programs in shipping and railroads has occurred many times in the history of our country, when the magnitude of the effort was beyond industries' financial capabilities.

The one unique feature of the U.S. SST prototype financial arrangement is that the taxpayers will get their investment back, with interest. By the time the 300th airplane is built, the government will, through royalties, get back its $1,342 million. The manufacturers will put up $322 million, including $132 million in new facilities and commercial costs. The airlines will have invested $81 million, $59 million at risk and $22 million for delivery position deposits. By the sale of the 500th airplane, it will receive another billion. Under terms of the contract, the government will pay for about 78% of the costs. The remaining 22% is being financed by the participating contractors, Boeing and General Electric.

In comparison to the amount of money the Government provides in grants, aide and assistance programs across-the-board, the investment in the American SST Program is small indeed. For example, during Fiscal Year 1971, the $290 million required for the U.S. SST, a revenue-producing program that will provide many nationally important benefits, is only 6% of the \$4.5 billion in Federal aid highway grants. The Government finances many other sizable programs such as foreign aid, shipping, agriculture price support, urban mass transport, and military support to other nations.

Considering the \$25 billion market available to the SST when it is put in service, the 150,000 to 200,000 jobs associated, the \$6.2 billion tax revenue benefits, the \$22 billion favorable balance of trade features and the continuation of world leadership in commercial aviation that are at stake, the SST Program becomes a very attractive and nationally important program for the Government to provide financial assistance.

There is nothing new or novel in providing Government financial assistance to a major U.S. transportation development program. Most commercial air transport advancements were based on some type of Government support. The one element of the American SST Prototype program that is different from past Government assistance is that the investment will be returned to the taxpayers with interest. Direct Government involvement in civil aviation includes the following:

- o Conduct of advanced aeronautical research through NACA and NASA since 1915.
- o Development of the airways, navigation aids, and air traffic control, and certification of aircraft and crews.
- o Development and subsidizing of the airlines.
- o Expenditure of \$400 million for development of airports during WWII, many of which were turned over to local governments after the war.

- Aid to airport development from 1946 to present was approximately $2.2 billion. With the enactment of the airport and airway development and revenue act of 1970, Federal funds of $2.5 billion are authorized for airport development over the next ten years. When matched by local and state governments over the next ten years, these funds will total $5 billion.

As a result of the powers of the FAA to certify aircraft and operate the airways, and of the powers of the CAB to control the routes, fares, and subsidies of the airlines, the government in fact is involved and always has been. It is entirely logical that government, which has sponsored the development of air transportation in the U. S. and inspired its continuous growth, should take a hand in the industry's future. It is inevitable if present economic realities are realistically appraised and the attendant benefits to the nation recognized.
The Government's involvement in the financing of the prototype program has always been based on these economic realities and benefits to the nation:

- The size of the financial burden exceeds the capabilities of any single or joint private U. S. industrial aerospace concern.
- The 100% Government-subsidized French-British Concorde is already at least 4 years ahead of our SST and has completed more than 400 hours of successful prototype flight testing.
- The potential adverse impact upon our nation's balance of trade if we forfeit the SST market to the foreign manufacturers precludes our not building the prototype if we are to protect our future options. To forfeit the SST, in the face of intense and dedicated foreign subsidized civil aircraft competition, could well lead to a serious erosion of our total civil aviation market and aircraft employment.

The cost-sharing nature of the prototype U.S. program features:

- A 90% Government - 10% industry cost share up to a cost incentive point of $625 million for Boeing and $284 million for General Electric after which industry shares 25% of added costs.

- o Industry bears the burden of all facility costs, about $54 million for the prototype and $100 million for production. The manufacturers also will spend about $78 million in commercial costs during the prototype time period.
- o Prototype Cost Summary

	U.S. Government	Manufacturers/Operators
Government	$1,342 Million	
Manufacturers		$322 Million
Manufacturers' Facilities		54 Million
Manufacturers' Commercial Costs		78 Million
Airlines, for Building Two Prototypes		59 Million
Airlines, for Delivery Positions		22 Million
TOTAL	$1,342 Million	$535 Million

SUMMARY

Gentlemen, I want to assure you that the United States SST program is in a "go" status. As you have seen, the hardware construction of the aircraft is well underway with strong activity at the contractors' plants and at the many subcontractors and suppliers located all over the country. Further, the actual flight test engine is now running on the test stand and all performance objectives have been equalled or bettered.

The program is essentially on schedule and within cost.

Keen competition is expected from the Russian and British/French SSTs. Unless we produce a better SST, the United States is likely to incur severe adverse effects in the future:

Balance of Payments Loss

Aerospace Industry Decline

Disbanding of the Most Advanced Technology Aerospace Team in the Industry

Unemployment Increase

Strong charges have been raised that the American SST will adversely affect the environment. I have been in contact with the best scientific authorities in the country in all these areas and have yet to find a reputable key authority that would recommend against the American SST prototype program on consideration of environmental effects. We have established highly-qualified scientific committees in environmental effects, including noise. They will carefully monitor the extensive research work that will be carried out to ensure that our knowledge is complete in all these areas. The U.S. SST will not be approved for production until these environmental committees are satisfied.

In the area of takeoff and landing noise, I am most encouraged. Our recent breakthrough in noise reduction, due to improved engine characteristics, better aircraft aerodynamics and advanced suppression technology, gives me great confidence that the production SST will comply with the same noise regulations as the future subsonic jets in all respects.

As to the program progress, we are proceeding on schedule and within cost. However, we are now faced with crucial options, depending on our allotted funding for this year and next. I believe the urgency of this program is such that we should press for the $290 million amount for 1971 as I discussed. This will allow for an orderly buildup after March and would minimize slippage in the program. With this amount we can move ahead with a strong program.

Mr. Chairman, this concludes my statement. My staff and I will be happy to answer any questions the Committee may have and to provide such further information as may be desired.

COMPETITION – CHARACTERISTICS

	BOEING 2707-300	CONCORDE	TU-144
1. MAXIMUM T.O. GROSS WT., LB.	750,000	385,000	330,000 ?
2. LENGTH	298'	193'	188.5'
3. SPAN	143' 5"	83' 10"	72'
4. MATERIAL	TITANIUM	ALUMINUM	ALUMINUM
5. THRUST (AUGMENTED) LB/ENG.	67,800	38,300	38,500
6. RANGE, STATUTE MILES	4,000	4,000	4,000
7. PASSENGERS	298	128	120
8. CRUISE SPEED, MACH NO.	M 2.7	M 2.05	M 2.35 ?
	(1,782 MPH)	(1,350 MPH)	(1,550 MPH)
9. MEAN CRUISE ALTITUDE (FT.)	63,000	56,000	59,000
10. TAKEOFF DISTANCE, STD. DAY + 15°	10,000'	10,900'	–
11. LANDING DISTANCE	8,250	8,200	–

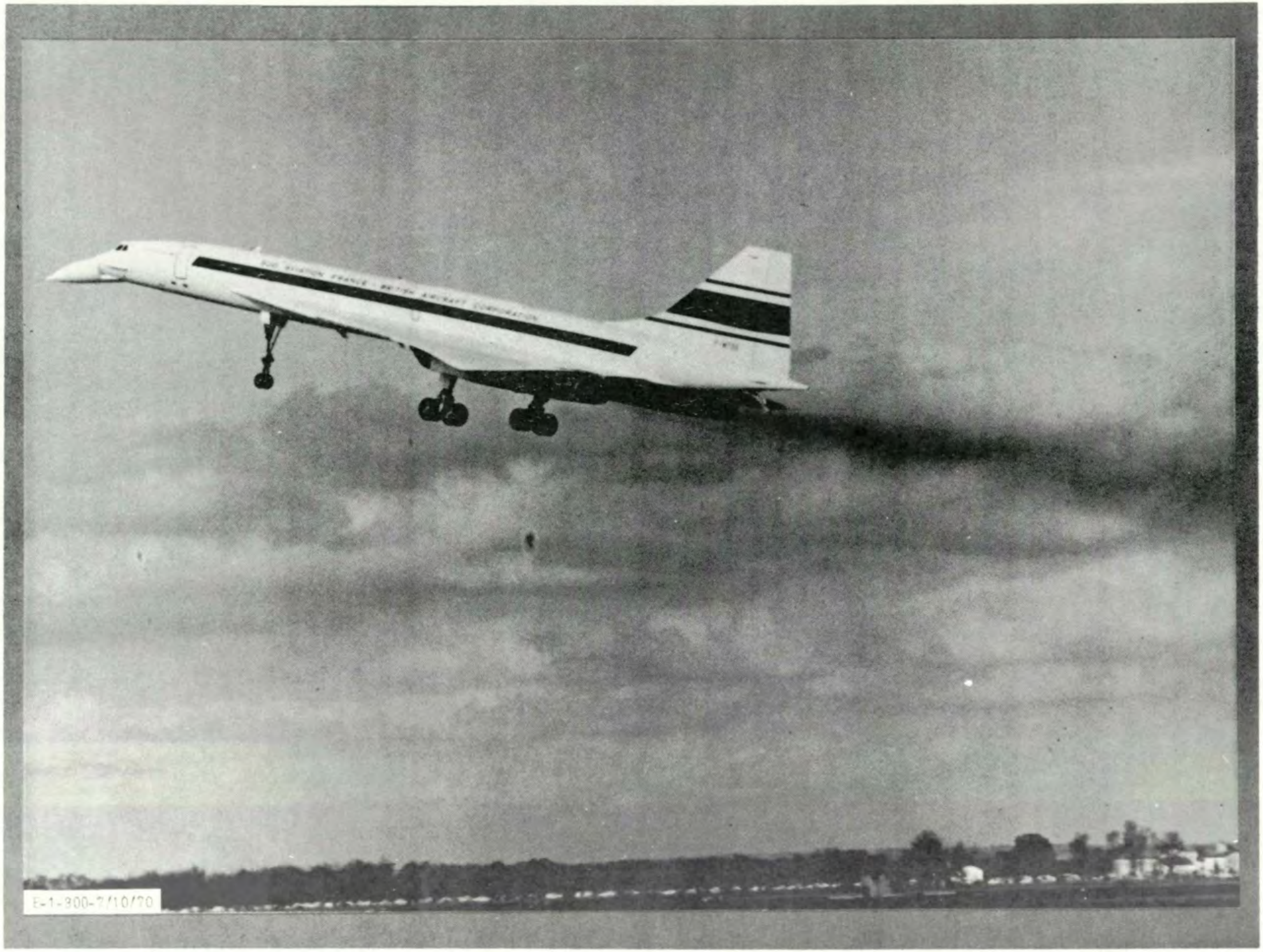
E-4-300-7/10/70

COMPETITION - STATUS

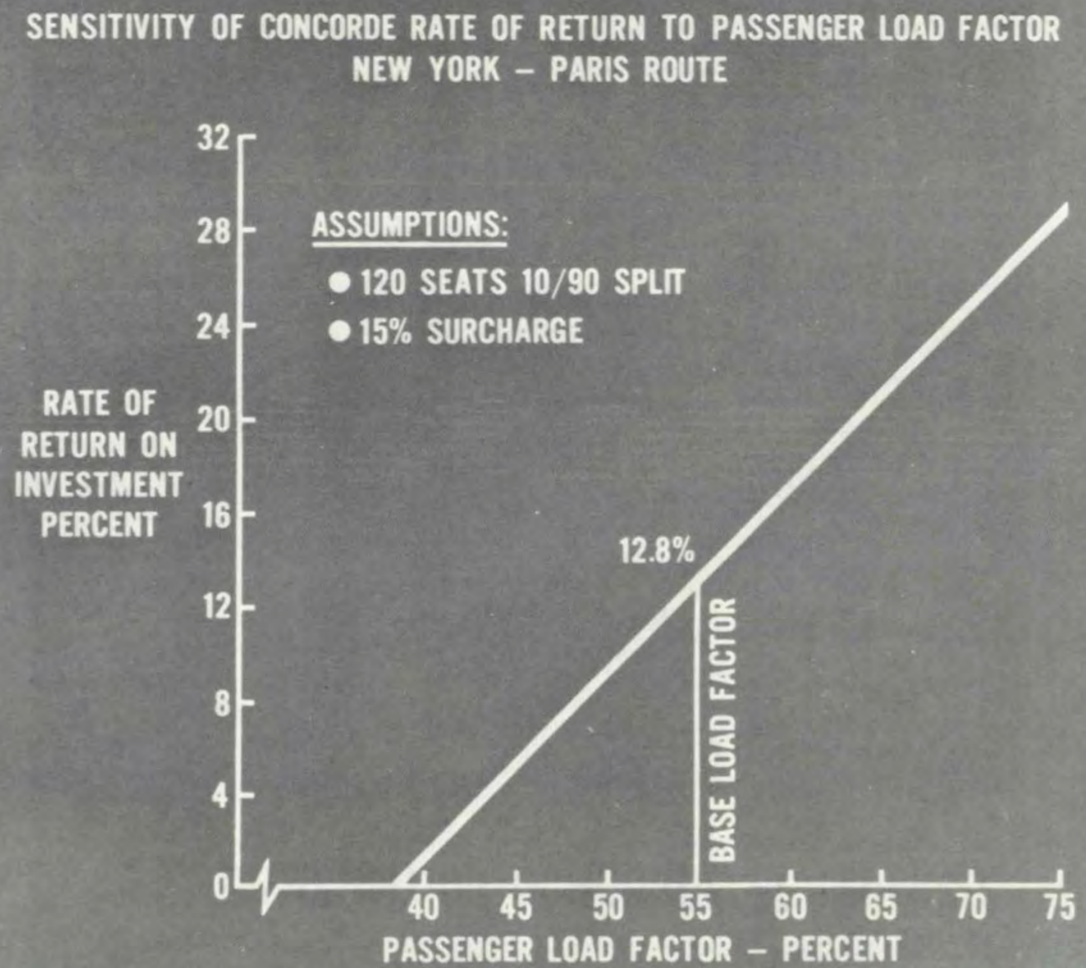
	B-2707	CONCORDE	TU-144
1. FIRST FLIGHT DATE	11-30-72	3-2-69	12-31-68
2. NUMBER OF HOURS	---	394	OVER 250 (BY END 1969)
3. SPEED ACHIEVED	---	M 2.05	M 2.2
4. EST. IN-SERVICE DATE	1978	EARLY 1974	1971/72
5. NUMBER OF POSITIONS	122	74	?
6. AIRLINES	12 U.S. 14 NON-U.S.	7 U.S. 9 NON-U.S.	INTERESTED; JAL KLM AIR INDIA PAKISTAN

E-5-200-2/22/71

CONCORDE

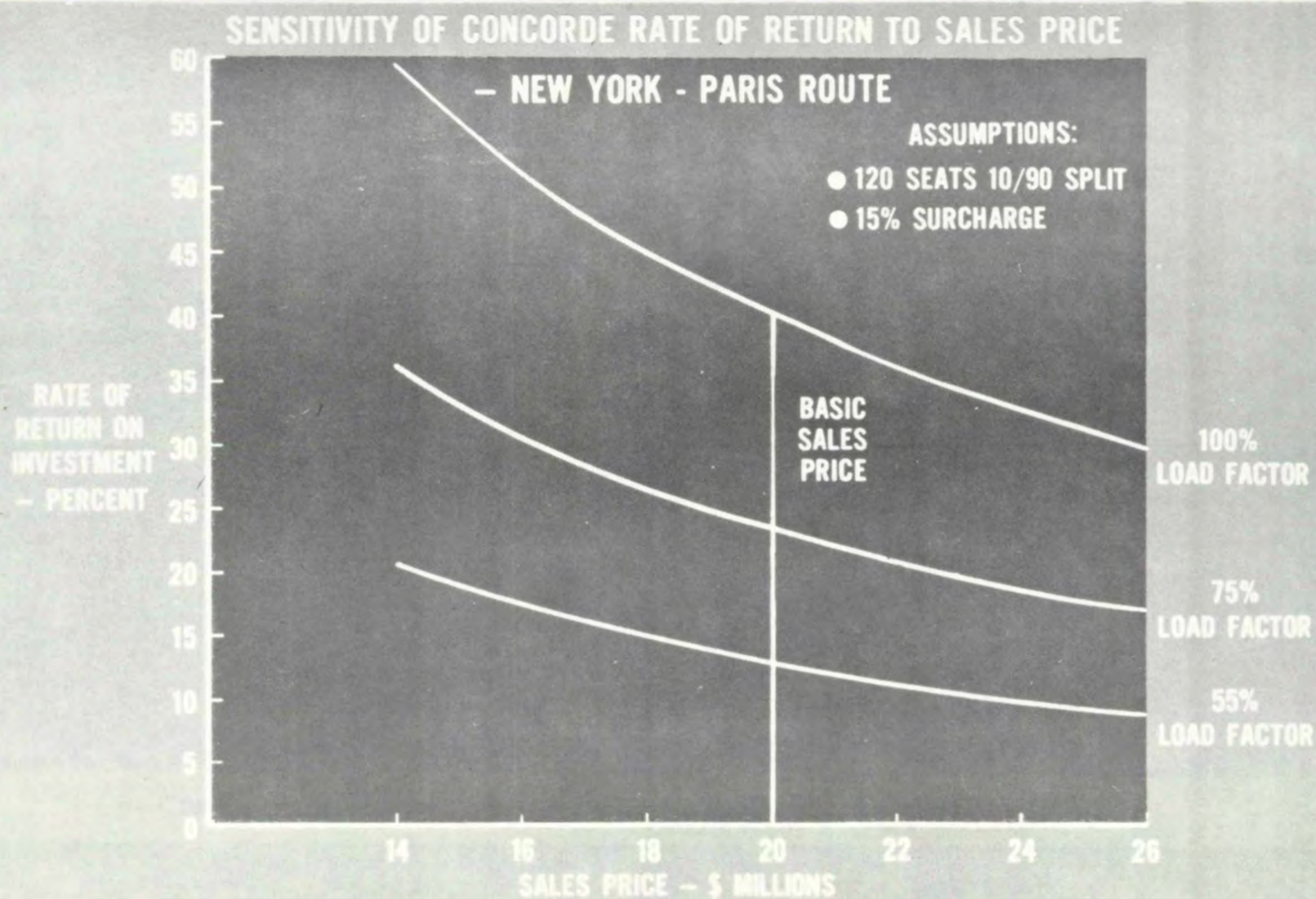


COMPETITION – CONCORDE ECONOMICS



E-8-300-8/11/70

COMPETITION CONCORDE ECONOMICS



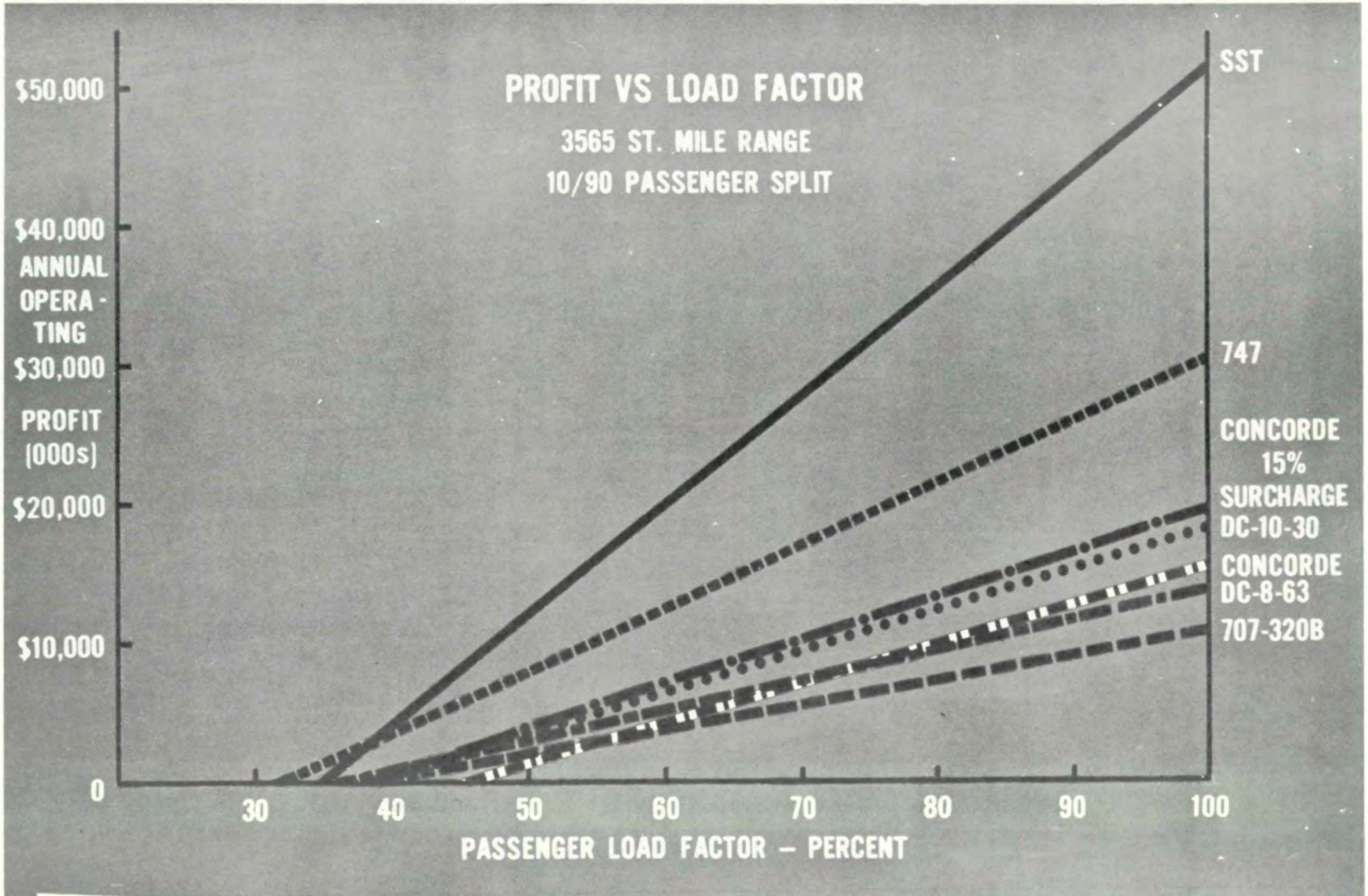
COMPETITION – BREAKEVEN LOAD FACTORS

NEW YORK – PARIS ROUTE

	CURRENT YIELD	15% SURCHARGE
CONCORDE	44.8%	39.0%
SST	35.3	30.7
747	31.5	–
707	36.5	–

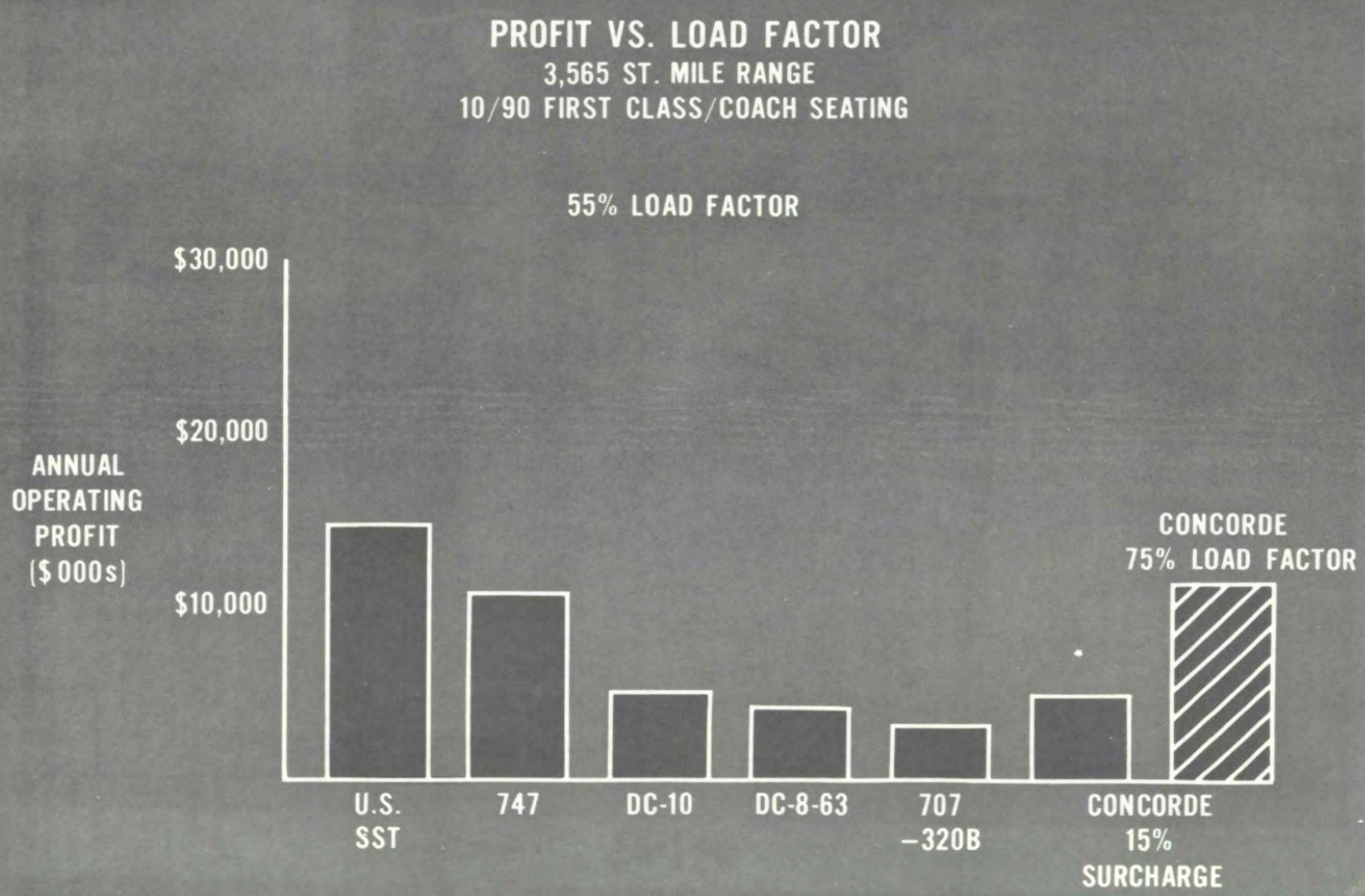
E-9-300-8/7/70

COMPETITION – PROFITABILITY



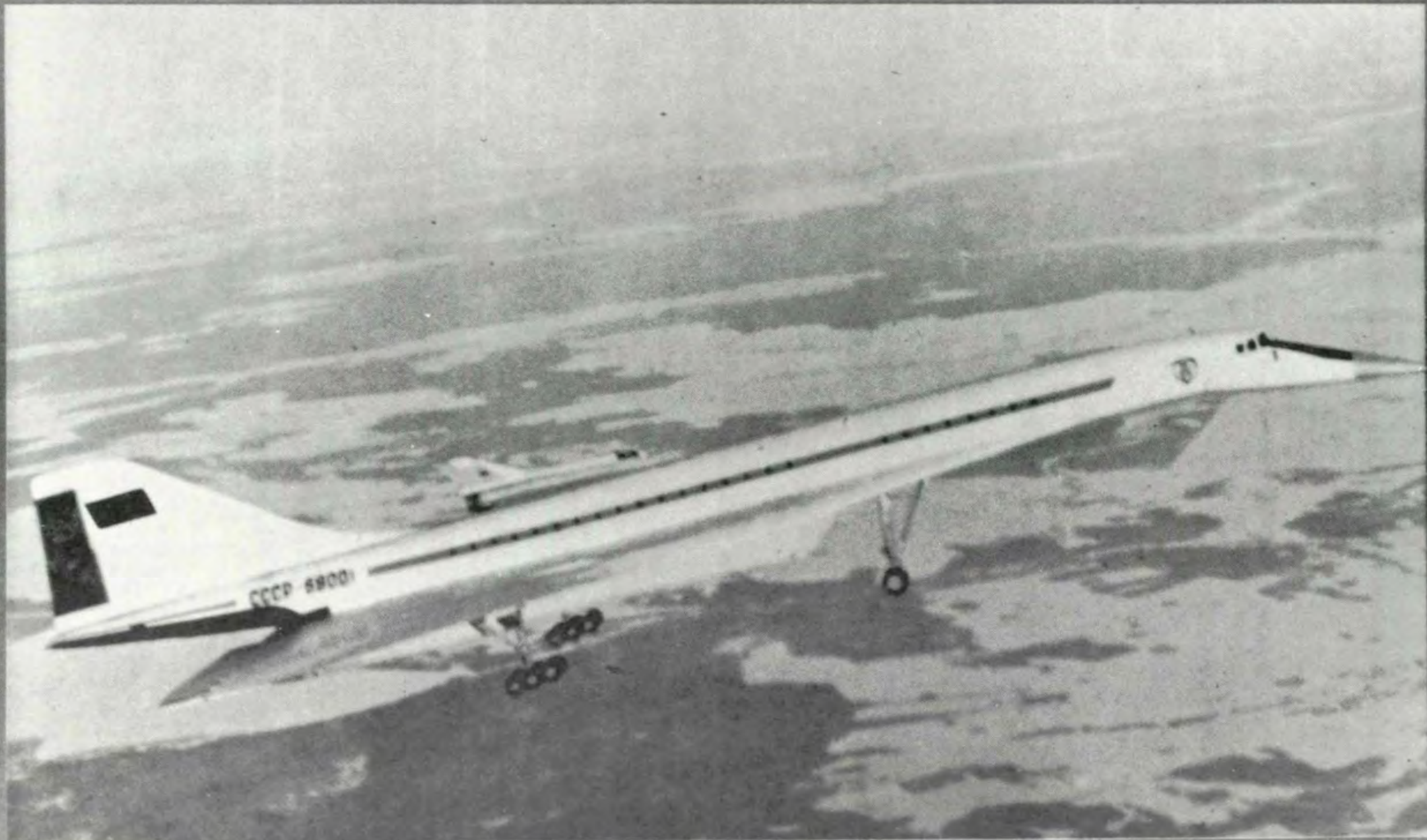
E-10-300-8/12/70

COMPETITION – PROFITABILITY



E-10A-300-2/22/7[illegible]

Tu-144




IT'S COMING FAST NOW!
The European A 300 B, 250-passenger transport designed to fill a major gap in airline carrying capacity of the coming decades for short and medium route segments, is
IN THE MAKING!
French, German, British and Dutch workers are steadily turning out components for an aircraft of the 80's which will be flying in the 70's.
A300 B
Société Nationale Industrielle AEROSPATIALE
DEUTSCHE AIRBUS - HAWKER SIDDELEY AVIATION - FOKKER

G-6-300-7/10/70


day after day
Dassault's Mercure
keeps its pro mise.
for mercure, a year well spent...
At the Paris Air Show 1969, crowds thronged by the thousand to get a glimpse of the full-scale model of the twin jet short haul « Mercure ».
Anybody can make a full scale model: all you need are the means. But DASSAULT had also made firm dates.
A year has passed. A year filled with activity. All the promises have been kept. « Mercure » has left the drawing board: it is already a reality. In their plants at St-Cloud, Boulogne and Merignac, DASSAULT has built the nose, wings and central fuselage.
Fiat, in Italy, is constructing the rear fuselage and the tail unit. CASA, in Spain, the forward fuselage. SABCA, in Belgium, is also on the job. And all the makers of equipment, in Europe and in the United States, are working to make sure that « Mercure » keeps its promise.
For its timing. And for the weight as well. « Mercure » is not one of those planes that put on weight under construction. Each element built is weighed and checked against the calculated weight — always successfully!
All goes well for « Mercure ». Rendez-vous, in flight, at the next Paris Air Show.
FRONT FUSELAGE
REAR FUSELAGE
Mercure
the money-maker by DASSAULT
It won't be long now!
CIRCLE 173 ON READER SERVICE CARD

G-7-300-7/10/70

The supersonic Tu-144 Airliner.

The flexible tri-jet Tu-154 Airbus.

The short- to medium-range AN-26 Airfreighter.

The all-field YAK-40 Aircraft.

The Amphibian Air-Sled.

AVIAEXPORT gives you rendezvous at the 29th PARIS AIR SHOW Le Bourget 27 May-6 June 1971

The general-duty light Ka-26 Helicopter.

The general purpose commercial V-8 Helicopter.

The new modern long-range radar "Utyos."

The NK-8 turbofan jet engine.

The general purpose weather radar "Groza."

AVIAEXPORT with its wide range of aerospace products can meet buyer's needs in any part of the world.

AVIAEXPORT sells quality and economy in its products and services.

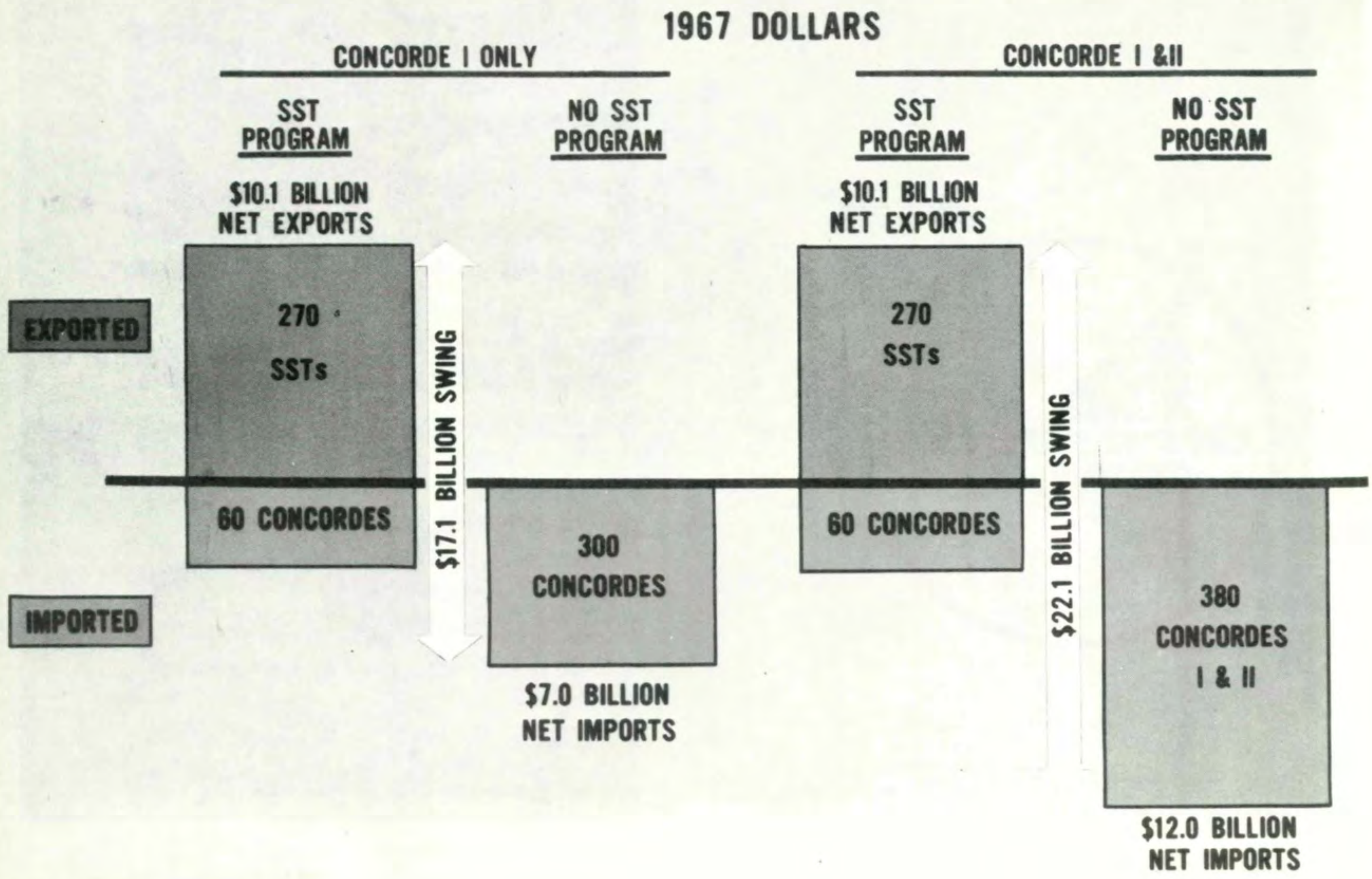
AVIAEXPORT

AVIAEXPORT is the national organization for export of the entire range of Soviet-made commercial airplanes, helicopters, engines, avionics instruments, airport and ground handling equipment.

AVIAEXPORT is also responsible for the supply of spare parts, maintenance, overhaul and repair service as well as for the training of specialized personnel.

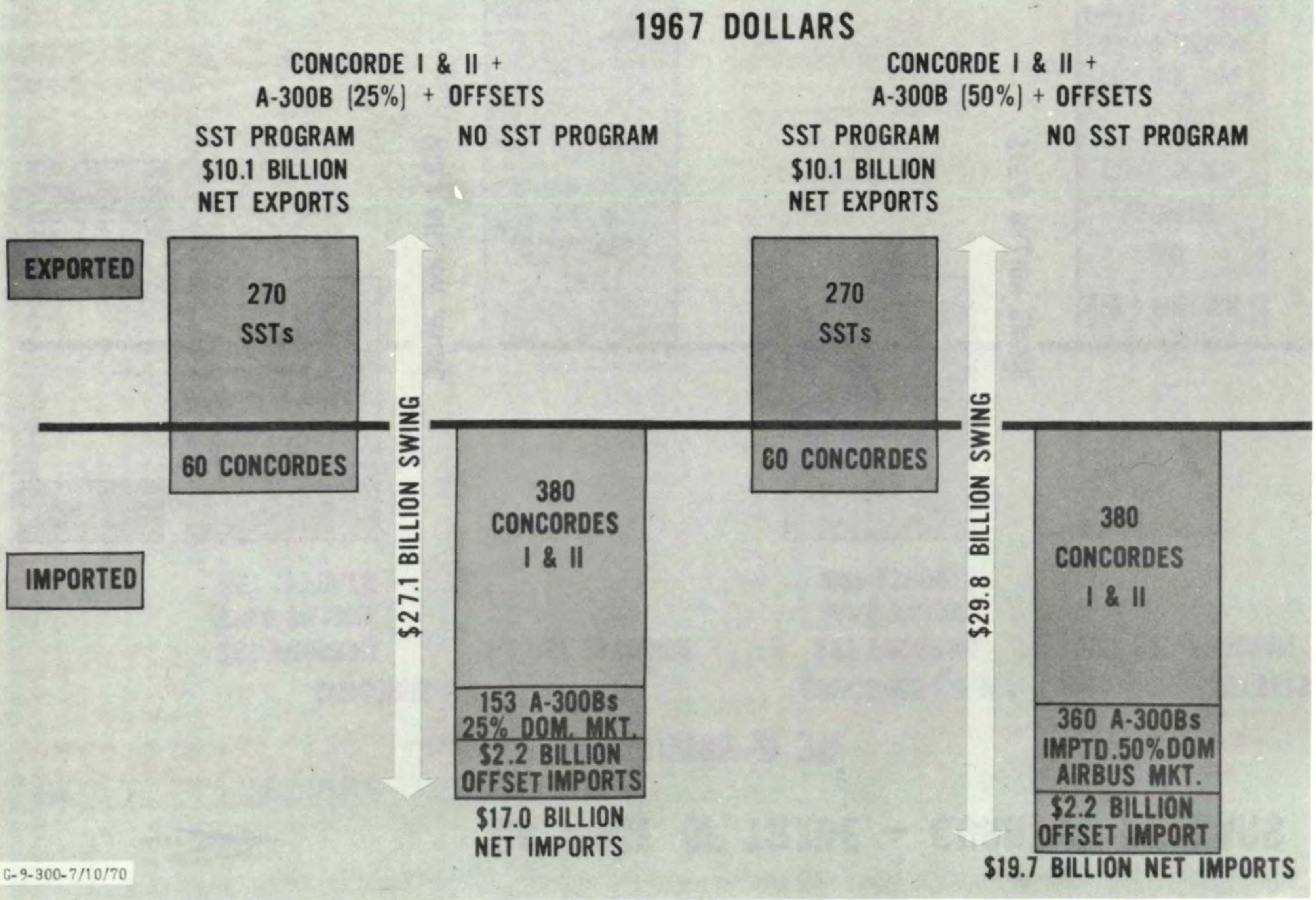
AVIAEXPORT

BALANCE OF TRADE – 1967 DOLLARS



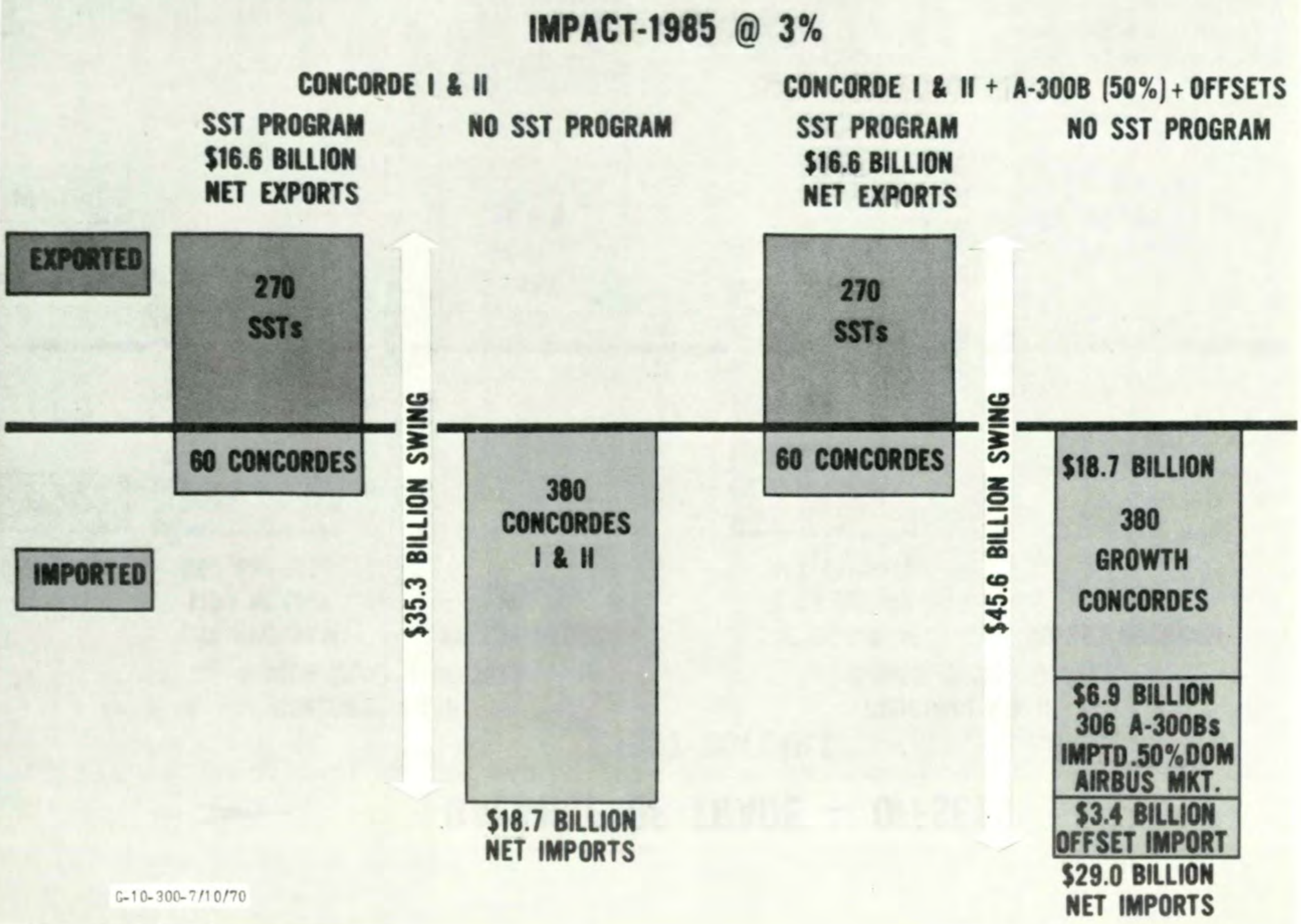
G-8-303-7/10/70

BALANCE OF TRADE – OFFSETS



G-9-300-7/10/70

BALANCE OF TRADE – CURRENT DOLLARS



BALANCE OF TRADE – HOW U.S.A. IS DOING

(DOLLARS IN BILLIONS)

	1965	1966	1967	1968	1969	1970
OTHER INDUSTRIAL MACHINERY AND PARTS	2.1	2.2	2.2	2.4	2.6	3.9
CIVILIAN AIRCRAFT ENGINES AND PARTS	1.0	1.0	1.5	2.1	2.0	2.5
CHEMICALS, EXCLUDING MEDICINALS	1.4	1.6	1.7	2.0	2.1	2.6
CONSTRUCTION AND NON-FARM MACHINERY	1.6	1.7	1.7	1.7	1.9	1.4
HIDES, MINERALS, WOODS, ECT.	1.3	1.4	1.5	1.6	1.7	1.3
ELECTRICAL, ELECTRONIC MACHINERY PARTS	.8	.8	.9	.9	1.0	1.0
BUSINESS AND OFFICE MACHINES, COMPUTERS	.5	.5	.7	.7	.9	1.2
TOBACCO UNMANUFACTURED	.3	.3	.3	.4	.5	.4
SCIENTIFIC, PROFESSIONAL EQUIPMENT	.3	.4	.4	.4	.5	.5
CONSUMER GOODS, EXCEPT AUTOS	–1.5	–1.9	–2.1	–3.0	–3.9	–4.8
FUELS AND LUBRICANTS	–1.3	–1.3	–1.1	–1.4	–1.7	–1.5
AUTOMOTIVE VEHICLES, PARTS AND ENGINES	1.0	.5	.2	–.8	–1.4	–2.3
BUILDING MATERIALS, EXCEPT METALS	–.6	–.8	–.8	–1.1	–1.2	–.9
TIRES, RUBBER, RESINS, GUMS, ETC.	–.7	–.7	–.7	–.9	–1.0	–.3
IRON AND STEEL PRODUCTS	–.6	–.6	–.7	–1.4	–.8	–.5
OTHER METALS	–.7	–1.0	–1.1	–1.2	–.8	–.7
PAPER AND PAPER BASE STOCKS	–.7	–.8	–.7	–.6	–.7	–.4
FOODS, FEEDS AND BEVERAGES	1.0	1.0	.4	–.5	–.5	–.3
TEXTILE SUPPLIES AND MATERIALS	–.1	–.3	.1	–.2	–.3	–.8
STEEL MAKING MATERIALS	–.4	–.4	–.4	–.4	–.2	–.2
OTHER	.2	.3	–.1	–.1	–	–
TOTAL	4.9	3.9	3.9	.6	.7	2.1

G-12-300-2/22/71

SOURCE: Dept. of Commerce

PRODUCTIVITY - TRAFFIC GROWTH RATES

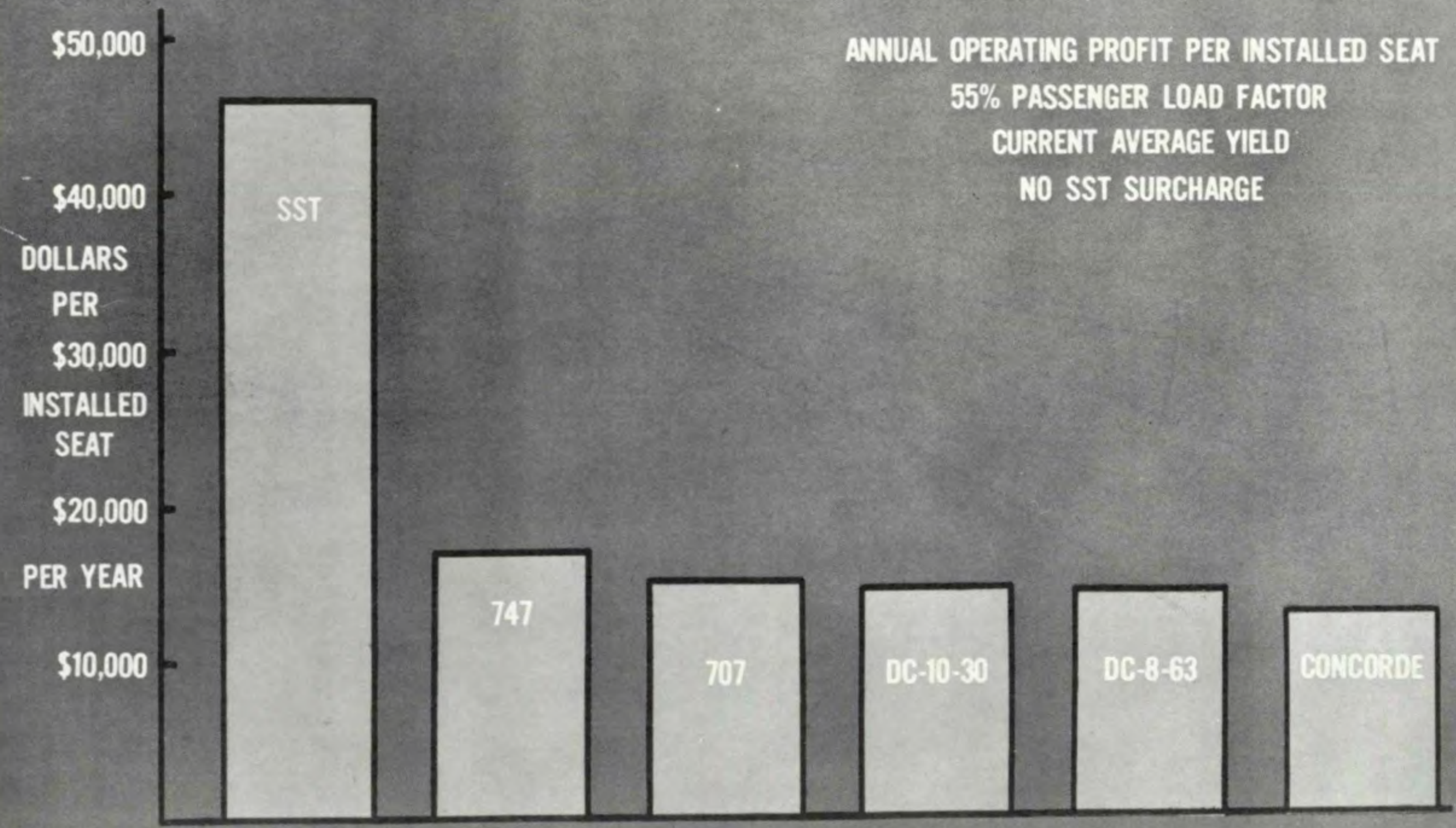
ANNUAL RATES IN PERCENT

BETWEEN U.S. AND CANADA AND:	ACTUAL 1966-1968	FORECAST 1966-1975	FORECAST 1975-1980
EUROPE	18	14	8
CENTRAL AMERICA	16	13	9
HAWAII	21	17	12
FAR EAST	17	19	13
SOUTH AMERICA	13	14	10
AUSTRALIA AND NEW ZEALAND	24	20	13

SOURCE: BOEING

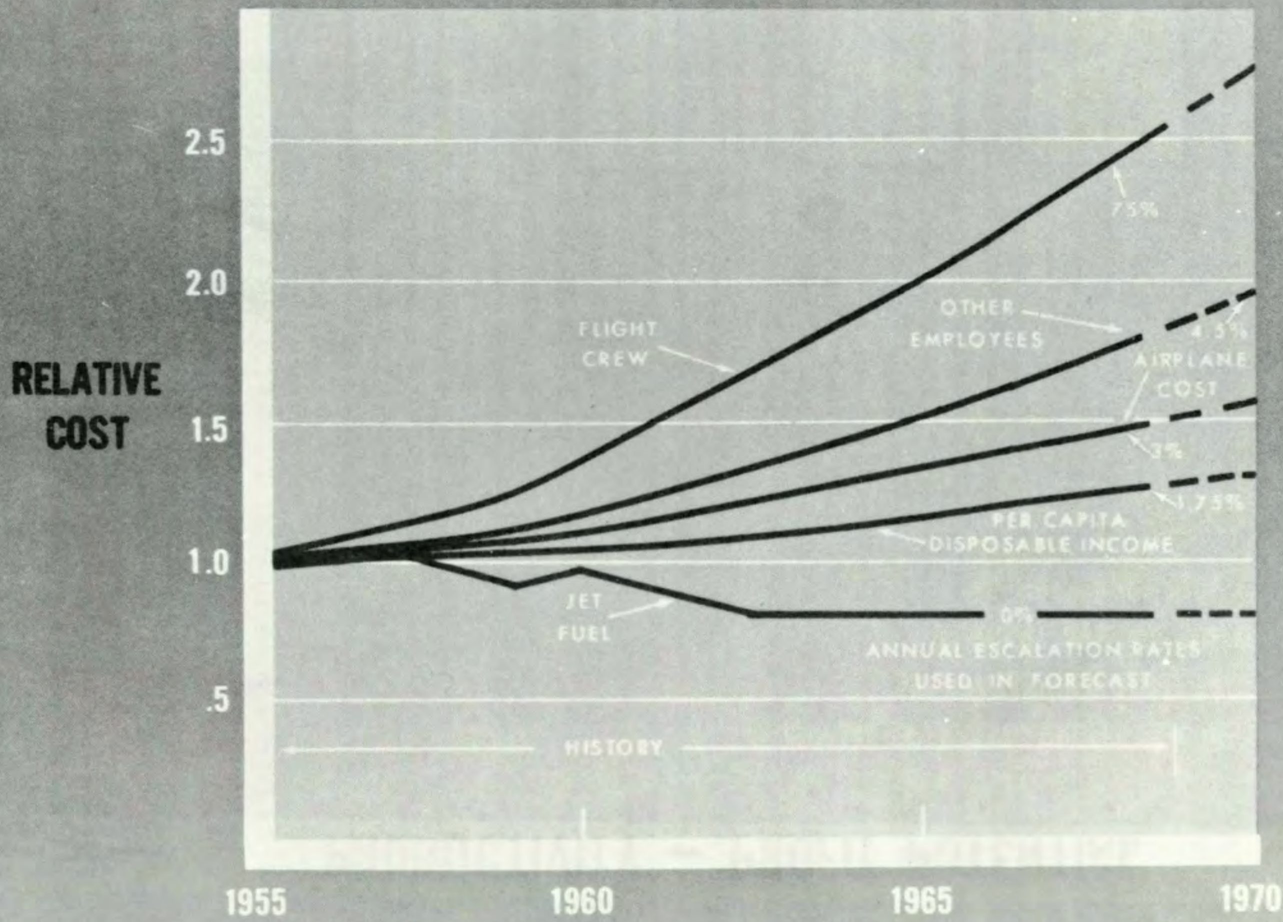
H-14-300-7/31/70

PRODUCTIVITY – PROFIT POTENTIAL



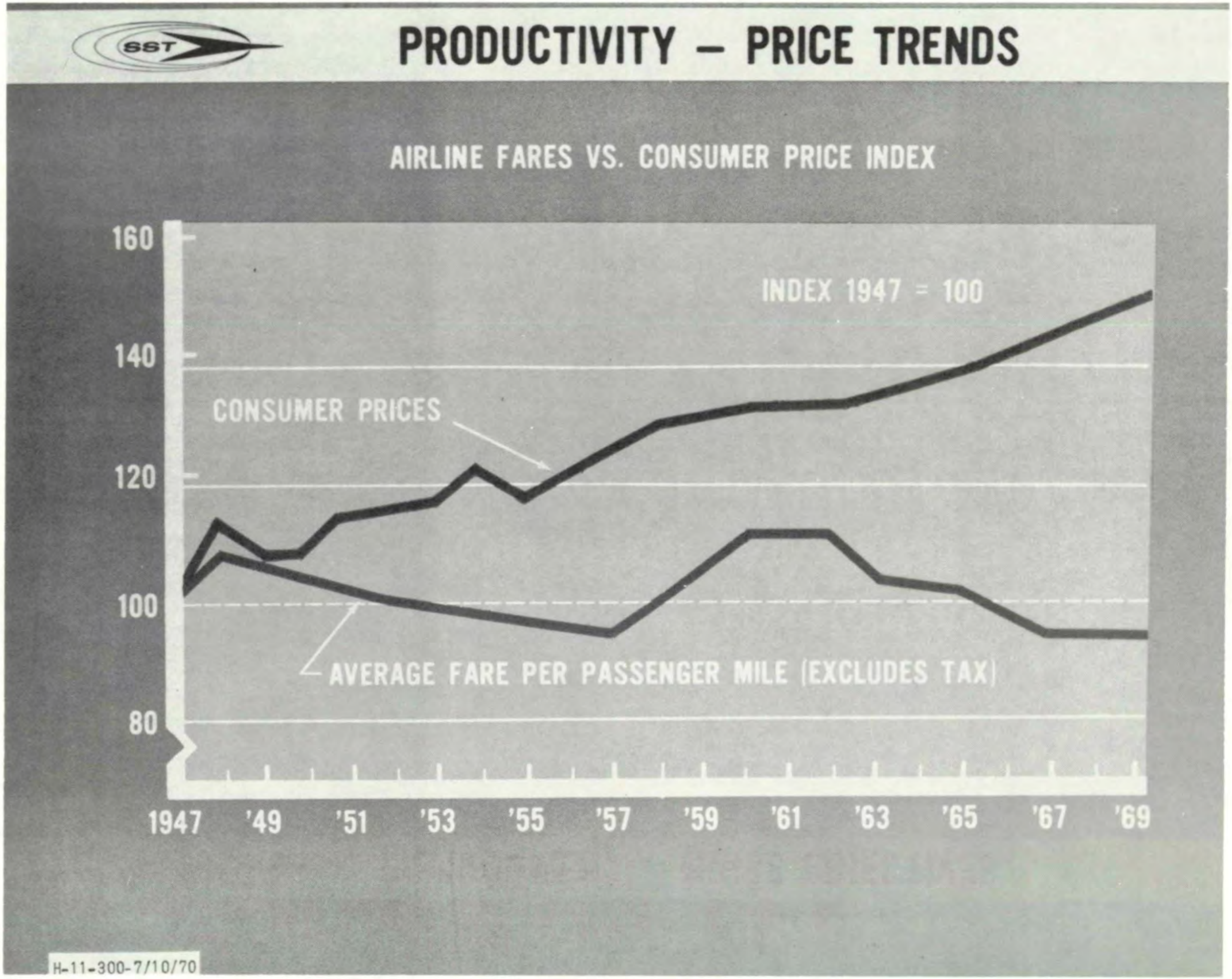
H-15-300-8/7/70

PRODUCTIVITY – COST ESCALATION



SOURCE: ATA Facts and Figures

H-10-300-7/10/70


SST
PRODUCTIVITY – PRICE TRENDS
AIRLINE FARES VS. CONSUMER PRICE INDEX
INDEX 1947 = 100
CONSUMER PRICES
AVERAGE FARE PER PASSENGER MILE (EXCLUDES TAX)
160
140
120
100
80
1947
'49
'51
'53
'55
'57
'59
'61
'63
'65
'67
'69
H-11-300-7/10/70

ENVIRONMENT – NOISE OBJECTIVES

TO ACHIEVE NOISE LEVELS CONSISTENT WITH THOSE REQUIRED FOR CERTIFICATION OF NEW FOUR-ENGINE, INTER-CONTINENTAL, SUBSONIC TRANSPORT AIRCRAFT.

F-6-200-2/22/71

CLIMATIC EFFECTS

CONCERN	SCEP REPORT	REF. PAGE
CARBON DIOXIDE	– CO_2. NO PROBLEM	72
INCREASED WATER VAPOR	– 0.2 PPM INCREASE (3.0 TO 3.2 PPM) IN WATER VAPOR ON GLOBAL AVERAGE AND 2.0 PPM INCREASE (3.0 TO 5.0) IN NORTH TEMPERATE LATITUDES.	73
INCREASED CLOUDINESS	– MAY INCREASE FREQUENCY THICKNESS AND EXTENT OF POLAR CLOUDS.	210
	CANCELLATION OF SST WILL INCREASE CLOUDINESS IN TEMPERATE ZONES.	
OZONE & ULTRAVIOLET RADIATION	– REDUCED OZONE COULD ADMIT MORE ULTRAVIOLET RADIATION TO LOWER ATMOSPHERE.	100
	OZONE CHANGES LIE WELL WITHIN NORMAL DAY-TO-DAY AND GEOGRAPHIC VARIABILITY -- CHANGES SHOULD BE INSIGNIFICANT.	106
PARTICLES; SULFATES, HYDROCARBONS AND SOOT	– WILL CAUSE CONCENTRATIONS OF CO, NO, SO_2, HC AND SOOT RANGING FROM FRACTIONS OF A PPB TO 68 PPB IN NORTH TEMPERATE LATITUDE.	73
	ROLE OF PARTICULATES IN ALTERING HEAT BUDGET IS SMALL.	107
	EMISSIONS OF PRODUCTION SST ENGINES WILL BE APPRECIABLY DIFFERENT THAN USED IN STUDY.	73
	USE OF JET FUEL WITH 0.01% SULFUR CONTENT INSTEAD OF 0.05% WOULD REDUCE EMISSIONS BY 80%.	74
TEMPERATURE CHANGE	– THE ROLE OF PARTICULATES IN ALTERING HEAT BUDGET IS SMALL AND WOULD TEND TO WARM THE STRATOSPHERE.	107
	WATER VAPOR WILL INCREASE TEMPERATURE AT GROUND LEVEL LESS THAN 0.1°C. AND COOL STRATOSPHERE A FEW DEGREES.	106
LARGE-SCALE SST OPERATIONS	– CANNOT BE CERTAIN ABOUT MAGNITUDE OF EFFECTS DUE TO UNCERTAINTIES IN AVAILABLE INFORMATION.	107
	UNCERTAINTIES SHOULD BE RESOLVED BEFORE LARGE-SCALE SST OPERATIONS.	107

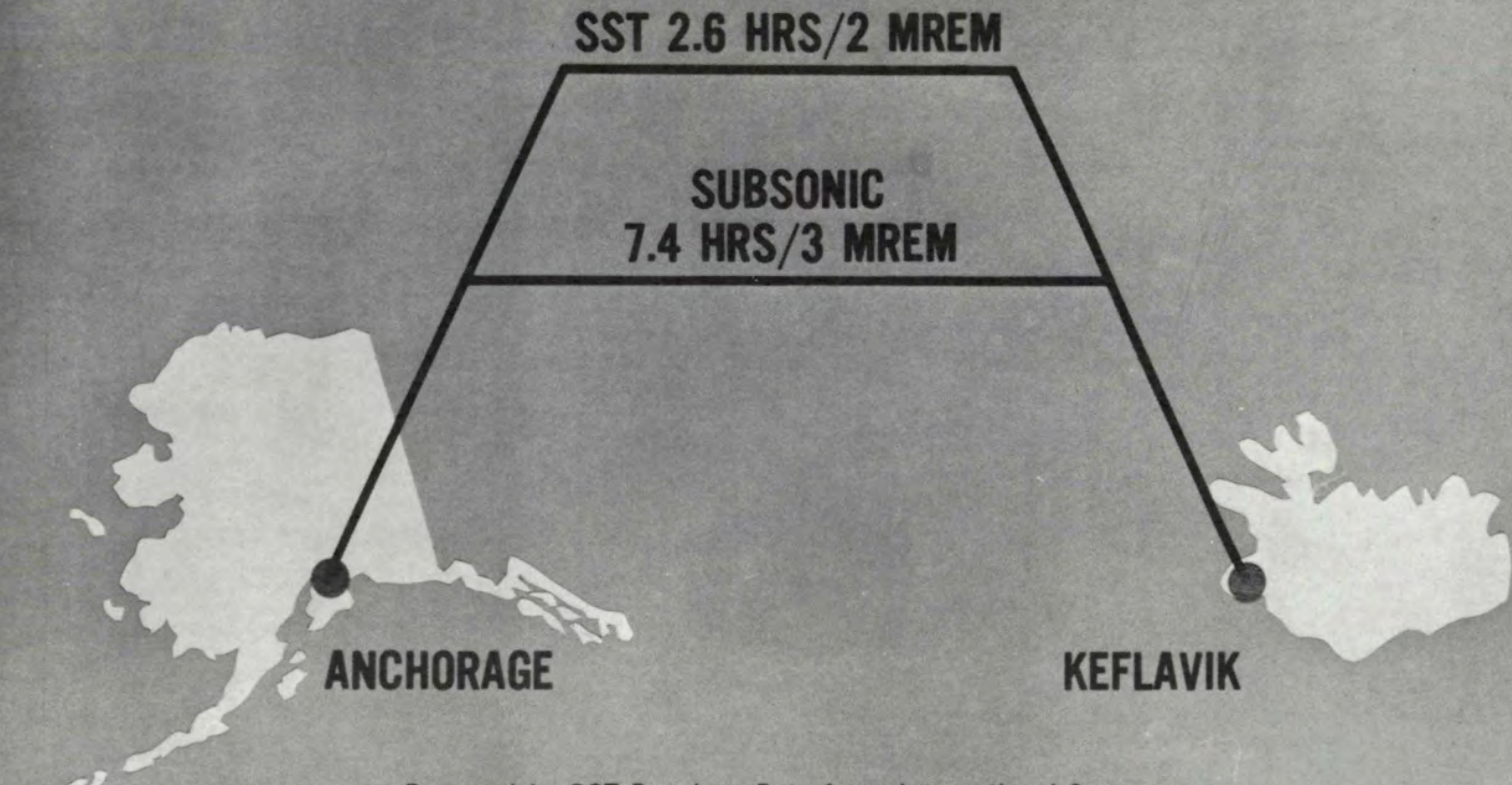
F-38-200-2/22/71

ENVIRONMENT – RADIATION/GEOGRAPHY

LOCATION	DOSE RATE, MREM/YEAR
OLYMPIC PENINSULA, WASHINGTON	35
MID-ATLANTIC	55
NEW YORK CITY	70-130
DENVER - COLORADO SPRINGS	130-200

F-15-200-2/22/71

ENVIRONMENT – RADIATION/PROFILE



Prepared by DOT Based on Data from: International Comm. on Radiological Protection Confirmed by: Dr. Tribus & Dr. Rossi

F-14-200-7/10/70

SST ENVIRONMENT – ENVIRONMENTAL ADVISORY COMMITEE

DR. S. FRED SINGER – DEPUTY ASSISTANT SECRETARY, DEPARTMENT OF THE INTERIOR (CHAIRMAN*)

DR. MYRON TRIBUS – SENIOR VICE PRESIDENT FOR RESEARCH AND DEVELOPMENT, XEROX CORPORATION

DR. WILLIAM W. KELLOGG – ASSOCIATE DIRECTOR, NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

DR. LESTER MACHTA – DIRECTOR, AIR RESOURCES LABORATORY, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

MR. H. J. MASTENBROOK – ATMOSPHERIC PHYSICIST, U. S. NAVAL RESEARCH LABORATORY

MR. GEORGE CHATHAM – AERONAUTICS AND SPACE SPECIALIST, LEGISLATIVE REFERENCE SERVICE, LIBRARY OF CONGRESS

DR. HARALD ROSSI – PROFESSOR OF RADIOLOGY PHYSICS, COLUMBIA UNIVERSITY AND CHAIRMAN, FAA COMMITTEE ON RADIO BIOLOGY ASPECTS OF THE SST

DR. PAUL TOMPKIN – CHAIRMAN, FEDERAL RADIATION COUNCIL

DR. ROBERT M. WHITE – ACTING ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

DR. S. J. GERATHEWOHL – CHIEF, RESEARCH PLANNING BRANCH, OFFICE OF AVIATION MEDICINE, FAA

DR. ARTHUR H. WOLFF – DEPUTY ASSISTANT ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT, ENVIRONMENTAL HEALTH SERVICE, HEW

* CHAIRMAN WILL DESIGNATE ADDITIONAL MEMBERS AS REQUIRED.

F-2-200-2/22/71

ENVIRONMENT – CTAB SST ENVIRONMENTAL RESEARCH PANEL

DR. FREDERICK HENRIQUES (CHAIRMAN)	– CHAIRMAN, BOARD OF TECHNICAL OPERATIONS, INCORPORATED
DR. THOMAS F. MALONE	– DEAN OF THE UNIVERSITY OF CONNECTICUT
DR. PAUL P. MACCREADY, JR.	– FORMER PRESIDENT, METEOROLOGICAL RESEARCH, INCORPORATED
DR. JOSEPH D. HIRSCHFELDER	– PROFESSOR OF CHEMISTRY, UNIVERSITY OF WISCONSIN
DR. HARRIET L. HARDY	– ASSISTANT MEDICAL DIRECTOR, MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DR. RICHARD S. MILLER	– PROFESSOR OF FOREST ECOLOGY, YALE UNIVERSITY
DR. MARTIN A. POMERANTZ	– DIRECTOR, BARTOL RESEARCH FOUNDATION
MR. ROBERT W. RUMMEL	– VICE PRESIDENT, PLANNING AND RESEARCH, TWA

F-2A-200-2/22/71

ENVIRONMENT – NOISE ADVISORY COMMITEE

PERMANENT MEMBERS:

DR. LEO L. BERANEK, CHAIRMAN: BOLT, BERANEK & NEWMAN, INC.

DR. RAYMOND A. BAUER, HARVARD BUSINESS SCHOOL

DR. JACK L. KERREBROCK, MASSACHUSETTS INSTITUTE OF TECHNOLGY

MR. FRANK W. KOLK, CHAIRMAN: SAE COMMITTEE ON AIRCRAFT NOISE

MR. KENNETH McK. ELDRED, WYLE LABORATORIES

MR. AUBERT L. McPIKE, MEMBER: NATIONAL AIRCRAFT NOISE ABATEMENT COUNCIL

MR. CLIFTON A. MOORE, LOS ANGELES DEPARTMENT OF AIRPORTS

F-3-200-2/22/71

ENVIRONMENT – NOISE ADVISORY COMMITTEE

LIAISON MEMBERS:

MR. HARVEY H. HUBBARD, NASA LANGLEY RESEARCH CENTER

MR. NEWELL D. SANDERS, NASA LEWIS RESEARCH CENTER

DR. JOHN O. POWERS, FEDERAL AVIATION ADMINISTRATION

MR. CHARLES R. FOSTER, DEPARTMENT OF TRANSPORTATION

MR. GEORGE N. CHATHAM, LIBRARY OF CONGRESS

MR. DANIEL R. FLYNN, DEPARTMENT OF COMMERCE

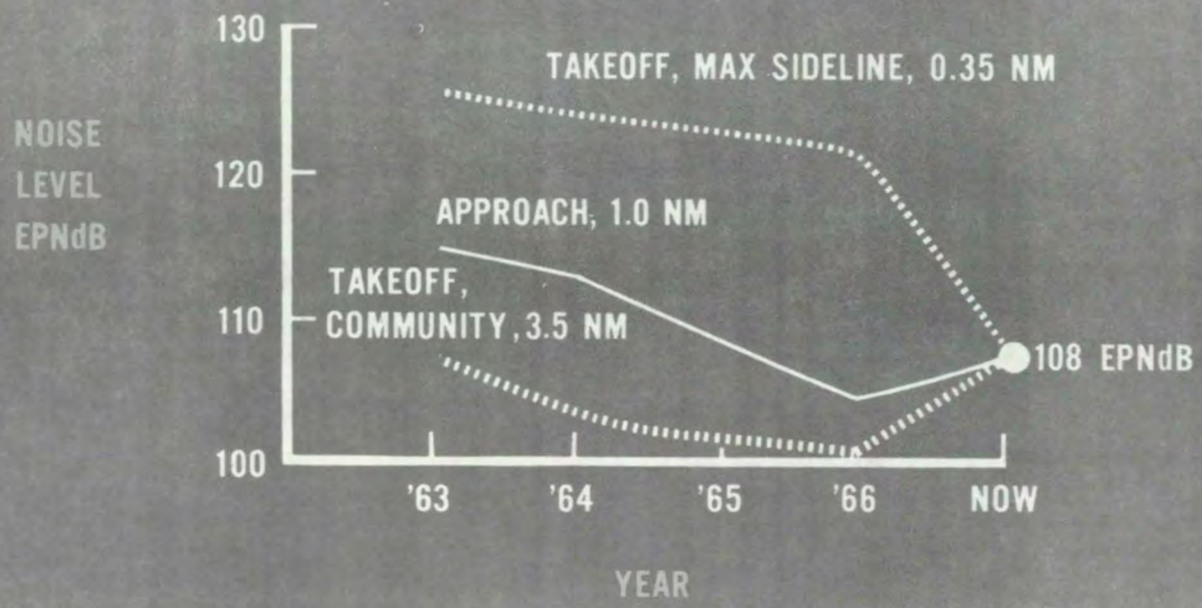
DR. ALEXANDER COHEN, DEPARTMENT OF HEALTH, EDUCATION & WELFARE

DR. HENNING E. Von GIERKE, UNITED STATES AIR FORCE

MR. JOHN C. SCHETTINO, EXECUTIVE SECRETARY: OFFICE OF SST DEVELOPMENT

F-3A-200-2/22/71

ENVIRONMENT – PRODUCTION SST NOISE OBJECTIVES



F-41-200-2/22/71

ENVIRONMENT – NOISE

CONCERN

- ARE PRODUCTION SST NOISE OBJECTIVES ACHIEVABLE

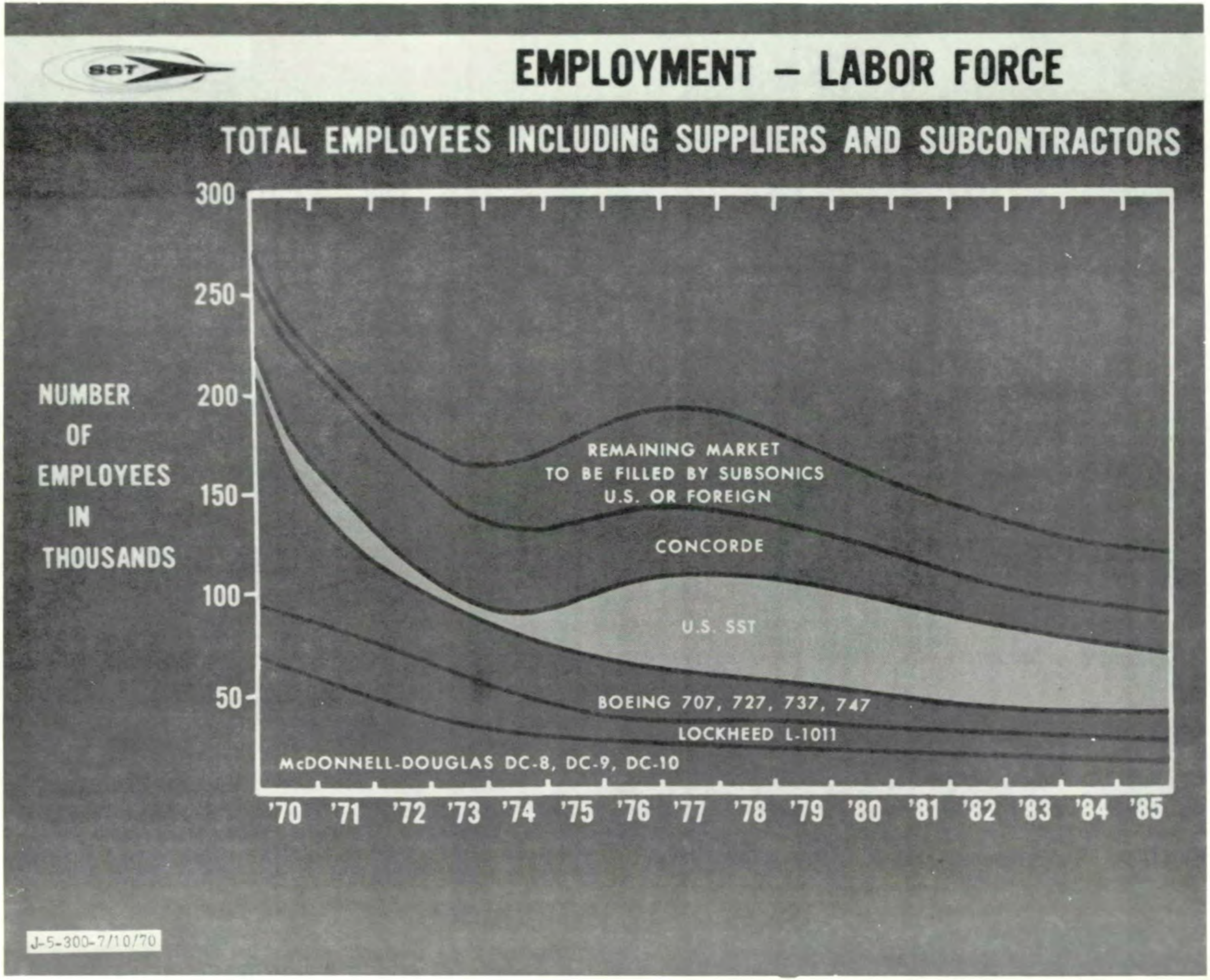
FACTS

- PRIOR TO PRODUCTION COMMITMENT, THE CAPABILITY OF THE COMMERCIAL SST TO ACHIEVE NOISE LEVELS CONSISTENT WITH THOSE REQUIRED FOR CERTIFICATION OF NEW FOUR-ENGINE, INTERCONTINENTAL, SUBSONIC TRANSPORT AIRCRAFT WILL BE DEMONSTRATED
- PROGRAM PHILOSOPHY -- MAXIMUM EFFORT TO BE MADE IN REDUCING AIRCRAFT NOISE
- ADVANCED RESEARCH AIMED AT REDUCING SIDELINE NOISE LEVEL WITHOUT ADVERSE EFFECT ON COMMUNITY NOISE
- SST CONTRACTORS CONFIDENT THAT OBJECTIVES CAN BE ACHIEVED FOR PRODUCTION SST
- SST NOISE ADVISORY COMMITTEE AGREE THAT OBJECTIVES ARE TECHNICALLY FEASIBLE

RESEARCH (FY 71 $6.15 MILLION)

- SIGNIFICANTLY REDUCE SIDELINE NOISE LEVEL WITHOUT UNACCEPTABLE AIRCRAFT PERFORMANCE PENALTY
- FURTHER EXAMINE HUMAN FACTORS
- CONTINUE FUNDAMENTAL RESEARCH

F-9-200-2/22/71


SST
EMPLOYMENT – LABOR FORCE
TOTAL EMPLOYEES INCLUDING SUPPLIERS AND SUBCONTRACTORS
NUMBER OF EMPLOYEES IN THOUSANDS
300
250
200
150
100
50
REMAINING MARKET TO BE FILLED BY SUBSONICS U.S. OR FOREIGN
CONCORDE
U.S. SST
BOEING 707, 727, 737, 747
LOCKHEED L-1011
McDONNELL-DOUGLAS DC-8, DC-9, DC-10
'70 '71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82 '83 '84 '85
J-5-300-7/10/70

EMPLOYMENT – SUMMARY

AEROSPACE EMPLOYMENT TREND

18 MONTHS ENDING MARCH 1971

(000s OF EMPLOYEES)

	TECHNICIANS	SCIENTISTS & ENGINEERS	PRODUCTION EMPLOYEES	ALL OTHER	TOTAL
SEPTEMBER 1969	71	201	694	379	1,345
JUNE 1970	63	198	575	322	1,158
DECEMBER 1970	61	179	515	312	1,067
MARCH 1971	58	175	503	308	1,044
MARCH 1971 (% OF TOTAL)	6%	17%	48%	29%	100%

CUMULATIVE PERCENTAGE DECLINES

FROM SEPTEMBER 1969

	TECHNICIANS	SCIENTISTS & ENGINEERS	PRODUCTION EMPLOYEES	ALL OTHER	TOTAL
SEPTEMBER 1969					
JUNE 1970	11.3	1.5	20.7	15.0	13.9
DECEMBER 1970	14.1	12.3	25.8*	17.7	20.7
MARCH 1971	18.3	12.9	27.5	18.7	22.4

Source: AIA News 6/24 & 11/10/70

J-6-300-2/22/71

36162 7

STATEMENT BY WILLIAM M. MAGRUDER
DIRECTOR, SUPERSONIC TRANSPORT DEVELOPMENT
DEPARTMENT OF TRANSPORTATION
BEFORE THE
SENATE COMMITTEE ON APPROPRIATIONS
MARCH 10, 1971

Mr. Chairman, gentlemen of the committee, I am pleased to have this opportunity to report to you on the status of the United States program to develop and flight test two experimental prototype Supersonic Transport aircraft. I also want to highlight the significant progress that has been made since I last appeared before the Senate Appropriations Transportation Subcommittee on August 27, 1970. At that time I described the extensive SST personal review that I had made before accepting Secretary Volpe's invitation to head up the SST Program for the Government last year.

That review involved, over a period of eight months, discussions with industry, NASA, the Air Force, and key personnel representing the airlines, the financial community, and the Concorde program to ascertain their feelings, interest, and general evaluation of the overall SST programs. At that time I told you that I was convinced as to the strong merits of the SST and the need for our country to undertake this advanced program of far-reaching implications for the future well being of our citizens.

I feel even more strongly today that my impression was and is correct. We are in our tenth year of a 13-year research and development program. We have studied every concern and examined every conjecture relative to the detrimental environmental effects the SST might produce, and have found none that are supported by recognized scientific authorities as being of sufficient concern to halt or delay the program.

There are four key factors often misunderstood by the public. Accordingly, I would like to state as clearly as I can and emphasize as necessary the following conditions:

- The program is to develop and flight test two experimental aircraft in order to keep our options open in the international competition.
- There will be no commitment to production unless the airplane is economically viable and will have been shown to be environmentally acceptable.
- No Government commitments have been made for production appropriations for U.S. SSTs.
- All Government participation will be repaid by means of a sales royalty plan already contractually established.

My testimony before the House Subcommittee on Transportation last week was quite lengthy and the many important facts on such key areas as environmental effects, productivity, balance of trade, employment, international competition, and national benefits are covered in detail in the record. You will recall that I also spoke to these subjects in some detail during my appearance before the Committee last August. Therefore, my intention today is to simply summarize some of these key areas and concentrate on the significant progress made since last summer. I particularly want to highlight the dramatic improvement in the SST noise situation.

PROGRESS

Progress in all areas has been extremely encouraging. Both Boeing and General Electric have been able to remain essentially on schedule in spite of the stringent funding situation.

Funding

As of March 30, 1971, a total of $1,009 billion will have been invested in the program since 1961. The Government's share of this is $864 million of which $708 million has been appropriated and $156 million authorized under the FY 1971 Joint Resolution. Industry's share is $144 million of which $85 million was provided by the manufacturers and $59 million contributed by the airlines. In addition, the manufacturers have also invested $54 million in new facilities and $25 million in nonallowable commercial expenses for a total of $223 million by industry or 21 percent, compared to the $864 million, or 79 percent by the Government.

Schedule and Management

During this fiscal year, the program has advanced well into the final hard design, fabrication, and procurement phase. We are basically on schedule, within budget, and the configuration has remained essentially stable throughout. If anything it appears to be better than predicted.

Engineering manpower peaked in the fall of 1970 with the factory peak scheduled for 1971. Seventy percent of the total manpower required to complete the prototype program will have been expended by the end of FY '71. Presently 14,000 people are working on the prototype program at the Boeing Company, General Electric, the major subcontractors and the suppliers. Through the multiplier factor it safely can be stated that at least 50,000 jobs will result from the SST prototype program.

Monthly DOT/Boeing and DOT/GE management reviews are continuing as well as joint Boeing/GE meetings to ensure that current information is available at all times. Program visibility is good and all program controls appear to be operating effectively.

Reacting to the admonishment by Congress to assure optimum management controls, the Director decided to employ two line Deputies. This was deemed advisable in view of the increasing program tempo and the flexibility that it would provide in the day-to-day management of internal and external SST office activities.

One deputy, R. E. Parsons, will assist in handling those activities directly related to project management, dealing with the contractors and evaluating project performance and rendering timely direction. The other Deputy, B. J. Vierling, will assist in conducting the necessary staff work and formulating policy recommendations necessary to convert the program to the private sector when the present prototype phase is completed.

The office staffing is still considerably under authorization and we are recruiting to strengthen the following areas: financial management and economic forecasting, on-site field representation, environmental specialist, and data handling and processing specialist. While we have doubled the size of our field representation, we have not been able to staff the on-site field organization with the types or numbers of personnel I feel are required for optimum management, due to the present uncertain nature of the program.

Airplane Progress

The full-scale metal mockup duplicating the prototype design was completed and unveiled in June 1970, on schedule and below budget. Since that time, it has been continuously in use progressively verifying the structural design of the prototype aircraft and the optimum location of ducts, tubing, wiring and equipment and checking functional installation of systems within the structure.

A steady flow of drawings has continued from the design tables to the factories and shops across the nation. Over half of the detail design has been released for manufacturing with the 75% point scheduled by the end of FY 1971. Detail parts fabrication is underway both at The Boeing Company and the seven major subcontractors.

The major subcontractors were all placed under contract last year. The team consists of major companies across the country - Aeronca, Fairchild Hiller, North American Rockwell, Northrop, Rohr, Cleveland Pneumatic and Heath Tecna. Each firm has invested its own capital in special facilities and equipment to accommodate use of the latest manufacturing technologies and has agreed to share the costs of the prototype phase. The first major airplane section begins assembly this month at Northrop.

Contracts have been awarded for the majority of the airplane systems and substantial orders have been placed for titanium raw materials. There are approximately 550 Boeing first tier suppliers involved, located in 40 states. Raw materials began arriving at Boeing in June 1970 in support of the detail parts fabrication. Finished parts are accumulating in storage as required for the wing major assembly start scheduled for June 1971.

Now, I want to describe in some detail the actual hardware construction that is underway, which is extensive.

The SST prototype manufacturing effort is distributed approximately 60% at Boeing and 40% at the subcontractors. The program participants have made substantial investments in new facilities for Phase III, most of which are complete and in operation.

Boeing's $35 million investment in new facilities at the Development Center includes a $6 million titanium processing facility built by Austin Company M-1 of Chicago, Illinois, a $2 million high bay extension built by Baugh Construction Company of Seattle, Washington, and a $2-½ million Control Development facility also built by Baugh Construction Company of Seattle. The latter facility is necessary in design and development of flight control M-2 systems and in the operation of flight simulators driven by $1.7 million computers leased from the C. C. Leasing Corporation of New Jersey for $30,000 per month.

The simulators were designed by Boeing, and test rigs built by Bertea of Irvine, California, and General Electric Co. of Waynesboro, Virginia. Additional efforts of many companies were required in making the facility operational including contracts for:

- Electronic attitude indicator with Norden Company of Connecticut for $300,000.
- Attitude directional display with Sanders Company of New Hampshire for $150,000.
- Various displays with Sperry Company of Arizona for $131,000.
- Horizontal situation display with Astronautics of Wisconsin for $65,000.

Lesser miscellaneous contracts include:

Weber Co. and Kratos Co. from California

Hartman Co. of New York

Collins Co. of Iowa

National Cash Register Co. of Ohio

Motorola Co. of Arizona and

Tektronics Co. of Oregon

The facility is computerized and has extensive flexibility for simulating the myriad of flight conditions. Hundreds of the world's airline pilots have already flown the SST simulators and the prototype design reflects their inputs.

The $6 million titanium processing facility was completed last year by Austin Company of Chicago, Illinois, and has extensive hot work capability for manufacturing aircraft longerons. Special purpose machines for the hot forming capability were made jointly by Boeing of Seattle and Loma, Inc., of New York.

This facility can also produce fuselage frames and includes a special stretch straightener capable of handling sections up to 50 feet long. Auxiliary equipment includes a stretch straightener built by Boeing and Loma, Inc., of New York and the $80,000 power supplies built by Research Inc., of Minneapolis, Minnesota.

Airplane frames are hot formed on standard machines built by Cyril Bath Company of Cleveland, Ohio which are fitted with special adapters for titanium. Processing frame sections by the resistance heating method (10 X faster) was developed by Boeing in Seattle.

Heavy wing extrusions made by Curtiss-Wright of Buffalo, New York, are M-3
formed in Boeing's $½ million large furnace made by Lindberg Company of Chicago, Illinois, and subsequently machined in large multimillion dollar spar mills made by Cincinnati Milling Machine of Ohio.

The Boeing cleaning and chemical milling facility built by Austin Company of Chicago, Illinois, represents a $1 million investment for processing titanium airplane parts. Supporting facilities include a $650,000 penetrant inspection line built by Austin Company of Chicago and a $575,000 coating line made by Lentz Company of Tacoma, Washington.

The facility is capable of processing parts over 50 feet in length.

The large bonding furnace facility at Boeing built by Lindberg Company of Chicago is used in manufacturing honeycomb sandwich panels. Supporting equipment includes a $1.5 million electron beam welder built by Sciaky of Chicago, Illinois, which has been installed and operating in Seattle, Washington.

Another $1.3 million Sciaky electron beam welder is currently being installed M-4
in Boeing's plant in Seattle, Washington.

The first prototype airplane wing rib was produced recently using the electron beam welder and is ready for assembly. M-5

The $76,000 new plasma arc welder made jointly by Boeing and Sciaky Company of Chicago, Illinois, has a 65 foot capacity for splicing integrally stiffened panels and was used to make the first integrally stiffened panel for the prototype airplane last fall. M-6 M-7

Integrally stiffened skins for the wing have been formed using heated ceramic tools which match the required airplane contours. M-8

Over 54% of the wing tool assembly models have been completed at the Boeing Seattle plant and assembly tools for the lower wing spars have been completed and parts assembly started on 22 February 1971. M-9

The $2 million high bay facility made by Baugh Construction Company of Seattle has been designated for assembly of the prototype airplanes. Currently the prototype mockup is the largest tool in place at Boeing. The mockup provides for engine fit up and space capability checks, system installations and wire bundle verification and checkout of the main landing gear, in the extended position as well as the retracted or up position. Boeing also has extensive facilities supporting the Development Center effort in Seattle such as the detail fabrication plant at Auburn.

The multimillion dollar Auburn plant has some of the largest machining facilities in the world such as large spar mills built by Giddings and Lewis of Fondulac, Wisconsin and Cincinnati Milling Machine Company of Ohio.

The Auburn plant also has extensive numerical control milling capability produced by Sunstrand Company of Rockford, Illinois, Kearney and Treaker Company of Milwaukee, Wisconsin, and Cincinnati Milling Machine of Ohio. Additional machines used in manufacturing airplane details include:

Numerical Control Hydrotels made by Cincinnati Milling Company of Ohio totalling $175,000.

Numerical Controlled Routers from Cramic Ltd., of England totalling $450,000.

Sine Wave Welders by Sciaky Company of Chicago, Illinois, totalling $420,000.

Four numerically controlled profile mills from Sciaky Company.

Four Knee Milling machines from Bohle Company of Germany totalling $178,000.

Five Gorton tracer mills from Racine, Wisconsin, totalling $114,000.

Numerically controlled digitizer by Gerber Scientific Instrument Company of Hartford, Connecticut, for $203,000.

Pratt and Whitney jig borer from Hartford, Connecticut, totalling $146,000.

Many smaller machines used in detail fabrication at Auburn include:

Numerical control drills by Pratt and Whitney of Connecticut.

Portable drills by Omark of Houston, Texas.

Metal Shears by Luter Work in Germany.

Abrasive saws from Tysamen of Knoxville, Tennessee.

These machines along with the titanium facility at the development center have already produced some of the world's largest titanium aircraft components. For example, the 20 foot titanium landing gear beam used on the 747 was developed in the SST facility.

The subcontractor support to Boeing is quite extensive.

A $5.6 million contract has been signed with Aeronca of Middletown, Ohio, for various airplane components including the core assembly for the left hand elevator and brazing fixture grids for the trailing edge wedges for flaps and flaperons, and fabrication tools for the inboard flaps.

Part of Aeronca's $1.3 million facility investment for Phase III includes a $22,000 argon gas system which was installed by Air Products of Middletown, Ohio, and is used in brazing titanium honeycomb wing panels, a new breakthrough in technology by Aeronca for the SST Program.

One of the larger subcontracts has been signed with two divisions of the Fairchild-Hiller Republic Company for $34 million to be cost shared.

Body skin panel assembly models have been completed in Hagerstown, Maryland, and the vertical stabilizer skin panels machined to the required contours at Farmingdale, Long Island, New York.

Fairchild's new facilities investment for the SST Program in the two divisions exceeds $2-1/2 million.

North American Rockwell Company of Los Angeles, California, has completed most of the work on tools for the wing box assembly fixture which is part of a $32.2 million cost sharing contract with Boeing.

A portion of the assembly model tools for the leading edge flaps has been completed by the North American Rockwell Company in the Tulsa, Oklahoma, Division. The first prototype part for the 4 foot leading edge closeout rib has been completed at North American Rockwell in Los Angeles, California, as has the outboard wing skin panel. M-10

North American has invested more than $4.2 million of their own money in new facilities which includes a brazing furnace which was made by Lindberg Company of Chicago, Illinois.

At the Northrop Company in Hawthorne, California, the cab major assembly jig is rapidly approaching completion as part of their $12 million cost sharing contract for the nose and forward fuselage.

Test hardware has also been completed at Northrop which was used for verification of the manufacturing process. Northrop has invested approximately a $½ million in their own money in new facilities to date.

In Chula Vista, California, the Rohr Company has a $17.8 million cost sharing contract with Boeing for the propulsion pods and landing gear doors.

Test inlets have been completed and delivered to Boeing for use in the engine test program and also several inlet door assembly models have been completed.

Heath Tecna of Kent, Washington, has a $1.8 million contract with Boeing for the SST aft body section. Forming tools have been completed as has the polyimide bonding jig. Prototype parts for a 5 foot section of the tail cone have been completed on these tools.

At the Ladish Company in Cudahy, Wisconsin, forging dies for the landing
gear outer cylinder have been completed and forgings formed with these M-11
dies utilizing the world's largest counterblow hammer. These forgings weigh over 16,000 pounds and are part of a $½ million contract. The Wyman Gordon Company of Grafton, Mass., also utilizes the Air Force's largest free world forging facility made by Loewy Company of Pittsburgh, to fabricate landing gear forgings totaling over $140,000.

Forgings have been inspected and shipped to Cleveland Pneumatic who has
a $2.1 million contract with Boeing for the prototype SST landing gear. M-12

There are several thousand smaller subcontractors on the SST Program producing the thousands of additional parts, components and systems that go into the prototype aircraft. These include companies like Air Research of Torrance, California, the Bertea Company of Irvine, California, etc.

Approximately 6,000 items have already been received by Boeing from subcontractors and vendors throughout the country for the prototype airplane.

Engine Progress

General Electric has made steady advances in the development of the prototype engines for the U.S. SST. The engines continue to demonstrate their ability to meet thrust and fuel consumption values equal to or better than those required. The engine program remains on schedule and within budget.

Significant program accomplishments have been numerous; however, the following are particularly noteworthy:

One engine successfully operated for more than 80 hours at simulated 1,800 mph cruise conditions and established a new world's thrust record of 69,900 lbs. for aircraft gas turbine engines.

One engine successfully operated for 150 hours at rated turbine inlet temperature or above.

Smokeless operation has been demonstrated.

In December 1970 the first of the actual flight test configured engines became available and testing was initiated. During the first half of M-13
FY '71, some 400 hours of testing were accomplished bringing the total to over 1,500 hours for the Phase III program.

Much of the General Electric testing is performed in their $12 million altitude test facility which was fully paid for by General Electric as part of their $20 million investment in new facilities.

Additional testing is performed at General Electric's Peebles, Ohio, facility in rural Ohio where extensive cross wind and noise testing is performed. M-14

With the design of the flight test engine completed, material procurement and manufacturing are proceeding as scheduled. General Electric's first tier suppliers number approximately 2,000 and are situated in 38 states. General Electric has placed 118 million dollars worth of orders out of an estimated Phase III total of 170 million dollars.

Noise Suppression Progress

The Boeing Company is working closely with the engine company, members of industry, and the Government on a coordinated aggressive noise technology program. Recent testing has revealed three significant breakthroughs in noise reduction which have dramatically improved the SST noise posture.

1. Actual ground tests on the prototype engine and detailed flight performance analysis have revealed significantly less effective perceived noise than was estimated initially.
2. Wing flap tests in the NASA wind tunnel showed an improvement in lift and drag and a marked beneficial effect on takeoff thereby improving the altitude of the airplane over the community during climbout.
3. Recent tests of advanced suppressors are encouraging in their acoustic and performance characteristics.

The combination of these features, characteristics and suppressor developments will result in achieving a marked reduction in SST noise.

Prior to production commitment, the capability of the commercial SST to achieve noise levels consistent with those required for certification of new four-engined intercontinental subsonic transport aircraft will be demonstrated.

Airline Reviews

The Airline/SST Committee completed a review of the Prototype and Production design status in November 1970 and continues to be actively engaged in all phases of the program. In April this year a major review of the engine and noise suppressor studies and experimental work for the eventual production aircraft will be held.

Environmental Effects Progress

Scientific authorities who have counseled the Government over the past five years have voiced the considered opinion that in the light of existing data there is no evidence of likelihood that SST operations will cause significant adverse effects on our atmosphere or our environment. Nevertheless, concerns have been expressed which must be fully and professionally examined. Therefore, an Environmental Advisory Committee was formed in July 1970, composed of some of the most knowledgeable atmospheric, radiation and noise specialists in the United States. This committee advises me on these matters and recommends and plans research in those areas where uncertainties may exist.

Likewise, a Community Noise Advisory Committee has been established to counsel us in this very important area.

Comprehensive research programs in the key areas of climatic effects, cosmic radiation and noise reduction have been defined and are being undertaken. Already, as I have mentioned, dramatic improvements in the community noise reduction area have been achieved.

FUNDING OPTIONS

Last April the original funding request for FY-71 was reduced from $315 million to $290 million and the DOT estimated total cost for Phase III was placed at $1,283 million.

Judicious replanning of schedules, deferral of work to subsequent phases, and general belt tightening allowed us to gain the assurances of the two prime contractors that with timely and adequate future funding there was still a high probability of holding the original schedule and total cost estimate (November 1972 and $1,207 million) even with the reduced funding in FY-70 and FY-71. We are currently trying to control to this plan by utilizing all in-house Boeing and General Electric management pressure and maintaining the major subcontractors as originally planned.

If we receive the funding as originally requested, i.e., $290 million for FY-71 and $235 million for FY-72, I believe we will be able to recover schedule time lost under the continuing resolution and meet a March 1973 first flight date within our Phase III estimate of $1,283 million. This will permit sufficient funds early in FY-72 to support the rapid buildup and schedule acceleration necessary to effect the transition from the continuing resolution to the $290 million level. The risk of schedule slippage is obviously higher now than if we had been able to proceed on a timely basis, but we believe it is no higher than that assumed by the contractors when they previously gave us assurance that they could maintain the November 1972 flight date within the $1,207 million cost figure.

The costly option would be to remain at the level of the continuing resolution, i.e., $210 million for FY-71. This would result in a schedule impact of at least five months (March 1973 to August 1973) and would require renegotiation of both prime and major subcontracts with as associated unfavorable loss to the Government of the existing cost overrun points. It should be noted that, while the cumulative FY-71/FY-72 funding would be less due to our inability to recover schedule time in FY-72, the total Phase III cost impact would be appreciably higher. Preliminary estimates of this impact range from $95 to $115 million depending on our ability to negotiate the prime contracts and, in turn, the prime contractors' ability to negotiate with the major subcontractors. The element of fiscal doubt introduced by such a drastic program change does not enhance the Government's chances of controlling costs or schedule.

THE INTERNATIONAL THREAT

The great potential for a major breakthrough in the speed of commercial transportation has been recognized by aeronautical engineers and scientists for well over the past decade. Now SST programs by three nations are well into the final stage of proof by flight test. DOT information indicates that both the British/French Concorde and the Russian TU-144 have performed satisfactorily at all speeds, including the design supersonic cruise, and are well on the way to demonstrating that the SST age has definitely arrived and cannot be ignored.

As of the end of 1970, the Concorde prototype airplanes (001 and 002) had completed a total of 376 hours of development flying. Of these total hours, 86 have been at supersonic speeds and approximately 12 have been at supersonic cruise speed. The total number of flights is 188 with 98 of these involving supersonic flight. The highest Mach number achieved to date is 2.07 (1,360 mph) and the highest altitude is 58,000 feet. The TU-144 is estimated to have flown over 400 hours with the highest Mach number being about 2.2 (1,450 mph).

Comparative characteristics and status of the competing SSTs are shown in the charts. E-4
E-5

Next I would like to discuss the Concorde and its economic potential in some detail.

Concorde E-1

The British/French supersonic transport is a pure delta wing airplane. This differs from the U.S. SST, which features a conventional horizontal tail, allowing the use of high-lift devices on the wing for better low-speed performances. As a result, the U.S. plane has shorter takeoff distances and higher rates of climb over the community, thereby resulting in lower community noise and better subsonic performance. The Concorde is smaller and shorter, about the length of a Boeing 707, and carries about half the payload of the SST. It is also slower, being constructed of aluminum, which loses strength at the higher speeds which produce higher skin temperatures. By employing a more advanced technology and using titanium, the Boeing 2707 is being designed to cruise at just under 1,800 mph. It should have advanced model structural growth capability to speeds over 2,000 mph. Approval has been given for construction of six production Concorde models, in addition to the two flying prototypes and two pre-production models currently under construction. Model specifications and performance guarantee negotiations appear to be complete at BOAC and Air France. Sales agreements could occur as early as March 1971. Reportedly, an advanced model Concorde is also being considered which would be larger and therefore more competitive with the American SST and the State Department has indicated Germany may join in the financing of this advanced model.

Skepticism regarding the economic viability of the Concorde has been heard. When compared with the jumbo jets on the basis of seat mile costs alone, we could draw the conclusion that the Concorde will compare unfavorably. However, a quick review of the Concorde performance to date versus what the engineers had laid out in their test plans, gives us good reason to believe that the Concorde will perform as designed. When one recalls the original 707 range and payload, there is no basis at this time to question the adequacy of the Concorde's range/payload, since all indications are that the first Concorde will carry its design payload across the Atlantic and will have better range than the first 707 in service which has a range of about 3,300 statute miles with full payload.

The results of the Concorde test program will go a long way toward answering the question, "how profitable will the first supersonic transports be?" The Concorde has performed better than predicted in many areas. Both prototypes are flying at their supersonic cruise speed and have not encountered any serious difficulties. The specific fuel consumption and vital aircraft operating characteristics have been generally established for the speed regime through Mach 2.0 (about 1,350 mph) and have confirmed engineering estimates.

In any event, one must recognize that the Concorde introduces a new class of transportation. It will be the queen of the international commercial aircraft fleet as the first of a new generation transport because of its much shorter trip times. History has shown that speed has value, and the key to the advancement of transportation is the reduction of travel time. This value could contribute to airline revenues in several ways. The most obvious are higher load factors and the willingness of passengers to pay a rather modes premium fare for speed.

The Concorde may have a surcharge, not because it is needed, but to protect the slower subsonic jets flying the same routes from early obsolescence. Even with a small 15% surcharge above economy fare (which is much less than the present difference between the economy and first class fares) the Concorde can return 12.8% after taxes at a nominal 55% load factor. However, at a 70% load factor (equivalent to only 84 passengers) the Concorde could earn over 20% E-8
after taxes. It is reasonable to expect this to be achieved during the first several years of operation, because the Concorde will have a near monopoly of

supersonic operations, and the potential demand for the higher speed will far exceed the number of Concordes available.

The Concorde manufacturers have been emphasizing the desirability of the Concorde as a single-class airplane, with a probable fare level 15% below jet first class, catering to travelers who are sensitive to the value of time savings. With the advent of the U.S. SST, however, in a likely mixed-class configuration, the Concorde would probably be changed accordingly. Furthermore, rather than be used in a head-on competition with the more economical U.S. SST, the Concorde would more likely be shifted to long-range routes with low traffic density, where frequency and load factor considerations would favor a smaller airplane with lower airplane mile costs. On this basis, the initial Concorde would probably continue in service until improved models became available.

Depending on the test program and on the performance of the production Concordes, the British and French Governments could decide to partially subsidize production costs. Since sales price and airline return on investment are directly coupled, a decrease of 20% in the selling price of the Concorde through subsidization could make the aircraft one-third more profitable to the world's airlines, even at a relatively moderate load factor of 55%.

Chart E-8A illustrates the relationship of load factors and the sales price on airlines rate of return. E-8A

The Concorde breakeven load factor for the New York - Paris route at a 15% surcharge is only 7½% higher than the 747 at the current fares and only 2½% higher than the 707. Because of the potential for high load factors, the Concorde should have a good opportunity to earn as much as the advanced subsonic jets, particularly on the high-density routes where it will first be introduced. The U.S. SST's breakeven load factor is about 9 percentage points less than the Concorde and at surcharge fares would be less than both the 747 and 707. E-9

Another way of looking at the effect of load factors on profit is to measure the effect on gross operating profit for the aircraft that will be competing in the supersonic era. Chart E-10A shows that the Con- E-10A
corde at a 15% surcharge will earn a higher annual profit than the long-range DC-10-30 at load factors above 55%, as well as more than the current long-range jets. As a matter of fact the Concorde without any surcharge will earn as much profit at 75% load factor as the stretched DC-8. The U.S. SST, as might be expected because of its much greater productivity, will earn substantially more annual operating profit than any other aircraft, and at 55% load factor will earn about 50% more than the 747 on long-haul routes in transatlantic and transpacific operations.

Russian TU-144 E-2

Unfortunately, we do not have anything like the depth of information on the TU-144 that we have on the Concorde. However, representatives of Pan American and Boeing have inspected the aircraft at Moscow.

The aircraft is a delta wing supersonic transport quite similar in planform to the Concorde. Its range equals that of the Concorde. It is reportedly designed to fly somewhat faster, the higher speed capability being dependent upon the application of titanium in certain critical temperature areas. The payload is slightly less than the Concorde at 120 all-tourist passengers. The TU-144 is the first commercial supersonic transport to have flown and the first to be flown at supersonic speeds. It reportedly will be in airline service this fall.

The Feb. 26, 1971 issue of the Aviation Daily states:

"RUSSIA PLANS FIRST SST COMMERCIAL FLIGHT IN OCTOBER

"Russia's Tupolev Tu-144 supersonic transport flying Aeroflot colors is scheduled to enter commercial operation in October on both domestic and international routes. First domestic route will be Moscow to Khabarovsk located at the extreme eastern edge of Soviet Russia near the Sea of Japan. First international route will be Moscow to Calcutta, India with first flight tentatively scheduled for the week of Oct. 23-27.

"This gives the Russian SST a three to four year jump on the Anglo-French Concorde which is expected to go into commercial operations in 1974 or '75. The U.S. SST, if it continues to be funded at the original rate and if the program continues as planned, will enter commercial service in 1978.

"The Moscow-Calcutta route is approximately 2900 nautical miles and is almost exactly the same distance as London-New York, the route for which the Concorde was planned. The Moscow-Khabarovsk route is farther, about 3300 nautical miles. This may call for an intermediate stop along the route over Siberia."

FAMILY OF AIRCRAFT

I have just expressed to you my conviction that foreign governments do have promising SST developments that are much further along than ours. These aircraft represent a distinct threat to our present position of superiority in the air transport and aviation industry, and further to our ability, as a nation, to continue to maintain a favorable balance of trade. This threat does not concern the U.S. SST alone but reaches out to cover the whole family of aircraft that the United States is now able to offer the nations of the world for any and all missions or transport needs. Before going further into the "family" concept and its effect on the aviation world market, I would like to discuss some key aspects of balance of trade, which is, after all, the prime index of whether or not this country is maintaining economic viability and prosperity on an international basis.

The balance of payments problem is amazingly complex. It is virtually impossible to accurately relate one account like aircraft exports to the total balance of payments. Our payments' balance depends upon many interrelated aspects of the financial and economic fibers of our economy and for that reason the U.S. SST Program analyses are in terms of the balance of trade considerations. Historically, this country has had a strong position in its balance of trade that has enabled it to help other countries of the world and in so doing still maintain equilibrium in the total balance of payments picture.

It is very significant that estimates of the magnitude of the SST impact upon our U.S. balance of trade, made in 1969, were to a large extent, influenced by cables from our overseas sources indicating the Concorde program would probably not reach the commercially-viable production stage. In 1970, however, most of the Government agencies having concern with SST development, including the State Department, concluded that the Concorde flight test program to date was going better than originally anticipated. It appears that their SST is headed for commercial service in early 1974. United Kingdom and French officials indicate initial sales announcements are expected early this year. The airlines, while not completely satisfied with the capacity of the first Concorde, nonetheless continue to support the program and both the French and British Governments have made sizable financial investments to get the initial production Concordes underway, in their determined bid to overcome the U.S. lead in air transport sales. If a supersonic transport of British-French design appears on the world airways within three years, a few essential facts and factors related directly to trade balance are worth considering.

In the earlier balance of payments studies there was serious concern that the U.S. SST through its speed would generate increased tourism and that this tourism would have an adverse effect on our total balance of payments picture and negate the advantages the U.S. would obtain in the trade account from selling 500 SSTs. Underlying these studies was a general consensus by those departments having such concern that the Concorde program would fail.

However, if there is a viable Concorde this oft-described "speed-induced travel" factor almost disappears since only the difference between the Mach 2.2 design speed Concorde and Mach 2.7 SST is relevant. The speed-induced travel concept, if accepted, was used to illustrate a potential negative services account impact from travelers' expenditures abroad, port expenditures, and the like <u>that would all be charged to the U.S. SST</u>. Under the assumption of no Concorde, the amount could be sizable. But with the Concorde in airline service, as all responsible agencies now indicate, then the induced U.S. expenditures abroad over the SST time period to 1990 are roughly estimated at about $3 to $4 billion as compared to a roughly estimated favorable trade swing of between $17 and $22 billion in 1967 dollars. Also, there is considerable difference of opinion as to the validity of speed-induced travel and for this reason we did not include this input in our charts. Additionally, no weight has been given, either in the past or in our present computations, to the positive effects on exports or on overseas investment income from increasing the producitivity of business air travelers, a further conservatism.

The trade balance computations used prior to last year did not adequately reflect the "real world" of airline equipment purchases. The assumption that the free world airlines will continue to buy about 84% of American made civil subsonic jets regardless of our action on the U.S. SST is not a valid premise. Airline executives make their purchases only after careful examination of the manufacturer's "family of aircraft." If the United States restricts itself to the jumbo jets and the tri-jets for the 1980s, then the foreign family of civil transports -- the Concorde for "blue ribbon" overwater routes, the A-300 twin engine 250-passenger low-cost airbus (Figure G-6) and the French Mercure replacement for the DC-9/Boeing 737 G-6
(Figure G-7) -- may well, and probably will, induce many airlines, G-7

especially nationally-owned foreign airlines, to purchase their "family" outside the U.S., in fact, "closer to home." In addition to pressure on foreign flag airlines to re-equip with home-manufactured airplanes, there are many inducements that can make purchase of non-U.S. transports attractive. These include price discounting, trade-in allowances, purchase loans, low interest rates, favorable warranties, and low-cost spare parts and servicing arrangements. The efforts of the Soviets to develop their own family of aircraft for export is shown here in the recent advertisement of E-12
Aviaexport.

When the U.S. technology is matched by the civil aviation industry abroad, the U.S. airplane manufacturers begin to encounter a business arrangement commonly referred to as the "offset agreement." For example, for McDonnell-Douglas to make a Canadian airline sale, they may have to put the wing and tail manufacture into a Canadian plant, and for the McDonnell-Douglas jet to be eligible for Alitalia markings may require fuselage panels built in Italy. These are common occurrences today. The significant impact of this fact (which reaches billion-dollar levels) upon balance of trade was not considered in prior trade balance studies. However, when our technology takes a big jump ahead of foreign technology, this negative offset disappears. We already have an advantage in technology in the U.S.A. The labor and material to build the all-titanium U.S. SST will be all American, an added safeguard to our trade balance and national economy, for no other free nation has the titanium manufacturing technology of the United States.

One thing is clear in the balance of payments area: it is extremely difficult to predict with much precision future developments of the major nations and aircraft companies of the world. We do know that the continuing high GNP growth rate of the developed nations will increase the air travel of foreign nationals and the need for greater capacity and productivity. Note the North Atlantic travel growth in 1970 in spite of a domestic travel levelling off with the business recession. It is questionable that comparison of the U.S. SST versus the Concorde should be done on an all-black or all-white premise. Nevertheless, in order to simplify the presentation of potential trade swings, it is necessary to make assumptions that there would or would not be a U.S. SST competing with the foreign-built supersonic transports. To the best of our ability, our trade balance studies consider real life factors, but, at best, these projections only convey possibilities of what could happen.

A summary of the results of DOT studies shows that if there is a viable Concorde and no U.S. SST, we suffer a trade imbalance from 200 Concordes imported worth \$7.0 billion and lose by not building an SST, \$10.1 billion from sales abroad, for an unfavorable swing in trade balance of \$17.1 billion. (Figure G-8). If a more airline-economical Concorde II G-8
appears, this unfavorable trade impact would grow to \$22.1 billion. This represents our conservative or base estimate and is due to a greater impact upon the jumbo tri-jet market from a more commercially attractive Concorde II. However, taking into account the effect on import sales of a more favorable "family of civil aircraft," this impact G-9
could grow to \$27.1 billion and, when the real world offset agreements

are accounted for, then this trade impact could reach almost \$30 billion, all computed in 1967 dollars, over a 12-year period (1978-1990). (Figure G-9).

When we apply a conservative escalation of 3% per year to current dollars through 1985, only half the life of the production program, the trade impact numbers can rise dramatically from a minimum of \$17.1 billion to \$45.6 billion over a 12-year period, or \$3.5 billion per year. (Figure G-10). G-10

Finally, when aircraft are sold over a time period such as the U.S. SST 1978-to-1990 time span, the spare parts for airframe and engine support can add exports with a value of 50% of the initial sales price. This factor has also been largely ignored in our previous trade balance assessments. If we add this to the above highest estimate, <u>over \$50 billion trade swing can be projected</u>. This does not include U.S. servicing activities worldwide that employ U.S. people and bring revenue into the U.S.A.

Export business of this magnitude is no longer easily attained or duplicated in other product fields. An examination of Commerce Department statistics shows a steady erosion of our export markets and a migration of our technology abroad. Automobiles, for example, passed from a favorable to an unfavorable balance of trade in 1968 and in 1970 we imported \$2.3 billion more than we exported. G-12

Unfortunately this trend is continuing and information recently available indicates that imported car sales set a new high in July 1970 up 25% from the year ago figure. Imports of iron and steel products are up 145% over a 10-year period. Consumer goods, excluding automobiles, has shown more than a 297% import rise in the same period. Exports associated with our electrical and electronics industries also represent a disturbing situation. Since the mid-1960s, our electronics exports have been growing approximately 15% per year. However, during this same period, imports have been increasing at the rate of 40% per year. Should these trends continue, it appears that by the end of 1972, our imports will exceed our exports in a field in which we originally excelled in technology. On the other hand, the products of American civil aircraft technology have been near the top of the export list for the past 10 years. This is a strong technology base that we cannot afford to default.

It is a significant fact that our exports of civil aircraft are being converted to favorable trade balances at a ratio in excess of 90%. In other words, 9 of every 10 dollars of civil aircraft exports contribute to our favorable trade balance. This point has not been lost in the deliberations of Sir George Edwards, Managing Director of British Aircraft Corporation, who recently said that the economic future of Great Britain is largely dependent upon the advance of aerospace and related technologies, mainly due to the high conversion ratio of exports against imports for high technology items. Quite clearly the $2.7 billion of civilian aircraft engines and parts which the U.S. exported in 1970 would have a much greater impact on the British economy where the total Gross National Product is less than one-eighth of that of the U.S., should the British be able to achieve this level of aircraft exports.

A high technology base by means of an advanced competitive aerospace industry, provides an advanced technology spillover to other areas such as titanium usage in the chemical industry. The maintenance of an advanced technology base serves to enhance the position of the United States in its dealings with the other nations of the world. Civil aviation leadership means advanced technology unmatched outside the U.S. and promotes a stable trade balance These attributes work together toward a common end - a sound U.S. economy. Without a sound economy, we can never honor our commitments to better education, better housing, better health, better law enforcement, better transportation, and, to improve our environment, a better quality of life for all.

PRODUCTIVITY

Aside from the need for an SST as an overall U.S. national transportation requirement, there is the very important consideration of the attactiveness of the U.S. SST to the airlines, both U.S. and international, based on its speed and productivity.

Productivity refers to the ability to do work efficiently. In air transportation terms, one measure of productivity is available seats per airplane times the speed. Analyses in these terms show the U.S. SST to be:

- o Three times as productive as the Concorde and the jumbo tri-jets.
- o Almost twice as productive as the 747.
- o Four times as productive as a 707.
- o Sixteen times as productive as a DC-6.
- o About one hundred times as productive as the DC-3.

New productivity levels provide the basis for the airlines to:

- o Accommodate the normal travel growth requirements coincident with attractive service in terms of departure and arrival schedules.
- o Maintain a reasonable financial return in spite of cost escalation.
- o Provide the traveling public with reasonable fares, and
- o Maintain reasonable worldwide civil air transport fleet sizes.

The impact of productivity increases in the light of these factors, is to facilitate international revenue passenger miles' growth, conservatively projected by Boeing, to be such that by 1985, the SST traffic alone will equal the entire free world traffic of today. This means 260 billion revenue passenger miles or 100 million people traveling by SST -- and this with no supersonic overland flights. Almost 75% of all intercontinental flights are projected to be in SSTs. This would require about 720 additional 747s or about 1,200 Concordes to do the job of 423 U.S. SSTs. As a means of showing how important it is for aviation to plan ahead, and to underscore why we must go ahead now, examine what would have transpired had the aviation industry not been ready, capable and willing to offer the needed advances in aircraft technology, reflected in improved productivity per dollar, through improved models about every 5 to 8 years.

- Only 345 pre-war DC-3s were built to serve the airlines of the entire world. By 1947 the DC-3/4 and Constellation fleet had grown to 2,000 civil aircraft.
- At the end of the piston engine airplane era, a total of some 4,500 DC-6s, DC-7s, Constellations and other piston airplanes were in use by the airlines of the world.

Today the airline fleets of the free world number about 3,500 subsonic jets, and these aircraft carry about 3½ times more traffic than the airline fleet at the end of the 1950s. Had the industry not pressed ahead with the jet age, in spite of all the outcry of the critics of progress of the early Fifties, we would today be choking the airways and airports with piston aircraft and be causing significant environmental degradation.

Looking forward to the 1980s and 1990s, if the U.S. aircraft industry does not continue to move ahead with its advanced generations of more productive, more comfortable, safer, more reliable and cleaner air transportation, then it must fall behind -- there is no standing still. The economic benefits resulting from meeting the increased demand will be reaped by countries currently planning and aggressively pursuing this lucrative market.

Some critics of the U.S. SST contend that international air travel is limited to an insignificant segment of the U.S. population. Consider the composition and magnitude of air transportation projected for the 1980s. It appears this next advance in travel - communication - cultural exchange - business will be of service to a significant segment of our U.S. population. Examination of present day travel and that predicted for the 1980s shows that:

- o Today, some 44.7 million separate Americans (22% of our population) travel by air domestically and over 6 million internationally (3% of our population).
- o By 1985, which is only the mid-life of the first generation of SSTs, 50% of our population, 126.4 million Americans will travel by air domestically and 25 million, or 10% of our population, internationally. This is hardly a "jet set."
- o 62.3% of international air passengers between the U.S. and foreign countries are U.S. citizens.
- o The business/pleasure split of international air passengers is 26%/74% for the North Atlantic and 24%/76% worldwide. Passengers in the Pacific area are split about 50-50, business and pleasure.
- o The North Atlantic routes represent the most lucrative airline route system in the world, carrying over 6 million people in 1969 between North America and Europe and projected to carry 28 million in 1985. About 2 million Americans or 1% of our population flew this route

in 1969, and about 9 million are expected to fly in 1985. During the 1960s, 19 North Atlantic carriers flew 31.3 million passengers. Passenger volume increased 243% from 1960 - 1968. This air communications system links the two most powerful economic communities in world history - Europe and the United States. By shrinking distances on the entire globe to 12 hours or less, the U.S. SST will open up similar traffic in other directions from the U.S. The forecast growth rates shown in Chart H-14 indicate that the Pacific area H-14 including Australia and New Zealand will grow at higher rates in the period to 1980 than the North America-Europe traffic. The 1975-1980 period should reflect the initial impact of Concorde and SST operations, yet the growth rate indicates about one-third reduction from the preceding period. This indicates the conservative nature of the SST forecast. It is very significant that although 1970 was a bad year for domestic airline travel, with a growth of only 2%, international traffic on U.S. airlines was up about 19%.

- From a profit standpoint, the SST clearly aims at the prime market. Long-haul routes are traditionally more profitable than short haul. Most SST flights will be "long distance." International operations have been shown from CAB statistics to be consistently 60% higher in rate of return on total investment than domestic operations, returning 9.6% internationally versus 5.9% domestic, based on the 10-year average through 1969. This is important to the SST program and fleets of the future in terms of:

  Repayment of the Government cost share.

  A healthy airline industry.

A more rapid payoff of the new equipment directly for a greater return on investment.

Greater productivity is also the way the airlines generate the funds to pay back the loans required for new equipment. Much has been said about the potential price of a U. S. SST escalating from a 1970 estimate of $37 million per airplane to the order of $50 million in 1978. Historically, new equipment has produced sufficient revenue to pay back its cost in about 5-6 years. The SST is not expected to be an exception in this respect because of its expected very high productivity -- the ability of the airplane to produce revenue. This is strikingly illustrated in Chart H-15, showing that the SST can earn H-15 annually over 2½ times as many dollars per installed seat as the 747, and an even greater margin over the Concorde and other long-range subsonic jets. This comparison assumes no supersonic surcharge and 55% passenger load factor.

There still remains the question of what the U. S. SST productivity will do for the average internationally traveling citizen,(all 25 million of us) in 1985. An examination of cost history and projections to 1985 shows a steady rise in costs for all aspects of airline operations -- except for fuel. In spite H-10 of this all too familiar trend, airline fares, compared to the Department of Labor Consumer Price Indices, have actually decreased since 1947. The ability of the airplane manufacturing industry, combined with progressive airline management, enables nearly 45 million Americans or about 22% of our population today, to enjoy the phenomenon of one of the few remaining 5 cent cigars in the form of lower air fares while other prices have risen an average of H-11 50%! The U. S. SST will be available to the 25 million Americans who will fly internationally or 10% of our population to further enjoy these beneifts in the 1980s.

In summary, productivity has made it possible for the airline industry to accomplish the following:

- Hold fleet sizes to manageable levels and offset cost escalation.
- Maintain a low fare level, enabling more people to fly.
- Accommodate known travel growth trends with adequate service and constantly improving level of comfort and safety.
- Provide airlines with earnings generally adequate for solvency and continued growth.
- Keep airway and airport congestion from reaching impractical levels.

THE ENVIRONMENT and the SST

The Administration's position, Secretary of Transportation Volpe's position, and certainly my own position on the SST in relation to the environment is that the U. S. Supersonic Transport must be demonstrated to be acceptable under the terms of the Nation's commitment to higher environmental standards. We do not intend to allow supersonic air transportation to further blemish what astronaut Frank Borman so aptly described as "the good earth -- an oasis in space".

Secretary Volpe made the Administration's position quite clear when he said in a speech last month "that the production program will not proceed if tests of the prototypes indicate serious damage to the fabric of the natural world, or social problems that we can't treat and assimilate".

The apprehensions that have thrust environmental aspects of SST operations into public prominence are based on theory, conjecture or scientific speculation. While many of these concerns are sincere, and while I consider it entirely proper that we examine the potential environmental consequences of our actions, I suggest we should differentiate between fear and fact, and not confuse possibility with probability.

On that basis, I would like to summarize for the members of the Committee the circumstances pertaining to the SST and the environment, as they now stand.

First, the program never has sought to avoid environmental issues or evade environmental responsibilities. For example, the SST contract was the first transportation development program to contain noise objectives, acknowledging that noise has been a common concern and lower noise levels a goal of our efforts.

Similarly, smokeless engines for the airplane have long been a production requirement.

For nearly five years, the Government has acknowledged that flights of civil supersonic aircraft will not be allowed over the United States at speeds that would cause a sonic boom to reach the ground.

Every possible environmental effect — radiation on passengers and crew, sonic boom,noise pollution, atmospheric effects - all of these concerns were subjected to inquiry or investigation even before "environment" and "ecology" became household words. Further research in all of these areas is continuing.

Secondly, there is no evidence or likelihood that supersonic aircraft operations will cause any significant adverse effects on our atmosphere or the global environment. That is the consensus of the scientific community at this point in time, based on existing data. Further, there is general agreement that two prototype aircraft will in no way endanger the environment. Mr. Russell Train, Chairman of the President's Council on Environmental Quality, has so testified before the Senate Joint Economic Committee. Mr. William D. Ruckelshaus, Administrator of the Environmental Protection Agency, said the same thing in his testimony last week before the House Appropriations Subcommittee.

The question that concerns all of us is what effects, if any, will large-scale operations by supersonic aircraft have on the environment we all share -- bearing in mind that whether or not the U. S. SST goes into commercial service, the British-French and Russian supersonic transports will be flying in some numbers, in addition to the countless military aircraft operating at supersonic speeds or altitudes. We cannot answer the question completely or absolutely today, but there are certain facts -- presently available -- which provide insight into the problem and indicate to me that the more conclusive answers we all seek are within reach.

First, there are the findings of the MIT-sponsored Study of Critical Environmental Problems (SCEP), a month-long seminar held on the campus of Williams College during the summer of 1970. A portion of the study was given over to the possible impact of the SST on world climate. F-38

Not surprisingly, the SCEP advocated more research. But equally important, I believe, the chairman of this scientific working group made it clear that there is no reason to halt or delay work on the U.S. SST prototype program. This fact, unfortunately, did not always emerge in the press reports and commentary on the SCEP findings. The misleading accounts of the SCEP's position led the Chairman of the Working Group, Dr. William Kellogg*, to issue a subsequent statement, saying in part:

> "I am very much distrubed over recent gross exaggerations and scientific mis-statements regarding the SST's potentially harmful effects upon the atmosphere and man's environment. Last August a group of scientists at the MIT Summer Study stated that there are indeed environmental uncertainties, caused in no little part by gaps in available information, which require additional research in order that they may be resolved. I pointed out at that time and want to strongly reaffirm that there is no environmental reason to delay construction of the two prototype SST's.
>
> "It is my profound hope that the U.S. Congress will not be mislead by these exaggerations or by scientific mis-statements. Dr. Ed David's** statement, which Dr. Walter Roberts*** and I strongly endorse, says it well: 'Let's not suppress technological advances but through research, development and experimentation make sure that those advances are obtained without undesirable side effects.' I support a vigorous environmental research program in parallel with prototype SST construction. Don't downgrade the ability of American scientists and engineers to apply their genius to the successful resolution of uncertainty."

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* Associate Director of the National Center for Atmospheric Research, Boulder, Colorado.

** Dr. Edward E. David, Jr., the President's Science Adviser, in a statement issued December 5, 1970.

***Director, National Center for Atmospheric Research.

Without going into detail, let me enumerate the principal findings of the SCEP group as they relate to the SST and the environment.

1. The additional carbon dioxide from SST operations at 60,000 feet to 70,000 feet altitudes will cause no problem.

2. The water vapor content of the stratosphere will probably be increased, but the significance of this change is not known. The SCEP group did express opinions on several possibilities:

-- One, that increased winter cloudiness in the polar region might occur.

-- Two, the added water vapor may increase the thickness and extent of stratospheric clouds already observed in the polar region at night. However, the direct radiation effects would result in warming of air at ground level in regional areas of peak moisture concentrations by less than 0.1 degree centigrade on a world-wide basis and cooling in the stratosphere by a few degrees centigrade.

-- Three, the reduction of ozone due to water vapor interaction would lie well within the present day-to-day and geographical variability of total ozone.

3. The group noted that reduced ozone could admit more ultraviolet radiation to the lower atmosphere. Predicted ozone changes, however, would be insignificant.

4. With regard to particulates, the direct role of quantities of CO, CO_2, NO, NO_2, SO_2, and hydrocarbons in altering the heat budget is small. It is also likely that their involvement in ozone photochemistry is even less significant than water vapor.

5. The Group found that SST operations will introduce particles into the stratosphere in proportion to the sulphur content of fuels and the amount of hydrocarbons and soot contained in the exhaust products. We know, however, that tomorrow's aviation fuels will contain much less sulphur than today's fuels, which contain about 0.05 percent sulphur by weight. Sulphur in fuel serves no practical purpose, and its reduction will result in a significant decrease in the generation of particulates by aircraft engines. In fact, use of jet fuel with a 0.01 percent sulphur content (instead of 0.05 percent) would reduce emissions by 80 percent.

The overall conclusion reached by the scientists who participated in the MIT Summer Study is one of uncertainty as to the extent of effects from supersonic aircraft operations. The course they recommended is very likely the one you and I would propose -- the obtaining of more information on which a factual, well-reasoned, objective decision can be made.

An American Geophysical Union Symposium on environmental effects of supersonic aircraft was held in San Francisco in December 1970. The papers and panel discussions featured during that symposium were in general agreement with the conclusions reached by the MIT study group.

The SCEP and the AGU did not deal with cosmic radiation, but facts are available which show that SST passengers and crew will actually experience less radiation exposure than subsonic jet travelers because of the shorter time duration of travel in supersonic transports.

It is known, for example, that radiation exposure at different geographical locations on the surface of the earth vary from 35mrem to 200mrem per year, showing that human beings are continually exposed to radiation F-15 of varying intensities. In some parts of the world people in their normal environment receive greater annual exposure than encountered in SST or in subsonic jet travel.

A flight crew of the SST, based on an assumed 200 flights a year, F-14
will be exposed to approximately the same radiation as crews of subsonic jets -- generally less than 10 percent of the 5.0 rem per year exposures allowable by the International Commission on Radiobiological Protection as permissible. (Normal international jet flight crews today average about 120 flights per year.)

To evaluate and apply the facts that are known, and to investigate, analyze and advise on the concerns that do not yet have full or final answers, we have -- first -- established the SST Environmental and Noise Advisory Committees, and -- secondly -- assembled a comprehensive research program encompassing all of the areas where more information and data are necessary.

The members of the SST Environmental Research Committee are identified on this chart. The Committee is chaired by Dr. S. Fred Singer of the F-2
Department of Interior. Dr. Singer is a former Dean of the School of Environmental Sciences of the University of Miami, and is Chairman of the American Geophysical Union's Committee on Environmental Quality. His committee includes the most knowledgeable and highly respected professionals in the atmospheric and radiation fields.

I asked Secretary of Commerce Stans to request the Commerce Technical Advisory Board (CTAB), a body of distinguished, non-governmental scientists, to convene a panel on SST Environmental Research. CTAB agreed and the panel is now conducting an independent analysis of SST environmental concerns. It is reviewing the environmental research program to insure that it is correctly structured to resolve environmental uncertainties. Their findings and recommendations will be most helpful in support of our environmental research effort. CTAB, as you probably know, recently tackled the issue of removing lead from automotive fuels.

Dr. Fredrick Henriques, a photochemist, and CTAB member, chairs its SST panel. The other panelists are listed on this chart. They represent a range of environmental interests and expertise. The CTAB Panel has available to it, government liaison representatives from every concerned agency, including EPA, HEW, CEQ, NOAA, HUD, STATE, DOD, DOT, and INTERIOR. F-2A

Also, in cooperation with other departments and agencies of the Government, we have defined and have underway a program of research into many of the areas where concerned groups, like the SCEP, have indicated research is needed. In the SST Climatic Impact Assessment program, for example, the Government will conduct research to improve our knowledge of engine exhaust emissions, atmospheric monitoring, chemical dynamics, atmospheric modeling, and contrails and polar cloudiness. As information becomes available it will be communicated to the Congress and to the agencies charged with responsibilities for environmental preservation and protection.

Let me turn now to the subject of noise, which has long been a major concern in the development of the SST. I touched on this matter earlier, but some elaboration, I believe, would be useful.

The members of the SST Community Noise Advisory Committee are identified on this chart. The representation is diverse, and includes some of the outstanding authorities in the propulsion and acoustic fields. It is not F-3 F-3A only very gratifying to me that these gentlemen have agreed to serve in this important capacity, but I believe their presence indicates the intense desire of people in Government and the private sector alike to overcome the excessive noise which has been detrimental to the broader acceptance and greater progress of air transportation.

The noise characteristics associated with the SST have been perhaps the most misunderstood and generally confused aspect of the various SST environmental concerns. Some apprehension is certainly understandable, but the facts do not support the degrees of concern and emotion that have been expressed.

These are the facts:

First, the SST will be quieter over the community than the typical jet in the present intercontinental fleet. The noise level, at the designated measuring point -- one-and-a-half miles from the end of the runway, approximately -- will be within the limits of the FAA rule for subsonic jets. This means the SST can be expected to relieve, not aggravate, the present noise situation over the community, where people live or work.

Secondly, the approach noise of the SST over the community will also be lower than the present-day 707 and DC-8 jets. The high-pitched "whine" of the compressor of today's jets will not be heard from the SST because of the unique supersonic engine inlet. This inlet prevents the whine from propagating forward, thus reducing annoyance to the people on the ground.

Now, thirdly, we have the question of noise on the airport itself, or what is referred to as "sideline" noise.

In most communities this is not a serious concern with present aircraft, simply because airports are not expected to be quiet places and the people who work there or frequent airports understand and accept this. In fact, the operators of a major international airport have told me they have never had a public complaint attributable to sideline noise.

With the SST, however, because of the size and power of the engines, sideline noise has been a major technical challenge. Based on the propulsion and acoustic technologies then in hand, the sideline noise levels from the SST appeared in the past to be greater than we preferred. We have, however, had intensive and aggressive noise reduction programs under way for a number of years, and these programs are yielding results. F-41
Recent testing has revealed significant breakthroughs which have dramatically improved the SST noise posture.

Last month I received a letter from Dr. Leo L. Beranek, Chairman of the SST Community Noise Advisory Committee, informing me of his Committee's latest findings on the noise characteristics for the production U. S. SST. Because of the importance of Dr. Beranek's conclusions, I would like to present the letter in its entirety for the record.

> "We are pleased to submit this interim report on the activities of the SST Community Noise Advisory Committee, which you appointed in July 1970. Our initial step was to review the SST noise objectives in relation to the noise situations currently prevailing at the Nation's airports together with the projected improvements resulting from the introduction of new, quieter subsonic

airplanes meeting certification requirements of FAR 36 (Federal Aviation Regulation - Noise Standards: Aircraft Type Certification). This review also included meetings with the airlines, airport operators, Boeing, General Electric and representatives of Government agencies active in aircraft noise.

"On September 11, 1970, I reported the first conclusions of the Committee to you as follows:

1. The noise levels for the production SST should be the same as those imposed by FAR 36 for new 4-engine, intercontinental, subsonic transport aircraft.

2. To meet the above objective, added emphasis should be given by Boeing and General Electric in their respective noise programs.

"Since that oral report, the Committee has kept abreast of progress on the program relative to reduction of the noise levels projected for the production SST. On February 4, 1971, we reviewed in detail with Boeing and General Electric the status of engine and aircraft design of the production SST with respect to noise. This review included results of recent tests on a number of jet noise suppressors, aircraft and engine performance, and the adequacy of engineering methods in predicting the noise levels for the production SST.

"We conclude that the level of technology demonstrated by Boeing and General Electric is sufficient to achieve the noise level objectives we recommended. We are available to discuss our findings with you and other concerned parties, as you deem appropriate."

We have discussed these findings with Dr. Beranek, and with Boeing and General Electric. On the basis of the analyses now available, we are confident that prior to production commitment, the capability of the commercial SST to achieve noise levels consistent with those required for F-9
certification of new four-engined, intercontinental subsonic transport aircraft can be demonstrated.

The Airport Operators Council International has been sufficiently impressed with the projected SST noise levels to write a letter of endorsement of the SST program to the President. In this letter the

Council says, and I quote: "We see the SST program as a unique opportunity to reduce community noise, air pollution, and congestion while improving air transportation service through an orderly, well-planned program involving international coordination between airport and airline operators, manufacturers, and governments."

There is one other environmental factor that remains to be discussed, and that is sonic boom. Here there is little to say, except that no one I have any acquaintance with advocates flights at boom-producing speeds over the United States, and everyone involved in any way with the program is agreed that restrictions on overland flight are appropriate. The proposed Federal Air Regulation specifically prohibits civil aircraft flights over the United States at speeds that would create a boom on the ground. A law to that effect has been proposed, and the Department of Transportation poses no objection if a law is the desire of the people and the Congress.

I would point out, however, that flights over land area are not, and never have been considered necessary in order for SST operations to be profitable. The economics of the SST are based on the fact that 70 percent of the surface of the globe is water, and that 89 percent of all international airline route mileage (over 700 miles) is over water.

To conclude this portion of my statement, let me summarize by saying that the Department has complied with the terms of the National Environmental Policy Act (Section 102) requiring that new technical developments be demonstrated as being compatible with sound environmental practices. Our SST Environmental Impact Statement was submitted, along with the comments of the reviewing agencies, on December 7, 1970, to the Council on Environmental Quality. We have discussed the environmental issues with members of the Counciland with the Administrator of the Environmental

Protection Agency and his staff. We have considered carefully the findings and opinions of qualified environmental authorities, such as those engaged in the SCEP, and all concerns are being given the close attention of our Advisory Committees. We are continuing the research necessary to enable us to determine the environmental acceptability of the SST before any commitments are made for commercial production.

As I mentioned earlier, the question that concerns us all pertains only to large-scale operations. The prototype program, rather than a threat, is a means by which environmental questions can be better answered and unknowns resolved.

EMPLOYMENT

Gentlemen, as we are all painfully aware, aerospace employment and more specifically commercial transport aircraft development and manufacturing employment has been experiencing a sharp downtrend since its mid-1968 peak. Elements contributing to this include declining sales of large civil transport aircraft as well as reduced expenditures for military aircraft, missiles and spare programs.

Aside from the international balance of trade implications of the U.S. SST Program, I would like to emphasize the very important consideration of the domestic economic impacts. Certain sections of the country are already experiencing significant economic problems and without increased employment stability, these can be expected to multiply. Inherent in employment losses, of course, are other material considerations, such as personal hardships including severe relocation expenses and increased burdens on state and local governments which tend to compound rather than alleviate the problems.

The foregoing factors should be considered in evaluating the U.S. SST's contribution to the overall good of this country. During the production phase, the SST Program will provide a direct labor force of 50,000 jobs. Through the multiplier factor, the impact more reasonably can be expected to concern 150,000 jobs in the next 15 years if we fail to respond to the foreign SST challenge which is being posed. In this way, we will contribute to a "brain drain" on the aerospace industry specifically and on the technological expertise inventory of the U.S. in general.

Foreign Impacts

We have already experienced some labor impacts growing out of the business arrangements commonly referred to as "offset agreements." Basically, these come about when U.S. technology is matched by the civil aviation industry abroad and in order for U.S. aircraft manufacturers to sell their export products, a portion of the plane is required to be manufactured in the purchaser country, as I have already pointed out.

Quite obviously in these circumstances, U.S. aircraft manufacturers were placed in a position of having to adopt a "half a loaf" approach in dealing with these agreements. However, in the SST program we are now dealing with the whole loaf, since we alone possess the necessary titanium technology.

As opposed to the feeling which has persisted in some quarters that the Concorde would never be a viable product, there is ever increasing evidence that this program is for real. Given the opportunity to extend the initial Concorde effort into a second-generation aircraft which could be more competitive with the U.S. SST, it is wishful thinking to assume that the British and French will not do so.

SST Employment Potential

The significance of the SST upon our aircraft employment, is shown J-5
in this chart. This indicates a loss of 28% of all jobs available at the end of 1979 if we do not have the U.S. SST Program. If we have a less favorable family of civil airplanes to offer to the airlines of the world and if, as a consequence, future subsonic sales are filled by foreign aircraft such as the A-300B and the French Mercure, then the 28% can be much larger and represent an even more severe employment loss.

Current Aerospace Employment Downtrend

Perhaps the present condition of aerospace employment in the United States can be used as a mirror of the future. In current perspective, as shown in the chart, employment in the aerospace industry is already J-6 suffering from declining sales of large civilian transport aircraft coupled with reduced expenditures for military aircraft and missiles and space programs, because of the conversion from stepped-up production for the Vietnam war to essentially a peacetime basis, and because of the end of hardware development and production for the Space Program. For the year ending September 1970, employment will have dropped by 12½% from a year ago -- a loss of 168,000 jobs or one out of every 8.

Contrary to popular misconceptions that the aerospace industry employs only white collar workers, I would like to point out that this job loss is not restricted to any particular type of employee but rather has an across-the-board application. Scientists and engineers who comprise only 15% of the work force will lose 28,000 jobs, down 13.8% from the year-ago level, production workers representing 51% of the force will lose 89,000 jobs, a drop of 12.8% and technicians representing 5% will lose 10,000 jobs, a drop of 14.1%.

Accompanying Consequences

Impressive as these statistics appear in totality, they tend not to convey the true import of the situation. For example, the 168,000 jobs comes more into perspective when viewed in light of the fact that this is roughly comparable to the population of Arlington County, Va.

which according to the 1960 census was slightly more than 163,000 persons. Quite obviously, the loss of this number of tax-paying Americans, if even for a limited time, must have repercussions in various segments of the economy.

Present Mirrors Future

The present aerospace employment picture, depressing as it is to all of us can be useful in that it can be a mirror of the future, if we experience the loss of employment from having exported one of our best national resources -- which is what will happen if we fail to answer this foreign SST challenge. I feel that there is a very important message for us here, that our aircraft industry is an essential force in our overall economy and a substantial contributor to our well being.

Program Support

That this fact has been recognized by others is evident in the following sections of a "Statement by the AFL-CIO Executive Council on SST." At their meeting on August 3, 1970 in Chicago, the Council in supporting this program said in part..."Today, the USSR and the French and British are developing airliners that will fly at supersonic speeds on trans-oceanic flights. These nations, using government funds, have produced prototypes and are now well along in their testing programs.

"Without an SST, the American aerospace industry will be unable to maintain its leadership in world aviation, losing most of the market for trans-oceanic airliners.

"American aerospace workers will also lose sorely needed employment.

"We urge the United States Senate to vote funds for the development of an American SST. The age of supersonic travel over water will soon be here. The United States cannot afford to be left in the lurch."

In his testimony on March 3, 1971, before the House Subcommittee of the Committee on Appropriations, Mr. Floyd E. Smith, International President of the International Association of Machinists and Aerospace Workers and member of the Executive Council of the AFL-CIO stated the following:
"In urging development of these two prototypes we are fighting for the future life of the American aerospace industry. We believe the SST is the key to continued U. S. technological superiority in this industry. If we tramp the brakes down on our SST development at this point other nations will not only shoot rapidly ahead in aerospace technology but will inevitably take over world markets we have long dominated. Even more important, however, if we lose this industry we will lose the research, development and production team that is necessary to our military strength.

"America has already lost too many of its industries because of national policies that encourage the export of jobs. At one time we were the leading shipbuilding nation in the world. Today our once proud shipbuilding industry has been reduced to that of a fourth-rate power. Moreover, in the last decade many other important industries have succumbed to floods of foreign imports. It's becoming increasingly difficult to buy a U. S.-made television, radio, typewriter, calculator or many other kinds of goods.

"Having taken over so many of our other industries, foreign producers will only be too happy to take over our markets in aerospace as well. And there can be no other outcome if Congress now permits the SST to die by default.

BENEFITS FOR THE NATION

I have discussed at some length how the SST vitally affects our national aerospace industry and how essential a successful SST program is to the health of this major United States industry, with major effects on future balance of trade and employment.

Now I would like to concentrate on the government-industry partnership involved here and show that a most beneficial result should be expected, both for the government and for the aerospace industry.

The American SST Program is a unique government-industry partnership more in the nature of an investment than a direct Federal subsidy. This is, of course, the American way of doing business, for the U.S. SST is a civil transport in the business sense and the Government is most certainly not to be involved in competing with private industry for profit. The contract arrangements provide for both parties to realize a reasonable return as follows:

- The Government's prototype investment will be returned by the time the 300th airplane is delivered.
- When the 500th airplane is delivered, the Government's investment will have been recovered along with a projected additional billion dollars. None of this, of course, includes any consideration of the tax revenues which will accrue. Inclusion of taxes calculated from SST employment (50,000 direct jobs and 150,000 total jobs, including indirect) would add an additional $6 to $7 billion to be returned by 1990.
- Returns to the manufacturers are sufficient to cause them to actively pursue the program's objectives.

The planning for financing of the production phase has not assumed Government participation nor was it, nor is it, intended to do so. A finance plan is evolving with discussions already in progress with financial organizations, industry, labor, CAB, etc. The present timing for a plan is June 30, 1972. It is hoped that this year an outline of the plan can be developed; however, the success of the prototype design and the associated research and development are the keys to attracting the private financial community to this program. As one leading financial expert put it, "with a proven successful prototype flying and the prospect of more than $25 billion worth of business, someone will find the cash to promote this business."

The industrial financing of a program as large and with such national economic impact is a truly U.S.-wide project. Labor, the airlines, the manufacturing industry, the lending institutions, the government fare-route regulating authorities and the international fare-route regulating authorities will all be directly involved in developing the necessary actions to assure:

- o A healthy airline-industry economy.
- o An attractive economical design.
- o A well-managed, imaginative total transportation system to accommodate the SST.

Two important factors, normally representing the only requirements for private financing assurance, are implicit in the SST Program --

- o A willing buyer (10 airlines have invested nearly $60 million of risk money to show their support for the program).
- o A proven vehicle which this prototype program is designed to demonstrate.

From a study of previous commercial transport development, it is apparent that commercial aircraft development has been Government supported one way or another many times. Government participation in the U.S. SST prototype program should not, therefore, be considered either extraordinary or as a detriment. The $1.7 billion required to develop the U.S. SST prototype is simply too large a price tag to expect contractors and financial concerns to underwrite, particularly in view of the long "dry spell" before return on investment is realized. Government financing of other transportation programs in shipping and railroads has occurred many times in the history of our country, when the magnitude of the effort was beyond industries' financial capabilities.

The one unique feature of the U.S. SST prototype financial arrangement is that the taxpayers will get their investment back, with interest. By the time the 300th airplane is built, the government will, through royalties, get back its $1,342 million. The manufacturers will put up $322 million, including $132 million in new facilities and commercial costs. The airlines will have invested $81 million, $59 million at risk and $22 million for delivery position deposits. By the sale of the 500th airplane, the government will receive another billion. Under terms of the contract, the government will pay for about 78% of the costs. The remaining 22% is being financed by the participating contractors, Boeing and General Electric.

In comparison to the amount of money the Government provides in grants, aid and assistance programs across-the-board, the investment in the American SST Program is small indeed. For example, during Fiscal Year 1971, the $290 million required for the U.S. SST, a revenue-producing program that will provide many nationally important benefits, is only 6% of the $4.5 billion in Federal aid highway grants. The Government finances many other sizable programs such as foreign aid, shipping, agriculture price support, urban mass transport, and military support to other nations.

Considering the $25 billion market available to the SST when it is put in service, the 150,000 to 200,000 jobs associated, the $6.2 billion tax revenue benefits, the $22 billion favorable balance of trade features and the continuation of world leadership in commercial aviation that are at stake, the SST Program becomes a very attractive and nationally important program for the Government to provide financial assistance.

There is nothing new or novel in providing Government financial assistance to a major U.S. transportation development program. Most commercial air transport advancements were based on some type of Government support. The one element of the American SST Prototype program that is different from past Government assistance is that the investment will be returned to the taxpayers with interest. Direct Government involvement in civil aviation includes the following:

- o Conduct of advanced aeronautical research through NACA and NASA since 1915.
- o Development of the airways, navigation aids, and air traffic control, and certification of aircraft and crews.
- o Development and subsidizing of the airlines.
- o Expenditure of $400 million for development of airports during WWII, many of which were turned over to local governments after the war.

- o Aid to airport development from 1946 to present was approximately $2.2 billion. With the enactment of the airport and airway development and revenue act of 1970, Federal funds of $2.5 billion are authorized for airport development over the next ten years. When matched by local and state governments over the next ten years, these funds will total $5 billion.

As a result of the powers of the FAA to certify aircraft and operate the airways, and of the powers of the CAB to control the routes, fares, and subsidies of the airlines, the government in fact is involved and always has been. It is entirely logical that government, which has sponsored the development of air transportation in the U. S. and inspired its continuous growth, should take a hand in the industry's future. It is inevitable if present economic realities are realistically appraised and the attendant benefits to the nation recognized.
The Government's involvement in the financing of the prototype program has always been based on these economic realities and benefits to the nation:

- o The size of the financial burden exceeds the capabilities of any single or joint private U. S. industrial aerospace concern.
- o The 100% Government-subsidized French-British Concorde is already at least 4 years ahead of our SST and has completed approximately 400 hours of successful prototype flight testing.
- o The potential adverse impact upon our nation's balance of trade if we forfeit the SST market to the foreign manufacturers precludes our not building the prototype if we are to protect our future options. To forfeit the SST, in the face of intense and dedicated foreign subsidized civil aircraft competition, could well lead to a serious erosion of our total civil aviation market and aircraft employment.

The cost-sharing nature of the prototype U.S. program features:

- o A 90% Government - 10% industry cost share up to a cost incentive point of $625 million for Boeing and $284 million for General Electric after which industry shares 25% of added costs.

- o Industry bears the burden of all facility costs, about $54 million for the prototype and $100 million for production. The manufacturers also will spend about $78 million in commercial costs during the prototype time period.
- o Prototype Cost Summary

	U.S. Government	Manufacturers/Operators
Government	$1,342 Million	
Manufacturers		$322 Million
Manufacturers' Facilities		54 Million
Manufacturers' Commercial Costs		78 Million
Airlines, for Building Two Prototypes		59 Million
Airlines, for Delivery Positions		22 Million
TOTAL	$1,342 Million	$535 Million

SUMMARY

Gentlemen I hope that the dramatic progress achieved in our SST development program since last August has convinced you that we do, in fact, have the potential here for a most attractive aircraft that will have equal or better noise characteristics than the future long-range subsonic jet transports and which, according to the outstanding environmental scientists in the country, should not degrade the environment, based on present evidence.

Before the U.S. SST will be approved for production,all aspects of the environmental effects will have been subjected to the intensive review and approval of committees of outstanding environmentalists. Moreover, I will not be the judge of the SST's environmental acceptability. That decision will be made by those entrusted with the responsibilities for environmental protection and correction consistent with the National interest.

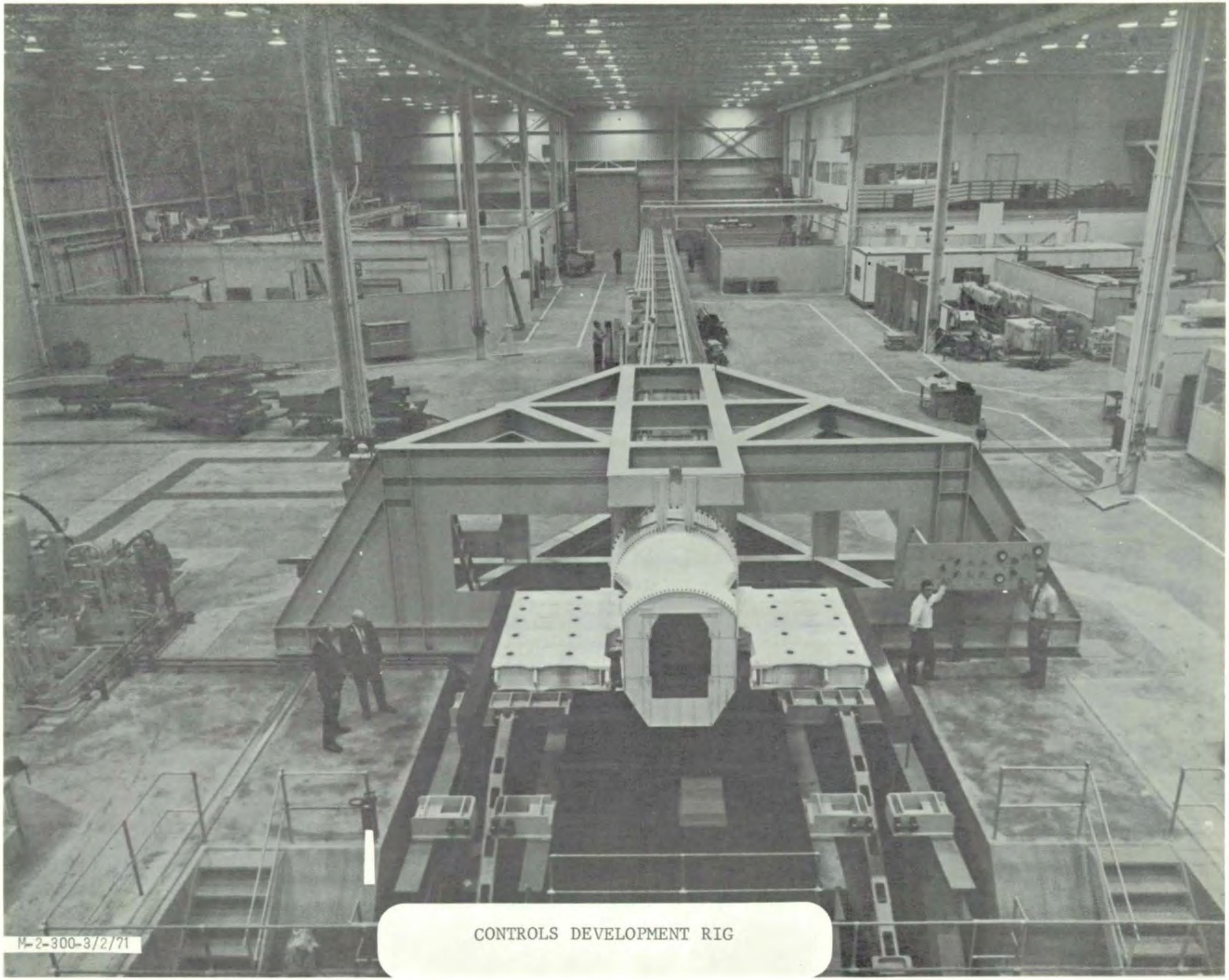
The SST prototype is will along in design and construction. The contractors, subcontractors and suppliers all over the country are hard at work making this new concept of air transportation a reality. The actual flight test engine is now running on the test stand with all performance objectives equaled or bettered.

The program is essentially on target for schedule and costs. I believe the pace of the program supports funding in the amount of $290 million for FY 1971 as the most efficient and fiscally prudent course of action.

In the final analysis, the prototypes must demonstrate to the decision-makers, in the industry, that we do, in fact, have an aircraft with good flight characteristics, attractive to the traveling public and economically advantageous for the airlines to operate. The prototype program, in concert with noise and environmental research work, also affords the opportunity to demonstrate the acceptability of SST's in our society, according to tough new standards, without forfeiting our option to compete for the world supersonic and transport market. I believe that the progress so far gives strong confidence that all these capabilities will be demonstrated. To stop now when we are so close to the final proof would seem to be a most unwise decision.

Mr. Chairman, this concludes my statement. My staff and I will be happy to answer any questions the Committee may have and to provide such further information as may be desired.

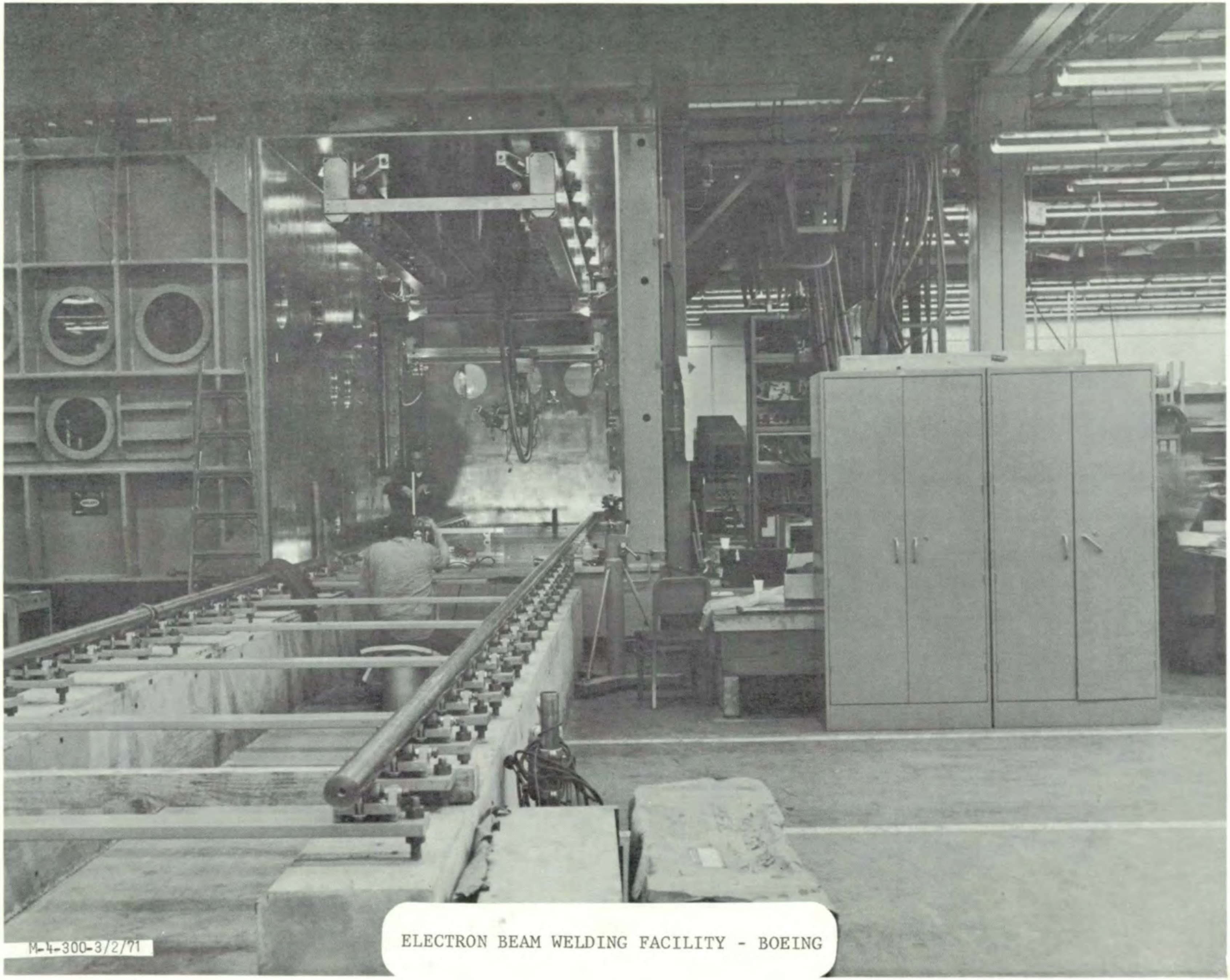
BOEING DEVELOPMENT CENTER



CONTROLS DEVELOPMENT RIG

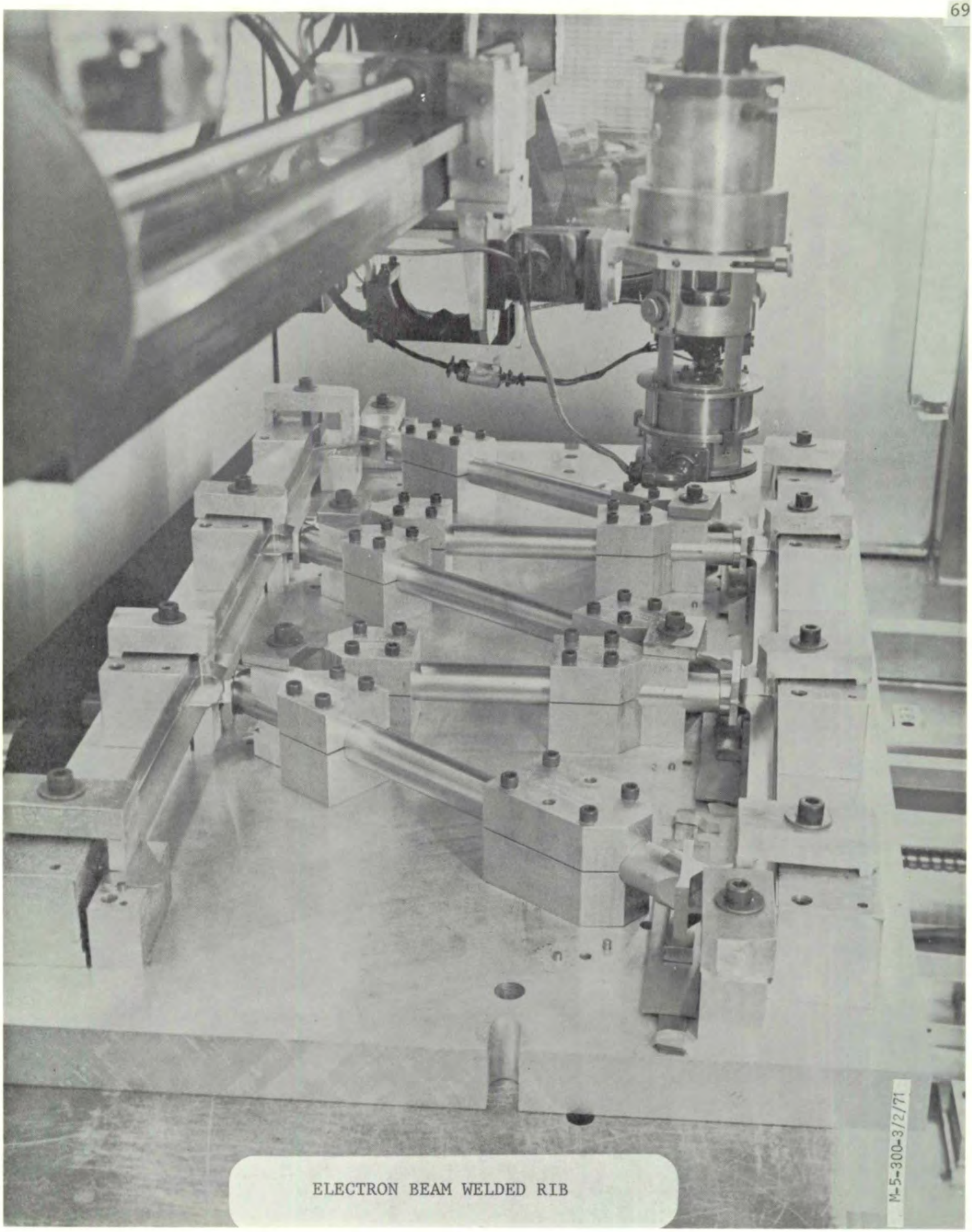
M-3-300-3/2/71

LOWER SPAR CHORDS - CREEP FORMED

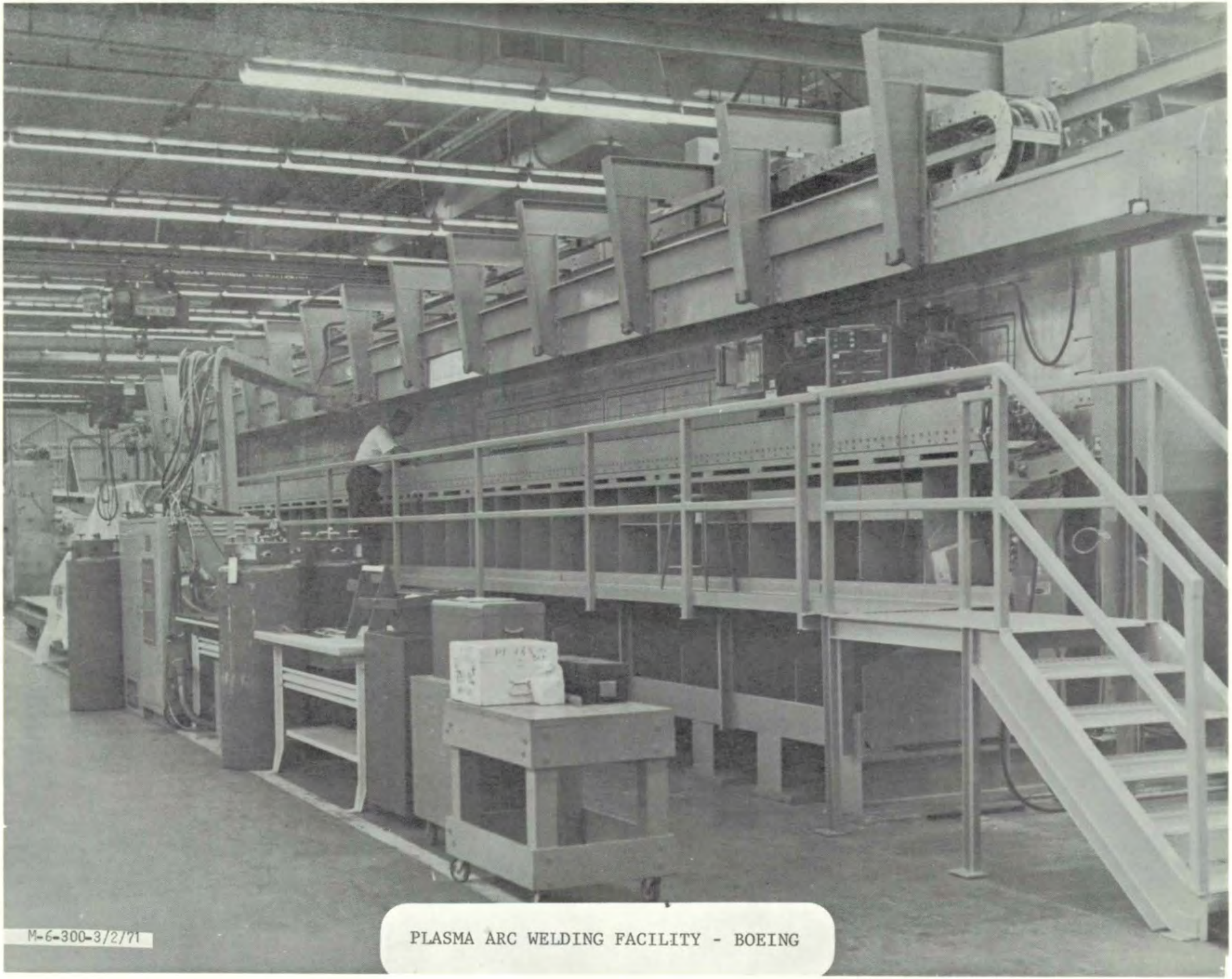


M-4-300-3/2/71

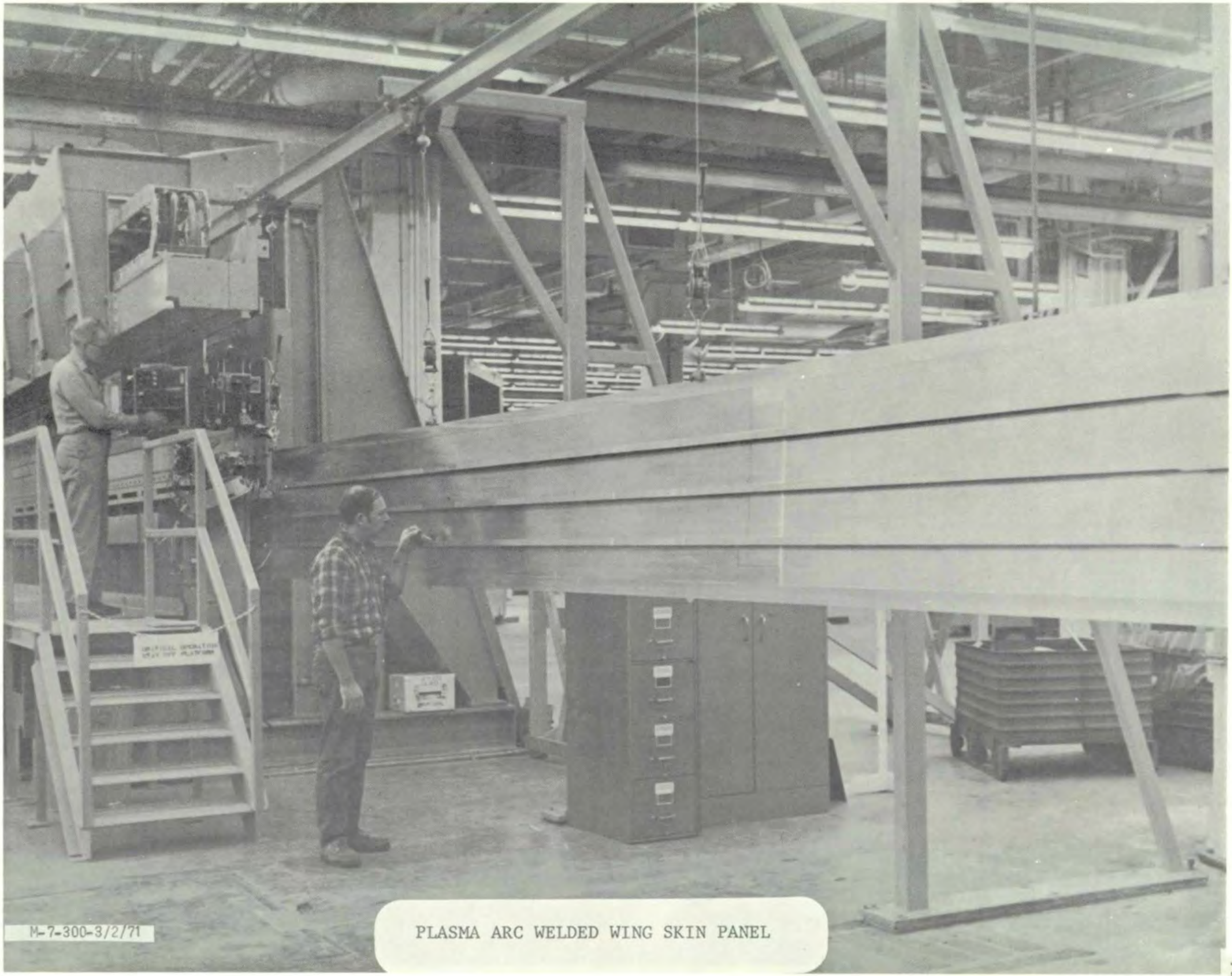
ELECTRON BEAM WELDING FACILITY - BOEING



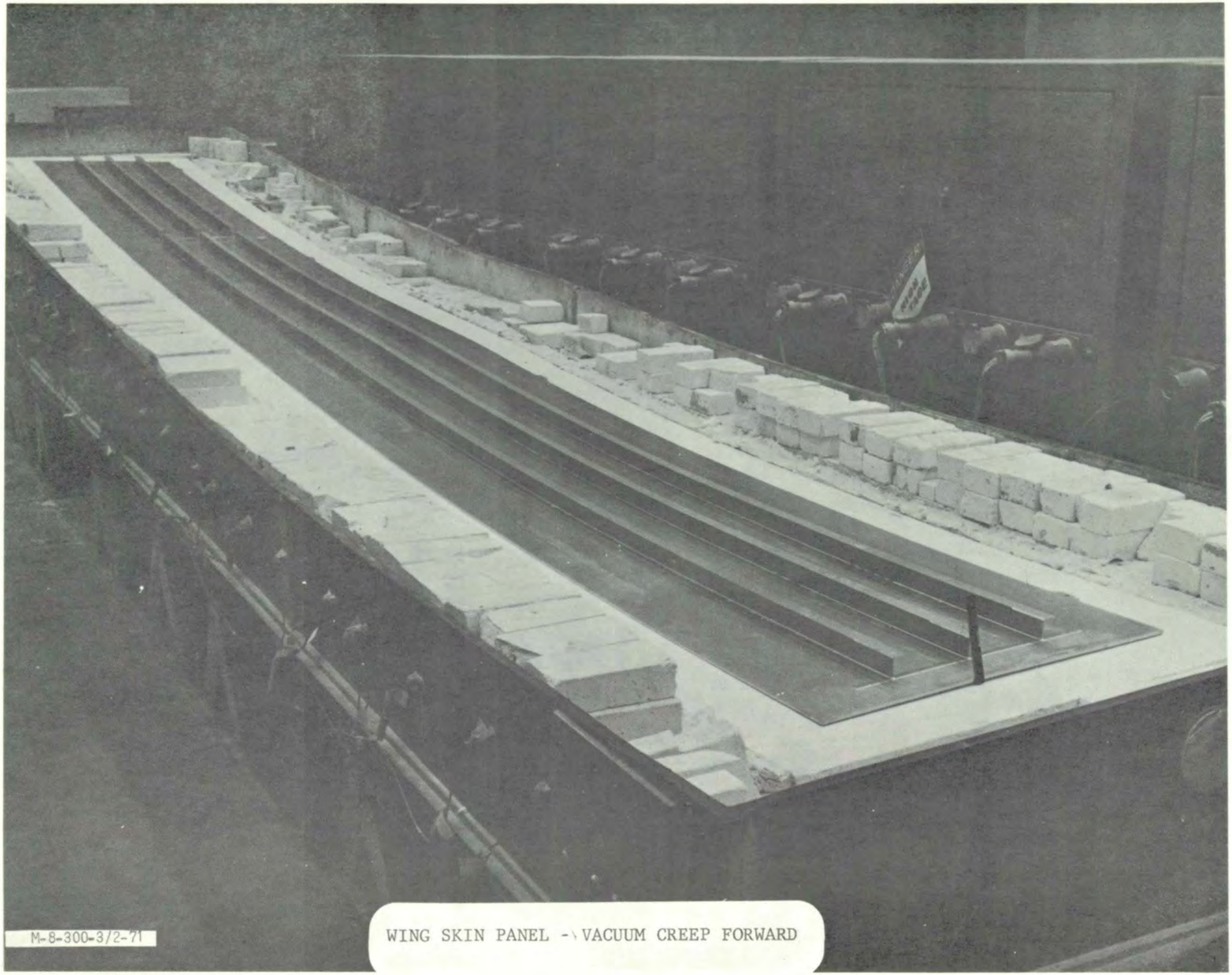
ELECTRON BEAM WELDED RIB



PLASMA ARC WELDING FACILITY - BOEING


M-7-300-3/2/71

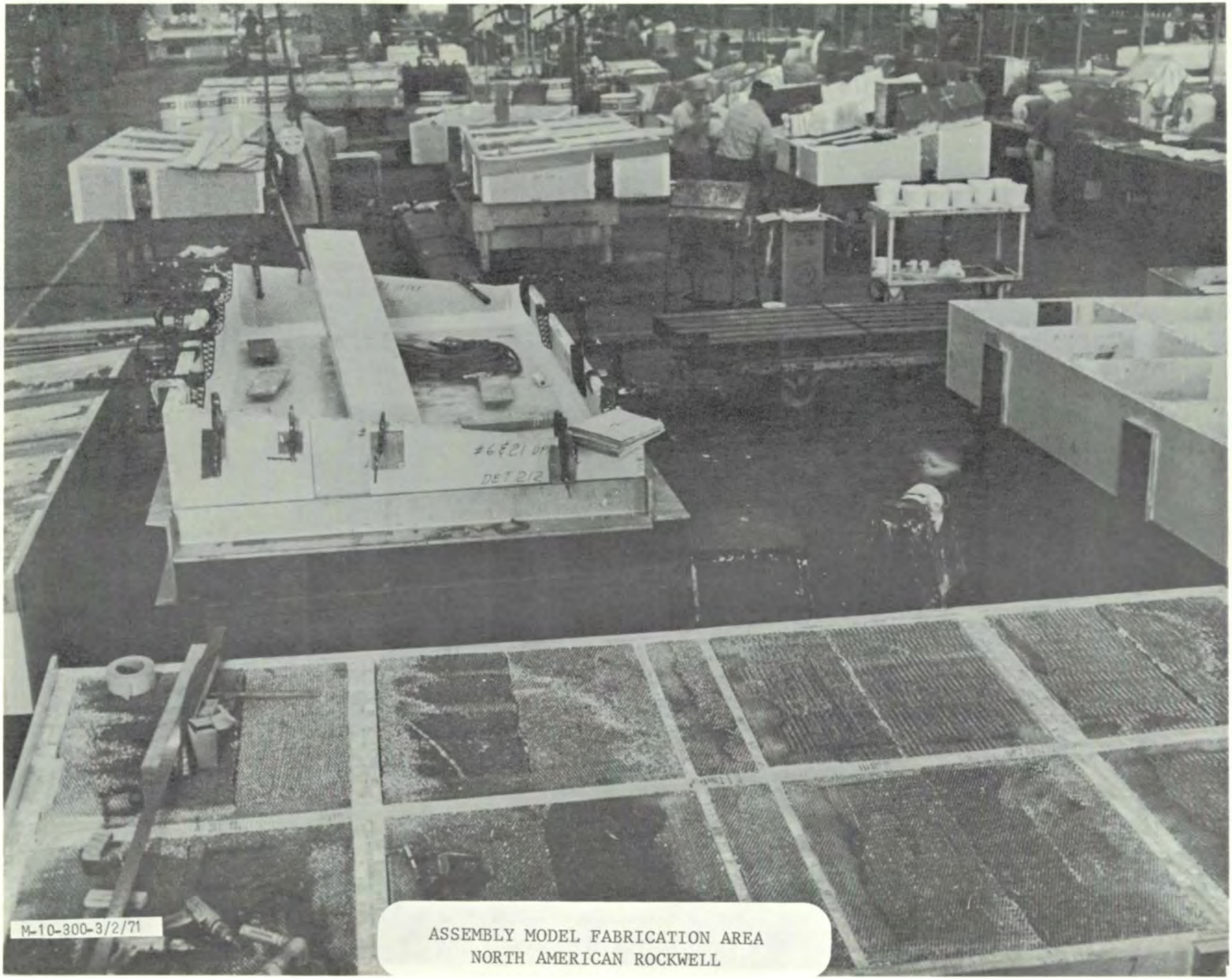
PLASMA ARC WELDED WING SKIN PANEL



WING SKIN PANEL - VACUUM CREEP FORWARD

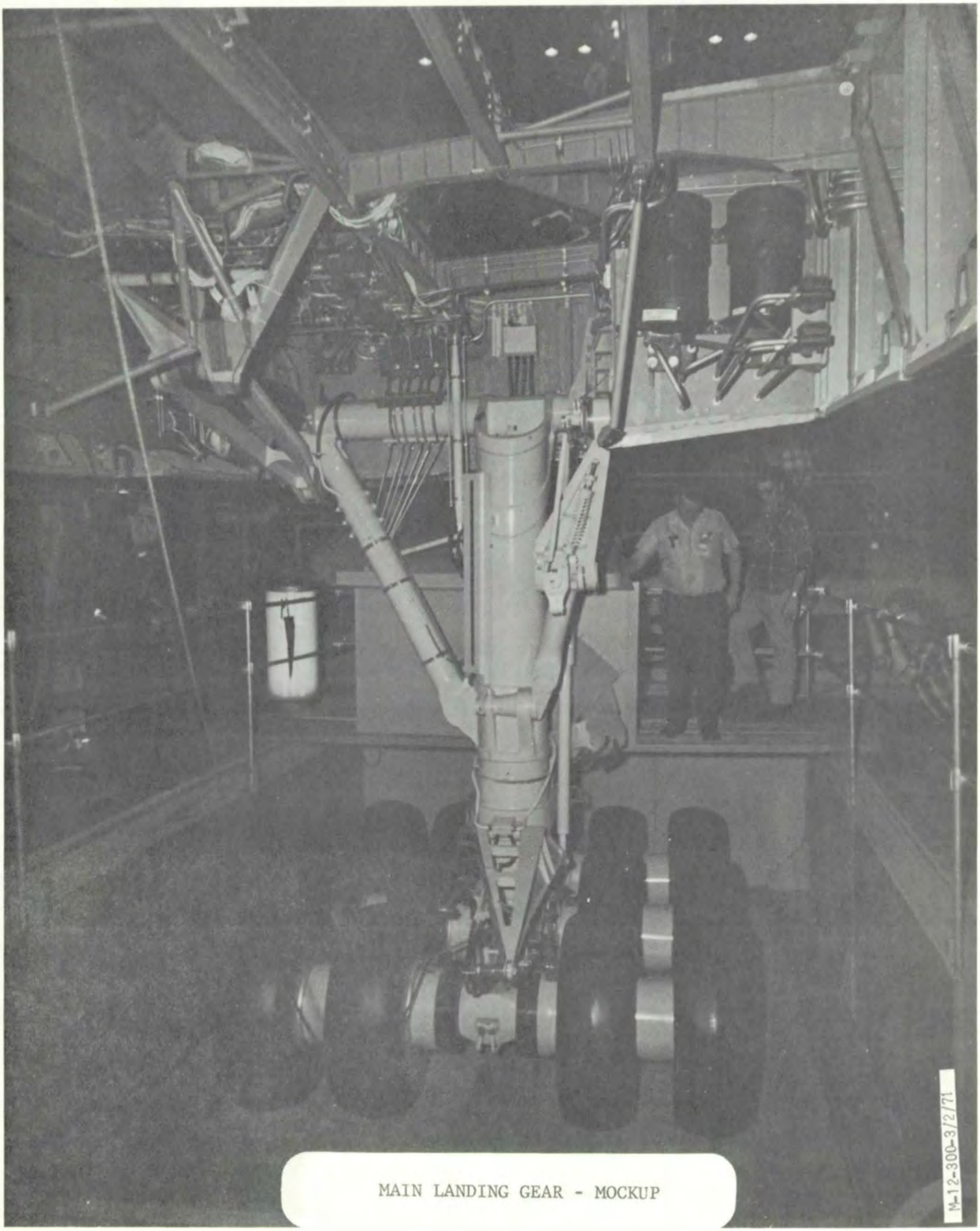
M-9-300-3/2/71

SPAR ASSEMBLY JIGS - BOEING

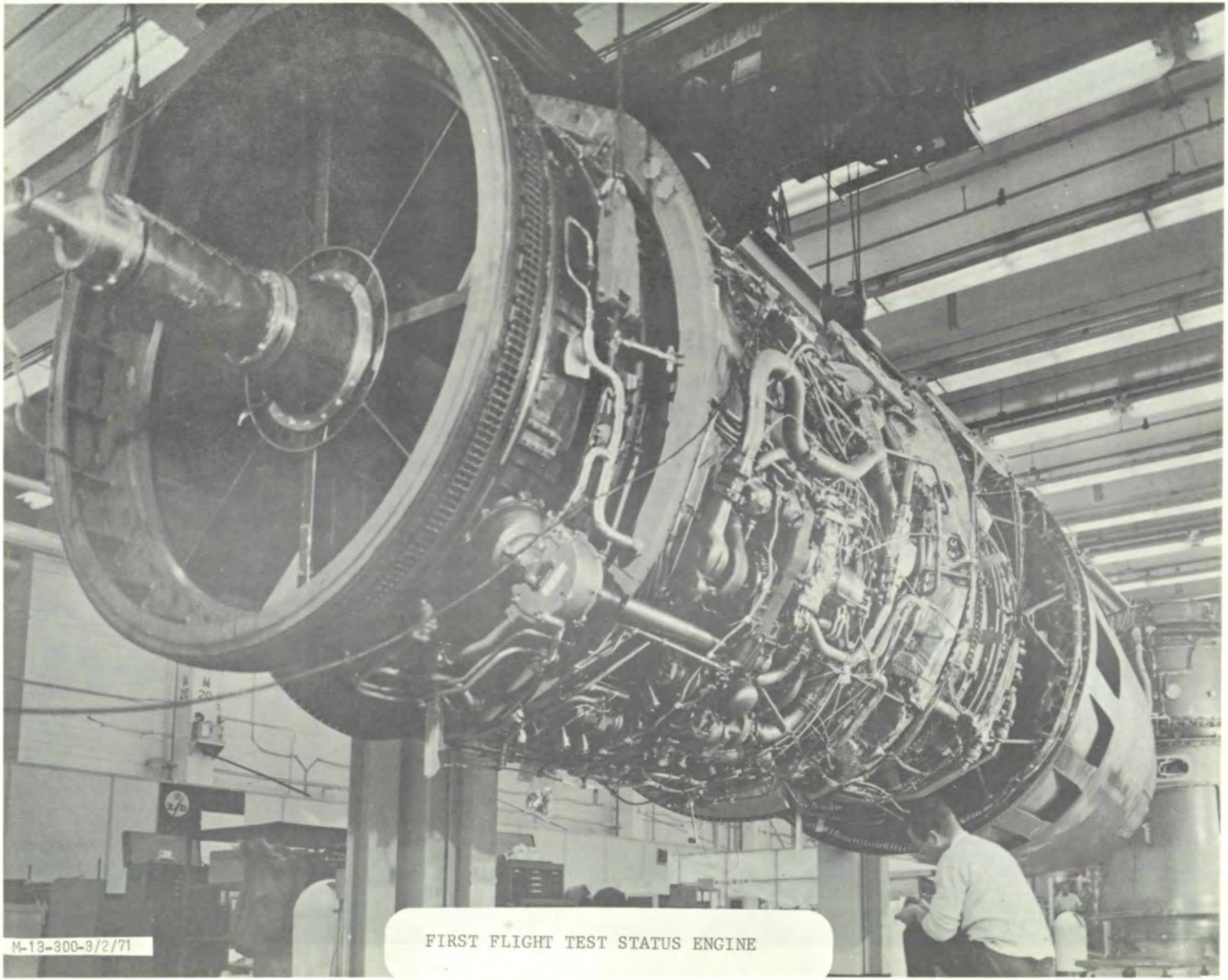


ASSEMBLY MODEL FABRICATION AREA
NORTH AMERICAN ROCKWELL

MAIN LANDING GEAR OUTER CYLINDER FORGING
LADISH COMPANY, CUDAHY, WISCONSIN

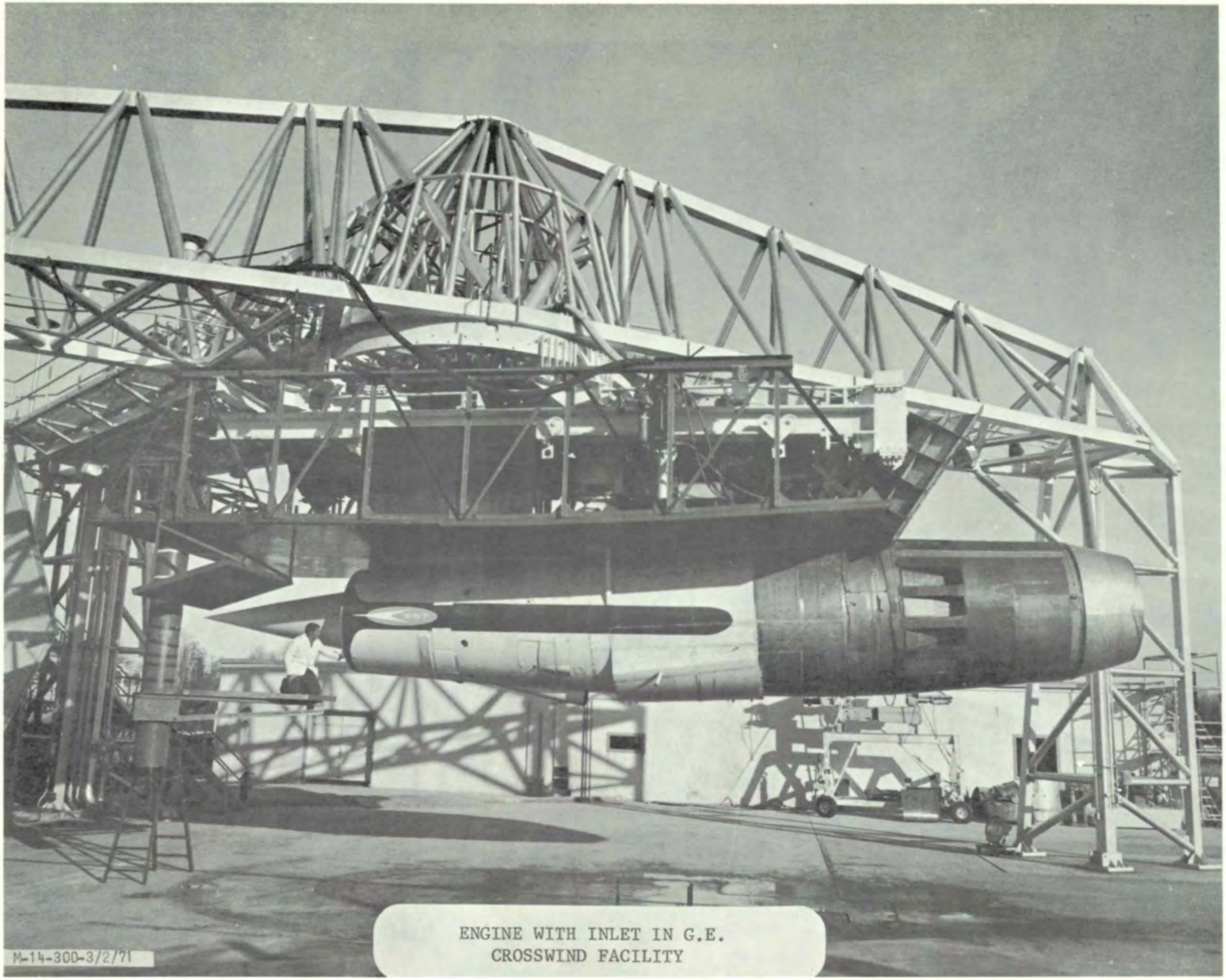


MAIN LANDING GEAR - MOCKUP



M-13-300-3/2/71

FIRST FLIGHT TEST STATUS ENGINE



ENGINE WITH INLET IN G.E.
CROSSWIND FACILITY

COMPETITION – CHARACTERISTICS

	BOEING 2707-300	CONCORDE	TU-144
1. MAXIMUM T.O. GROSS WT., LB.	750,000	385,000	330,000 ?
2. LENGTH	298'	193'	188.5'
3. SPAN	143' 5"	83' 10"	72'
4. MATERIAL	TITANIUM	ALUMINUM	ALUMINUM
5. THRUST (AUGMENTED) LB/ENG.	67,800	38,300	38,500
6. RANGE, STATUTE MILES	4,000	4,000	4,000
7. PASSENGERS	298	128	120
8. CRUISE SPEED, MACH NO.	M 2.7	M 2.05	M 2.35 ?
	(1,782 MPH)	(1,350 MPH)	(1,550 MPH)
9. MEAN CRUISE ALTITUDE (FT.)	63,000	56,000	59,000
10. TAKEOFF DISTANCE, STD. DAY + 15°	10,000'	10,900'	–
11. LANDING DISTANCE	8,250	8,200	–

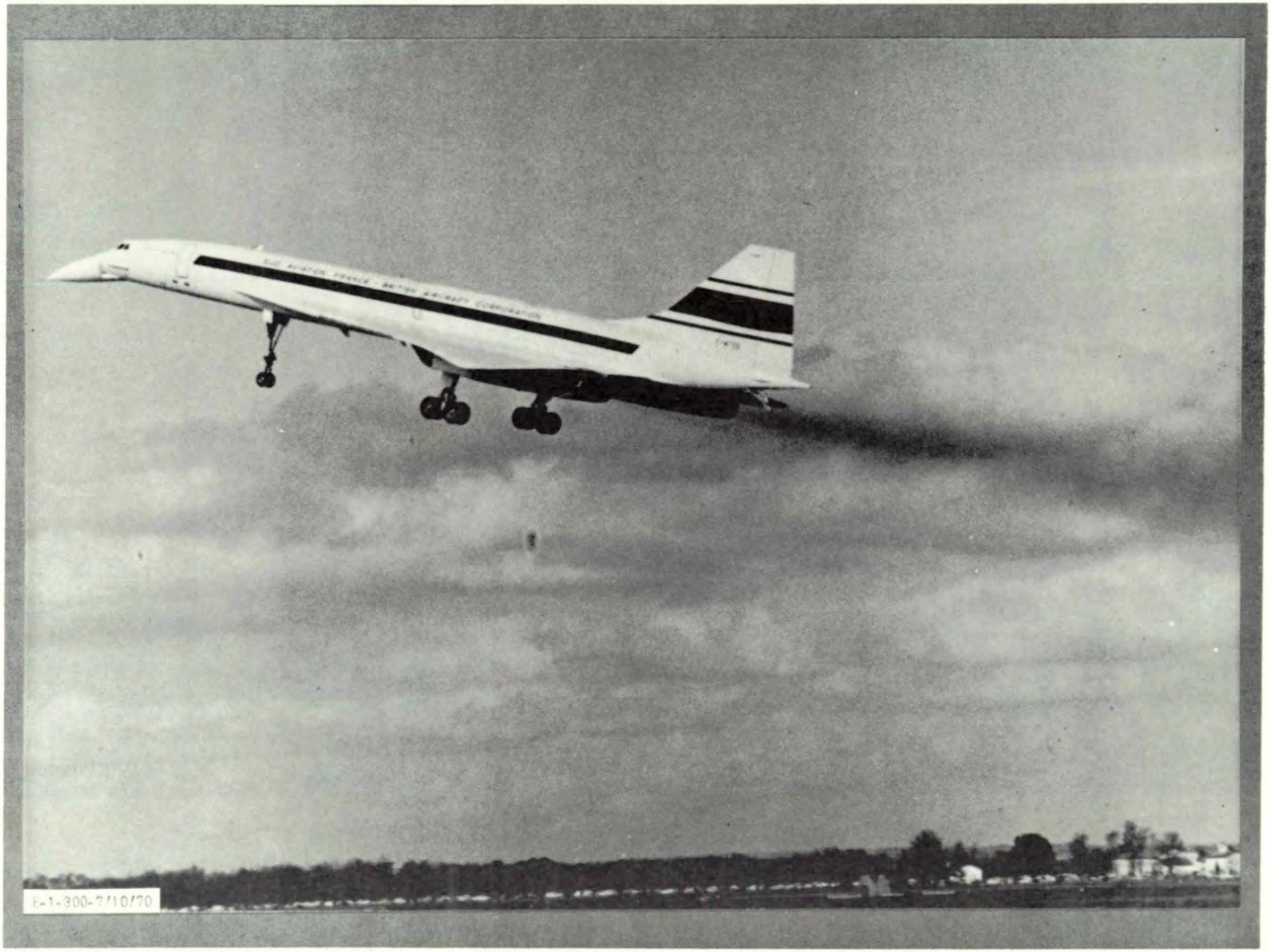
E-4-300-7/10/70

COMPETITION - STATUS

	B-2707	CONCORDE	TU-144
1. FIRST FLIGHT DATE	11-30-72	3-2-69	12-31-68
2. NUMBER OF HOURS	---	394	OVER 250 (BY END 1969)
3. SPEED ACHIEVED	---	M 2.05	M 2.2
4. EST. IN-SERVICE DATE	1978	EARLY 1974	1971/72
5. NUMBER OF POSITIONS	122	74	?
6. AIRLINES	12 U.S. 14 NON-U.S.	7 U.S. 9 NON-U.S.	INTERESTED; JAL KLM AIR INDIA PAKISTAN

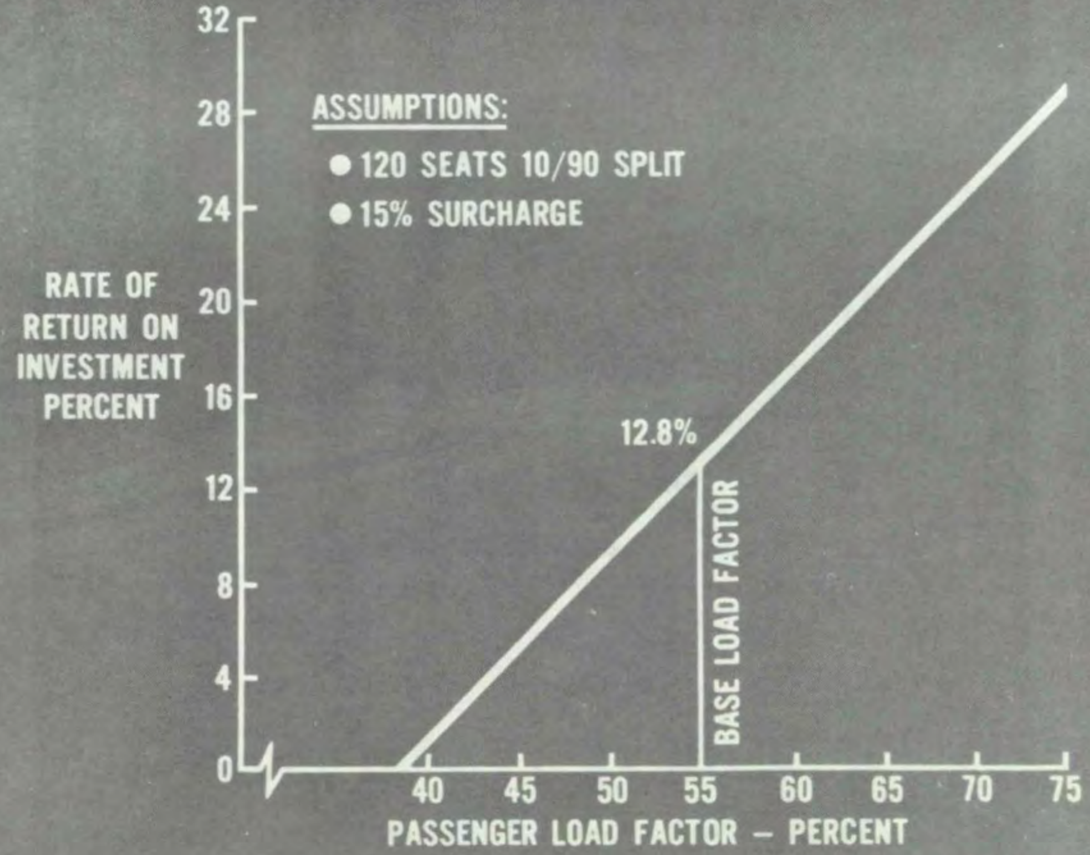
E-5-200-2/22/71

CONCORDE

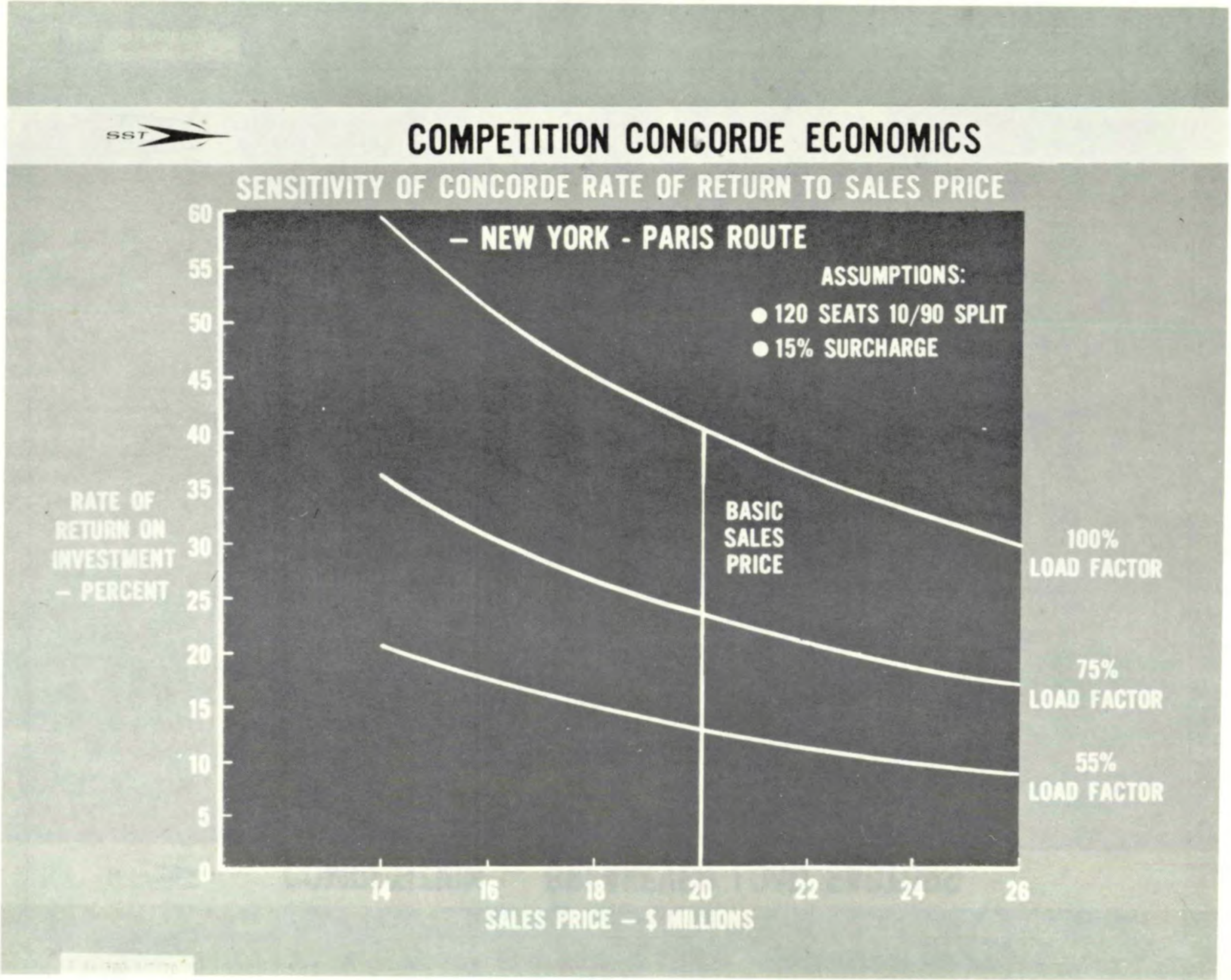


COMPETITION – CONCORDE ECONOMICS

SENSITIVITY OF CONCORDE RATE OF RETURN TO PASSENGER LOAD FACTOR
NEW YORK – PARIS ROUTE



E-8-300-8/11/70


SST
COMPETITION CONCORDE ECONOMICS
SENSITIVITY OF CONCORDE RATE OF RETURN TO SALES PRICE
– NEW YORK - PARIS ROUTE
ASSUMPTIONS:
● 120 SEATS 10/90 SPLIT
● 15% SURCHARGE
RATE OF RETURN ON INVESTMENT – PERCENT
0
5
10
15
20
25
30
35
40
45
50
55
60
BASIC SALES PRICE
100% LOAD FACTOR
75% LOAD FACTOR
55% LOAD FACTOR
14
16
18
20
22
24
26
SALES PRICE – $ MILLIONS

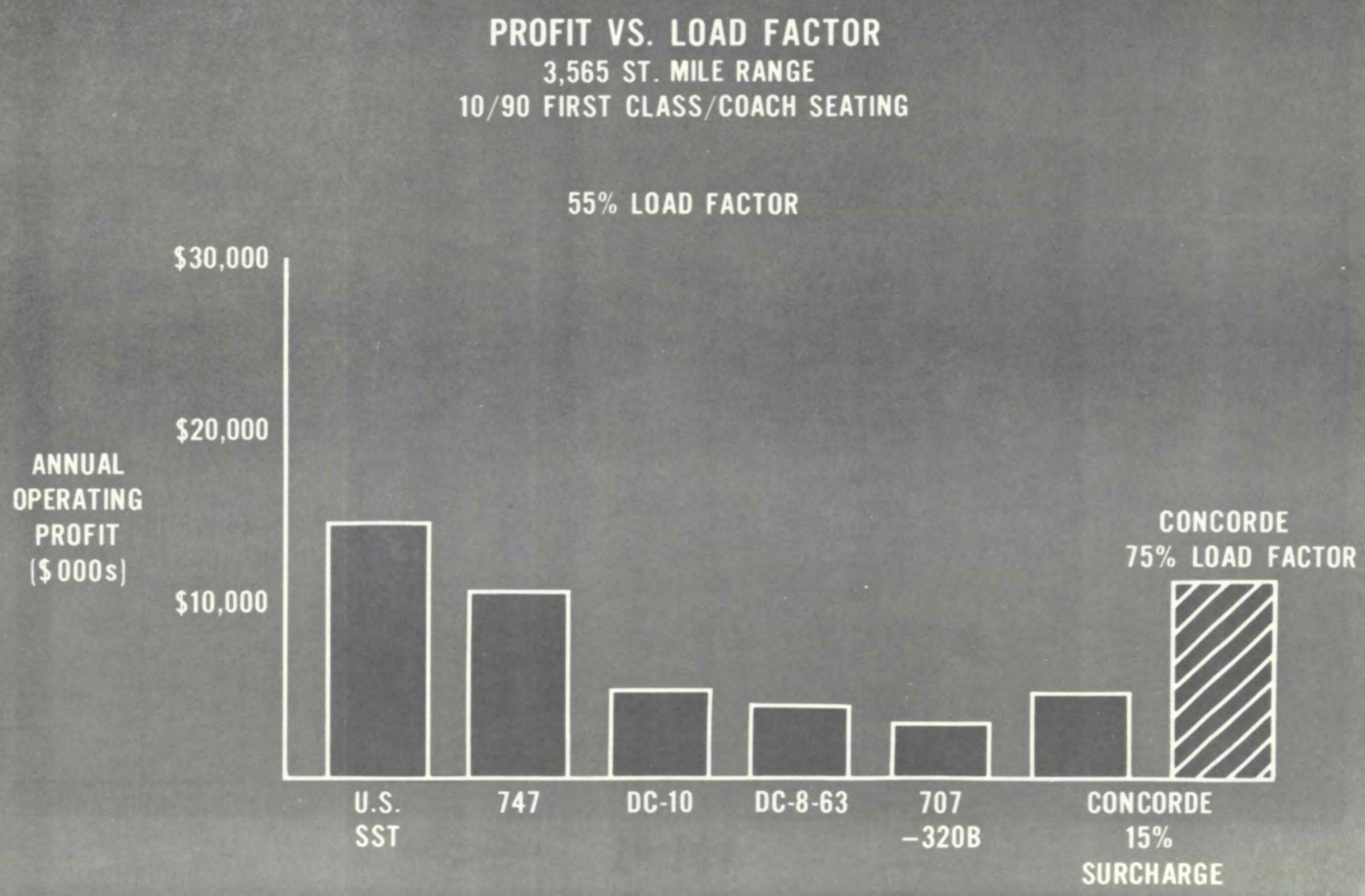
COMPETITION – BREAKEVEN LOAD FACTORS

NEW YORK – PARIS ROUTE

	CURRENT YIELD	15% SURCHARGE
CONCORDE	44.8%	39.0%
SST	35.3	30.7
747	31.5	–
707	36.5	–

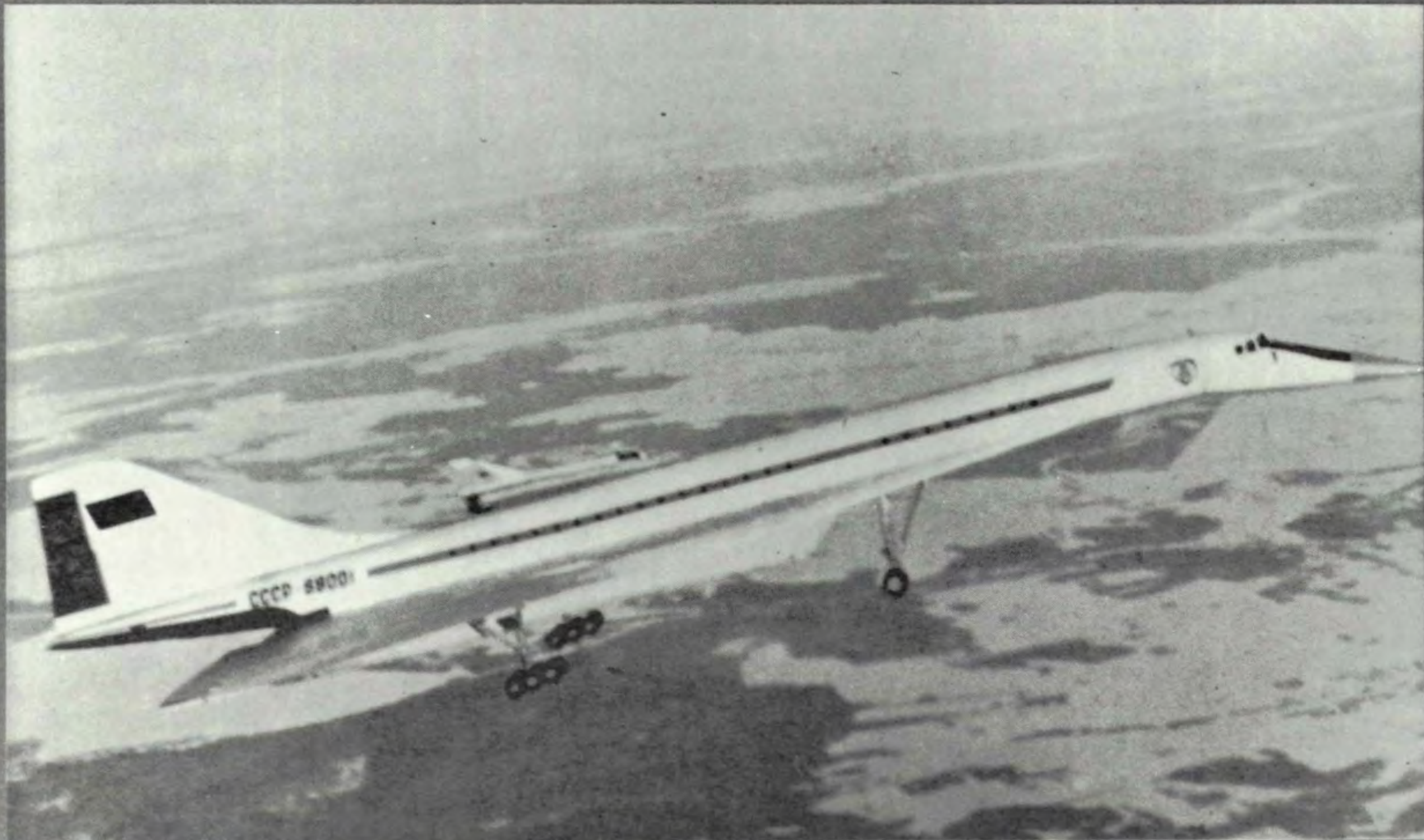
E-9-300-8/7/70

COMPETITION – PROFITABILITY



E-10A-300-2/22/7

Tu-144



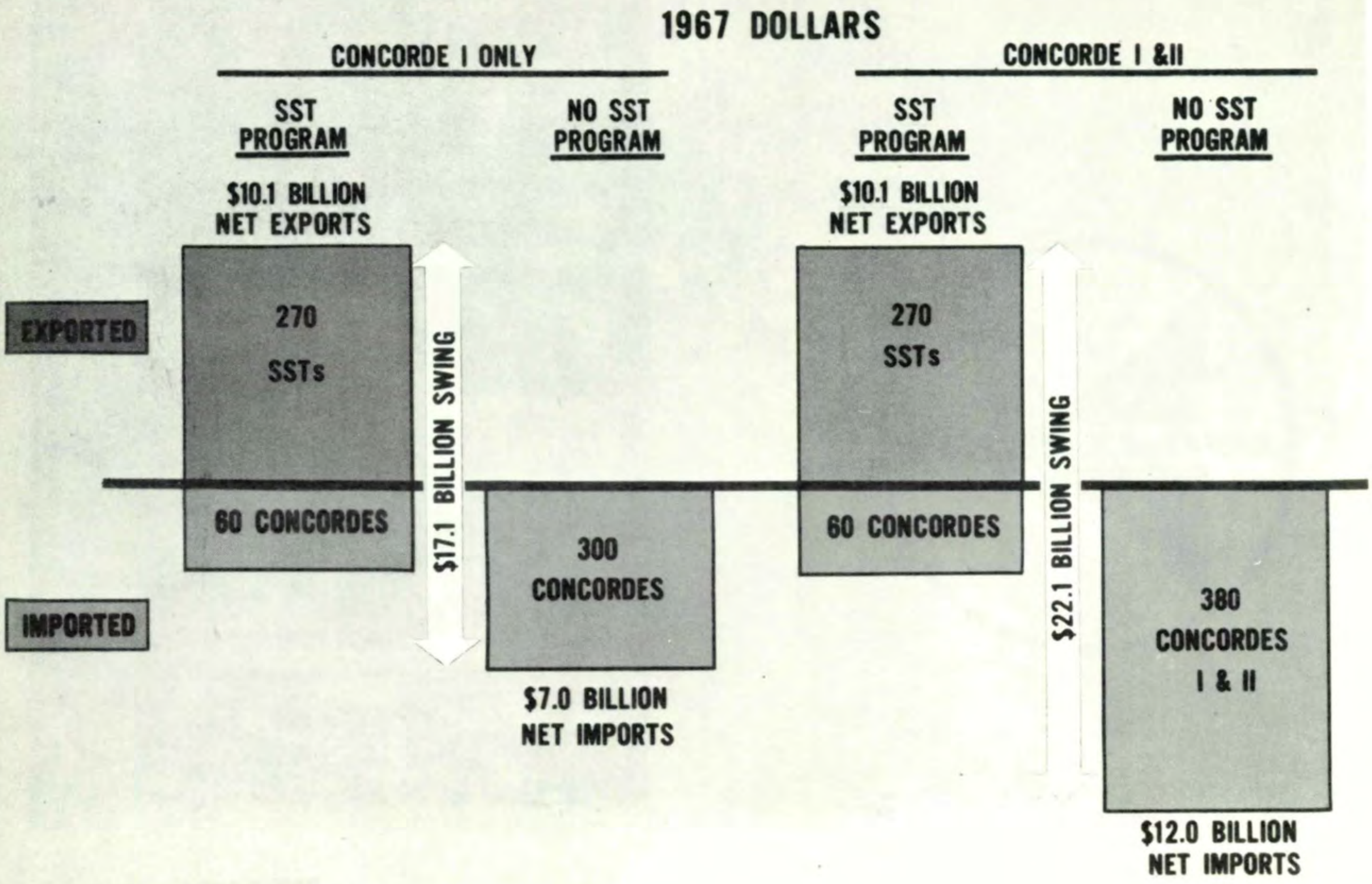

IT'S COMING FAST NOW!
The European A 300 B, 250 - passenger transport designed to fill a major gap in airline carrying capacity of the coming decades for short and medium route segments, is
IN THE MAKING!
French, German, British and Dutch workers are steadily turning out components for an aircraft of the 80's which will be flying in the 70's.
A300 B
Société Nationale Industrielle AEROSPATIALE
DEUTSCHE AIRBUS - HAWKER SIDDELEY AVIATION - FOKKER

G-6-300-7/10/70

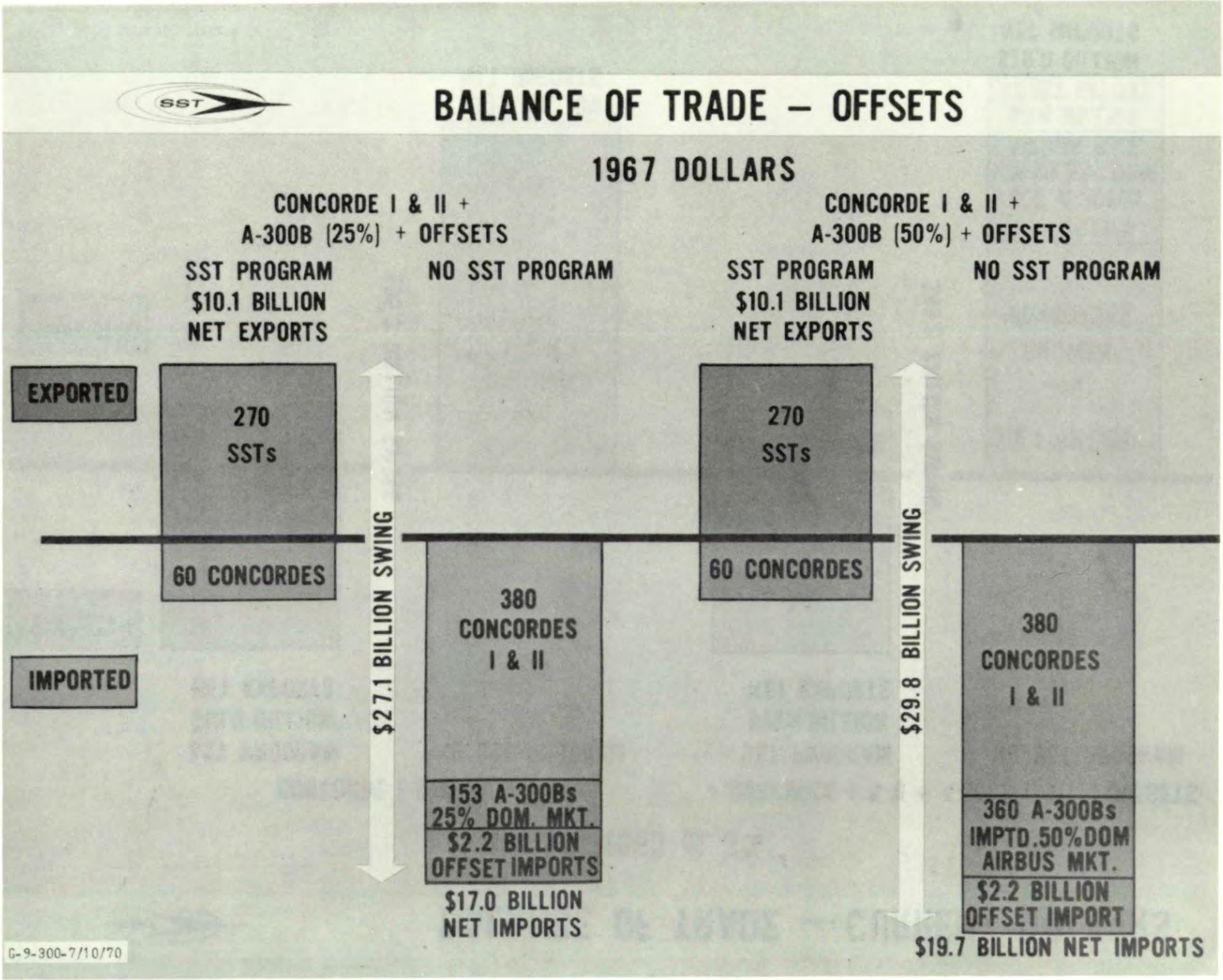
day after day
Dassault's Mercure
keeps its pro mise.
for mercure, a year well spent...
At the Paris Air Show 1969, crowds thronged by the thousand to get a glimpse of the full-scale model of the twin jet short-haul « Mercure ».
Anybody can make a full-scale model : all you need are the means. But DASSAULT had also made firm dates.
A year has passed. A year filled with activity. All the promises have been kept. « Mercure » has left the drawing board – it is already a reality. In their plants at St-Cloud, Boulogne and Mérignac, DASSAULT has built the nose, wings and central fuselage.
Fiat, in Italy, is constructing the rear fuselage and the tail unit. CASA, in Spain, the forward fuselage. SABCA, in Belgium, is also on the job. And all the makers of equipment, in Europe and in the United States, are working to make sure that « Mercure » keeps its promise.
For its timing. And for the weight as well. « Mercure » is not one of those planes that put on weight under construction. Each element built is weighed and checked against the calculated weight — always successfully!
All goes well for « Mercure ». Rendez-vous, in flight, at the next Paris Air Show.
Mercure
the money-maker by DASSAULT
It won't be long now!

G-7-300-7/10/70

BALANCE OF TRADE – 1967 DOLLARS

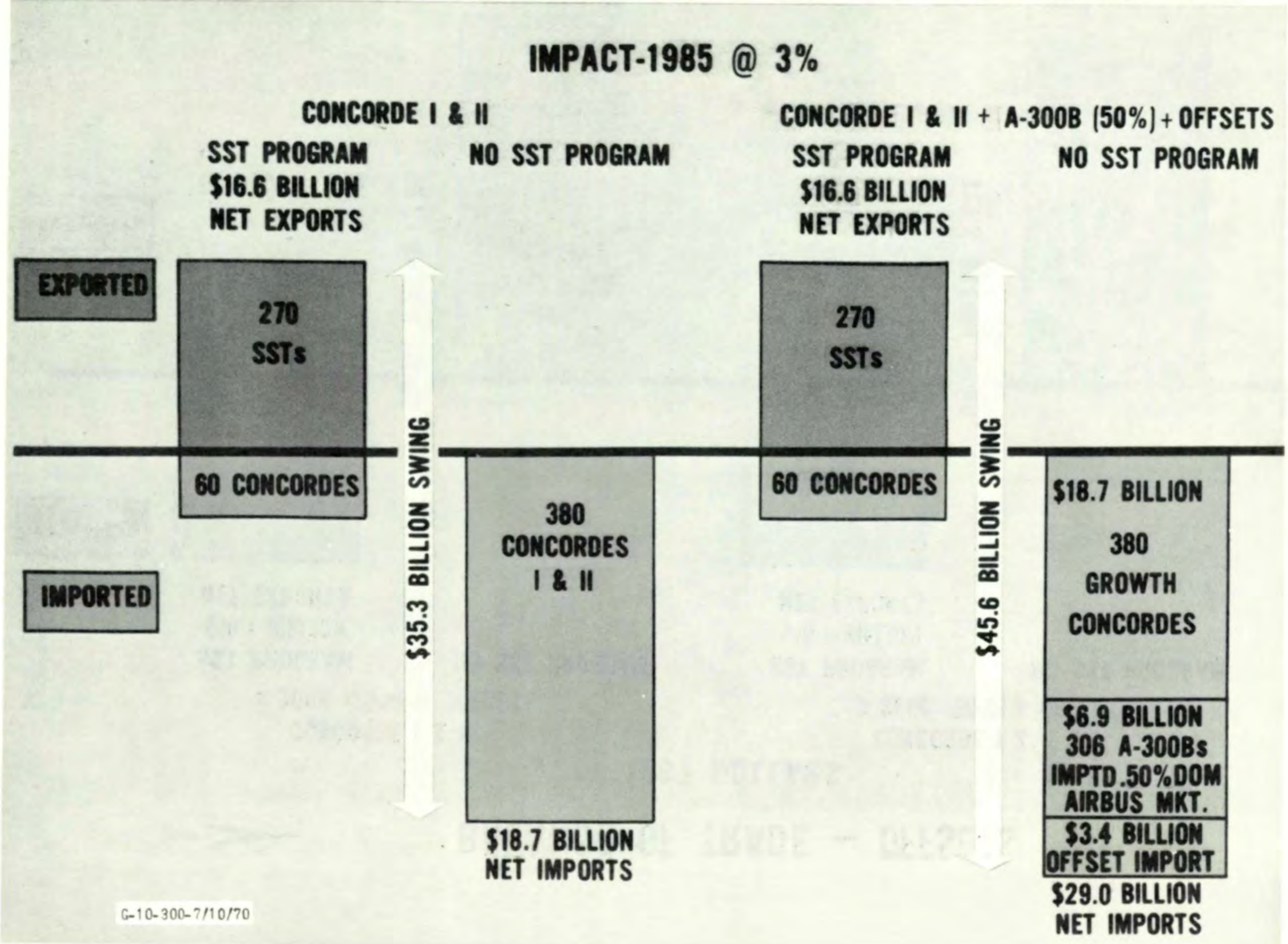


G-8-300-7/10/70



BALANCE OF TRADE – OFFSETS
1967 DOLLARS
CONCORDE I & II + A-300B (25%) + OFFSETS
SST PROGRAM $10.1 BILLION NET EXPORTS
NO SST PROGRAM
CONCORDE I & II + A-300B (50%) + OFFSETS
SST PROGRAM $10.1 BILLION NET EXPORTS
NO SST PROGRAM
EXPORTED
IMPORTED
270 SSTs
60 CONCORDES
$27.1 BILLION SWING
380 CONCORDES I & II
153 A-300Bs 25% DOM. MKT.
$2.2 BILLION OFFSET IMPORTS
$17.0 BILLION NET IMPORTS
270 SSTs
60 CONCORDES
$29.8 BILLION SWING
380 CONCORDES I & II
360 A-300Bs IMPTD.50%DOM AIRBUS MKT.
$2.2 BILLION OFFSET IMPORT
$19.7 BILLION NET IMPORTS
G-9-300-7/10/70

BALANCE OF TRADE – CURRENT DOLLARS



BALANCE OF TRADE – HOW U.S.A. IS DOING

(DOLLARS IN BILLIONS)

	1965	1966	1967	1968	1969	1970
OTHER INDUSTRIAL MACHINERY AND PARTS	2.1	2.2	2.2	2.4	2.6	3.9
CIVILIAN AIRCRAFT ENGINES AND PARTS	1.0	1.0	1.5	2.1	2.0	2.5
CHEMICALS, EXCLUDING MEDICINALS	1.4	1.6	1.7	2.0	2.1	2.6
CONSTRUCTION AND NON-FARM MACHINERY	1.6	1.7	1.7	1.7	1.9	1.4
HIDES, MINERALS, WOODS, ECT.	1.3	1.4	1.5	1.6	1.7	1.3
ELECTRICAL, ELECTRONIC MACHINERY PARTS	.8	.8	.9	.9	1.0	1.0
BUSINESS AND OFFICE MACHINES, COMPUTERS	.5	.5	.7	.7	.9	1.2
TOBACCO UNMANUFACTURED	.3	.3	.3	.4	.5	.4
SCIENTIFIC, PROFESSIONAL EQUIPMENT	.3	.4	.4	.4	.5	.5
CONSUMER GOODS, EXCEPT AUTOS	–1.5	–1.9	–2.1	–3.0	–3.9	–4.8
FUELS AND LUBRICANTS	–1.3	–1.3	–1.1	–1.4	–1.7	–1.5
AUTOMOTIVE VEHICLES, PARTS AND ENGINES	1.0	.5	.2	–.8	–1.4	–2.3
BUILDING MATERIALS, EXCEPT METALS	–.6	–.8	–.8	–1.1	–1.2	–.9
TIRES, RUBBER, RESINS, GUMS, ETC.	–.7	–.7	–.7	–.9	–1.0	–.3
IRON AND STEEL PRODUCTS	–.6	–.6	–.7	–1.4	–.8	–.5
OTHER METALS	–.7	–1.0	–1.1	–1.2	–.8	–.7
PAPER AND PAPER BASE STOCKS	–.7	–.8	–.7	–.6	–.7	–.4
FOODS, FEEDS AND BEVERAGES	1.0	1.0	.4	–.5	–.5	–.3
TEXTILE SUPPLIES AND MATERIALS	–.1	–.3	.1	–.2	–.3	–.8
STEEL MAKING MATERIALS	–.4	–.4	–.4	–.4	–.2	–.2
OTHER	.2	.3	–.1	–.1	–	–
TOTAL	4.9	3.9	3.9	.6	.7	2.1

G-12-300-2/22/71

SOURCE: Dept. of Commerce

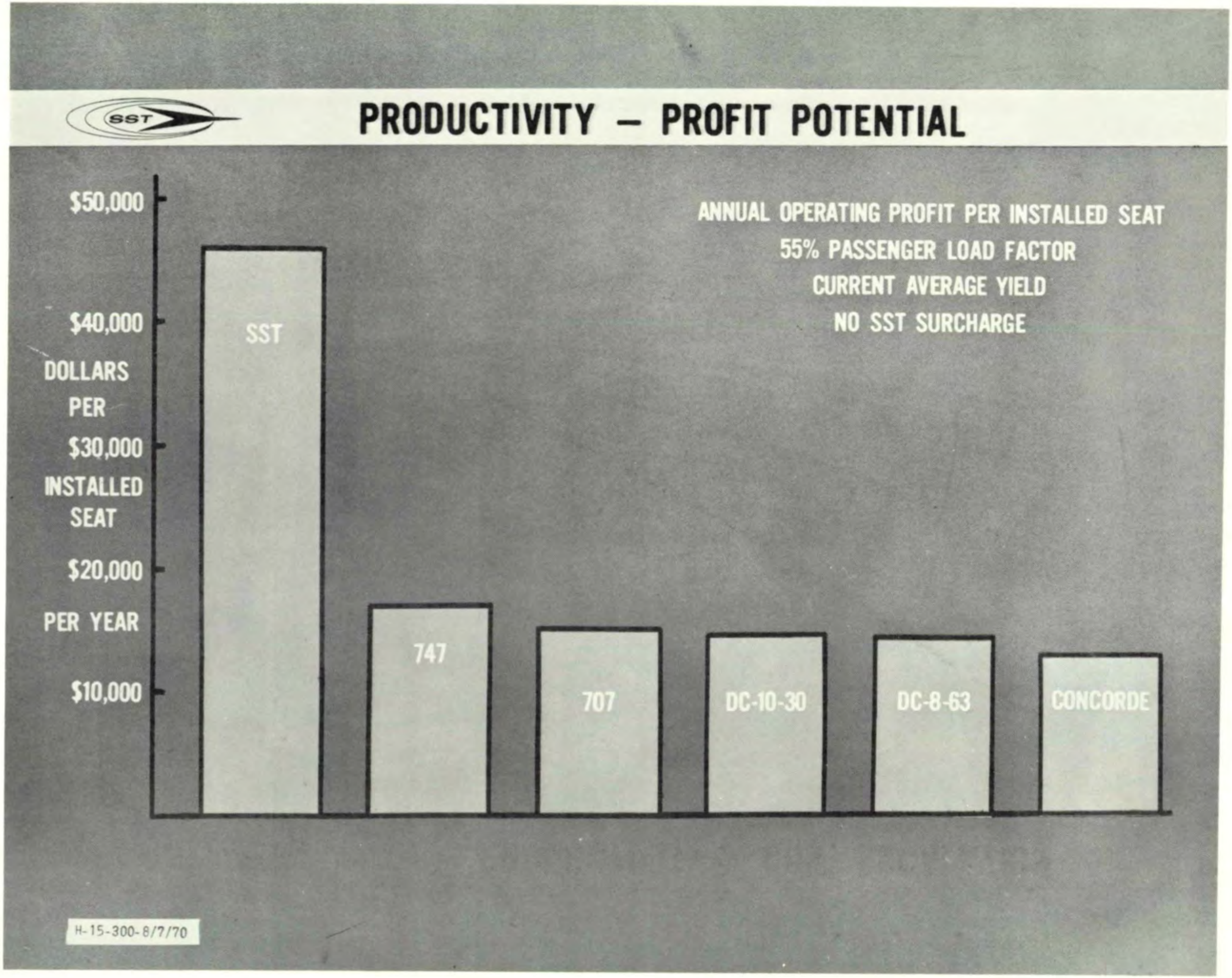
PRODUCTIVITY - TRAFFIC GROWTH RATES

ANNUAL RATES IN PERCENT

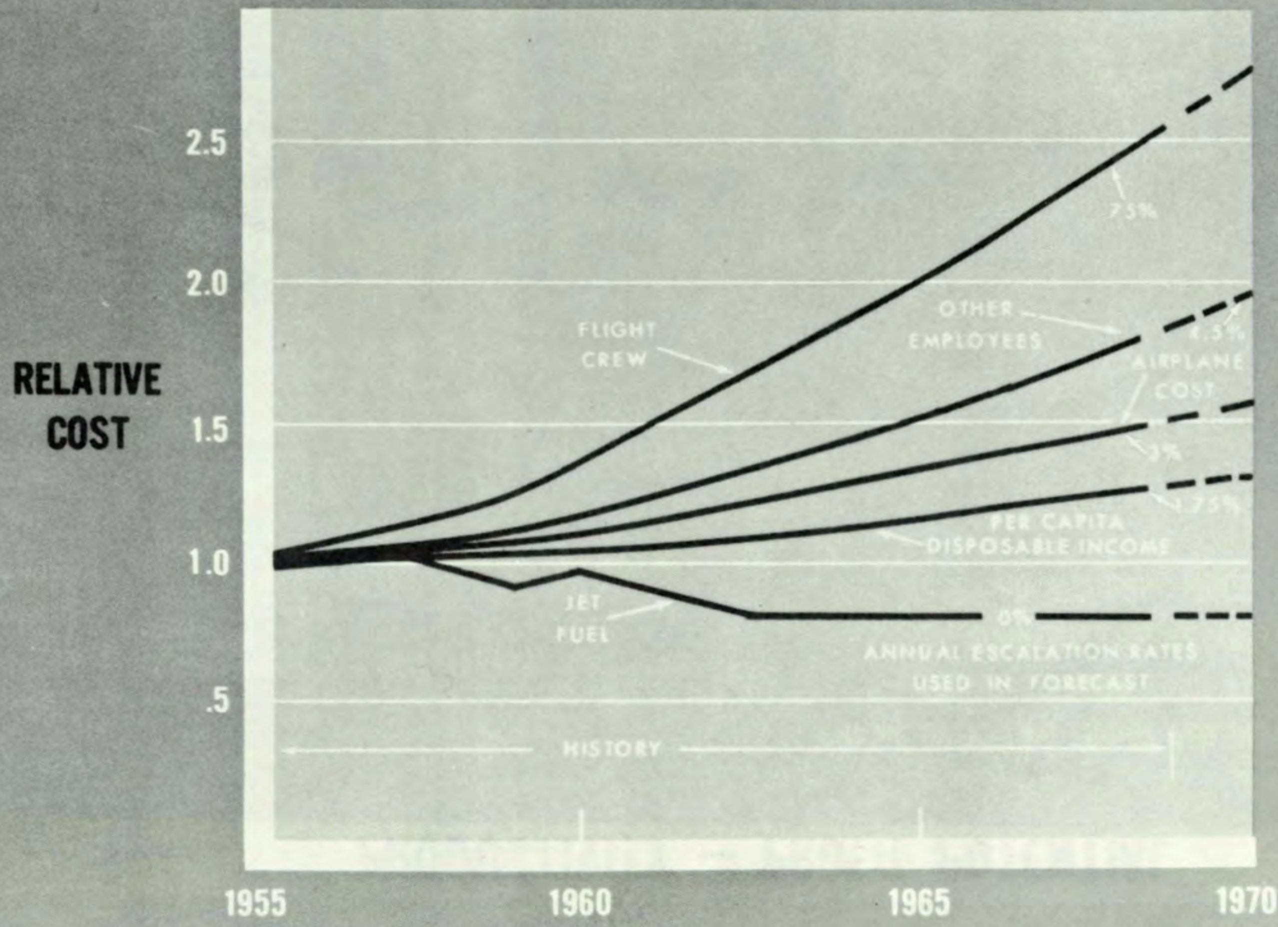
BETWEEN U.S. AND CANADA AND:	ACTUAL 1966-1968	FORECAST 1966-1975	FORECAST 1975-1980
EUROPE	18	14	8
CENTRAL AMERICA	16	13	9
HAWAII	21	17	12
FAR EAST	17	19	13
SOUTH AMERICA	13	14	10
AUSTRALIA AND NEW ZEALAND	24	20	13

SOURCE: BOEING

H-14-300-7/31/70


SST
PRODUCTIVITY – PROFIT POTENTIAL
$50,000
$40,000
DOLLARS
PER
$30,000
INSTALLED
SEAT
$20,000
PER YEAR
$10,000
ANNUAL OPERATING PROFIT PER INSTALLED SEAT
55% PASSENGER LOAD FACTOR
CURRENT AVERAGE YIELD
NO SST SURCHARGE
SST
747
707
DC-10-30
DC-8-63
CONCORDE
H-15-300-8/7/70

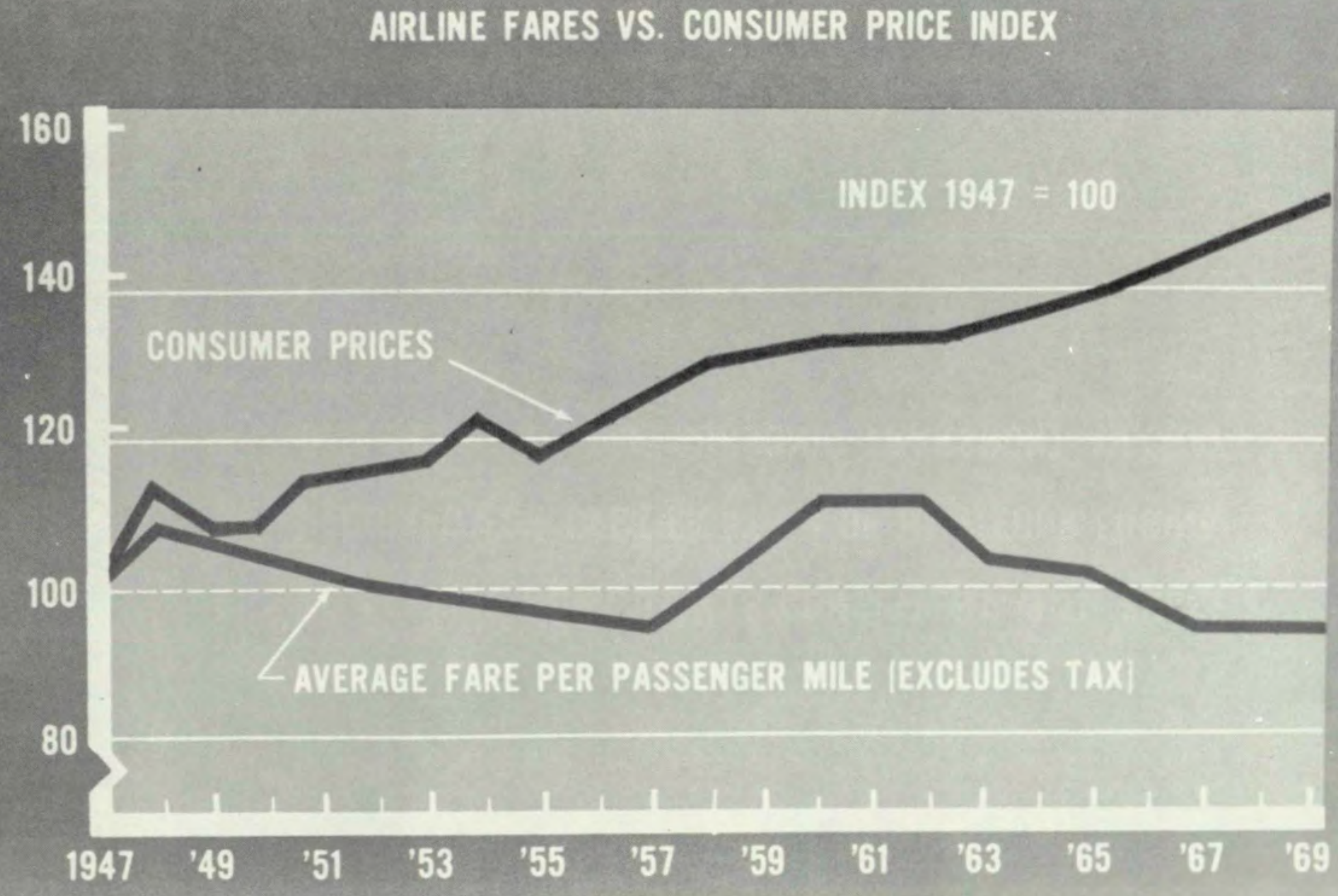
PRODUCTIVITY – COST ESCALATION



SOURCE: ATA Facts and Figures

H-10-300-7/10/70

PRODUCTIVITY – PRICE TRENDS



H-11-300-7/10/70

ENVIRONMENT – NOISE OBJECTIVES

TO ACHIEVE NOISE LEVELS CONSISTENT WITH THOSE REQUIRED FOR CERTIFICATION OF NEW FOUR-ENGINE, INTER-CONTINENTAL, SUBSONIC TRANSPORT AIRCRAFT.

F-6-200-2/22/71

CLIMATIC EFFECTS

CONCERN		SCEP REPORT	REF. PAGE
CARBON DIOXIDE	–	CO_2. NO PROBLEM	72
INCREASED WATER VAPOR	–	0.2 PPM INCREASE (3.0 TO 3.2 PPM) IN WATER VAPOR ON GLOBAL AVERAGE AND 2.0 PPM INCREASE (3.0 TO 5.0) IN NORTH TEMPERATE LATITUDES.	73
INCREASED CLOUDINESS	–	MAY INCREASE FREQUENCY THICKNESS AND EXTENT OF POLAR CLOUDS. CANCELLATION OF SST WILL INCREASE CLOUDINESS IN TEMPERATE ZONES.	210
OZONE & ULTRAVIOLET RADIATION	–	REDUCED OZONE COULD ADMIT MORE ULTRAVIOLET RADIATION TO LOWER ATMOSPHERE.	100
		OZONE CHANGES LIE WELL WITHIN NORMAL DAY-TO-DAY AND GEOGRAPHIC VARIABILITY -- CHANGES SHOULD BE INSIGNIFICANT.	106
PARTICLES; SULFATES, HYDROCARBONS AND SOOT	–	WILL CAUSE CONCENTRATIONS OF CO, NO, SO_2, HC AND SOOT RANGING FROM FRACTIONS OF A PPB TO 68 PPB IN NORTH TEMPERATE LATITUDE.	73
		ROLE OF PARTICULATES IN ALTERING HEAT BUDGET IS SMALL.	107
		EMISSIONS OF PRODUCTION SST ENGINES WILL BE APPRECIABLY DIFFERENT THAN USED IN STUDY.	73
		USE OF JET FUEL WITH 0.01% SULFUR CONTENT INSTEAD OF 0.05% WOULD REDUCE EMISSIONS BY 80%.	74
TEMPERATURE CHANGE	–	THE ROLE OF PARTICULATES IN ALTERING HEAT BUDGET IS SMALL AND WOULD TEND TO WARM THE STRATOSPHERE.	107
		WATER VAPOR WILL INCREASE TEMPERATURE AT GROUND LEVEL LESS THAN 0.1°C. AND COOL STRATOSPHERE A FEW DEGREES.	106
LARGE-SCALE SST OPERATIONS	–	CANNOT BE CERTAIN ABOUT MAGNITUDE OF EFFECTS DUE TO UNCERTAINTIES IN AVAILABLE INFORMATION.	107
		UNCERTAINTIES SHOULD BE RESOLVED BEFORE LARGE-SCALE SST OPERATIONS.	107

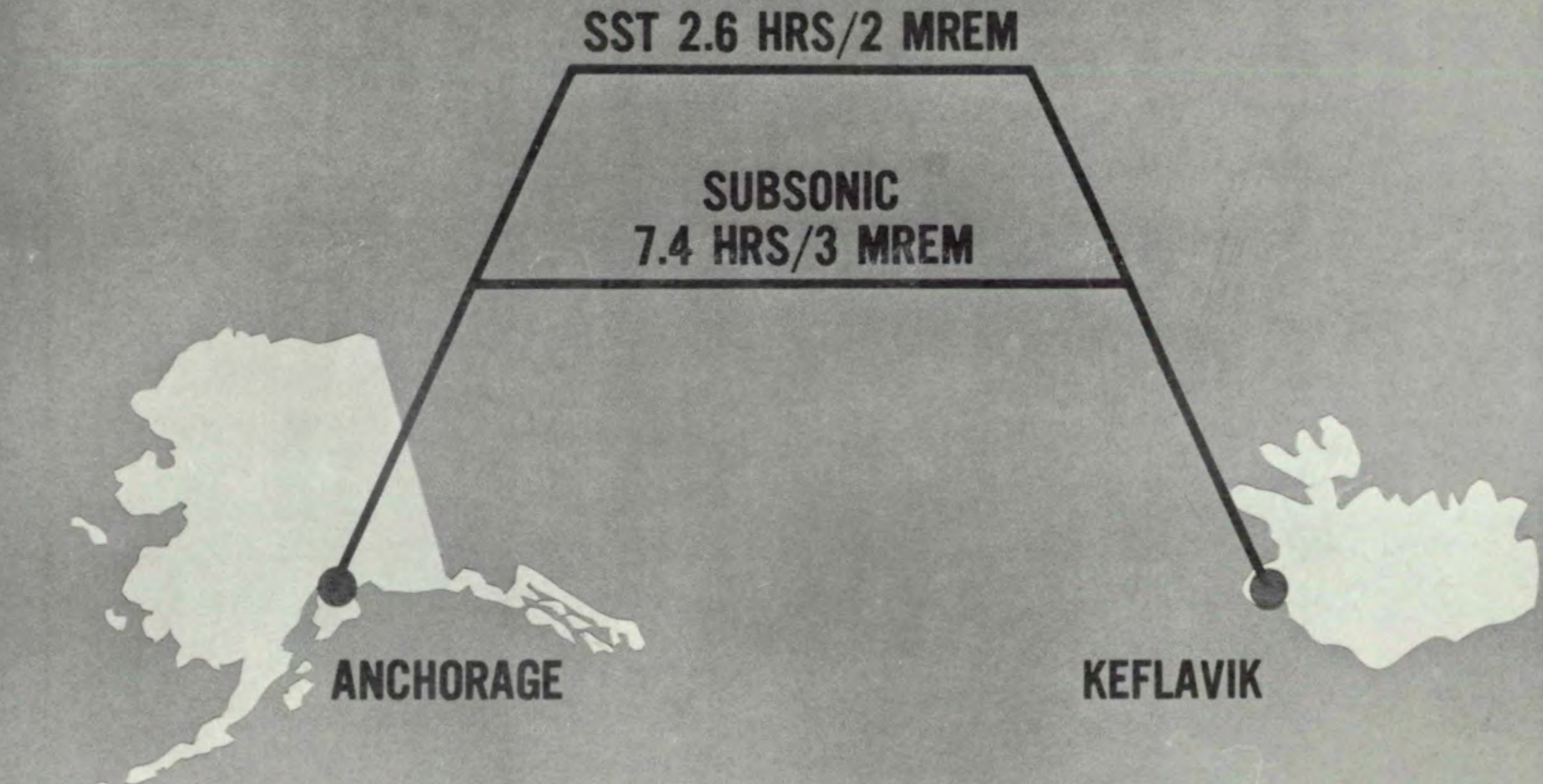
F-38-200-2/22/71

ENVIRONMENT – RADIATION/GEOGRAPHY

LOCATION	DOSE RATE, MREM/YEAR
OLYMPIC PENINSULA, WASHINGTON	35
MID-ATLANTIC	55
NEW YORK CITY	70-130
DENVER - COLORADO SPRINGS	130-200

F-15-200-2/22/71

ENVIRONMENT – RADIATION/PROFILE



Prepared by DOT Based on Data from: International Comm. on Radiological Protection Confirmed by: Dr. Tribus & Dr. Rossi

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ENVIRONMENT – ENVIRONMENTAL ADVISORY COMMITEE

DR. S. FRED SINGER – DEPUTY ASSISTANT SECRETARY, DEPARTMENT OF THE INTERIOR (CHAIRMAN*)

DR. MYRON TRIBUS – SENIOR VICE PRESIDENT FOR RESEARCH AND DEVELOPMENT, XEROX CORPORATION

DR. WILLIAM W. KELLOGG – ASSOCIATE DIRECTOR, NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

DR. LESTER MACHTA – DIRECTOR, AIR RESOURCES LABORATORY, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

MR. H. J. MASTENBROOK – ATMOSPHERIC PHYSICIST, U. S. NAVAL RESEARCH LABORATORY

MR. GEORGE CHATHAM – AERONAUTICS AND SPACE SPECIALIST, LEGISLATIVE REFERENCE SERVICE, LIBRARY OF CONGRESS

DR. HARALD ROSSI – PROFESSOR OF RADIOLOGY PHYSICS, COLUMBIA UNIVERSITY AND CHAIRMAN, FAA COMMITTEE ON RADIO BIOLOGY ASPECTS OF THE SST

DR. PAUL TOMPKIN – CHAIRMAN, FEDERAL RADIATION COUNCIL

DR. ROBERT M. WHITE – ACTING ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

DR. S. J. GERATHEWOHL – CHIEF, RESEARCH PLANNING BRANCH, OFFICE OF AVIATION MEDICINE, FAA

DR. ARTHUR H. WOLFF – DEPUTY ASSISTANT ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT, ENVIRONMENTAL HEALTH SERVICE, HEW

* CHAIRMAN WILL DESIGNATE ADDITIONAL MEMBERS AS REQUIRED.

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ENVIRONMENT – CTAB SST ENVIRONMENTAL RESEARCH PANEL

DR. FREDERICK HENRIQUES (CHAIRMAN)	– CHAIRMAN, BOARD OF TECHNICAL OPERATIONS, INCORPORATED
DR. THOMAS F. MALONE	– DEAN OF THE UNIVERSITY OF CONNECTICUT
DR. PAUL P. MACCREADY, JR.	– FORMER PRESIDENT, METEOROLOGICAL RESEARCH, INCORPORATED
DR. JOSEPH D. HIRSCHFELDER	– PROFESSOR OF CHEMISTRY, UNIVERSITY OF WISCONSIN
DR. HARRIET L. HARDY	– ASSISTANT MEDICAL DIRECTOR, MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DR. RICHARD S. MILLER	– PROFESSOR OF FOREST ECOLOGY, YALE UNIVERSITY
DR. MARTIN A. POMERANTZ	– DIRECTOR, BARTOL RESEARCH FOUNDATION
MR. ROBERT W. RUMMEL	– VICE PRESIDENT, PLANNING AND RESEARCH, TWA

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ENVIRONMENT – NOISE ADVISORY COMMITEE

PERMANENT MEMBERS:

DR. LEO L. BERANEK, CHAIRMAN: BOLT, BERANEK & NEWMAN, INC.

DR. RAYMOND A. BAUER, HARVARD BUSINESS SCHOOL

DR. JACK L. KERREBROCK, MASSACHUSETTS INSTITUTE OF TECHNOLGY

MR. FRANK W. KOLK, CHAIRMAN: SAE COMMITTEE ON AIRCRAFT NOISE

MR. KENNETH McK. ELDRED, WYLE LABORATORIES

MR. AUBERT L. McPIKE, MEMBER: NATIONAL AIRCRAFT NOISE ABATEMENT COUNCIL

MR. CLIFTON A. MOORE, LOS ANGELES DEPARTMENT OF AIRPORTS

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ENVIRONMENT – NOISE ADVISORY COMMITTEE

LIAISON MEMBERS:

MR. HARVEY H. HUBBARD, NASA LANGLEY RESEARCH CENTER

MR. NEWELL D. SANDERS, NASA LEWIS RESEARCH CENTER

DR. JOHN O. POWERS, FEDERAL AVIATION ADMINISTRATION

MR. CHARLES R. FOSTER, DEPARTMENT OF TRANSPORTATION

MR. GEORGE N. CHATHAM, LIBRARY OF CONGRESS

MR. DANIEL R. FLYNN, DEPARTMENT OF COMMERCE

DR. ALEXANDER COHEN, DEPARTMENT OF HEALTH, EDUCATION & WELFARE

DR. HENNING E. Von GIERKE, UNITED STATES AIR FORCE

MR. JOHN C. SCHETTINO, EXECUTIVE SECRETARY: OFFICE OF SST DEVELOPMENT

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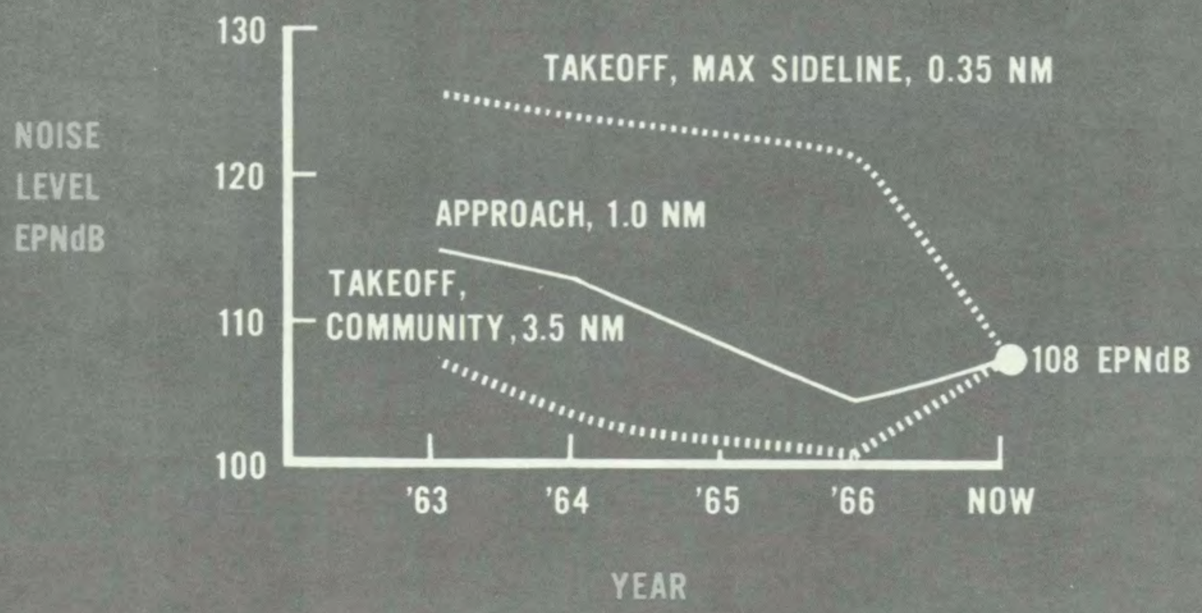
ENVIRONMENT – PRODUCTION SST NOISE OBJECTIVES



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ENVIRONMENT — NOISE

CONCERN

- ARE PRODUCTION SST NOISE OBJECTIVES ACHIEVABLE

FACTS

- PRIOR TO PRODUCTION COMMITMENT, THE CAPABILITY OF THE COMMERCIAL SST TO ACHIEVE NOISE LEVELS CONSISTENT WITH THOSE REQUIRED FOR CERTIFICATION OF NEW FOUR-ENGINE, INTERCONTINENTAL, SUBSONIC TRANSPORT AIRCRAFT WILL BE DEMONSTRATED
- PROGRAM PHILOSOPHY -- MAXIMUM EFFORT TO BE MADE IN REDUCING AIRCRAFT NOISE
- ADVANCED RESEARCH AIMED AT REDUCING SIDELINE NOISE LEVEL WITHOUT ADVERSE EFFECT ON COMMUNITY NOISE
- SST CONTRACTORS CONFIDENT THAT OBJECTIVES CAN BE ACHIEVED FOR PRODUCTION SST
- SST NOISE ADVISORY COMMITTEE AGREE THAT OBJECTIVES ARE TECHNICALLY FEASIBLE

RESEARCH (FY 71 $6.15 MILLION)

- SIGNIFICANTLY REDUCE SIDELINE NOISE LEVEL WITHOUT UNACCEPTABLE AIRCRAFT PERFORMANCE PENALTY
- FURTHER EXAMINE HUMAN FACTORS
- CONTINUE FUNDAMENTAL RESEARCH

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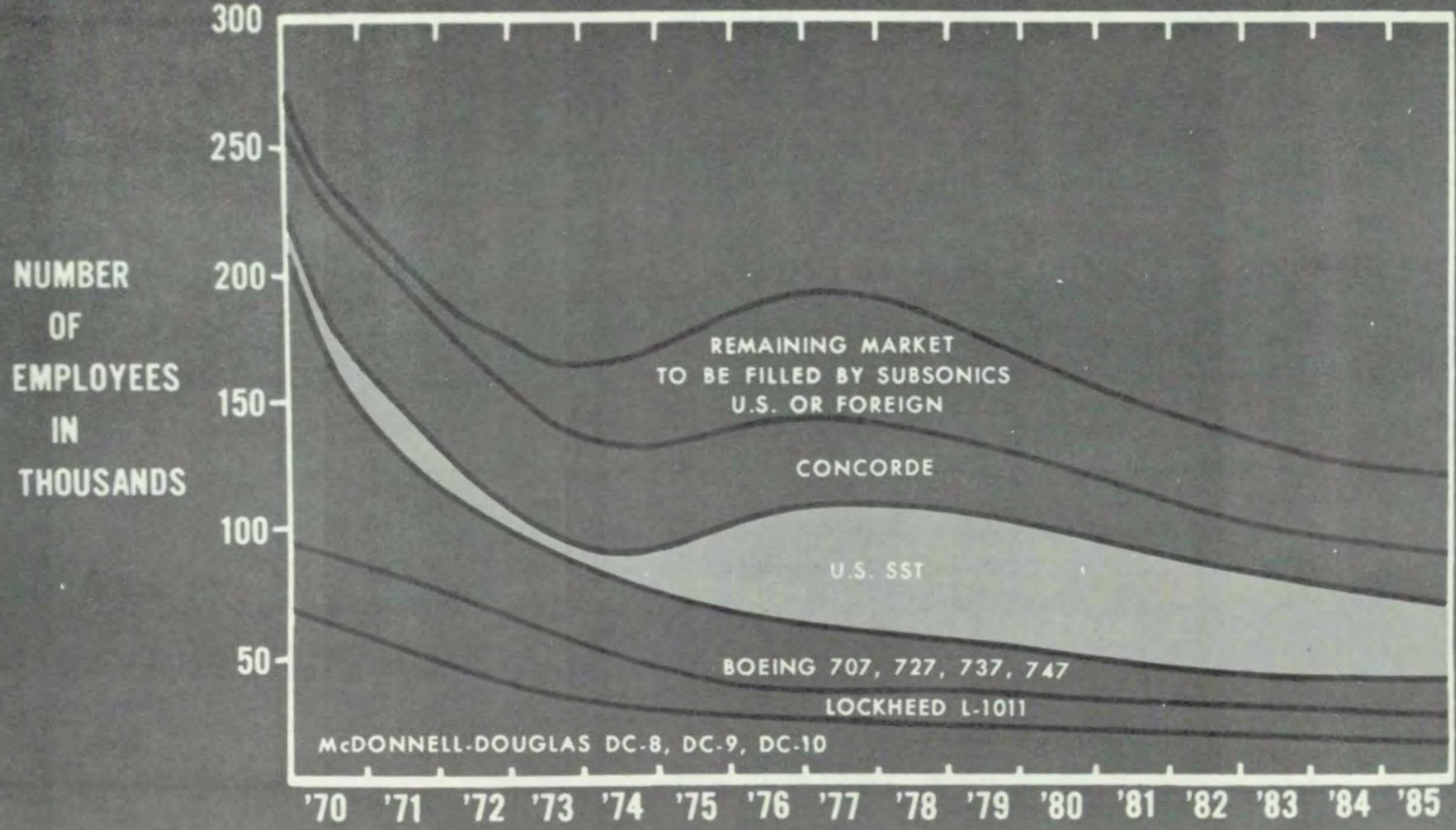
EMPLOYMENT – LABOR FORCE

TOTAL EMPLOYEES INCLUDING SUPPLIERS AND SUBCONTRACTORS



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EMPLOYMENT – SUMMARY

AEROSPACE EMPLOYMENT TREND

18 MONTHS ENDING MARCH 1971

(000s OF EMPLOYEES)

	TECHNICIANS	SCIENTISTS & ENGINEERS	PRODUCTION EMPLOYEES	ALL OTHER	TOTAL
SEPTEMBER 1969	71	201	694	379	1,345
JUNE 1970	63	198	575	322	1,158
DECEMBER 1970	61	179	515	312	1,067
MARCH 1971	58	175	503	308	1,044
MARCH 1971 (% OF TOTAL)	6%	17%	48%	29%	100%

CUMULATIVE PERCENTAGE DECLINES

FROM SEPTEMBER 1969

SEPTEMBER 1969					
JUNE 1970	11.3	1.5	20.7	15.0	13.9
DECEMBER 1970	14.1	12.3	25.8	17.7	20.7
MARCH 1971	18.3	12.9	27.5	18.7	22.4

Source: AIA News 6/24 & 11/10/70

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