larly the new urban public universities. This driving force will generate the opportunity to upgrade the science activities of these universities and they should be provided with the requisite resources in faculty and physical plant. Although, admittedly, this is a painstaking, slow process, it must certainly represent the most effective, rational means to achieve "more equitable geographic distribution of federal funds."

Sources of Funds for the National Science Enterprise

In view of the broad impact of science on all aspects of society, of the magnitude of the enterprise, of the institutionalized forms of science, and the intrinsic cost of individual research projects, it seems unlikely that the role of the federal government as the major patron of science will be challenged in the foreseeable future. Even the minimum unit package of support has become a sum so substantial that few other potential sources may be seriously considered. This prospect is also evident from the fact that the nation's largest philanthropic foundations have abandoned to the public purse the support of this vital enterprise. If the general grant philosophy presented above is to be implemented, a serious challenge will be posed to the pluralistic support mechanisms of the moment, particularly to the roles of the mission agencies on the academic scene. Inevitably, the National Science Foundation, the Endowment for the Humanities, and the Office of Education must assume ever larger shares of the responsibility for academic research-education and for the welfare of academic institutions, while a special role is reserved to the National Institutes of Health in the field of biomedical research-education. Indeed, although the time is not yet at hand, it appears to be increasingly logical to consider regrouping these agencies into a single Department of Science and Education.

Meanwhile, the other mission agencies should foster specific centers for relevant fundamental research, associated with universities, rather than broad institutional programs directed at academia. The fact that agencies such as DOD, AEC, and NASA require large numbers of trained scientists and engineers, and have large total budgets, should no longer be used as an argument in favor of their support of graduate education, broadly conceived. The same Congress that votes their budgets can also provide direct support of graduate education–academic research in its own right in the budget of an appropriate agency. However, all agencies should develop uniform guidelines and minimize the number of individual types of programs. The present federal grants structure evolved rapidly as the consequence of many actions taken by both the Congress and the Agency administrators. This structure has repeatedly been altered or extended by imaginative bureaucrats who have frequently been more perceptive of academic needs and more zealously mindful of academic autonomy than have those in the universities. But now that the federal government has accepted responsibility in large part for the science–graduate education endeavor, programs for its support should be relatively few in number, simple, and forthright.

When our nation again knows peace, the academic research endeavor may hope to find stable and much enlarged support. There are few who challenge that the R & D effort is essential to solution of some of the more pressing problems of our society. The great social revolution of our times was begotten by the previous successes of the industrial, scientific, and agricultural revolutions. The condition of our nation at the turn of the next century will be determined by the research accomplishments of the few years which remain.

Note

This article is adapted from a statement presented at a symposium at the annual meeting of the National Research Council, Washington, 11 March 1967. In preparing this statement, the author has drawn heavily upon his experience as a member of the National Science Board, the President's Science Advisory Committee, and the National Advisory Council for Health Research Resources, but the views expressed are not necessarily those of these official bodies.

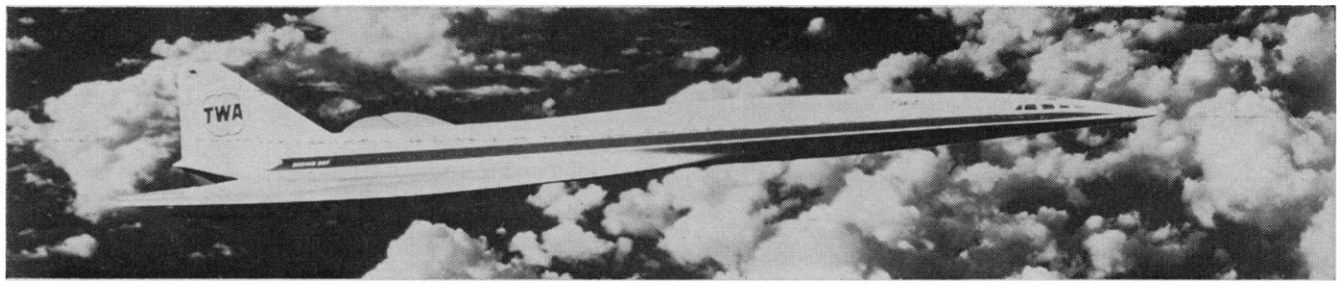
NEWS AND COMMENT

The SST and the Government: Critics Shout into a Vacuum

The construction of a United States Supersonic Transport (SST) has grown from small beginnings to an immense enterprise. Before the first production model rolls off the assembly line in 1974, the project's cost will have reached at least $4.5 billion. Each SST will sell for no less than $40 million, more than five times the cost of today's subsonic commercial craft. The airlines will receive a sleek and impressive plane for their money. More than 300 feet long, the SST will carry 280 passengers at 1800 miles an hour. The plane's planners have repeatedly said that the SST represents a new family of commercial aircraft and that its introduction is as significant a step as the shift from prop planes to subsonic jets. There is more to this claim than public relations rhetoric.

Not everyone, however, thinks the SST is a blessing. The plane flies fast, but at supersonic speeds it creates a thunderous sonic boom that people in a 50- to 60-mile path below the plane will hear. In addition, building the SST is a project too big even for the enormous aircraft industry, and the government is financing most of the development and prototype costs, now estimated at more than $1.4 billion. Critics ask not only whether the government should get into the noise-making business but also whether so much money should go to support speed when taxes are about to rise and when many domestic programs are facing an austere future.

The SST program rests on assumptions which ignore such abstract objections. The project was born in the early 1960's when many key problems, including the sonic boom, were apparent; the pressures to build the plane overwhelmed these difficulties. Time has swelled the number of opponents, sharpened their criticism, and added



A mockup of how the American SST will look in flight.

aggressiveness to their approach. But time has also favored the supporters. Congressmen have become committed, administrators have lent their prestige, public and private money has been invested, and industry has geared for production of the plane, planning for more jobs and new facilities. The opponents are trying to undo what is done, and that is always difficult. A common paradox has developed and seems destined to continue: the longer the project survives, the more enemies it will generate and the more invulnerable it will become.

The plane's supporters see no reason to reverse earlier decisions. The original rationale for constructing an SST still seems compelling. The rationale is, in a word, Concorde.

Concorde is a joint British-French supersonic plane. The first protoype will be unveiled this fall. It should have its first flying tests late next winter or early spring. Unless there are formidable technical problems, Concorde will enter commercial service in 1971, 3 years ahead of its American competitor. Symbolically, only 6 days after Pan American Airways had placed the first American orders for Concorde, President Kennedy culminated a winter of internal government studies by announcing a major commitment to an American SST.

In a recent speech, Major General J. C. Maxwell, the project head of the SST, explained the government's reaction bluntly: "The government involved itself in the development of a commercial supersonic transport because failure to do so would have brought a loss of jobs and progress to one of our major industries. The aircraft industry had been challenged by a powerful consortium of two large aircraft companies [Sud Aviation of France and the British Aircraft Corporation] fully subsidized by two major governments. Our aircraft companies did not have the resources to meet this challenge. The government acted."

The fear that drew in the government sprang from commercial, scientific, economic, and patriotic instincts. If there was no American SST, it was argued, a commercial calamity would follow: Concorde would dominate the market and create a massive outflow of dollars (the balance of payments was then, and still is, a problem). The industry feared—rightly or wrongly—that it might never recover. The Americans had not forgotten the lesson of the British Comet, when early failures allowed the U.S. to overtake and pass the initial lead of the British in the subsonic jet market. Once established, the Americans had never been displaced. Moreover, if there were no American SST, jobs would be lost, valuable technological "fallout" from the plane's development would be sacrificed, and the American airlines would be at the mercy of foreign plane manufacturers. The consequences were considered too serious, and so, despite internal disagreement about the plane, the government plunged in.

The Concorde not only forced the government into the supersonic race but also determined what kind of plane the Americans would build. Because the French-British model had a head start, proponents of an American SST believed that the U.S. would have to design a vastly superior plane to induce airlines to hold back on their Concorde orders and wait for the American product. Thus, the Concorde had a planned speed of 1200 miles per hour; the American SST will fly 1800 miles per hour. The Concorde's seating capacity was 136, the American SST's, 280. To construct a better plane required not only financial support but also technical resourcefulness, and the American SST will incorporate some genuine advances. The skin will be titanium (the British are using aluminum), and the wings will be mobile, to permit more efficient subsonic flight.

Because the American plane was born in an atmosphere of competitive fright, there have always been questions about the project's wisdom and workability. That the SST presents very serious commercial and environmental problems has consistently been clear. Would it be a profitable plane for its manufacturer and operator? Would its noise level be acceptable? These problems were obvious, but a decision could not wait until they were meticulously explored and a careful cost-benefit balance sheet could be drawn up. The Concorde deprived American decision-makers of that luxury.

Eugene Black, former head of the International Bank, and Stanley de J. Osborne, chairman of the Board of Olin Mathieson Chemical Company, who were appointed by President Kennedy to study the SST in 1963, clearly recognized the program's difficulties, including the sonic boom. So apparently did everyone else. "It is safe to say that there is near unanimity in the conviction that outside the field of economics, the problem of the 'sonic boom' gives all who are working on the supersonic transport the most worry," they concluded. But Black and Osborne, like others associated with the SST before and after them, decided that they could not resolve the problem and that a wise decision "requires testing with actual aircraft for a long enough period of time to supply satisfactory answers."

The sonic boom problem, now being seized upon by the SST's critics, could hardly be met head-on, for the sonic boom restrictions seemed to make the project unfeasible. The more restrictions there were, the less useful the plane would be, and the less sense it would make to invest public and private money in the plane's development. The relationship was so obvious that Black and Osborne had to acknowledge it—even if they did not have to answer it.

The dilemma persists and continues to color decision-making about SST. The Federal Aviation Administration,

the President's Advisory Committee on the Supersonic Transport, the new Department of Transportation (of which FAA is a part), and the Congress have all avoided making a clear-cut commitment about the overland flights. The official reason remains the same as it was in 1963: testing is needed with the SST, because no one knows how people will accept the sonic boom.

Actually, there is ample information on the boom. The FAA has itself compiled a 105-page bibliography of studies on aircraft noise and sonic boom. Extensive tests were held over Oklahoma City in 1964, and another series of boom experiments has just been completed at two locations in California. In addition, overflights of American cities by the supersonic SR-71 military reconnaissance plane are now providing more evidence of public reaction to the boom.

But the sonic boom problem has been avoided, in part, because the plane's commercial prospects remain—as they always have been—cloudy. Critics of the SST have continually charged that it is not going to sell. For every pessimist, there is an optimist. Boeing Aircraft, manufacturer of the airframe, has conducted economic studies that indicate a substantial market for the SST. An FAA Economic Feasibility report, based on sonic boom restrictions, predicts sales of at least 500 aircraft—200 more than necessary for both the manufacturer and the government to pass the break-even point. Yet, in reaching its estimate, the FAA had to reject the findings of its own consultants (the Institute for Defense Analyses), whose best guess was a market of 279 aircraft by 1990.

The plane's commercial prospects are of more than passing significance, because they may well determine the extent of future government participation in the SST program. The FAA is now committed to financing 90 percent of the prototype costs of the airplane—around $1.3 billion. But there is the question of what happens once the prototype is flying, and many people believe the government will go right on paying the bills. A report, prepared by the management consultant firm of Booz, Allen & Hamilton and commissioned by the FAA, indicates that post-prototype government costs may go as high as $1 billion.

The government is a partner with industry in the development of the SST, but it is clear that, except perhaps for the FAA, it is not a very happy

General J. C. Maxwell

partner. The costs of the program are becoming more and more oppressive as the war-induced budget squeeze becomes greater. Early this year there was even some doubt as to whether or not the Administration would make a major commitment to the SST prototype; the money problem undoubtedly led the FAA to plead (successfully, as it turned out) with American carriers to invest $1 million in the program for every SST they had ordered. The contribution, to be returned with interest if the program is successful, amounted to $52 million and correspondingly reduced the government's appropriation.

The FAA and the Department of Transportation repeatedly emphasize their hope—and expectation—that the government's financial support will end once the prototype is flying. But if the Booz, Allen & Hamilton report is right, and the government cannot make an easy exit (unless it scratches the whole program), then it will want to limit the extent of its future financial support. Here is where the sonic boom problem, the plane's commercial prospects, and government financing all merge. The fewer boom restrictions there are, the larger the market for the plane will be, the more private money will be encouraged to support the project, and the less the government will have to invest. Conversely, the more boom restrictions there are, the more the government may have to invest in the project.

The actual picture admittedly is not so two-dimensional. The decision on post-prototype financing is several years away (Boeing must submit a preliminary report next June), and a host of other factors—the conditions of the credit market, the financial health of the airlines, the squeeze on the federal budget—may come into play. In addition, if the FAA's predictions of 500 aircraft in a sonic-boom-restricted market (or Boeing's estimate, which is even higher) show signs of proving correct, or even conservative, then private money may flow freely into the SST project.

Even so, sonic boom restrictions may be on the minimal side at the start and could eventually disappear altogether. There is no determined desire in the FAA or the Department of Transportation to limit the overland flights more than necessary. General Maxwell, the SST's program director, thinks the supersonic age is inevitable and, as an Air Force man who has been around supersonic craft for many years, believes people can often adjust to the sonic boom. Secretary of Transportation Alan S. Boyd sees few problems with at least some domestic flights. He offers the flight from Chicago to Los Angeles as a good example: the plane could fly subsonic to Denver and then supersonic from Denver to Los Angeles, where there are "lots of mountains, lots of deserts, and very few people." (In addition, the first and last 100 to 150 miles of most flights would be at subsonic speeds to allow the plane to land and take off.)

Opponents of the SST claim that, once the airlines are flying at supersonic speeds over some land, they will naturally want to fly at supersonic speeds over other land. In simple economic terms at least, there is no doubt much truth in this. Every minute at subsonic speeds costs the airlines more on two counts: (i) it increases the flight operation costs, and (ii) by adding to the trip's time, it reduces the incentives to fly, especially for businessmen who value their time highly and therefore are expected to be heavy travelers on the SST. Airline officials recognize the problems of the boom, but talk hopefully of finding "solutions" to lessen the noise. Research along these lines is under way, but the boom is a product of physical laws, and making it quieter will be difficult.

The sonic boom decision is also complicated because it is, as Secretary Boyd points out, subjective. A small group of critics—the Citizens League Against the Sonic Boom, headed by

Harvard professors William A. Shurcliff and John T. Edsall—believes the SST will cause substantial property damage if it flies over land. If they are right, the anti-boom fight will be much easier. But most studies so far have shown that planes creating boom overpressures similar to those expected for the SST have not had an extensive effect on buildings. How much noise, then, is "acceptable"?

To read some government statements, not very much. "My mail indicates that there is only one thing that can drown out a jet on takeoff and that is the roar of protest from outraged citizens who live in airport neighborhoods," Secretary Boyd said recently. Yet, the most recent government-sponsored sonic boom experiments showed that test subjects found booms to be as objectionable as subsonic planes flying low just before landing or just after takeoff. In a recent interview with *Science,* Boyd belittled this comparison between sonic booms and subsonic plane noise, because, he said, people living near airports object not only to the noise per se but also to the frequency of overflights.

Sonic booms are not popular, however, as most tests over populated areas have shown. After the overflights of Oklahoma City, 2000 people were surveyed and 27 percent said they could not "learn to live" with sonic booms. A recent overflight of Boston prompted the tabloid *Record-American* to headline its story: "Sonic Boom Leaves Hub Trail of Terror."

The government is not unaware, of course, that planes make noise, and the SST has created some apparent contradictions in official policy. "The Department of Transportation assumes and welcomes leadership and responsibility in the aircraft noise abatement area," Secretary Boyd recently told a congressional subcommittee studying noise around airports. "What I am saying is that when we can obtain complete statutory authority, this noisy buck will stop with me." There was no mention of the SST, though Boyd characterized his department's "long-range objective [as the] producing of substantially quieter aircraft."

Government officials leave the clear impression that the decision on sonic boom restrictions will be decided by, among other things, popular and congressional pressure. The tempo of journalistic criticism clearly has been mounting. A number of prominent periodicals—the *Wall Street Journal,* the

NEWS IN BRIEF

● **ECOLOGY**: Nine grants, totaling nearly $2.5 million, have been awarded by the Ford Foundation to support ecological studies and the development of programs in ecology for natural resource planners and administrators. Awards were made to: the University of Chicago ($1.04 million) and Princeton University ($372,000) for expanded ecology programs; the Organization for Tropical Studies, a consortium of universities, $180,000 for pilot investigations of special problems in tropical field biology; Oak Ridge Associated Universities, $90,000 for analysis of the use of mathematical models to study natural systems; University of Michigan, $32,400 for the development and testing of a correspondence course on water pollution; Student Conservation Association, $75,000 for scholarships and administrative support; and Conservation Foundation ($450,000) and University of Pennsylvania ($200,000) for regional planning training.

● **GRANTS FOR SCIENCE DEVELOPMENT**: NSF has awarded $8.8 million to two universities under its University Science Development Program. The University of Georgia, Athens, was awarded $3.72 million, and the University of Iowa was given $5.1 million. Both are 3-year grants. The purpose of the Science Development Program is to increase the number of first-rate science programs in U.S. institutions. According to the NSF grant announcement, "Support is granted to institutions judged to have substantial potential for elevating the quality of their scientific activities and for maintaining this new high level of excellence." Both the University of Georgia and the University of Iowa will use the grants to support new faculty members and their supporting staffs, additional graduate students, new construction, and the acquisition of research equipment. During the 2 years in which the NSF program has been underway, $105 million has been awarded to 27 institutions.

● **BEHAVIORAL BIOLOGY JOURNAL**: A completely computerized journal in behavioral biology that is expected to reduce substantially the time between acceptance and publication of articles is underway at Johns Hopkins University. The first issue of *Communications in Behavioral Biology*, which will consist of one edition of abstracts and one of original articles, is scheduled for January. Both editions will be loose leaf for insertion into binders that will be supplied to subscribers. The Brain Information Center at UCLA is collaborating with Johns Hopkins on the journal. Stephen A. Weinstein is editor-in-chief of the publication, which is being aided by a 2-year, $40,000 NSF grant. Subscriptions may be obtained by writing to *Communications in Behavioral Biology*, Johns Hopkins University, 615 N. Wolfe St., Baltimore, Md. 21205. Rates for 6-month subscriptions are $22.50 for the abstracts and $9 for the articles.

● **STUDENT LOANS**: The U.S. Office of Education (OE) has announced the allocation of $189 million to 1701 colleges and universities to aid students under the National Defense Student Loan Program during the 1967–68 academic year. OE anticipates that one-half million students will receive loans under the program which enables undergraduates to borrow up to $1000 during each academic year and graduate students to borrow up to $2500 a year.

● **COLLEGE COSTS**: Increasing costs at state colleges and universities are threatening the educational chances of girls, minority groups, and children from low-income families, a booklet published by the Public Affairs Committee notes. The booklet by consumer affairs specialist Sidney Margolius, *Paying for a College Education*, states that girls are particularly handicapped in obtaining higher education because they earn less than boys and because their "parents are usually more reluctant to borrow money to finance the education of their daughters." According to Margolius, rising costs have forced state institutions to raise admission requirements which also adversely affects the underprivileged. The booklet indicates that publicly supported colleges now educate two-thirds of the college students compared with 50 percent 15 years ago. A reason cited for the increasing role of education in state schools was that annual costs at prestige institutions now are about $3500. Copies of the booklet may be obtained for 25 cents each from Public Affairs Pamphlets, 381 Park Ave. South, New York 10016.

Nation, Harper's, Punch (a British magazine), and the *National Review*—have run critical articles. Under the prodding of the Citizens League Against the Sonic Boom, small newspapers have begun writing anti-boom editorials; the League itself has published a number of large ads in several newspapers. But though criticism has been rising steadily in column inches, the change in Washington—if there has been a change—is much less dramatic. The appropriations for the SST easily passed the House, and Secretary Boyd asserts that most sonic boom criticism is coming from elements "on the periphery"—a euphemism for "nuts."

The support for the SST is understandable; anti-boom people fail to see it because their perspective is naturally restricted. The Department of Transportation's primary purpose is to get people from place to place faster and more efficiently. This job the SST unquestionably will do, despite airport snarls that threaten to get worse before they get better. Air time between Washington and Paris will be cut from a little over 7 hours to about 3 hours. Air time from New York to Rio de Janeiro would be reduced from 9 hours 15 minutes to 4 hours 45 minutes. But the most dramatic savings will come in the Pacific: Los Angeles to Sydney will drop from 15½ hours to 7½; the Tokyo-Honolulu-Los Angeles flight, which takes 15 hours today, will take 7. The supersonic plane may well do for the Pacific what the subsonic plane did for the Atlantic.

People Like to Fly

Moreover, it is clear that people like to fly. The annual increase in air travel during the past several years has averaged beween 16 and 17 percent. A tenfold rise by 1990 is forecast, and it is this dramatic demand that really sustains the SST and, no doubt, prompted the British and French to undertake the Concorde. In general, air fares have fallen with the introduction of the subsonic jet, and a new breed of subsonics—the Boeing 747, which will regularly carry more than 350 passengers and, with certain seat configurations, will handle nearly 500—will soon reach the market.

Because the SST will have slightly higher operation costs than the 747 and because the International Air Transportation Association, which sets international rates, may insist on higher fares for the SST, it will almost certainly cost more to fly supersonic than subsonic. The surcharge may be as much as 20 to 25 percent. Critics doubt that people will pay that much for faster flights; airlines spokesmen say there are plenty of businessmen and luxury travelers who will. Those who value time less will continue to take the 747. Moreover, the skeptics are warned not to discount the airlines' marketing ingenuity—special excursion fares, more movies, free drinks, and special scheduling patterns—to stimulate demand.

Economic Impact

The SST will have a big impact not only on travel but also on the economy. When there were signs that the Administration might be cool toward this year's appropriation, advocates of the SST began emphasizing just this. Production of the plane will create 50,000 jobs, General Maxwell estimates, and 200,000 more jobs will be created indirectly. Boeing (airframe) and General Electric (engine) were selected as the major contractors late last year following an intensive design competition with Lockheed and Pratt & Whitney. But, like all major projects, the economic benefits do not accrue only to the companies whose names get in the paper: nearly 70 percent of the Boeing airframe work, for example, will go to subcontractors. The aerospace industry draws much of its political strength from these imposing figures.

That the SST has solid political support cannot be doubted. Senator William Proxmire (D–Wis.) is leading a most determined fight against the plane, but the Senate appropriations subcommittee which handles the SST is loaded with SST backers—including the chairman, John Stennis (D–Miss.), longtime aviation spokesman Mike Monroney (D–Okla.), and Warren G. Magnuson (D–Wash.). Boeing is in Seattle and Magnuson is up for reelection next year.

The FAA has also been an able advocate of the program, some think too able. "If propaganda could power a plane, America's supersonic airliner probably would be flying by now," a *Wall Street Journal* reporter has written. But the FAA's campaign probably reflects the strength of the industry as much as its own commitment. And the FAA seems to have cordial ties with the private sector: N. E. Halaby, the FAA administrator who did the first substantial work on the SST, is now the senior vice president at Pan American, and Gordon Baine, the first head of the SST project, is now with General Dynamics. Baine's replacement, Maxwell, is by all accounts an able administrator. He is still with the Air Force (he has been the Chief of Staff of the Air Research and Development Command and commander of the Air Force Space Test Center at Vandenberg Air Force Base), and his support for the program no doubt reflects more than personal preference; he is on assignment, and in the best military tradition wants to complete his mission successfully. Maxwell presents a convincing case for the plane at public hearings and speaks frequently and forcefully at professional and trade association meetings.

All this—the FAA, the Concorde, the commitments of the airlines and plane manufacturers—has given the SST a great deal of momentum, momentum which will probably grow even greater with time. For most pro-plane arguments, the critics have their own answers. When SST supporters say there will be plenty of business and luxury travelers, the critics ask why the government is spending so much money for the rich while domestic programs for the less-well-off suffer malnutrition. But the critics often seem to be shouting into a vacuum, or at least not speaking in the same terms as the plane's sponsors. This exchange between General Maxwell and Representative William E. Minshall (R–Ohio) on the sonic boom damage illustrates the problem:

GENERAL MAXWELL: Let me read into the record the total for the period from 1956 through the first two quarters of 1967, or first quarter of 1967.

There were 34,335 claims, for a total amount. . . .

MR. MINSHALL: Yes, sir; you sort of minimized this, there were not very many claims. Thirty-four thousand claims is a lot of claims.

GENERAL MAXWELL: This is over a 10-year period.

MR. MINSHALL: This is still a lot of claims.

GENERAL MAXWELL: A total of 34,335 claims for a total amount of $19,175,000. Of that amount, the Air Force has approved in whole or in part some 12,226 of them and they have paid out to date $1,273,000.

MR. MINSHALL: That is not peanuts.

GENERAL MAXWELL: Over a 10-year period, that is $120,000 a year.

MR. MINSHALL: The bulk of that has been since supersonic jets have been in business in the last few years.

GENERAL MAXWELL: Without attempting to minimize the importance of sonic boom, I would say those figures are very small in comparison to the cash flow figures we are talking about.

The communication problem is bound to grow worse, not better. As the program goes forward, its opponents get angrier. And their objections strike to the heart of the project. Even if overland flights are limited, they ask, what about the well-traveled sea-lanes?

The critics are at an extraordinary disadvantage. Their strongest argument —their largest political lever—would be the voluminous citizen complaints about SST overflights. This sort of vindication, however, requires the existence of the SST, and, once the plane is in production and the airlines have made large commitments, the fighting will become much more intense.

A more fundamental problem is the fact that people may not be so sensitive as the boom critics would like. Americans may, as the plane's supporters hope, adjust to, or at least accept grudgingly, the noise and inconvenience. This would leave the plane's opponents in a weak position of a minority protesting for the sake of principle. Says Bo Lundberg, the director general of the Aeronautical Research Institute of Sweden and the best-informed of the critics, "Even if the majority [accepting the boom] were really overwhelming—say 90 percent—democracy's majority rule must not be so perverted as to give the majority the right to subject a minority—even a small one—to sufferings."

In simplest terms, the fight over the SST raises old questions of controlling the effect of technology on the environment. "I am convinced we have long since passed the point where we can make transportation decisions—affecting any or all forms of transportation —without weighing in advance their social as well as their economic impact upon communities and regions they serve," Secretary Boyd has said.

It is not that easy. The plane's promoters are not weak, and they are already beginning to feel the project's benefits; the opponents can only argue on what they *think* will be its drawbacks. This is largely a struggle between ideas and interests, and so far there's been no contest.

—ROBERT J. SAMUELSON

Oregon Graduate Center: A New Portland Scientific Institution

Portland, Oregon. "Why does Portland lag so far behind in the great surge of science-based industry?" a committee of the Portland City Club asked in 1963. The committee noted that many other western cities, even those with smaller populations, had been more successful than Portland in attracting such industry. In its 1963 report, the committee gave particular emphasis to the answer it had found to its question: *"Portland is the largest metropolitan area in the West without a full university."*

The committee's report called this lack of a university in Portland "a hard unpalatable fact." It concluded that Oregon has great need of the science-based industry which a university would help stimulate, especially because employment in the state's main industries—agriculture and timber—has substantially declined in recent years and because the rate of income growth in the state has been well below the national average.

The lack of a university has long bothered many Portlanders. Although Portland is by far the largest city in Oregon (with a metropolitan population of more than 800,000), the state's two universities are located a fair distance to the south. The University of Oregon at Eugene is 110 miles from Portland; Oregon State University at Corvallis is 82 miles away. The rapidly growing Portland State College is basically an undergraduate institution, as are the private colleges in the Portland area. Portlanders feel that their city is the logical place in Oregon for industrial development, but that growth is hindered because graduate programs in most scientific disciplines are not available locally.

During the last several years, the need for a fully developed university in Portland has been the topic of special study and discussion. In an interview with *Science*, Mark Hatfield (who began serving in the U.S. Senate this year) recalls that the "single main thrust" of his 1958 campaign as the Republican candidate for governor was the need to hasten Oregon's slow growth and to reduce its high unemployment rate. After his election as governor, Hatfield said that he tried to attract new industries. "The companies would ask questions," Hatfield said. "They wanted to know what kind of educational institutions we had. We had to face up to the fact that there was no graduate center in Portland to which sophisticated industry could relate." In the early 1960's, Hatfield appointed two committees on Science, Engineering, and New Technologies. After the report of the second committee in 1962, Hatfield and others made special efforts to obtain state money to help create a graduate center in Portland. These efforts failed for a variety of reasons: the unwillingness of many Oregon taxpayers to increase the amounts spent on higher education; the desire of some backers of the state's two major universities to preserve their institution's prerogatives and existing piece of the state financial pie; and the desire of some Portlanders to make Portland State College into a full-scale university rather than to create a separate graduate center.

During the years of their studies, the committees appointed by Hatfield documented a number of reasons why Portland needs a university. Many Portland companies reported that they wanted graduate training: (i) to enable their employees to finish their masters' and Ph.D. programs, (ii) to assist in enticing new employees into the area, and (iii) to help stop the "brain drain" from Oregon to other parts of the country. The area's largest employer, Tektronix, a major manufacturer of oscilloscopes, called the creation of a graduate center "an absolute necessity" for its operations because "we find it extremely difficult to attract competent people to our plant, and we find those who have acquired with us a degree of scientific competence often leave us for