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Aviation Noise: A National Policy is Needed

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Before the
Subcommittee on Aviation
Committee on Public Works
and Transportation
House of Representatives

Mr. Chairman and Members of the Subcommittee:

We are here today to present our assessment of the economic impact that noise restrictions have had and are likely to have on the aviation industry. We will also be discussing the policy issues that need to be resolved in developing a national noise policy. Our work was done at the request of the Subcommittee and Representative Vento.

Passage of the Airline Deregulation Act of 1978 led to an increase in the number of aircraft operations and the corresponding level of noise at many airports. This noise can impose substantial costs on the communities located near airports. Airport proprietors have reacted to the rising noise level by adopting noise restrictions on aircraft use that may, in some instances, restrict access to airports. We have issued several reports and testimonies dealing with aviation noise issues.[1]

The analysis we are presenting today is based on a survey we conducted of the 140 U.S. airports that have predominantly jet service; our analysis of various studies that have been done of the economic costs of noise restrictions; and an extensive series of interviews with airline, airport, and aircraft industry officials. A complete report on our work will be issued around the end of this year.

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[1]See, for example, Aircraft Noise: Implementation of FAA's Expanded East Coast Plan (GAO/RCED-88-143, Aug. 5, 1988), Aircraft Noise: Status and Management of FAA's West Coast Plan (GAO/RCED-89-84, May 8, 1989), Aircraft Noise: Eight Airports' Efforts to Mitigate Noise (GAO/RCED-89-189, Sept. 14, 1989), and Transportation Noise: Federal Control and Abatement Responsibilities May Need to Be Revised (GAO/RCED-90-11, Oct. 12, 1989). We will also be testifying this afternoon on a related set of issues before the Subcommittee on Transportation, Aviation, and Materials, House Committee on Science, Space, and Technology.

Overall, our review shows that, in the absence of a national noise policy, airports will likely continue to implement a variety of noise abatement measures in an attempt to respond to the concerns of their local communities. While these measures in many cases are needed to reduce the impact of airport noise on local communities, the lack of coordination among these local airport measures could place an increasingly heavy burden of higher costs and inefficient use of aircraft on the nation's air transportation system. A national policy specifying a schedule for phasing out the older, noisier stage 2 aircraft would provide for a more orderly transition, by a date certain, to a quieter stage 3 fleet for the nation as a whole.[2] The implementation of such a policy could pose trade-offs between meeting the needs of local communities and reducing the burdens which these needs impose on the nation's air transportation system.

Specifically, we found the following:

-- Based on our survey, the number of airports requiring the use of the quieter stage 3 aircraft will grow slowly until 1995, but will increase rapidly between 1995 and 2000. Our survey shows that, by the year 2000, 41 percent of the nation's 29 largest airports plan to have banned stage 2 aircraft.

-- The costs of delays and inefficient use of aircraft imposed on airlines by the uncoordinated adoption of noise restrictions by airports appear to be modest now. However,

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[2]Part 36 of Title 14 of the Code of Federal Regulations prescribes noise emission standards for the manufacture and certification of aircraft. Aircraft which do not meet these standards are commonly referred to as "stage 1" aircraft. These relatively noisy aircraft were no longer generally allowed to be operated in the United States after 1984. Aircraft meeting minimal standards issued in 1968 are commonly referred to as "stage 2." Quieter aircraft meeting more stringent standards promulgated in 1977 are commonly referred to as "stage 3."

we expect the proliferation of these noise restrictions after 1995 to cause these costs to grow rapidly.

-- The aircraft and airline industries believe they have the capacity to phase out stage 2 aircraft by the year 2000, but said they will need 10 years advance notice to achieve this goal. We estimate that the costs of phasing out stage 2 aircraft by 2000 are likely to fall between $2 billion and $5 billion, depending on whether airlines replace or retrofit their existing stage 2 fleets.[3]

-- The federal government will have to establish a national noise policy now if it wants the aircraft and airline industries to phase out stage 2 aircraft in an orderly fashion. The proliferation of uncoordinated airport noise restrictions after 1995 is likely to create growing costs in inefficient use of aircraft. A national schedule for phasing out stage 2 aircraft will permit a more orderly phase-out of stage 2 aircraft and allow the nation to achieve a quiet stage 3 fleet.

I will now discuss our findings in greater detail.

LOCAL NOISE RESTRICTIONS EXPECTED TO PROLIFERATE AFTER 1995

The Federal Aviation Administration (FAA) is authorized, under 49 U.S.C. Section 1431, to regulate aircraft noise. In 1976, FAA issued regulations under this provision requiring that all aircraft used at U.S. airports meet stage 2 standards starting in 1985. FAA also required that all aircraft designs newly certified after 1977 meet more stringent stage 3 standards; as a result, all aircraft now being built are stage 3 aircraft. However, the FAA's

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[3]All values are expressed in constant dollars.

regulations do not require the airlines to replace their old stage 2 airplanes with the quieter stage 3 aircraft. Airlines can buy or lease used stage 2 aircraft to expand their fleets. Airports, on the other hand, can set more stringent noise standards, and a number of airports, in response to pressures from local communities affected by aircraft noise, have done so. While noise restrictions are expected to spread slowly between now and 1995, our survey shows that airport officials expect these restrictions to proliferate between 1995 and 2000.

We surveyed airports to determine what noise restrictions they had now, what restrictions they expected to introduce between now and 1995, and what restrictions they expected to introduce between 1995 and 2000. We found that only three of the 140 airports in our survey currently ban the use of stage 2 aircraft.[4] Another 16 airports restrict their use by limiting the percentage of stage 2 aircraft used by each airline and/or by banning them at night. By 1995, only one additional airport told us that it is very likely to become all stage 3, while another 13 indicated that they are somewhat likely to. However, by 2000, 34 additional airports are very likely to become all stage 3, including 12 of the 29 largest airports. Seventy-seven airports are at least somewhat likely to ban stage 2 aircraft by 2000, including 20 of the 29 largest airports.

Representatives of the airline industry believe that if a substantial number of large airports adopt rules banning stage 2 aircraft, these rules will amount to a de facto ban on stage 2 aircraft anywhere in the country. Aircraft are normally scheduled to fly to a number of different airports as part of their regular routing. If a significant proportion of the airports require all stage 3 aircraft, an airline will have to acquire an all stage 3

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[4]They are Orange County, Long Beach, and Burbank airports in California.

fleet (by replacement or retrofitting) or be burdened with an inefficient routing system designed to steer stage 2 aircraft away from all-stage-3 airports.

UNCOORDINATED AIRPORT NOISE RESTRICTIONS ARE LIKELY TO IMPOSE GROWING COSTS ON AIRLINES

The independent and uncoordinated imposition of local noise restrictions by the nation's airports is often characterized by airline industry officials as a "patchwork quilt" style of regulation. Airline industry officials generally believe that this style of regulation threatens the efficient functioning of the national transportation system by causing delays and the uneconomic use of aircraft to service certain markets.

Nighttime noise curfews sometimes compound the effects of delays of evening flights caused by bad weather. If the delayed flight is using a stage 2 aircraft, which cannot operate after the curfew, the flight either will have to be cancelled or will have to be redirected to an alternative airport not subject to a curfew. If the flight is redirected, passengers are further delayed in reaching their destination. Alternatively, if mechanical problems ground a stage 3 aircraft, and the only back-up plane is stage 2, the flight might have to be cancelled. An official representing the air freight industry noted that nighttime restrictions strike directly at the ability of air cargo carriers to provide overnight service.

Scheduling of aircraft for particular flights sometimes results in inefficient use of aircraft, because the limited number of stage 3 aircraft must be used at the airports that require their use, rather than in the markets where their size is most appropriate. For example, airlines cited examples of being forced to use B757 (stage 3) aircraft to meet noise restrictions when smaller B737 (stage 2) aircraft would be better suited to traffic levels in the market. Other carriers cited being required to use (stage 3) B737-300s instead of more appropriately sized (stage 2) DC-9s to meet noise restrictions.

Air carrier officials also told us that aircraft require less thrust and generate less noise when they are less than fully loaded. As a result, noise restrictions that are specified in terms of allowable decibels (rather than in terms of the aircraft being stage 2 or stage 3) sometimes cause airlines to fly planes with less than a full load to reduce noise. This limits the airlines' ability to make the most efficient use of their aircraft. For example, one carrier flies B737-300s out of Orange County Airport in California with less than full loads to meet the noise restrictions there.

These costs arise as a result of having to meet separate restrictions at each airport. They would not arise if the same amount of noise reduction were achieved as a result of the airlines being required to meet national requirements that a certain percentage of their fleet meet stage 3 standards.

These costs have caused some air carriers to reduce service on some routes involving noise-controlled airports. Carriers reported reducing service, for example, at Orange County, Long Beach, San Francisco, and Boston as a result of noise restrictions. One airline abandoned a route because it would have had to make uneconomic use of its stage 3 aircraft, which were larger than the route required. While the number of such cases that have been reported to us so far has been small, further service cutbacks may occur as additional airports impose noise restrictions.

The extent of these costs under present conditions appears to be moderate. While the airlines were able to provide examples of many of these costs, they were not able to quantify the extent of these costs. However, these costs are expected to increase in the future as the number of airports with noise restrictions increases, particularly after 1995.

Local airport noise restrictions may also affect other airports because the imposition of noise restrictions at one airport could cause "dumping" of older, noisier aircraft on other airports. Our survey indicated that 23 airports reported receiving higher levels of noise as a result of the imposition of noise restrictions at other airports. Conversely, 24 other airports reported they were experiencing lower levels of noise, suggesting that the requirement to use stage 3 aircraft at some airports made those aircraft available at other airports as well.

A BAN ON STAGE 2 AIRCRAFT IS FEASIBLE, BUT WILL COST $2.2 - $4.6 BILLION

The aircraft and airline industries believe they have the capacity to phase out stage 2 aircraft by the year 2000, but said they will need 10 years advance notice to achieve this goal. We estimate that the costs of phasing out stage 2 aircraft by 2000 are likely to fall between $2 billion and $5 billion, depending on whether airlines replace or retrofit their existing stage 2 fleets.

Stage 3 Technology Availability

Air carriers can convert their fleets to stage 3 by replacing stage 2 aircraft with new stage 3 aircraft or by retrofitting their stage 2 aircraft with hushkits or new engines. According to airline officials, 10 years is the minimum lead time needed to accomplish such a transition. Although aircraft manufacturers presently have a 5-6 year backlog of orders, officials of Boeing, McDonnell Douglas, and Airbus (representing 95% of commercial aircraft manufactured) told us they believe production rates are capable of meeting a 10-year lead time.

Engine and hushkit manufacturers also told us they believe a 10-year lead time would be adequate since they can increase production capacity as demand increases. They also said that the necessary retrofit technology either is or will be available. Technology which has not yet been certified, such as hushkits for the stage 2 DC-9 and B737, is expected to be certified for production by the FAA within the next few years.

Costs of a Stage 2 Ban by 2000 Are Likely to Be $2.2 - $4.6 Billion

Four organizations have studied the cost of a stage 2 ban. The four studies were all reported in 1989 and were conducted by the FAA; American Airlines; AVMARK, Inc.; and Leeper, Cambridge, and Campbell, Inc. (LCC), on behalf of the air cargo industry.[5] The FAA and American Airlines studies reported similar estimates of $2.7 billion and $3.1 billion, respectively, for the cost of meeting stage 3 requirements in the year 2000, assuming a 30-year useful aircraft life. The AVMARK study reported a much higher estimate of $59.6 billion, while the LCC study estimated costs of $15.9 billion for the air cargo fleet alone.

Different Assumptions Result in a Range of Cost Estimates

The wide range of cost estimates in these studies reflects differences in key assumptions concerning the useful life of an aircraft, the discount rate used to compare costs and benefits occurring in different years, the growth rate of the airline industry, and the extent to which airlines can meet stage 3 standards by using hushkits or new engines rather than by replacing aircraft.

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[5]A fifth study, by the International Civil Aviation Organization (ICAO), did not conduct an original analysis of the U.S. market; it reported the results of the FAA study.

Two of the studies, by LCC and AVMARK, report very high estimated costs. These high cost estimates result from three key assumptions. First, both LCC and (implicitly) AVMARK assume that aircraft have infinite useful lives, so they would never have to be replaced in the absence of a stage 2 ban. Second, AVMARK assumes a zero discount rate, so that costs occurring in the distant future are weighted just as heavily as costs appearing this year. Third, LCC assumes that the growth rate of the air cargo industry will be 15-20 percent per year. When these assumptions are changed to better reflect a consensus of expert opinion on aircraft life spans, discount rates, and growth rates, their estimates change to approximately the level of our estimates. We present a detailed analysis of the impact of these different assumptions in appendix I to this statement.

We have developed our own estimates based on our review of all four studies. We used the FAA study as our starting point, but we used alternative assumptions when we thought they were more appropriate.

Assuming that stage 3 standards would be achieved by replacing non-complying aircraft, we estimated the cost of a stage 2 ban in 2000 as $4.6 billion. This is the capital (or present value) cost in 1990 of retiring stage 2 aircraft before they would have been retired in the absence of the stage 2 ban. It includes replacing 2,039 aircraft prematurely at an average cost of premature retirement of $2.2 million each.[6] It is based on the FAA model, except that three assumptions have been changed:

-- First, we assumed a real discount rate of 7.6 percent. The four studies used discount rates ranging from 0 to 9 percent; we concluded that 7.6 percent was most appropriate.[7]

-- Second, we assumed an economically useful life of passenger aircraft of 30 years. This is equal to the 30 years assumed by American Airlines, and is the center point of the 25, 30, and 35 year assumptions used by FAA. For cargo aircraft, however, we assumed a longer useful life of 50 years, reflecting the fact that cargo aircraft are used for fewer cycles per day, and thus can be expected to last for more years. We believe this is more reasonable than LCC's assumption that cargo aircraft have unlimited economically useful lives.

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[6]The cost per airplane of premature replacement is substantially smaller than the price of a new airplane for three reasons: (1) these costs are net of operating and maintenance savings which result from using a new airplane; (2) these are only the costs of replacing the aircraft prematurely--they deduct replacement costs to the extent that the old aircraft's useful life has been used up; and (3) most of these costs will be incurred several years in the future, and their present value is less than their value at the time that they are incurred. The average cost per aircraft replaced varies widely. Some aircraft, such as DC9-50s delivered in 1981, would have relatively high replacement costs ($6.83 million each). However, most of the aircraft that would be replaced are older aircraft nearing the end of their useful lives, so the cost of premature replacement will be small.

[7]Our assumed discount rate was the commercial prime rate, plus a 1.5-percent risk premium, minus the GNP deflator (which measures the overall rate of inflation in the entire economy). We believe this best measures the real private opportunity cost of money for firms like major airlines.

-- Third, we assumed, using an estimate by the Boeing Corporation, that the air cargo portion of the overall U.S. civil air fleet will grow at 6 percent per year through 2000. This is faster than the 1.9 percent per year growth rate projected by FAA for the industry as a whole, but slower than the 15-20 percent growth rate for the air cargo fleet assumed by LCC. We adopted Boeing's 6-percent estimate because it seemed reasonable and appeared to be based on more substantial analysis than LCC's estimate. The faster growth rate for the air cargo fleet, with its longer expected useful life, implies that the costs of a stage 2 ban will be increased.

Alternatives to Aircraft Replacement
Could Reduce the Cost of a Ban

The cost of a stage 2 ban would be significantly reduced if alternatives to aircraft replacement were followed. For example, new aircraft sell for approximately $25 million to $50 million or more. However, existing stage 2 aircraft can meet stage 3 requirements by installing new engines for about $9 million to $11 million. In some cases, hushkits can be installed on existing engines at a cost of about $1 million to $3 million per aircraft. According to the FAA, allowing hushkits when available results in a 41-percent savings, on average, versus requiring aircraft replacement. The savings are less than the difference in cost because new aircraft have lower maintenance and fuel costs than do retrofitted aircraft.

We did our own calculation assuming that airlines would adopt the cheapest strategy for each type of plane--either replacement, re-engining, or hushkitting. This calculation resulted in a (present value) cost estimate of $2.2 billion. It includes replacing 471 aircraft, at an average cost of $0.3 million, and retrofitting 1,569 aircraft, at an average cost of $1.2 million.[8] Our analysis suggests that the oldest stage 2 planes are most likely to be replaced, while newer planes are more likely to be brought into stage 3 compliance by hushkitting or re-engining. The exact proportion of aircraft that are retrofitted rather than replaced is uncertain, but we think the actual costs of achieving the stage 2 ban are likely to fall between $2.2 and $4.6 billion, spread out over 10 years. To put these costs in perspective, total industry revenues in 1988 were about $65 billion. Total revenues for the 10-year period over which these costs of noise abatement will be borne are likely to exceed $650 billion, so the costs of noise abatement are likely to be less than 1 percent of the industry's revenues.

A Stage 2 Ban by the Year 2000 Will Affect Individual Air Carriers Differently

Although industry officials generally believe a year 2000 stage 2 ban is achievable, they also believe that the impact of a stage 2 ban on individual airlines will depend on the size of each carrier's stage 2 fleet and on its financial health. Some airline officials said they are planning to acquire stage 3 fleets before the year 2000 even without a ban; others believe meeting that date may require them to downsize their operations and could inhibit their growth plans.

The costs of phasing out stage 2 aircraft are likely to be borne partly by the airline industry, in the form of lower profits, and partly by airline passengers. Since many airline passengers are very price-sensitive, the airlines will probably not be able to pass on all the costs of the stage 2 ban to their customers and

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[8]When retrofitting is an option, average costs of replacement fall, because only the oldest aircraft, with the fewest years of useful life (and hence the lowest replacement costs) are replaced. Newer aircraft are retrofitted.

will have to bear a substantial portion of the cost themselves. Some financially weak airlines may be further weakened by the costs of complying with a stage 2 ban.

Airline passengers are likely to experience both reduced service and higher fares as a result of a stage 2 ban. Carriers may not find it profitable to replace or retrofit all the old stage 2 aircraft in service, thus limiting the overall size of their fleets. This is likely to reduce the level of service that can be provided and the level of competition on some routes. Some carriers have stated that they have already reduced service on certain routes because they do not have enough stage 3 aircraft to meet the noise restrictions at the airports on the route. However, because of the relatively low cost of a stage 2 ban, the extent of service cutbacks is likely to be small also.

Fares are likely to rise both because of the costs of replacing and retrofitting aircraft, and because of the reduced levels of competition on some routes. However, because of the small relative cost of a stage 2 ban, the size of these fare increases is likely to be modest.

POLICY ISSUES FOR CONGRESSIONAL CONSIDERATION

We believe that the key issues that need to be resolved by the Congress in formulating a national noise policy are (1) how soon stage 2 aircraft should be phased out; (2) what other actions are needed besides a phase-out of stage 2 aircraft; and (3) to what extent should federal noise regulation preempt local airport restrictions.

How Soon Should Stage 2 Aircraft be Phased Out?

Our interviews with airline and aircraft industry officials indicate that phasing out stage 2 aircraft by the year 2000 is feasible. Most passenger airlines indicate that they plan to phase out stage 2 aircraft voluntarily between 2000 and 2010. However, our survey of airports suggests that, in the absence of any federal action, a large proportion of the nation's largest airports are likely to prohibit the use of stage 2 aircraft by the year 2000. In these circumstances, the airline officials we spoke with believe that a de facto stage 2 ban will result, because airlines will not be able to use stage 2 aircraft at enough airports to operate such aircraft efficiently.

Federal policy could delay this phase-out by preempting noise restrictions adopted by airports that would effect a year 2000 ban. The issue for federal policy is whether to adopt the year 2000 as a reasonable date for phasing out stage 2 aircraft, or whether to prevent airports from adopting this or some earlier date. Our analysis suggests that the cost of adopting this date would amount to about 1 percent of airline industry revenues over the next 10 years.

What Other Actions Are Needed Besides a Phase-out of Stage 2 Aircraft?

A ban on stage 2 aircraft is an example of noise abatement, that is, reducing noise at the source. A variety of other strategies to reduce noise are also available that focus on mitigating the impact of noise on the people who are exposed to it, for example by soundproofing homes and schools, buying homes that are affected by noise, and improving land-use planning. Noise abatement is more cost-effective than noise mitigation when an airport is located in an urban area where large numbers of people are affected by aircraft noise, because the costs of quieting the aircraft reduce noise for a large number of people. By contrast, the cost of reducing noise exposure by, for example, soundproofing homes in a large metropolitan area is so large that this is not a viable alternative to noise abatement.

However, there are limits to a noise abatement strategy. Aircraft manufacturers do not believe it is possible to make aircraft significantly quieter than the quietest aircraft being built today (though National Aeronautics and Space Administration researchers believe that a long-term research project might develop new noise control technologies). Even these relatively quiet aircraft cause a high level of noise exposure for people who live close to the airport. FAA estimates that 1.1 million people will continue to be exposed to excessive noise levels even if stage 2 planes are banned. The only way to reduce aircraft noise to reasonable levels close to an airport is through a combination of noise abatement and noise mitigation measures. Programs such as FAA's Part 150 program, which pays for noise mitigation, will continue to be needed even if a stage 2 ban is adopted.

Should the Federal Government Preempt Local Airport Restrictions?

The federal government has prohibited the use of stage 1 aircraft at U.S. airports, but beyond that has generally left the adoption of noise restrictions to individual airports. Airports participating in FAA's Part 150 program must have their noise control plans approved by the FAA. But airports are not required to participate in the Part 150 program, and many do not. FAA may sue an airport if it regards the airport's noise control program as unfairly discriminatory. In a few cases (for example, in a case involving San Francisco's airport) FAA has done so, but generally FAA has not contested noise restrictions adopted by the airports.

Leaving the responsibility for noise regulation to the airports has some advantages. Airports vary greatly in how sensitive their neighbors are to noise. One airport may be under great pressure to reduce noise from its neighbors, and may be willing to suffer a substantial reduction in service in order to reduce noise. Other airports may place a greater value on high service levels than on noise reduction, and may favor a less restrictive noise policy. Leaving noise regulation to the airports allows each airport to tailor its noise policy to its own individual situation. The benefits of noise reduction are greatest when the noise reduction is concentrated on airports that are most sensitive to noise.

On the other hand, our analysis shows that the potential for inefficient use of the nation's air transportation system as a result of a "patchwork quilt" style of regulation by individual airports exists and is likely to become much more significant as airport restrictions proliferate after 1995. It is much more difficult for the nation's airlines to meet uncoordinated airport requirements--a 50-percent stage 3 requirement at this airport, a 75-percent stage 3 requirement at that airport, and a 100-percent stage 3 requirement at yet another--than to meet a national requirement that a certain percentage of the airline's overall fleet in any one year be stage 3. If an airline meets an overall fleet requirement, then it is free to schedule those aircraft through its system in a cost-effective and efficient way.

Establishing a uniform rule, of course, would require preventing airports from adopting rules that were stricter than the federal rules. Preemption would prevent airports from tailoring noise restrictions to each area's sensitivity to noise. If airports were preempted from adopting stricter rules, their neighbors would be forced to accept more noise than the airport's own rules would have allowed. If the increased noise burden were attributable to federal preemption, plaintiffs might seek to hold the federal government liable for damages caused by the extra noise.

The extent to which the federal government would become liable for damages due to aviation noise in the event that it preempted local restrictions is uncertain. State and local governments, as commercial airport proprietors, are responsible for obtaining the necessary air easements from surrounding land owners as well as fashioning reasonable and nondiscriminatory noise rules for airport operation. Therefore, under present law, states and localities, not the federal government, are responsible for injuries resulting from airport noise.

Federal preemption of these local airport noise rules would remove the localities' ability to abate noise and thus the basis for liability for injury. As a result, the federal government could be liable for "takings" and torts arising from airport noise.[9]

Because the federal government has never before been exposed to liability for regulating commercial airport noise, and because liability for either a taking or a tort is dependent upon the facts in an individual case, we cannot predict whether an injured party could successfully sue the federal government for airport noise. However, we can outline the context within which such a suit might take place.

In order to show that aircraft flights over private property constitute a taking, the owner must demonstrate that the flights are so low and frequent as to cause direct and immediate interference with the use and enjoyment of the land. Landowners have successfully sued the United States, in its capacity as airplane operator, in a number of instances where planes were repeatedly flying at altitudes below 1,000 feet and where the plane passed directly over the property.

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[9]The Fifth Amendment to the Constitution prohibits the government's taking of private property for public use, that is, the direct and immediate interference with the use and enjoyment of property, without just compensation. A tort is an injury or wrong to the person or property of another; it is the breach of a duty fixed by law, independent of contract.

Under the doctrine of sovereign immunity, the federal government is not liable for torts, except where it has waived its immunity. The Federal Tort Claims Act (28 U.S.C. Sections 1346 and 2671-2680) waives the federal government's sovereign immunity in a limited number of cases. With respect to federal regulation of airport noise, there are two barriers that a plaintiff would have to overcome before being able to bring a tort suit against the federal government. First, no suit may be maintained based on discretionary government acts, and second, suits must be based on the negligent or wrongful act or omission of a government employee.

Determinations of whether a particular governmental function is discretionary depend upon the specific facts. Thus it is not possible to provide a definite answer on potential federal liability. However, as a general matter, the development of noise standards that balance local and national interests would appear to be discretionary and thus exempt from suit.

Assuming, however, that FAA's actions were not exempt, a plaintiff would still have to show that the government employee was negligent. It is not enough that state law provides a remedy in tort. Suits based on damages caused by airplane noise cannot be brought against the federal government absent a showing that the noise was caused by the wrongful act of a government employee.

The extent of preemption could be limited by "grandfathering" existing restrictions--that is, allowing airport restrictions already in place to continue, but preempting any new airport restrictions that were more stringent than the federal rules. This would ensure that no airport experienced an increase in noise as a result of the federal stage 2 ban. Grandfathering would, of course, reduce the degree of uniformity among airports and the benefits that uniformity would provide. However, since the number of airports with existing limitations on stage 2 aircraft is relatively small, and to date the airlines appear to be managing with these "patchwork" costs relatively easily, this may not be too costly.

The Congress might also wish to allow an exemption process by which airports that believed their local circumstances justified a more rapid phasing out of stage 2 aircraft could apply for an exemption to allow them to adopt restrictions more stringent than the national rules. This, again, would reduce the degree of uniformity in the national system, but would allow some degree of variation to reflect local variations in sensitivity to noise. Such an exemption process would require a weighing of local noise concerns against national air commerce objectives, which could be difficult to achieve.

CONCLUSIONS

In conclusion, Mr. Chairman, the cumulative effect of additional, independently derived, and uncoordinated local airport noise restrictions could create a serious cost burden on the nation's air transportation system after 1995. While the extent of these costs is not documented, airlines have stated that the current patchwork quilt pattern of local noise restrictions imposes costs and inefficiencies on the system. Based on our work, these costs appear likely to become much more serious as local restrictions proliferate after 1995.

In our view the FAA should make every reasonable effort to develop a national noise policy that balances the concerns of airports, airlines, local communities, and the nation's air transportation system. A key component of such a national policy would be a year-by-year phase-out of stage 2 aircraft, culminating in a ban on stage 2 aircraft by approximately the year 2000. Our analysis indicates that the cost of such a ban would be in the $2 to $5 billion range, depending on whether airlines replace or retrofit their existing stage 2 fleets.

This concludes our statement, Mr. Chairman. We would be pleased, at this time, to answer any questions that you or the other members of the Subcommittee may have.

ANALYSIS OF COST STUDIES

Four organizations have conducted major studies to determine the cost of a stage 2 ban. The studies were all reported in 1989 and were conducted by the FAA, American Airlines, AVMARK, Inc., and Leeper, Cambridge, and Campbell (LCC), Inc.[1] AVMARK is an aviation consulting firm whose clients own and operate commercial aircraft. LCC is a consulting firm whose study was conducted at the request of the Air Freight Association.

The American Airlines study focused on the nine major airlines; it did not consider the effect of a ban on smaller carriers or the air cargo industry. The FAA and AVMARK studies focused on the entire U.S. domestic fleet, both passenger and air cargo. LCC's study focused exclusively on the air freight industry.

DIFFERENT ASSUMPTIONS RESULT IN A RANGE OF COST ESTIMATES

The FAA, American Airlines, and AVMARK studies each reported a range of cost estimates. For example, by varying the assumptions about expected aircraft life and the proposed date of a stage 2 ban, the FAA study estimated the costs under 12 different scenarios. LCC's study, on the other hand, reported a single estimated cost for the air cargo industry.

Depending on the assumptions used, the estimated costs ranged from a low of $17 million to a high of almost $60 billion. To illustrate the effect of different study methodologies, we selected a "base case" scenario for comparison purposes, namely, that a

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[1]A fifth study, by ICAO, did not conduct an original analysis of the U.S. market; the study reported the results of the FAA study.

stage 2 aircraft ban will be implemented in the year 2000. Under this scenario, the cost estimates range from $2.7 billion (FAA study) to $59.6 billion (AVMARK study). Table I.1 illustrates the varying results under the base case scenario as well as under other assumptions.

Table I.1: Summary of Study Results
(in billions of constant dollars)

	FAA	American Airlines	AVMARK	LCC
Base case scenario[a]	$2.7	$3.1	$59.6	$15.9
Range of costs:				
High	$5.8	$3.1	$59.9	$15.9
Low	$0.017	$0.53	$22.5	$15.9

[a]The base case scenario assumes a year 2000 stage 2 aircraft ban and a 30-year useful aircraft life.

Given the common assumptions of the base case scenario, the remaining variations in the cost estimates resulted from the different cost estimating methodologies employed in the studies, as well as from different assumptions regarding the useful life of stage 2 aircraft and the expected fleet size in the year 2000.

STUDIES EMPLOY DIFFERENT ESTIMATING METHODOLOGIES

The FAA and American Airlines studies each assumed the cost associated with a stage 2 ban to be the incremental cost of retiring an aircraft early minus any savings associated with operating new, more efficient, replacement aircraft. For example, if an aircraft had to be replaced one year before it would normally be replaced, the cost attributable to the ban would be the cost of requiring the capital expenditure one year earlier than would have normally occurred, minus the discounted value of savings in operating and maintenance costs incurred by substituting a new aircraft for an older one. From an economic perspective, this is the correct approach to modeling this problem.

LCC and AVMARK used different approaches. LCC's study stated that the cost of a ban would be the full capital cost of the replacement aircraft minus any operating and maintenance savings. Although recognizing that aircraft must eventually be replaced, LCC argued that there are no technical reasons why an aircraft can't be maintained for safe use indefinitely and that, consequently, any forced retirement should result in the full cost of the replacement aircraft being charged to the ban. AVMARK's study assumed a 30-year aircraft life; however, under its methodology, if an aircraft had to be replaced before it was 30 years old--even one year before--then the entire cost of the replacement aircraft was attributed to the ban. Attributing the entire cost of replacement aircraft to the ban resulted in substantially higher cost estimates than resulted from the FAA and American Airlines methodologies.

The methodologies employed by LCC and AVMARK both, in essence, assume that used aircraft have an indefinitely long economic life and therefore do not depreciate in value. They implicitly assume that old aircraft would never be replaced in the absence of a government intervention requiring their replacement. Consequently, their studies argue that the full cost of replacement aircraft should appropriately be charged to the event--the ban--which led to the need for replacement. This assumption is not consistent with the fact that old aircraft are constantly being replaced even in the absence of any government requirement, primarily because, as aircraft age, the costs of maintenance and repair become greater than the costs of buying a new airplane.

In our analysis, we followed the methodology of FAA and American Airlines, and charged costs of replacement to the stage 2 ban only to the extent that they caused aircraft to be replaced prior to the expiration of their useful lives.

In their studies, the FAA, American Airlines, and LCC discounted future expenditures in order to express them as current dollars. This is a common practice in analyzing expenditures over time. The FAA, American Airlines, and LCC studies assumed discount rates of 7 percent, 9 percent, and 6.2 percent, respectively. AVMARK did not discount future costs (i.e., they assumed a zero discount rate). These assumptions affect costs since a discount rate which is too low tends to overstate both costs and benefits (the benefits include reduced operating and maintenance costs) of replacement, while one which is too high understates costs and benefits. We assumed that the real discount rate would equal 7.6 percent, which is the prime lending rate plus a 1.5 percent risk premium minus inflation as measured by the GNP deflator. We used that rate to recalculate the present value of the costs reported in each study. Table I.2 illustrates the results.

Table I.2: Costs Adjusted to Present Value Terms
(In Billions of Dollars)

	FAA	American Airlines	AVMARK	LCC
Reported Costs	$2.7	$3.1	$59.6	$15.9
Adjusted Costs	2.7	3.3	43.8	15.0
Difference	*$0.0*	*($0.2)*	*$15.8*	*$ 0.9*

AIRCRAFT USEFUL LIFE ASSUMPTIONS AFFECT COST ESTIMATES

Assumptions about aircraft useful life are also important in estimating the cost of a stage 2 aircraft ban. The useful life of an aircraft depends on how intensively it is used. A cargo aircraft, for example, which is flown fewer cycles (one takeoff and landing) per day than a passenger aircraft, can be expected to be economically useful for more years. This is a significant variable because the number of useful years removed from an aircraft's life by a stage 2 ban is a major determinant in the total cost of such a ban.

The American Airlines study assumed a 30-year useful life while the FAA study assumed a 25-35 year useful life. The LCC study, as noted previously, argued that aircraft can be maintained for safe use indefinitely and therefore did not assign a useful life. The AVMARK study, while assigning a 30-year useful life, agreed with the LCC study that aircraft can be maintained indefinitely.

While the technical life of an aircraft is, as LCC and AVMARK suggest, indefinite, the economically useful life is definitely limited. The economic life extends only to the point when it becomes cheaper to replace the aircraft with a newer aircraft rather than to make repairs. The economically useful life is likely to become shorter as a result of new and planned FAA Air Worthiness Directives, which will require ever more frequent and costly maintenance procedures for older aircraft. Neither LCC nor AVMARK explicitly considered these additional costs in their studies.

In our analysis, we adopted the assumption of a 30-year useful life for passenger aircraft, but assumed that cargo aircraft would have a longer useful life of 50 years. This appeared to be the longest useful life that is consistent with actual practice.

EXPECTED AIRCRAFT FLEET SIZE
CRITICAL TO ESTIMATED COSTS

A critical assumption in the LCC study is that the air freight industry will grow substantially in the next 10 years. LCC assumed that the fleet of 254 stage 2 aircraft owned by the air freight industry in 1987 would increase 20 percent annually through 1992, and thereafter 15 percent annually through the year 2000, resulting in a fleet of 1,933 stage 3 aircraft at that time. This assumption of rapid growth adds appreciably to the cost of a ban as calculated in the LCC study, particularly since LCC charged the full, undiscounted cost of replacement aircraft to the ban.

Several other studies have suggested that the rate of growth in this industry will be substantially less. The FAA estimates that the entire U.S. fleet will grow at the rate of 1.9 percent annually. The American Airlines study suggests that fleet growth will be only "a few" percent annually, and aircraft manufacturers forecast growth in the air cargo fleet at less than 6 percent annually.

We analyzed the impact of LCC's growth assumptions by substituting different growth rates. Using a growth rate of 1.9 percent annually would result in a fleet of 318 aircraft instead of the 1,933 calculated by LCC. The adjusted cost estimate, in present value terms, would be $1.8 billion instead of $10.9 billion. A growth rate of 6 percent would result in 511 planes and an adjusted cost of $2.8 billion. In our analysis of costs for the overall civil transport fleet, we assumed that the air cargo fleet would grow by the 6 percent per year estimated by Boeing. We assumed that 1.9 percentage points of this growth would come through purchases of new stage 3 aircraft, as FAA assumed. We assumed that the remaining 4.1 percentage points would come through purchases of used stage 2 aircraft.

We adjusted the estimates in the four studies to reflect what seemed to be the most reasonable assumptions, namely:

-- incremental cost of early retirement (rather than full replacement cost);

-- a 7.6 percent discount rate;

-- a 30-year useful life for passenger aircraft, but a 50-year useful life for cargo aircraft;

-- a 6-percent growth rate for the air cargo fleet, including 1.9 percent growth supplied by purchases of new stage 3 aircraft, and 4.1 percent supplied by purchases of used stage 2 aircraft.

These assumptions resulted in a cost estimate for replacing all stage 2 aircraft by the year 2000 of $4.6 billion. This is the present value in 1990 of the costs of premature replacement through the year 2000.

ALTERNATIVES TO AIRCRAFT REPLACEMENT COULD REDUCE THE COST OF A BAN

The cost of a stage 2 ban would be significantly reduced if alternatives to aircraft replacement were followed. For example, new aircraft sell for approximately $25 million to $50 million or more. However, existing stage 2 aircraft can meet stage 3 requirements by replacing the engines for about $9 million to $11 million. In some cases, hushkits can be installed on existing engines at a cost of about $1 million to $3 million per aircraft. According to the FAA, allowing hushkits when available results in a 41 percent savings, on average, versus requiring aircraft replacement.

We adjusted our estimate by assuming that any particular type and cohort of aircraft (e.g., B727s built in 1975) would be either replaced, re-engined, or hushkitted, depending on which alternative was least expensive, taking into account both the initial capital cost and the fuel and maintenance savings that replacement and (to some extent) re-engining provide. This analysis resulted in a present value cost estimate for a year 2000 phase-out of stage 2 aircraft of $2.2 billion.

END