PART 2

Appendixes

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Appendix A
GROWTH SCENARIOS IN FAA'S NATIONAL AIRSPACE SYSTEM PLAN

Members of Working Group 1 (February 25, 1982)

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Summary

In its most recent (2/16/82) forecasts of aviation activity for the period 1982-93, the Federal Aviation Administration (FAA) projected substantial rates of growth in commercial and general aviation (GA) traffic, as well as a large increase in the size of the GA fleet. These projections undergird FAA's National Airspace System (NAS) Plan for modernizing the Nation's air traffic control (ATC) system and the timetable the agency would follow in making the NAS Plan a reality.

The Working Group spent much of the day discussing the adequacy of FAA's aviation forecasts. These discussions centered on: 1) the internal structure of FAA's econometric model, 2) its reliance on the Office of Management and Budget (OMB) forecasts of the gross national product (GNP) and other economic indicators, 3) its high level of aggregation, and 4) its omission of cyclical economic behavior. The consensus appeared to be that FAA's forecasting methods may tend to produce unduly optimistic projections of economic growth and its effects on aviation.

The group also looked into a number of related factors that could limit substantially the growth envisioned in the Plan. These included: 1) airport congestion; 2) user fees; and 3) financing of aircraft purchases.

The group generally agreed that modernization would be desirable for reasons of reliability and productivity alone. Their questions dealt not with the need for the proposed improvements, but with their timing. Slower growth would allow more time, and several participants noted that the choice of technology might also be affected by the timing of the NAS Plan. A few extra years could be important, since the system one could develop now might be significantly different from one designed later in the decade.

Discussion

On February 12, 1982, the FAA Office of Aviation Policy and Plans issued "FAA Forecasts on Aviation Activity, Fiscal Years 1982-1993." On the title page, FAA explicitly noted that its projections were "based on OMB'S January 12, 1982, forecasts of economic variables."

Members of Working Group 1 were given a copy of that document at the outset of the meeting and referred to it often during the discussion of FAA's econometric model and the agency's use of the administration's economic projections.

The ideas expressed by the group during the meeting on February 25 fell into two major categories: 1) economic forecasts and 2) related factors of an economic and noneconomic nature that could affect FAA's forecasts for growth in aviation.

Economic Forecasts

The FAA Forecasting Model

David Lewis, an econometrician, with the Congressional Budget Office (CBO) led the discussion with an examination of FAA forecasts of aviation activity over the last 23 years. In comparing those projections with actual levels of activity, Lewis discerned three distinct chronological periods.

During 1959-65, FAA's 5-year projections for various measures of aviation activity and ATC workloads proved too low by an average of 18.7 percent. But the reverse of that pattern occurred during 1966-73. The agency's 5-year projections for that period were too high by an average of **32.5** percent.

In 1974 FAA shifted from trend extrapolation to an econometric model. While Lewis called this a step forward, he also suggested that the model might prove only marginally more accurate than past projections. According to his calculations, the average forecast error since 1974 has been high by **21.2** percent; the maximum error for any one year's forecasts was **34.7** percent too high. (Lewis' tables are attachment A-l.)

Lewis noted that "there's been an improvement in the projection of passenger demand on the air carrier side. " But even though some of the 1976 projections for 1981 were not far off, the Professional Air Traffic Controllers Organization (PATCO) strike led air carriers "to ground small planes, resulting in improved load factors, " he said. So, while FAA's forecasts for enplanements proved 4.3 percent too high, its estimate for domestic revenue passenger miles (RPMs) was **9.o** percent too low. The forecast for total tower operations, however, proved 34.7 percent too high.

Lewis raised this point not to criticize the FAA– which could not have anticipated the strike, he said— but to highlight "the importance of each factor in the forecasting chain, "

FAA uses four variables in a linear formula to predict RPMs. Lewis argued that two of those variables, disposable personal income and consumer expenditure in transportation, "are highly related to each other. " If that is so, he asked, "why are they both in here?"

With deregulation in **1978,** the airlines went into what Barney Parrella, Air Transport Association, called a "shakedown period." Dr. Robert Simpson, of the Massachusetts Institute of Technology Flight Transportation Laboratory, pointed out that ***"200*** or 300 years of transportation economics history tells us that the pricing activity is chaotic in an unregulated state. It always goes that way because in transportation you always have spare seats, spare capacity. "

Yet, the econometric model FAA is using to project air carrier traffic into the 1990's does not take into account the fare wars and other competitive behavior that followed deregulation.

The model also does not incorporate possible changes in labor costs, Because of agreements signed before deregulation, the older airlines are locked into high wage and salary scales. "You can suspect a problem, " said John Slowik of Citibank N. A., "when one major airline estimates it only needs **58** percent of employee-hours it now pays for. Or when the Civil Aeronautics Board's own data point out that certain majors' fully allocated costs are as much as 89 percent above a low-cost national carrier. "

The driving factor in FAA estimates of the workload imposed by general aviation is the size of the GA fleet. This is a critically important calculation because rapid growth in the GA fleet accounts for the greatest proportion of projected needs in FAA's NAS Plan. Yet, the agency ignores fuel prices in calculating changes in fleet size. Lewis suggested, and Robert Monroe of the Aircraft Owners and Pilots Association confirmed, that fuel prices are an important factor in the size of the ***active*** GA fleet and in the total number of hours flown.

Monroe estimates, however, that 15 percent of the GA fleet is inactive, meaning that those planes have not flown during the past year. If FAA greatly overestimates the utilization as well **as** the size of the GA fleet, it would affect both the agency's projected workload and the Government's ability to finance the NAS Plan through user fees. Specifically, Federal revenue collections from higher taxes on aviation fuels could fall far short of current projections. That, in turn, could shift a greater portion of the burden of financing the NAS Plan from system users to the general fund.

Economic Variables

GNP and disposable personal income, two highly related economic factors, are the principal variables underlying FAA's calculations of air carrier and GA operations. FAA does not calculate these factors independently; they are derived from forecasts of economic variables prepared by the Executive Office of the President, OMB, as of January 1982. Monroe labeled these projections "a political forecast."

Several members observed that the administration's numbers could be called "targets" rather than forecasts. Slowik characterized them as "hockey-stick forecasts. They are kind of flat for a while, and they start going up ... because things are always getting better in the future."

The air carrier projections led Samuel C. Colwell, of Fairchild Industries, Inc., to ask: "What forces are going to cause (air) traffic growth . . . to go faster than it did in the '70s? Every force that I see, everything that I look at, says it has to grow slower . . . Fuel prices, even if they moderate . . . are still at least going to go up as fast as inflation and probably faster . . . There are productivity increases coming, but they're minor compared to the productivity increases we had" in the last two decades.

Another example of this phenomenon may be seen in Government projections for general aviation. FAA estimates that the GA share of instrument operations at airports will rise from 48 percent in 1982 to 55 percent in 1993. The urgency of the NAS Plan timetable is based largely on this expected boom in GA traffic.

The FAA forecasts that the size of the GA fleet will rise from 211,000 in 1981 to 332,900 by 1993. Yet, in 1980, according to FAA, the fleet grew by only 700 aircraft. Last year, it was estimated to have grown by 3,000 planes. Growth is projected to remain slow in 1982-83 but should then explode in the out years. Between 1985 and 1993, FAA expects the GA fleet to expand by over 12,000 aircraft per year.

Because the timing in the NAS Plan seems to hinge on the growth of the GA activity, the accuracy of its forecasts for that sector is critically important. Zalman Shaven of OTA suggested that "we need greater disaggregation" in the data FAA uses to forecast GA activity and other operations. After considering the data, assumptions, and projections that went into the agency's GA forecasts, other members of the group seemed somewhat skeptical of the results.

In projecting the size of the GA fleet, for instance, FAA assumes "an elasticity of 17, each l-percent increase in GNP leading to a 17-percent increase in the change of the size of the fleet, " Lewis pointed out. "They (FAA) take the aggregate forecasts and just make a guess at the share of the aggregate that will be held by" each type or category of GA aircraft, he said. "There is no attempt to forecast sets, those individual classes, from the bottom up."

Although GNP drives the agency's projections for GA activity, said Lewis, the model assumes that "there's a saturation level . . . that means at the margin, progressively higher levels of income lead to progressively smaller changes in the demand for aircraft ."

Monroe questioned whether GNP should even be considered "a causal variable. It's always been my understanding that GNP was a consequence of doing something, not a cause of doing something . . . . If the airplane is indeed a business tool, then GNP is a consequence of buying and operating aircraft, not a causal factor."

Questions were also raised about the accuracy of FAA data on the present GA fleet. Consultant Gilbert F. Quinby found that Government recordkeepers "were very careless about purging accident aircraft out of the file." Monroe agreed, pointing out that "the difference between a sheet of paper and an airplane is where we get into trouble. " He also noted that the Government does not have "a good system of purging" to account for aircraft that were exported.

After comparing past GA growth rates with current FAA projections, Monroe suggested that "the projection of numbers in the Plan is not out of the realm of possibility." That, however, seemed to be the extent of his optimism.

Indeed, he argued that the importance of GNP and disposable income may be overstated in FAA calculations. Alluding to the Vahovich study,[1] he noted that "convenience seems to be the primary problem with most aircraft owners. It's not the cost. That actually came fairly well down in the line of concerns, about fourth or fifth or sixth."

But in the final analysis FAA seems to have pegged its aviation forecasts to the administration's optimism about economic growth. "All these equations are driven by highly aggregate variables: GNP, consumer expenditure (on transportation and) disposable income, " said Lewis. "They're very sensitive to those variables and changes in long-term growth rates. To the extent that those growth rates are too optimistic, the forecasts will be too optimistic as well. "

Cyclical Economic Factors

Although the U.S. economy has made impressive gains at times, it seldom moves in a straight line. In recent years, it has gone through several periods of recession and recovery. Yet, FAA's forecasts through 1993 apparently ignore the possibility of cyclical fluctuations in the future. The agency assumes a steady upward march in GNP.

Some members of the group were skeptical of the forecasts for this reason. "Any trend-extrapolation model that is just used arbitrarily is going to generate results like this, and they're always going to be bad, " said Colwell. "And I think they're making the same mistake now because we're in another basic structural

[1]S. G. Vahovich, ***General Aviation: Hours Flown and Avionics Purchase Decisions,*** FAA-AVP-78-9 (Washington, D. C.: US. Department of Transportation, Federal Aviation Administration, Office of Aviation Policy, May 1978).

change in the industry. And so, if FAA or whoever is using these models would then apply some logic and reasons and adjust the models appropriately—not just rely on the outcome—they would do much, much better."

The General Aviation Manufacturers Association (GAMA) has an understandable interest in estimating growth in the GA fleet. Yet when GAMA makes "forecasts of production, sales and deliveries (it) will only do it for one year in advance, " said David McGowan of GAMA. "We have no idea what's going to happen 2, 3, 5, even 12 years down the road . . . . What they (FAA) are using, I don't know."

Using charts, Herman Gilster, of Boeing Commercial Airplane Co., showed how Boeing's projections of domestic RPMs for 1980 fluctuated widely from its initial estimates in 1968 to its final prediction in 1979. The actual figure in 1980 proved to be 268 billion RPMs, but the company's forecasts ranged from about 475 billion (1969) down to 250 billion (1975-76). (See attachment A-2.)

These fluctuations, said Gilster, suggest that when "growth is high, or things look well, you forecast high. And then if you get into a depression area, such as '74 and '75, you lower your forecast dramatically. (So,) I think there's a tendency to have your long-range forecast highly influenced by the short-term economic situation. "

Cyclical changes have also lead Boeing to revise its forecast for 1985 from 700 billion RPMs (1971) down to 310 billion RMPs (1982). In comparing Boeing's projections with those of other firms in the industry, Gilster noted that "the engine manufacturers . . . have lower forecasts than the airframe manufacturers." But he also pointed out that the Boeing and FAA forecasts of the size of the U.S. commercial jet fleet in the year **2000** closely match. (See attachment A-2.)

The price of commercial airliners is another cyclical economic factor omitted from FAA's forecasting model.

U.S. air carriers, said Slowik, are suffering from a "serious over-capacity which has been fueled by back-to-back negative traffic-growth years. " Without good profits, many airlines cannot afford to modernize their fleet. Yet, he remarked, "there is little doubt that those airlines who want to operate profitably must replace old, inefficient aircraft with new-generation equipment ."

To get new aircraft, most companies will need to sell a portion of their current inventory. But the market for old aircraft is so depressed, said Colwell, that "the prices of corporate jets are now equivalent to a used (Boeing) **727.** They are up to $6 to $8 million for a new, large corporate jet. "

But if the market for airliners does bounce back, air carriers might find their benefits short-lived. "The doomsday scenario that I have," said Simpson, "is that the (new Boeing) **757s** and **767s** coming off the line" will have to compete against their ***727s*** and other older aircraft "when all our Columbia Airs and the rest . . . start grabbing them and putting them into service again." And, he added, "unless you put the axe to some of those airplanes, they don't physically disappear. They are always going to come back."

If that scenario were to transpire, it could also set off a new wave of price competition which might further erode the profitability of U.S. air carriers.

Other Factors Affecting Future Growth

Airport Congestion

In chapter II of the NAS Plan, FAA acknowledges that "it is growth in major metropolitan areas (covered by the large and medium hub airport and reliever airport statistics) that causes special concern. These areas contain the largest concentration of aviation industry consumers, representing **90** percent of the air carrier enplanements and 40 percent of itinerant aircraft operations . . . Because of their high population density, increasing resistance to the adverse environmental impact of airport growth, and the expensive and difficult task of land acquisition for the enlargement of existing facilities or construction of new airports, expansion in these areas is nearly impossible. "

This chapter, in Barney Parrella's view, shows that FAA realizes that "airport availability or capacity at airports will be the constraining factor, going out to the year **2000,** in terms of growth in the system. " Gilbert Quinby added that "One way to test the realism of doubling the (GA) fleet is to try to figure out where they're going to put them with the present trends in runways, tiedowns, etc. "

Yet, FAA's econometric model is unconstrained. In the words of H. Clark Stroupe, of Booz-Allen & Hamilton, the forecast "assumes an open-ended supply of air transportation." Is it consistent, then, for FAA to take airport congestion into account as a constraining factor in air-traffic management but to ignore that congestion when forecasting air-traffic growth?

This question was addressed by several members of the group. Parrella argued that "when you hit that ceiling, which is places to land, that seems to me to be . . . the ultimate definer of what your forecast will look like." Later, he added: 'We can project these numbers in a forecast and talk about growth scenarios . . . (but the) overriding constraint is capacity at the major airports , . . I mean, are we talking about a forecast that is really expected to come about, or are we really talking about some kind of target?"

FAA projects that the number of airports in the NAS Plan will grow from 3,163 to 4,000 by the turn of the century. That projection was greeted skeptically by Monroe, who recalled that "when they first established a Federal airport aid program back in 1945, the intent was to develop . . . 6,500 (to) 7,500 airports throughout the Nation . , . Well, the last three or four times that they have published any plan, the number of airports included in the plan has always declined. "

Several factors, including high real estate costs, are working to shrink the number of places where an airplane can land. Monroe cited the Los Angeles Basin as one area where public use airports are disappearing. He quoted FAA data showing that over 300 airports per year have been closed or abandoned since 1965.

Monroe believes that "convenience" has become more important than cost in an individual's decision to purchase a small plane. But when owners find that they cannot use major airports and are forced to drive long distances to use strips which provide considerably less service, they often give up flying. The result, according to Monroe, "is a terrific turnover . . . . Half the (GA) fleet turns over in terms of numbers of registrations. " Lack of convenient airports could also constrain the growth of the GA fleet and GA operations. "Growth is going to be very slow," Monroe said, "until we solve the airplane-airport problem. "

Constraints on airport growth appear inevitable. Citing his recent experience with Boston's Logan Airport, Simpson argued that "there is no limit on passengers at this airport. There are ways to handle the parking lot and some of the building problems at any of these airports. " The real constraints stem from restrictions on aircraft noise and insufficient land for additional runways.

At Logan, said Simpson, "what we are arguing about is one little, short 3,800-foot runway to handle commuter airlines and the possibility of talking the FAA into some parallel approaches on runways that are only 1,500 feet apart. That is it. There is nothing you can do with money to help Boston-Logan, and if you think you are going to go somewhere else in the Boston area and put another airport down, you are not going to do that either. "

User Fees

How will the United States pay for an improved ATC system? This seems certain to be one of the thornier questions Congress may have to face.

In the NAS Plan (page I-34), FAA indicates that the cost of upgrading the ATC system "will be borne by the user. "

During the discussion of user fees, Paul Phelps of OTA pointed out that the latest FAA forecast assumes that "the Administration's user-tax schedule will be in effect on July 1, 1982, and that money will start going into the (aviation) trust fund. " These revenues will come from taxes on passenger tickets and on aviation fuel. But the projection, he added, "does not reflect . . . the two-cent-a-year escalator on those gas taxes, which may be another reason why general aviation local operations and . . . tower operations are so high in the out years."

Because the price of fuel is a factor in FAA forecasts of GA activity, the agency's failure to take this fuel-tax escalator into account would tend to add an upward bias to its estimates of local GA operations and the projected workload of its Flight Service Stations, which are used primarily by GA aircraft. Monroe agreed that user taxes slowed GA growth in the 1970's.

Would increased user taxes exercise a similar restraining effect in the 1980's? And if the Government does not receive the expected revenues from these levies, how will it pay for these improvements to the system? Quinby suggested that the "economic consequences of total fleet and total (operations) much lower than this (traffic forecast) might call for a review of the funding forecast. "

Cost allocation turned out to be equally thorny. There are, as Quinby noted, "a lot of up-front costs that this Plan asks for which are very difficult to allocate. Who should pick up the tab for increasing the productivity of the technical personnel that it takes to man the system? . . . Who should pick up the tab for changing from leased Bell System lines to (an FAA-owned) microwave?"

FAA expects general aviation to account for 75 percent of the increased demand on the system. Should GA user fees be raised in rough proportion to the demand GA will put on the system?

Quinby did not think so. "From a standpoint of cash flow, assets (and) payroll," he said, "the air carrier business is on the order of 10 times as big as the general aviation business. "

Parrella took issue with "this ability-to-pay scenario, " which "in this current difficult air carrier market is not just . . . a simple thing that one can assert anymore . . . . You can't just say . . . it's the deep-pocket industry. We've heard from the bankers that that's just not the case in this environment . . . . It's very inequitable to have cross-subsidization from one industry to the other. "

Monroe argued that "only five percent, approximately, of general aviation flights make use of the IFR system. "

"And yet," countered Gilster, "we have another statistic, which is that more than 60 percent of the flights in the system are general aviation. "

As this exchange indicates, the group reached no consensus concerning either the impact of user fees on traffic growth or the appropriate level of user taxes each sector of aviation should, or could, bear.

Aircraft Financing

The FAA model for changes in the size of the GA fleet is driven principally by GNP. It is far less sensitive to aircraft prices and interest rates. That formula was criticized as too mechanistic as well as too highly aggregated. "Corporate operations are the fastest growing part of GA right now, " said Shaven. Yet by lumping corporate aircraft with the smaller planes, which are used largely for personal flying, one could come up with an estimate of GA fleet size that "may be totally invalid because you've ignored the detail," he said.

Lacking detailed and disaggregated data, the group was unable to reach any conclusions about the issue of financing GA purchases.

For the air carriers, however, there are essentially "three primary sources of funds, " said Slowik. They are: Commercial banks, equity-type securities and the long-term institutional market (mostly insurance companies). "There is also a long-term market through pension funds, " he added, "but they generally have rules where they will not lend money to companies with less than a double-A bond rating, which excludes all the airlines automatically. "

"The estimates made by several of the major airlines indicate net profits of $150 million to $200 million per year (each) will be necessary if their planned and already-ordered new-generation aircraft are to be financed, " he said. So, many carriers may not be able to take delivery of airliners currently on order. Gilster confirmed that some of Boeing's deliveries are being renegotiated.

With Wall Street unreceptive to airline equities and the institutional market charging the airlines interest rates 1 or 2 percentage points higher than their other customers, the carriers have nowhere to turn but to the banks.

"There would be quite a few carriers that wouldn't be in business today if it weren't for the banks making substantial concessions and putting more money into them, " said Slowik. At Citibank, he continued, "we have had to buy out banks, where Midwestern, regional-type banks have refused to go along with addition terms."

Many airlines do not actually own their aircraft; they lease them from Citibank and other financial institutions. This source of financing, Slowik cautioned, would be jeopardized by proposed changes in the lease provisions of the Tax Reform Act of 1981. Airlines may also be able to benefit from offshore capital. Two years ago, for instance, "the first Eurobond financing was arranged for a major airline, " said Slowik.

Though a return to profitability could save many of the carriers, it would have to be a very robust recovery to save them all from bankruptcy. A bank that foreclosed on an airline today would not be able to get a very good price for the carrier's aircraft. So, the banks might decide to wait until the price of used aircraft climbs substantially before calling in their notes.

Alternatively, a bank could force the large carriers to liquidate a portion of their fleet to pay off their debts. In other words, said SIowik, "it wouldn't necessarily require them to go bankrupt to get the money. "

Questions for Working Group 2

Near the close of the meeting, the group touched on some issues it would like to see Working Group 2 explore:

I. *If FAA's scenario of rapid growth is judged to be overly optimistic, can the Government prudently delay a decision to upgrade the ATC system?*

Quinby characterized the present system as "a tired bunch of hardware (that is) trying to run software with band-aids on it. It was designed to be shut down every night for maintenance, and it is not being shut down every night . . . When it breaks, the lack of redundancy and distributed-processing capability hurts them."

2. *How integrated are the various components of FAA's NAS Plan?*

From his reading of the Plan, Monroe concluded that "the elements are so interconnected and . . . interdependent that you almost have to make the decision at the beginning to go the whole 10 yards . . . and, hence, it is not subject to . . . modification at any major part by any short-term alternations in forecasts. "

But Stroupe expressed a "hope that any new technology would have flexibility to make mid-course corrections towards demand in the 10- and 15-year timeframe."

3. *Would the choice of technology be likely to change if more time were available before the improvements would be needed?*

"Well, quite frankly, " said Stroupe, "a 2- or 3-year error in some of the saturation points is a significant difference in what type of technology and what type of system you might consider feasible to implement . . . You may open up alternatives if the number to saturation is 8 years instead of 4."

4. *Specifically, which of the options rejected by FAA might prove to be superior alternatives if growth were slower than expected and more time were available before capacity improvements had to be in place? (See Response to Congressional Recommendations Regarding FAA's En Route ATC Computer System,* DOT/FAA/AAP-82-3, January 1982.)

Questions for Staff Investigation

The Working Group also raised several issues that might be addressed by OTA staff, possibly in cooperation with the General Accounting Office (GAO) or CBO:

1. *To what extent are the scope and timing of FAA's plans driven by the need to accommodate growing demand, as opposed to the need to replace obsolescent equipment or to increase productivity?*
2. *How reasonable and consistent are FAA's aviation forecasts, with regard to procedures and economic assumptions as well as specific projections, and do they provide a satisfactory basis for FAA's long-range plans ?*
3. *Specifically, how does FAA arrive at its forecasts of workloads and capacity constraints at individual en route centers, which seem so vital to the timing of its NAS Plan?*
4. *How accurately do FAA's forecasts reflect the potential impact of aviation user fees, and what effect will lower rates of traffic growth have on the revenues with which to pay for the proposed improvements ?*

ATTACHMENT A-1: CBO ANALYSIS OF FAA FORECAST ACCURACY AND MODEL

Table A-l-l .—Five-Year Aviation Activity Forecasts Compared With Outturn (percent difference)

Forecast made in	For the year	Commercial air carriers enplanements	Revenue passenger miles	Hours flown in general aviation	All itinerant operations	Total operations
1959	1964	– 1.3	– 6.5	– 0.6	6.0	9.7
1960	1965	– 9.5	– 9.7	– 1.2	– 12.7	–21 .6
1961	1966	–27.5	–26.0	– 15.3	–20.0	–28.9
1962	1967	–32.1	–31.4	–23.6	–20.6	–27.3
1963	1968	–41.3	–41.3	N/A	–26.9	–32.5
1964	1969	–31 .4	–33.6	–23.5	–24.0	–24.9
1965	1970	–14.1	– 19.8	– 16.3	– 8.0	– 5.2
1966	1971	9.4	0.5	– 1.6	32.4	42.2
1967	1972	23.6	13.0	9.1	43.8	54.9
1968	1973	23.9	15.9	7.4	49.7	58.4
1969	1974	21.1	21.2	4.6	37.7	42.4
1970	1975	26.3	33.0	– 0.6	19.7	25.9
1971	1976	19.0	28.6	– 0.6	14.1	22.9
1972	1977	22.3	33.7	– 6.8	1.2	4.5
1973	1978	14.0	18.3	– 10.4	2.3	8.8
1974	1979	–10.1	– 7.2	– 9.5	6.4	12.8
1975	1980	1.6	–14.7	– 1.2	11.3	16.0
1976	1981	4.3	– 9.0	15.7	25.7	34.7

SOURCE: David Lewis, Congressional Budget Office, from FAA Aviation Forecasts, 1959 to 1976.

Tabie A-1.2.—Summary of Forecast Periods

Period	Method	Performance 5 years ahead[a]	Environment
1959-65	Trend forecasting: unspecified links to economy, business cycle, population, fares, competition from other modes.	Average error – 18.7°/0 Worst year –32.5°/0	Expanding, prosperous economy. Rapidly growing population. Declining first-class and coach fares, (declining unit costs because of increasing use of jets).
1966-73	Trend forecasting: unspecified links to economy, business cycle, population, fares, competition from other modes.	Average error +32.5°/0 Worst year +58.4°/0	Softening trends in aviation activity. Increasing ticket taxes, rising fares. Forecasts made in 1969 (published January 1970) assumed 4.25 percent growth rate in fiscal 1973, to continue at that rate through decade. infla-tion 2 percent per year from fiscal year 1973. Fares projected to decline in real terms (flat in current dollars).
1974-onwards	Linear econometric models.	Average error +21 .2°/0 Worst year +34.70/0	

[a]Operations forecasts.

SOURCE: David Lewis, Congressional Budget Office.

Table A-1-3.—FAA Forecasting Models

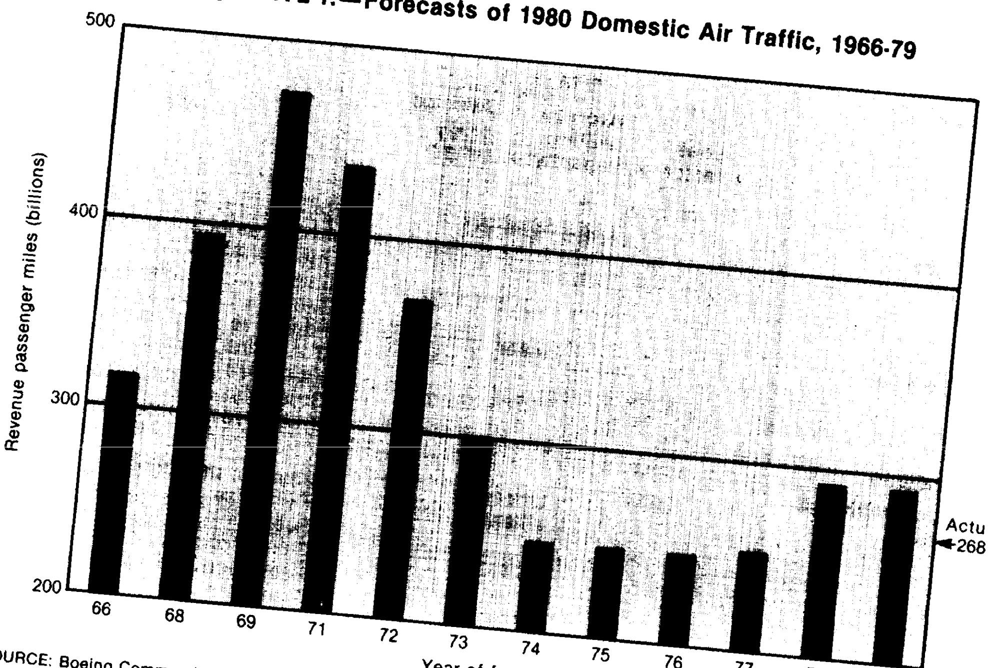
Measure	Model form	Causal variables	Elasticity (at mean)
Air carrier operations			
Revenue passenger miles (RPMs)	Linear econometric	Revenue per passenger mile	– 0.64
		Consumer expenditure in transportation	0.15
		Disposable income	1.80
		Investment in transportation	0.26
Total domestic operations	RPM x *2* / (Load factor x Average seating capacity x Average stage length)	N/A	N/A
General aviation			
Tower workload:			
Change in fleet size	Linear semilog	GNP	17,00
		Aircraft price	– 4.00
		Interest rates	– 2.00
		Sales	3.00
		Time	Negative
Itinerant operations	Linear	Fleet size	1.07
		Fuel price	– 0.23
Local operations	Linear	Fleet size	0.21
		Students	1.00
Instrument operations	Linear	Fleet size	1.50
Flight service station workload:			
Aircraft contacted	Linear	Itinerant operations	1.10
Pilot briefs	Linear	Fleet size	1.60
		Fuel price	– 0.30
VFR flight plans	Linear	Fleet size	0.60
		Fuel price	– 0.27
IFR flight plans	Linear	Fleet size	1.60
		Fuel Deice	– 0.21

N/A - Not applicable.

SOURCE: David Lewis, Congressional Budget Office

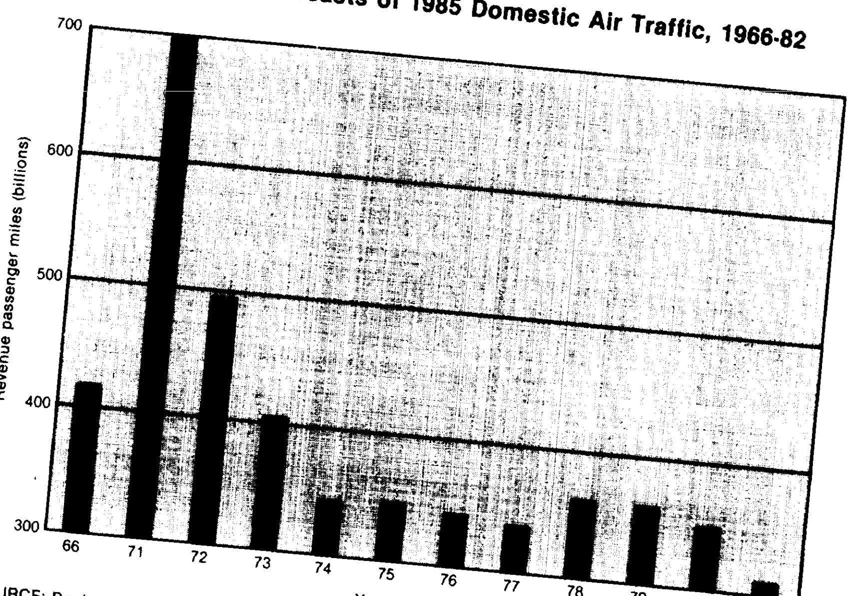
Attachment A-2: COMPARISON OF FAA FORECASTS WITH INDUSTRY FORECASTS (BOEING COMMERCIAL AIRPLANE CO.)

Figure A-2-1.—Forecasts of 1980 Domestic Air Traffic, 1966-79



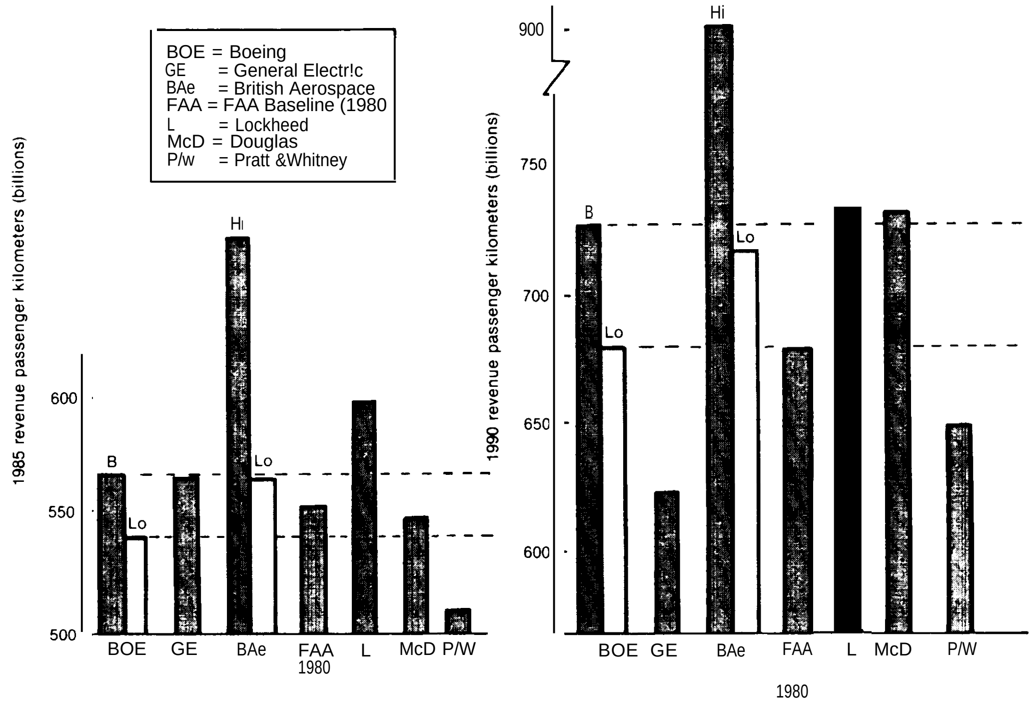
SOURCE: Boeing Commercial Airplane Co.

Figure A-2-2.—Forecasts of 1985 Domestic Air Traffic, 1966-82



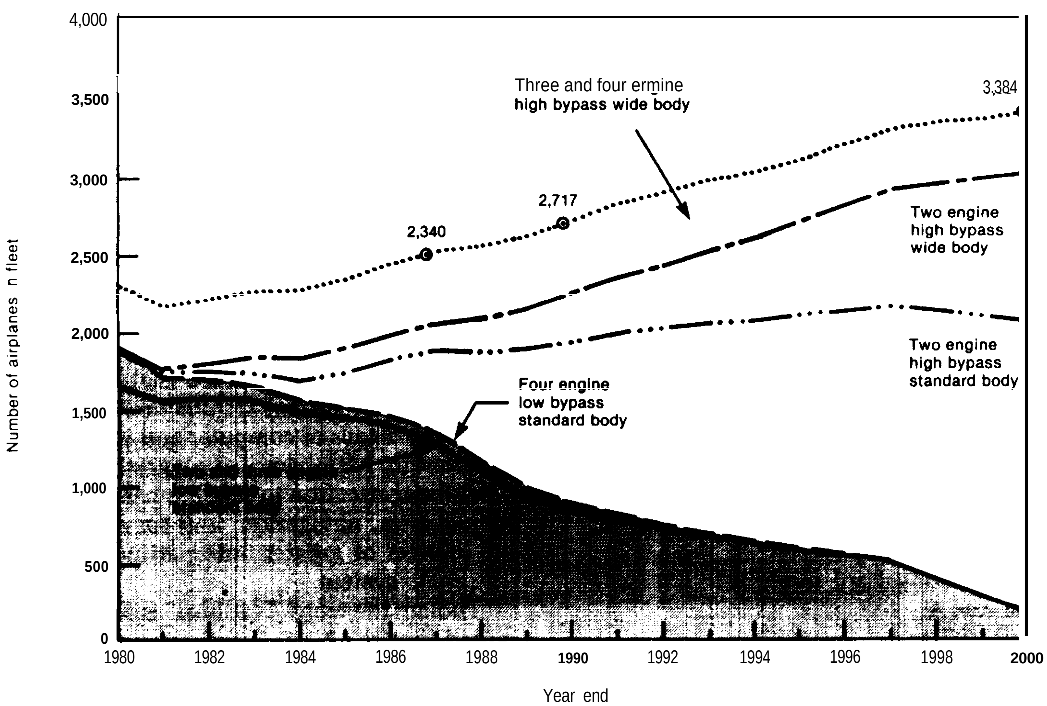
SOURCE: Boeing Commercial Airplane Co.

Figure A-2-3.—Comparison of Industry Forecasts of Domestic Air Traffic in 1985 and 1990



SOURCE: Boeing Commercial Airplane Co.

Figure A-2.4.—Market Forecast for U.S. Commercial Jet Passenger Fleet, 1980-2000



SOURCE’ Boeing Commercial Airplane Co.