AIRCRAFT TECHNOLOGY, IMPACT ON COSTS AND YIELDS

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This discussion is aimed at fares and service, especially fares, or more specifically, fare levels (yields). Fare levels are determined by costs and market conditions. Costs are determined by aircraft technology and how the airlines operate the airplanes. Airline operations result in costs but also affect the market conditions that translate these costs into yields. The jumping off point is technology -- the airplane.

The airplane to a market economist is nothing more than seats flying through the air. How many seats can the airplane hold, how far can it go, from which airports can it operate, what are its costs of operation? The airplane is also an income-producing asset. What kind of productivity can it get at what cost? Productivity is usually measured in terms of annual seat miles or ton miles. These are determined by multiplying the number of seats in an airplane by the speed (block miles/hour), daily hours of utilization, and the number of days in a year.

A brief history of how productivity has improved over the past 35 years is shown in Figure 1. Starting in the early years of the industry (the Civil Aeronautics Board was established in 1938), the DC-3 was introduced into service with about 21 seats. It had a block speed of 150 miles per hour, and produced six million seat miles per year. The direct operating cost (DOC) per available seat mile (ASM) is estimated at 5.9¢ in 1976 prices. Over the years there have been significant improvements, usually showing up in an aircraft's size and speed. Right after World War II the Lockheed Constellation (basically World War II technology) was introduced into service with more than twice the number of seats and a doubling of speed. This produced more than a five-fold increase in seat miles. DOC's per ASM in constant prices were cut by 33 percent. Then came the Super Constellation; there was no increase in speed, but it provided more range and 25 percent more seats. There was no reduction in costs but a significant increase in annual productivity as utilization improved. Moving into the jet era, beginning in the late 1950's, the first generation jets had twice as many seats and a 60 percent increase in block speed. Productivity more than doubled and real costs were lowered another 25 percent. Stretching the jets, e.g., the DC-8 series, significantly increased the seats as well as range. DOC's per ASM were reduced another 10 percent in real terms. Then came another big change into the wide bodies, the second generation jets -- first the B-747 and then the trijets (the L-1011 and the DC-10). These vastly increased productivity and reduced real costs another 25 percent.

Figure 1 illustrates how the tremendous improvements in the technology of the airplane resulted in seat-mile costs that were only one-third of the pre-World War II aircraft. Not shown here are the smaller aircraft (the 2 and 3 engine aircraft) which did not get the increases in speed and size until the late 1960's. The B-727's, the B-737's and the DC-9's resulted in similar improvements in productivity and in a lowering of operating costs, for these shorter range aircraft.

The question is: who received the benefit of all this technology? Was it the passengers, the airlines (stockholders), airline employees, the aircraft manufacturers, or did other groups receive the benefits? This is a big unknown. This question will not be considered in this presentation, but some insights should evolve.

Most historical improvements in technology take a long time to come to fruition. Most of the technological improvements were actually made in the late 1930's and the early 1940's. There were many years between the drawing boards and airline service. Such things as cabin pressurization allowed the airplane to fly higher, which reduced drag and reduced costs. It also provided a much smoother ride. Swept wings also resulted in a smoother ride. Without going into detail regarding improvements in technology, it must be stressed that these changes take years before they are put into commercial airline operation.

An analysis of aircraft technological development produced a surprise. The past improvement in aircraft efficiency resulting in lower operating costs was due more to the economy of scale (the size of the airplane) than to technological advance. Lockheed engineers compared B-747 and B-707 technology, and the impact of size on seat-mile costs. If the B-707 with its technology were the same size as the B-747, what would have been the difference in seat-mile costs? The conclusion, as shown in Figure 2, was that only 22 percent of the reduced seat-mile cost was due to technology and 78 percent was due to the increase in aircraft size (number of seats).

This is very important, because technological improvements in aircraft will be introduced at a much slower pace in the future than in the past. Also, in the past there was a mutually reinforcing upward spiral. As technology was introduced there was a reduction in costs; this resulted in lower yields which in turn generated increased traffic. In addition, the world economy was growing rapidly. Airline traffic was booming. The more efficient aircraft could be introduced into service because the airlines had the ability to buy new airplanes. Thus, the combination of an expanding economy, improving technology, and increasing efficiency (size and speed) of airplanes, mutually reinforced one another to produce a larger and more efficient air transportation industry. This is shown in Figure 3.

The impact of these technological changes on the average size of aircraft, their speed and safety, yields, and corresponding traffic, are shown. During the 30 year period from 1950 to 1980, the airplane increased about four times in size and 2.5 times in speed. The impact of safety on traffic growth is something seldom considered today. At today's prices, the 1950 yield (cents per revenue passenger mile) would have been 19.86 cents, or double what it is today. All these aircraft factors, combined with a growing economy, resulted in great traffic growth during the 1950's and 1960's and into the early 1970's. The traffic in 1970 was twelve times the 1950 volume measured in revenue passenger miles.

The airline world has changed since 1973. Two major events have taken place: the fuel crises and airline deregulation. The two fuel crises of 1973 and 1979 resulted in a six-fold increase in jet fuel prices, and completely altered the relationships between capital, energy and labor. The fuel crises also resulted in two world-wide economic recessions and a general slowdown in the rate of economic growth. Airline deregulation in 1978 has radically altered the competitive structure of the airlines. Today, the airline industry must be looked at through new glasses. Old relationships and "rules of thumb" no longer work.

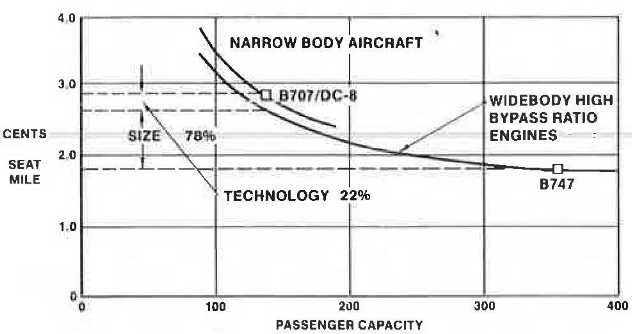
There is a historic relationship between fuel prices, productivity, unit operating costs, and real yields. Figure 4 shows the annual cost, in current prices, of a gallon of fuel since 1973, when the average price was about 12.5 cents. In 1980 the average price per gallon was 86.5 cents, an increase of about seven times. Our projection for 1981 is an average fuel price of $1.09.

As a consequence, fuel costs as a percent of total direct operating costs (DOC) increased from about 25 percent to almost 60 percent between 1973 and 1980. In 1973 there was a one-to-one ratio between indirect operating costs (IOC's) and DOC's; fuel cost per ASM in 1973 was less than 13 percent of total operating costs. Today the relationship between IOC's and COC's is no longer one-to-one, but is closer to 1.25-to-1.0. Fuel as a percent of a total cost is now about 31 percent.

Figure 1. Historical trend of capacity, seats, productivity and operating costs (U.S. domestic).

AIRCRAFT TYPE	YEAR INTRODUCED	AVAILABLE SEATS	BLOCK SPEED MILES/HOUR	ANNUAL AVAILABLE SEAT-MILES MILLIONS	D.O.C. PER AVAILABLE SEAT MILE 1976 $
DC-3	1936	21	150	6	5.90¢
CONSTELLATION	1945	46	290	33	3.90¢
SUPER CONSTELLATION	1952	58	285	55	3.95¢
B707-120/DC-8-10	1959	112	450	125	2.90¢
DC 8 60	1967	196	470	250	2.60¢
B747 100	1970	380	470	700	1.00¢
L-1011-1	1972	256	480	375	1.95¢

Figure 2. Economics of size and technology.



What has happened to productivity and costs in the past five years? Figure 5 shows the history of these factors in the form of an index with 1975 = 100. Even though the fuel price (in constant dollars) increased 111 percent, total operating costs in terms of available seat miles actually were constant until 1979. With the sharp increase in the price of fuel, total operating costs went up somewhat in 1980. Direct operating costs per ASM, which include fuel, went up 15 percent in constant prices. The airlines were able to keep DOC's fairly constant until the 1979 fuel increases. The other component, indirect costs per ASM, declined six percent in real terms during this period.

How were costs kept under control? One major factor was the 16 percent improvement in fuel burn over the five-year period. In addition, there was a 15 percent increase in seats per aircraft and an eleven percent increase in utilization in terms of block hours per day.

How do these factors impact yields? The relationship between total unit costs, load factors and yields is shown in Figure 6. Real costs were inching downward slowly from 1975 through 1979, as traffic increased due to lower yields, resulting in higher load factors. Load factors and yields play against one another. Higher load factors can usually be obtained at lower yields. Thus, during the period between 1975 and 1979, in spite of the doubling of real fuel prices, real yields decreased. Not until 1980, when more tremendous increases in fuel prices, and a traffic decline due to a poor economy resulted in declining load factors, was an increase in real yields required. Nevertheless, the real yield in 1980 was still lower than in 1975. This is most significant.

A year ago at this time, not yet knowing 1980 results, the Lockheed forecast was that real fares would have to increase. Past fuel costs had been absorbed by the increased use of wide body aircraft, which are more fuel efficient. Also, the existing fleet was operated with more seats, at higher load factors, and at higher utilization. These latter three factors are usually one-time events. Once load factors go up to 63 percent, they can not go much higher. Once a 9.5 block hour utilization is achieved it is difficult to go much higher. Once the additional seat in each row and extra rows are added in the L-1011, DC-10 and B-747, higher seating density is not probable. Therefore a year ago the basic assumption for Lockheed's long term traffic forecast was that real yields would have to increase to cover rising fuel costs.

In preparation for this presentation further

Figure 3. Impact on air traffic, airline service factors and yield (U.S. trunk carriers - domestic service).

YEAR	AIRCRAFT SIZE	SPEED	SAFETY	PASSENGER YIELD		REVENUE PASSENGER MILES
	AVAILABLE SEATS	AIRBORNE MILES PER HOUR	FATALITIES PER 100 MILLION RPM'S	U.S. ¢ PER PASSENGER MILE CURRENT	CONSTANT*	BILLIONS
1950	39.7	188	0.96	5.54	18.96	7.8
1955	54.5	220	0.79	5.32	16.37	19.2
1960	71.1	256	0.96	6.01	16.71	29.2
1965	98.3	365	0.38	5.94	15.51	49.0
1970	117.0	436	0	5.77	12.24	95.9
1975	140.1	431	0.08	7.35	11.25	119.4
1980P	156.0	438	0	10.93	10.93	168.2
PERCENT CHANGE						
1950/1960	+ 79%	+ 36%		+ 8%	- 12%	+ 274%
1960/1970	+ 65%	+ 70%		- 4%	- 27%	+ 228%
1965/1970	+ 19%	+ 19%		- 3%	- 21%	+ 96%
1970/1975	+ 20%	- 1%		+ 27%	- 8%	+ 25%
1970/1980	+ 33%	0		+ 89%	- 11%	+ 75%

48 STATE DATA PRIOR TO 1970; 50 STATE DATA BEGINNING 1970
P - PRELIMINARY
*1980 DOLLARS

analyses were carried out. It was determined that there were other efficiencies that would permit the airlines to absorb fuel price increases. Crew costs, depreciation, maintenance, aircraft and traffic services, and general administrative expenses, when measured in available seat-miles, had also decreased between 1975 and 1979. Figure 7 shows direct and indirect costs per ASM, by cost component, for total trunk domestic service for 1975 and 1979, expressed in 1979 dollars. The total operating cost per ASM actually went down two percent between 1975 and 1979, even though fuel per ASM increased 36 percent. The total direct operating cost per ASM increased 0.6 percent as there were improvements in crew costs (down 4.3 percent), insurance, depreciation (down 17 percent) and direct maintenance (down 19 percent) which offset the increased fuel costs. The indirect operating cost items that went up were passenger service, and promotion and sales. These were due probably to higher commissions and increasing reservation costs, both the result of the more competitive deregulated environment.

Another significant item is the change in the ratio between DOC's and IOC's. Historically, the rule of thumb was one-to-one. It increased to 1.04 in 1975 and to 1.10 in 1979. That ratio has continued to increase in 1980, reaching 1.25-to-1.0. Fuel had been 35.7 percent of DOC in 1975, but in 1979 it reached 48.4 percent. That was the most significant increase. Promotion and sales and passenger service also increased in proportion. Most other items decreased as a percent of total costs.

How did all of this come about? Analyzing the data by airplane type, Figure 8 provides an explanation. Fuel gallons per ASM for all domestic trunk aircraft dropped eleven percent, that is from .0298 gallons of fuel per ASM to .0265. There was

Figure 4. Fuel costs - U.S. trunks, domestic service.

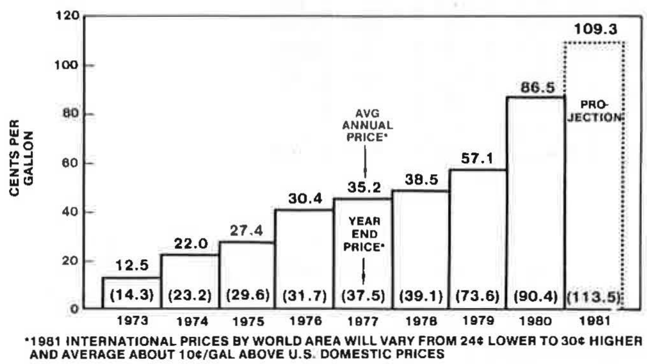


Figure 5. Industry trends - fuel prices and unit cost trunks domestic service (1975-1980).

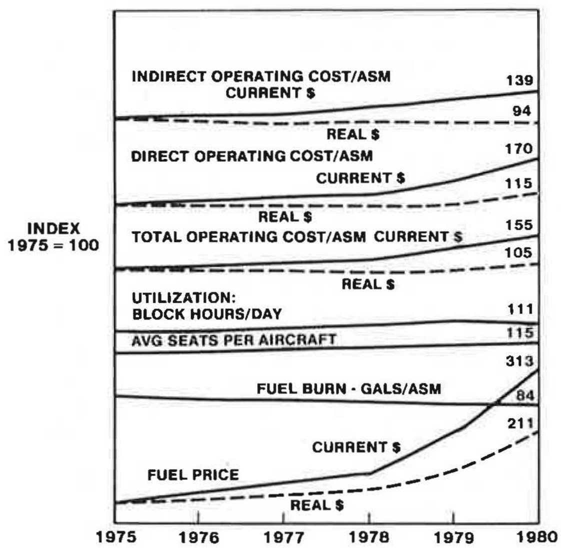


Figure 6. Impact of unit costs and load factors on yields trunks domestic service (1975-1980).

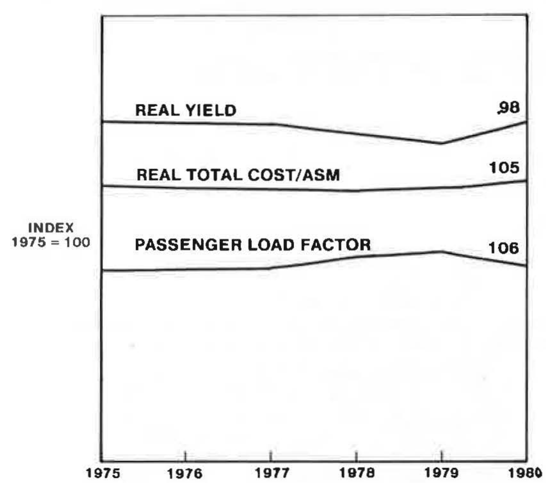


Figure 7. Real operating costs per ASM (U.S. trunks - domestic service - 1979 dollars).

	CENTS PER ASM 1975	1979	% CHANGE 1975-1979
DIRECT COSTS			
CREW	0.738	0.706	- 4.3
FUEL	1.125	1.532	36.2
INSURANCE	0.022	0.012	-45.5
OTHER	0.146	0.008	—
DEPRECIATION	0.402	0.331	-17.7
MAINTENANCE	0.719	0.582	-19.1
TOTAL DOC	3.152¢	3.171¢	0.6%
INDIRECT COSTS			
MAINTENANCE	0.102	0.097	- 4.9
PSGR SERVICE	0.617	0.635	2.9
AIRCRAFT/TRAFFIC SERVICE	1.075	0.999	- 7.1
PROMOTION/SALES	0.672	0.739	10.0
GENERAL AND ADMINISTRATIVE	0.262	0.212	-19.1
DEPRECIATION	0.085	0.070	-17.6
TRANSPORTATION RELATED	0.216	0.133	-38.4
TOTAL IOC	3.029¢	2.885¢	- 4.8%
DOC/IOC RATIO	1.041	1.099	—
TOTAL OPERATING COST	6.181¢	6.056¢	- 2.0%

Figure 8. U.S. trunk domestic service fuel efficiency (gallons per ASM by aircraft type: 1975-79).

	FUEL GALLONS PER ASM			1975				1979			
	1975	1979	% CHANGE	%ASM	SEATS	HRS/DAY	DIST	% ASM	SEATS	HRS/DAY	DIST
DC-9-30	0.0330	0.0321	- 2.7%	5.6%	90	9.01	342	3.4%	91	9.41	356
B737 (ALL)	0.0302	0.0274	- 9.3	2.4	96	6.17	301	2.1	104	8.06	309
B727-100	0.0350	0.0321	- 8.3	15.8	97	8.00	565	12.7	102	9.23	633
B727-200	0.0303	0.0281	- 7.3	22.4	127	9.02	492	34.3	132	10.29	577
B707 (ALL)	0.0300	0.0276	- 8.0	11.6	138	8.89	949	7.5	144	9.33	1,042
DC-8-10/50	0.0368	0.0311	-15.5	3.8	131	7.23	829	1.3	134	8.02	1,090
DC-8-60	0.0256	0.0247	- 3.5	5.1	184	8.47	975	4.3	187	9.81	1,043
L-1011	0.0251	0.0206	-17.9	6.8	242	7.93	882	10.1	284	10.23	1,000
DC-10	0.0227	0.0205	- 9.0	14.6	234	8.71	1,100	13.4	256	9.94	1,295
B747	0.0212	0.0193	- 9.0	9.7	353	8.85	1,775	8.5	378	12.09	2,021
A300B	—	0.0204	—	—	—	—	—	0.9	240	10.11	893
SUB TOTAL	0.0288	0.0259	-10.1	97.8	139			98.5%	153		
OTHER	0.0745	0.0651	-12.6	2.2	51			1.5	63		
TOTAL	0.0298	0.0265	-11.1%	100.0%	137	8.28	588	100.0%	150	9.72	644

Figure 9. Fuel price forecast (in current U.S. dollars).

AREA	AVERAGE PRICE PER GALLON				
	1980	1981	1983	1985	1990
UNITED STATES	$ .87	$ 1.09	$ 1.50	$ 1.74	$ 2.80
CANADA	.70	.86	1.40	1.74	2.80
MEXICO	.80	.96	1.45	1.74	2.80
CARIBBEAN	1.12	1.25	1.70	1.84	2.90
CENTRAL/SO. AMERICA	1.08	1.25	1.70	1.84	2.90
EUROPE/MID-EAST/AFRICA	1.21	1.34	1.75	1.90	3.00
FAR EAST	1.16	1.30	1.70	1.84	2.90
SOUTH PACIFIC	1.09	1.20	1.65	1.80	2.85

AREA	OIL PRICE PER BARREL				
WORLD	$31.20	$36.00	$46.00	$57.00	$95.00
UNITED STATES	28.00	37.50	49.00	60.00	98.00

SOURCE: CAB DATA-U.S. TRUNKS ALL SERVICES (1980)
1981-90 FORECAST BY LOCKHEED MARKETING

Figure 10. Outlook for 1985 real operating costs per ASM.

ASSUMPTIONS:

- REAL FUEL PRICE: PERCENT INCREASE

1981	+ 15%
1982	+ 8%
1983-5	+4-5% PER YEAR

- ALL OTHER DIRECT AND INDIRECT OPERATING COSTS PER ASM AVG ANNUAL CHANGE AT THE 1975-80 HISTORIC TREND:

CREW	-1.1%
DIRECT DEPRECIATION	-4.2%
DIRECT MAINTENANCE	-4.5%
INDIRECT MAINTENANCE	-1.1%
PASSENGER SERVICE	+0.6%
AIRCRAFT/TRAFFIC SERVICE	-1.7%
PROMOTION/SALES	+2.5%
GENERAL AND ADMINISTRATIVE	-4.5%
INDIRECT DEPRECIATION	-3.5%
TRANSPORTATION RELATED	-8.5%

a fuel consumption improvement across the board; even the old aircraft improved. Some were higher than others, but there was a significant improvement in gallons per ASM in almost every airplane type. What caused these improvements? In every case the number of seats increased; the overall average rose from 137 to 150. Daily hours of utilization increased almost an hour and a half. They increased for every airplane type. There was also a small increase in the average distance flown which provides a little more efficiency. This analysis covers only trunk domestic service; some of the shorter haul markets went to the locals and other carriers.

Another significant factor is the distribution of total ASM's accounted for by each of these airplane types. Almost every single type of airplane that had a higher-than-average fuel consumption per ASM in 1975 decreased as a percent of total ASM's in 1979. The B-727-200 data include the old 200's plus the advanced 200's; there is no way of separating them. The newer 727-200's are much more fuel efficient than the older aircraft.

What is going to happen to real fares in the future in view of continuing inflation and the uncertainty of future fuel costs? Lockheed's assumption on future fuel costs is shown in Figure 9. From an average of $.87 per gallon today, it is assumed that the fuel price will increase to $2.80 by 1990. Assuming also a rate of inflation of about 9.7 percent between 1979 and 1990, jet fuel prices will increase about 4 percentage points faster than the average rate of inflation.

What else is expected to happen between now and 1985? First, there will be a more efficient fleet in the future. At least 300 aircraft will be phased out, and at least 200 new aircraft will be introduced. There will also be some retrofitting of existing airplanes, probably the DC-8-60's and some derivatives of the L-1011. Another important factor is increasing seating density. Airlines are experimenting with removing heavier seats and replacing them with a greater number of lighter seats. Some airlines on short-haul services are removing galleys and adding seats.

Second, it is also expected that the improvement in gallons per ASM will continue at the historical rate of about 4 percent. An analysis of the historical rate prior to 1975, back to the late 1960's, indicates that the 3 to 4 percent annual improvement has been going on for years. The impact on real fuel costs depends, obviously, on the future fuel price. It may be concluded that an annual increase of 4 to 5 percentage points above inflation can be absorbed by this 4 percent increase in efficiency. If fuel prices increase annually by more than 5 percentage points above inflation, then continued efficiencies in other areas are required.

The projected level of real operating costs per ASM for 1985 is based on the following assumptions. Real fuel prices will increase by about 15 percent in 1981. Since this is on an ASM basis, 4 percent must be added for the fuel improvement and about 10 or 11 percent for inflation. That results in the 30 percent expected increase in the current fuel price for 1981. Some price increase spillover is expected in 1982, assumed to be 8 percent. Beyond 1982 a long term trend of about 4 percent was

Figure 11. Real operating costs per ASM (1979 dollars).

	CENTS PER ASM				% AVG ANNUAL CHANGE		
	1979	1980*	1982	1985	1979-80	1980-82	1982-85
DIRECT COSTS							
CREW	0.706¢	0.71¢	0.69¢	0.61¢	0.5	-1.4	-4.0
FUEL	1.532	2.00	2.30	2.30	30.5	7.2	-
INSURANCE	0.012	0.01	0.01	0.0+	-16.6	-	-
OTHER	0.008	0.01	0.01	0.01	25.0	-	-
DEPRECIATION	0.331	0.32	0.30	0.27	-3.3	-3.2	-3.5
MAINTENANCE	0.582	0.58	0.52	0.47	-0.3	-5.3	-3.3
TOTAL DOC	3.171¢	3.63¢	3.83¢	3.67¢	14.5	2.7	-1.4
INDIRECT COSTS							
MAINTENANCE	0.097¢	0.10¢	0.09¢	0.09¢	3.1	-5.1	-
PSGR SERVICE	0.635	0.63	0.65	0.66	-0.8	1.6	0.5
AIRCRAFT/TRAFFIC SERIVCE	0.999	0.96	0.95	0.89	-3.9	-0.5	-2.2
PROMOTION/SALES	0.739	0.77	0.79	0.84	4.2	1.3	2.1
GENERAL & ADMINISTRATIVE	0.212	0.20	0.18	0.15	-5.7	-5.7	-5.9
DEPRECIATION	0.070	0.07	0.06	0.05	-	-7.4	-5.9
TRANSPORTATION RELATED	0.133	0.13	0.10	0.08	-2.3	-12.3	-7.2
TOTAL IOC	2.885¢	2.86¢	2.82¢	2.76¢	-0.9	-0.7	-0.7
DOC/IOC RATIO	1.099	1.27	1.36	1.33	-	-	-
TOTAL OPERATING COST	6.056¢	6.49¢	6.65¢	6.43¢	7.2%	1.3%	-1.1%

* PRELIMINARY

Figure 12. Industry trends - fuel prices and unit costs trunks domestic service.

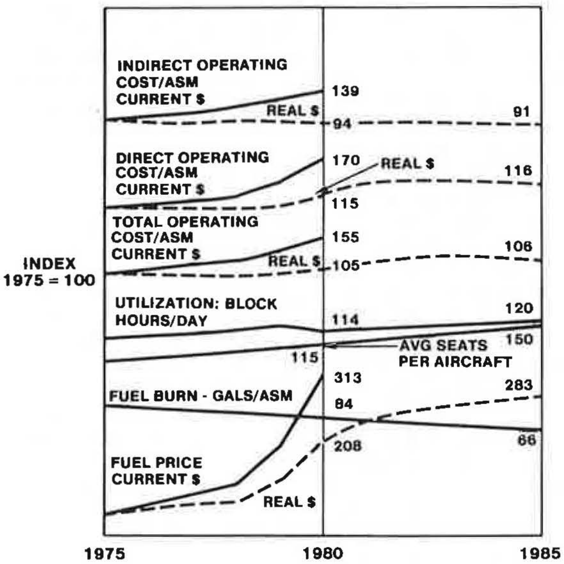
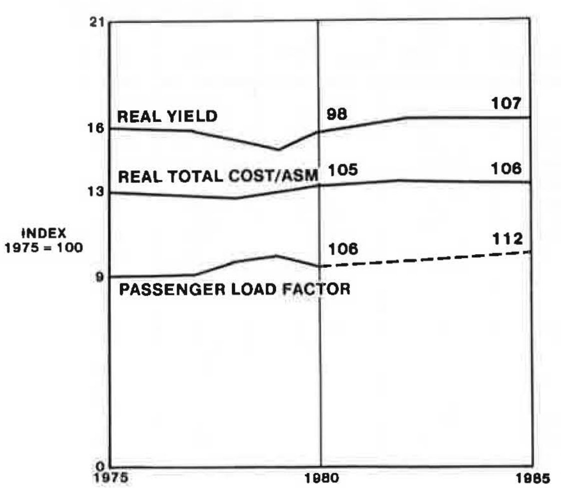


Figure 13. Impact of unit costs and load factors on yields trunks domestic service.



assumed. It was also assumed that the individual component costs per ASM mentioned earlier will maintain the historical 1975-1979 trend. These include crew costs decreasing one percent annually, as shown on Figure 10. Under these assumptions, the cost per ASM was determined for 1982 through 1985 and is shown on Figure 11. Real prices would keep rising through 1982. After 1982 there could be a drcrease in real fares, provided the assumptions hold.

This is a significant change from views of last year. One of the major differences between the Lockheed forecast and the FAA forecast was the assumption regarding real fares. Lockheed assumed real fares would go up while the FAA assumed real fares would go down. Now it appears that real fares will continue to go up during the next few years, but they could come down after that. It all depends on international and domestic political factors that could still result in higher fuel prices.

Figure 12 translates all these assumptions into a graph for 1985. Real fuel cost will be 2.8 times the 1975 average. Fuel burn (gallons per ASM) will continue to decline. Average seats per aircraft will go up. Utilization and load factors are functions of the market place, rather than of technology. Utilization cannot go up much from its level in 1979. While utilization actually dropped in 1980, the 1985 utilization is roughly back where it was in 1979. Real DOC's will continue to go up through 1983 and then tend to level off. Real IOC's will continue coming down, year by year. Real total operating costs will go up the first few years and then level off.

How do these assumptions relate to future yields? If the 1979 passenger load factor of 63 percent can be achieved (it is difficult to get much higher than that), the yield increase could be moderate. The increase will take place mostly in the 1981-82 time period. The real 1985 yield will be only 7 percent higher than the 1975 yield, in spite of the assumption that the real fuel price will increase 36 percent.

Summing up (Figure 13), real fares are assumed to continue to increase through 1982. Real fares could decline one percent per year after that provided fuel does not increase by more than 5 percentage points over the rate of inflation; the operating efficiency improvement trend between 1975 and 1980 continues; and load factors gradually go back up to 62 percent.

What will be the future load factors? This really gets down to market planning and airline operations. Does the airline have the right mix of airplanes for its strategy that takes into account the entirety of its operations and the right balance between market shares versus profitability and the assessing of long term financial strength versus short term market objectives? In other words, the right scenario must be implemented.

What of the impact of deregulation on future fare levels? It is becoming evident that the most significant long term impact of deregulation will be to bring labor costs under control. This issue has been a sleeper; in all the years of the deregulation argument there was no discussion of the impact of deregulation on labor. It was always assumed that labor's rights would be protected. Even Senator Edward Kennedy, a staunch supporter of unionized labor, was an early supporter of deregulation.

At least 20 percent of the pilots are on furlough. Moreover, traffic is below last year and is forecast to grow at a much slower rate in the future than in the past. The average number of seats per airplane will continue to increase. Future airplanes will be designed for two crew members rather than three. There are too many pilots for the anticipated requirement. The handwriting is on the wall -- consider how the PSA and the Continental strikes were settled. The PSA pilots finally went back once PSA threatened to bring in new pilots, and they agreed to what was offered three months earlier. The Continental cabin crew members also went right back to work without much of a fight.

How can Air Florida and other new carriers offer such low fares compared to the old carriers. They are flying the same airplanes in the same regions. The fuel price per gallon to these carriers was slightly higher than average since they usually could not take advantage of long term contracts and had to pay higher spot fuel prices.

An analysis was made of the comparative operating costs of one airplane type by several different airlines: the new carriers, the locals, and the trunks. The only airplane type that seems to be operated by all three carrier groups is the B-737-200. Two trunk carriers operated it, as did most local service airlines, as well as Southwest, Air Florida and Air California. Figure 14 shows the results for these three airlines for three quarters in 1980 and for the trunks and locals for the year ending September 1980. It is not exact but is close enough for comparison.

What stands out most clearly is the high crew costs per ASM by the trunks, even though the aircraft had roughly the same number of seats (the smaller carriers do have a few more seats) and were operating at about the same distances. The smaller carriers had better utilization and operated at higher load factors. There was hardly any difference in fuel gallons per ASM. The crew costs per ASM were .42 cents for Southwest; .36 for Air Flordia; .67 for Air California; .86 for all the locals; and 1.495 for the trunks. Crew costs per ASM accounted for a major part of the total DOC differences.

It is interesting to note that one corporation operates Texas International Airlines with unionized crews. The nonunionized New York Air has a 60 percent lower cost per crew that results from two factors. It is not only that New York Air crews are paid less, their annual salary is probably $35,000 versus $65,000 for TIA), but TIA is flying about 45 to 50 hours per month while New York Air crews are flying about 65 to 70 hours. Put together, these two factors produce a tremendous reduction - this is something worth thinking about for the future.

Crew costs per ASM account for only 10 percent of total operating costs by trunk carriers. If crew productivity could be increased by 25 percent, total operating costs could be reduced 2.5 percentage points, a significant improvement. It has to be the way of the future, if the larger airlines are to remain competitive.

What of future technological improvements? Figure 15 illustrates what is being planned for the L-1011, which is indicative of changing technology in the industry. Basically it provides marginal improvements relating to fuel savings. There are modest improvements in technology producing about a 10 to 15 percentage point improvement in fuel efficiency through the mid-1980's. These include composites, center of gravity control, air foil modification, and so on.

Real reductions in fare levels must come from imaginative airline marketing. Figure 16 shows the range of yields available with the same airplane type as a function of seating density and load factors. All costs could be covered with only 230 seats in a L-1011, with about a 55 percent load factor and a 14 cent yield.

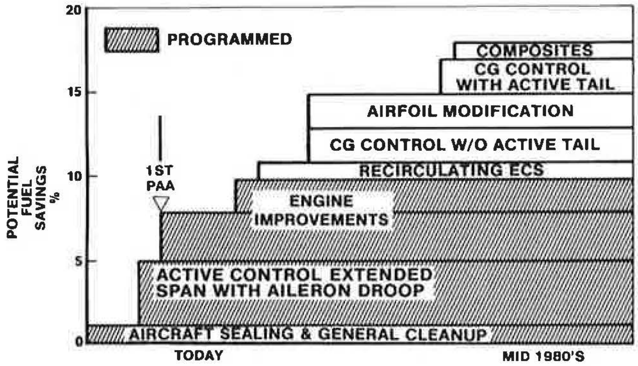
At the other seating density extreme -- 400 seats -- the L-1011 could cover costs also at a 55 percent load factor with only a 8 cent yield or at

Figure 14. Comparative direct operating costs per ASM (B737-200).

	3 QUARTERS 1980			YEAR END SEPT 1980	
	SOUTHWEST	AIR FLORIDA	AIR CALIFORNIA	LOCALS	TRUNKS
OPERATING COSTS					
CREW	0.418¢	0.361¢ E	0.669¢	0.861¢	1.495¢
FUEL	2.065	2.065	2.485	2.163	2.117
INSURANCE	0.028	0.054	0.022	0.030	0.011
OTHER	0.011	0.009	—	0.001	—
DEPRECIATION	0.360	0.839	0.432	0.375	0.324
MAINTENANCE	0.483	0.460	0.980	0.653	1.083
TOTAL	3.365¢	3.788¢	4.588¢	4.083¢	5.030¢
OPERATIONAL FACTORS					
LOAD FACTOR	68.4%	64.0%	70.6%	55.0%	59.7%
SEATS	118	116	121	107	106
BLOCK HOURS/DAY	11.13	9.36	10.42	9.31	7.16
DISTANCE (ST. MILES)	276	402	286	328	334
GALLONS/ASM	0.0246	0.0227	0.0249	0.0250	0.0256
AVG NO. AIRCRAFT	60	11	12	68	68

E = ESTIMATED

Figure 15. L-1011 fuel efficiency plan.



a 6 cent yield with a 70 percent load factor. There are numerous alternatives and today this is what is at the heart of airline marketing - how to get the right yield/load factor combination with the right number of seats in the right market, all year long.

What is the future outlook for fares, considering these additional factors? Fares cannot be considered as only a function of costs and technology. How the airlines operate, the role of the market place, and competition must also be considered. There will be technological improvements, but these will be incorporated in small increments. The airlines are not going to have the doubling and tripling in aircraft productivity that they had in the past. The size of the airplane is not a function of technology but of market demand. The manufacturers can build any size airplane desired. The B-747 was built before the smaller L-1011 and DC-10 because it was developed from C5A technology which is more than 15 years old. The C5A could

Figure 16. Imaginative Airline Marketing - Impact of Alternative Seating Densities, Load Factors, and Fares on Profits.

1,000 ST. MILE TRIP COST • TOTAL COST ABOUT $17,000* (1980$)

L-1011-1 NO. OF SEATS	YIELD ¢/RPM		50% LF	55% LF	60% LF	65% LF	70% LF	80% LF
230		PSGR	115	126	138	150	160	184
LUXURY	10.0¢	REVENUES	11,500	12,600	13,800	15,000	16,000	18,400
	12.0¢	REVENUES	13,800	15,100	16,600	18,000	19,200	22,100
	14.0¢	REVENUES	16,100	17,600	19,400	21,000	22,400	25,800
275		PSGR	138	151	165	179	192	220
STANDARD	8.0¢	REVENUES	11,000	12,100	13,200	14,300	15,400	17,600
	10.0¢	REVENUES	13,800	15,100	16,500	17,900	19,200	22,000
	12.0¢	REVENUES	16,600	18,100	19,800	21,500	23,000	26,400
330		PSGR	165	181	198	215	231	264
ECONOMY	6.0¢	REVENUES	9,900	10,900	11,900	12,900	13,900	15,800
	8.0¢	REVENUES	13,200	14,500	15,900	17,200	18,500	21,100
	10.0¢	REVENUES	16,500	18,100	19,800	21,500	23,100	26,400
400		PSGR	200	220	240	260	280	320
HIGH DENSITY	6.0¢	REVENUES	12,000	13,200	14,400	15,600	16,800	19,200
	8.0¢	REVENUES	16,000	17,600	19,200	20,800	22,400	25,600

*AT FULLY ALLOCATED TOTAL OPERATING COSTS

have held over 700 passengers in a commercial configuration. Thus, size is not a question of the ability to build big airplanes. The question is what size will the market bear? The interrelation of higher density seating, load factors and utilization is the key. These have very little to do with technology; they are all functions of market demand.

Over the long term, then, fares will probably equal the rate of inflation. It is possible that real yields could decline. It depends on the price of fuel, which in turn depends on the international political situation; airline labor relations which depend on the U.S. domestic political climate; and on the degree of competition in the domestic and international airline regulatory environment. Technological improvements will be a less important factor than marketing considerations in determining future fare levels until the late 1980's.