

Future Aviation Activities

Eighth International Workshop

National Academy of Sciences
September 13-15, 1993
Washington, D.C.

CONTENTS

MAJOR FINDINGS	7
PRESENTATIONS	11
Economic Forecast	
Ross DeVol, The WEFA Group	11
Aviation Infrastructure and Demand as Complex Adaptive Systems	
Jonathan L. Gifford, George Mason University	23
Telecommunications and Business Travel: The Revolution Has Begun	
Ernest S. Arvai, The Arvai Group	28
Global Aviation Alliances	
David E. Raphael, Marcar Management Institute	32
Airline Consolidation: Consumer Welfare and Policy Implications	
Dong Liu and Richard R. Mudge, Apogee Research, Inc.	35
DISCUSSION PANEL REPORTS	38
Domestic U.S. Airlines	
Joseph P. Schwieterman, DePaul University,	
and Mark Diamond, Mercer Management Consulting, Inc.	38
International Aviation	
Bouke M. Veldman, INB-Pegasus B.V.	43
Regional Aviation	
Steven M. Horner, Bombardier Regional Aircraft	46
Aircraft and Engine Manufacturers	
Vernon F. Thomas, GE Aircraft Engines	50
Aviation Infrastructure	
Richard S. Golaszewski, Gellman Research Associates, Inc.,	
and Lloyd A. McCoomb, Transport Canada	55
Business Aviation	
Ralph A. Aceti, Learjet, Inc.	59
Vertical Flight	
David S. Lawrence, Sikorsky Aircraft	62
Light General Aviation	
Ronald L. Swanda, General Aircraft Manufacturers Association	64

APPENDICES	74
A. Commercial Aviation in the CIS, 1992-1993	
John S. Strong	
Harvard Institute for International Development	
Harvard University, and	
School of Business Administration	
College of William and Mary	74
B. Airline Industry Outlook and Infrastructure Needs	
Clinton V. Oster, Jr.	
School of Public and Environmental Affairs	
Indiana University	76
C. The Market and Aviation Infrastructure: Pricing, Productivity and Privatization	
David Gillen	
University of California, Berkeley, and	
Wilfrid Laurier University	82
D. Piston Aviation Engines: A Manufacturer's Perspective	
Michael D. Wolf	
Textron Lycoming Reciprocating Engine Division	87
E. List of Participants	88

FOREWORD

Since 1979 the Transportation Research Board, under the sponsorship of the Federal Aviation Administration, has conducted a series of biennial workshops on trends and developments that will affect civil aviation here and abroad. The eighth workshop in this series was convened by TRB on September 13-15, 1993, at the National Academy of Sciences in Washington, D.C. The purpose of the workshop was to assist public and private-sector managers and decision makers in forecasting the long-term evolution of commercial, business, and personal air transport. The topics discussed included the macroeconomic outlook, the structure and operating patterns of major and regional U.S. air carriers, developments in international aviation, aircraft technology, aviation infrastructure, trends in business aviation, the civil use of helicopters and other vertical-lift vehicles, and the future of personally owned and operated light aircraft.

The workshop was attended by 128 invited participants drawn from government, industry, academic institutions, and private consulting firms. The majority were from the United States, but there was also significant representation from Canada, England, France, Germany, Italy, Japan, the Netherlands, Sweden, and several foreign firms with offices in the United States.

The program was divided into three parts: an opening plenary session consisting of presentations by distinguished speakers on the broad outlook, eight concurrent discussion panels on sectoral interests and trends, and a concluding plenary session where panel leaders summarized the findings and conclusions of their group discussions.

The panel reports represent the views of panel participants and not necessarily those of the discussion leaders, their organizations, the Federal Aviation Administration, or the Transportation Research Board.

The Transportation Research Board is indebted to all who took part for the generous gift of their time and experience, especially the panel leaders and the workshop co-chairmen -- John W. Fischer of the Congressional Research Service and Jack P. Wiegand of Forecast International/DMS -- who so ably organized the endeavor and prepared this report of the proceedings.

MAJOR FINDINGS

DOMESTIC U.S. AIRLINES

The U.S. airline industry is emerging from a tumultuous half-decade of price cutting only to find itself confronted with a new set of issues: changing customer demographics, softening demand for business travel, and pressing need to modernize their fleets.

Despite these changes, the airline industry will continue to follow the evolutionary pattern established during the 1980s. It will experience modest increases in concentration as one or more struggling carriers retrench or liquidate. Stimulated by declining average fares, air carriers will enjoy steady growth of pleasure travel, but disappointing decline in business travel.

The panel concluded that five factors would be of critical in the long term for domestic airlines.

Financing

Traditional industry financing tools will be unattractive. The consensus of the panel was that new financing vehicles will be developed, such as: employee equity, foreign investment (changes in U.S. laws can be expected), state and local government investment, and new risk-management tools required by venture capitalists, particularly for new entrants.

Aviation Commission Recommendations

The panel believed it would be unwise to radically adjust forecasting models on the basis of the Commission's proposed agenda. Congress is not expected to adopt the Commission's recommendations for stimulating traffic or bolstering industry profitability. Further, the recommendation that the Federal Aviation Administration be reorganized is unlikely to have any significant effect on the character or performance of domestic airlines. The panel's remaining concern about the Commission's recommendations was that its report could inadvertently divert attention from the industry's other competitive problems.

Structural Changes

The three megacarriers (American, Delta, and United) will remain the dominant forces in long-distance travel. On short- and medium-haul routes, startup carriers will enjoy brisk growth in market share. Any expansion by megacarriers and startup airlines is likely to come at the expense of second-tier carriers. The success of Southwest

Airlines will accelerate these structural shifts. The panel, however, urged forecasters to recognize that the Southwest model is not applicable everywhere.

Capacity and Pricing Changes

Carriers are already committed to reducing their capacity in upcoming years. These cutbacks could provide temporary relief for the industry by slowing down historical yield declines. Unfortunately, there is little evidence to suggest that carriers have learned from the price wars of the past.

Maturity of the Air Travel Industry

As the millennium approaches, the U.S. air travel market exhibits the telltale signs of a mature industry. As the industry matures, its growth will be roughly proportional to overall U.S. economic growth. The enduring wild card in long-range forecasts remains the state of the macroeconomy.

INTERNATIONAL AVIATION

The panel believed in the overall growth potential of international aviation. There was also general agreement that market forces will drive government regulations and policies as they effect international aviation. Policy, however, is likely to be made as a result of events and crisis, rather than as a result of careful planning.

The current problematic state of the world airline industry is the result of overcapacity. This overcapacity is largely the result of barriers to market exit, which not only prevents airlines from discontinuing service but, more importantly, causes underutilized assets to remain available.

It was the panel's sense that regional liberalization will precede globalization. Regionalization will cause the number of national airlines with global ambitions to decrease. Denationalization will be a necessary precursor to further deregulation.

Two industrywide trends can be distinguished. The first is a concentration of the global carriers on a limited number of profitable city pairs. Often these city pairs contain at least one airport with traffic congestion. This situation will provide a future market opportunity for very large aircraft (800 plus seats). The second, and somewhat contrary, trend is the growth in routes between secondary cities which are receiving nonstop

service by carriers using twin-engine aircraft that bypass the major hubs.

It is fair to say that the Pacific still offers the greatest growth potential for the airline industry. Most Pacific Rim nations involved are not, and will not, be ready for liberalization in the near future. In this market bilateral conflicts will have a limited impact, however, as long as the total market grows. The situation is different on the North Atlantic routes where the total market is barely growing and the fight is over market share.

Although the National Commission to Ensure a Strong and Competitive Airline Industry advocated that the United States pursue an open skies policy, the U.S. definition of this concept is still uncertain. Even if there were agreement on the definition, general questions about implementation remain. Open skies involve free market access, but if that access is limited by infrastructural constraints on both sides of the ocean, there will be very little enthusiasm to pursue it. Because of the dissimilar attractiveness of open skies to different countries, the likelihood of block negotiations and hence multilateral treaties is small.

It is primarily a lack of market access, due to existing regulatory restrictions, that is driving the creation of multinational airlines. The panel remained skeptical of wide spread multinationalization, however, due to the lack of success in several mergers and the additional difficulties engendered by mergers across borders.

REGIONAL AVIATION

Regional airlines have been one of the fastest growing and most profitable segments of commercial aviation for several years. However, their continued success is inextricably tied to that of major airlines which are their marketing partners. Any change in major airline operating structure affects regional carriers. Frequent fare adjustments, usually downward, during the past two years illustrate the closeness of this relationship.

Three factors are key to the future of regional aviation. The slow worldwide economic recovery of the 1990s has dampened both business and leisure travel. Still, the struggle of major airlines to cope with mediocre market growth has not necessarily been all bad news for regional carriers. In the short term they have picked up routes that might have been served by major airlines. But over the long term regional carriers must be concerned about the health of major airlines and adjust their operational strategy and planning accordingly.

The second factor is the maturity of the air travel market. Is the market mature and driven only by the rise of GNP, or can it be stimulated by fare elasticity? Whatever the answer, the instability caused by industry restructuring and experimentation will have an effect on regional airlines.

Hand in hand with these concerns is a third factor, competition from new-entrant carriers that focus on short-haul nonstop services, an area that regional carriers have until now had largely to themselves.

The economic pressure of recent years is catching up with major airlines on their short-haul routes. For regional carriers this is a double-edged sword: advantageous to regionals if they can pick up the short routes abandoned by majors, disadvantageous if there are rapid structural changes that affect the business philosophy of regional feeder services.

The short-haul airlines are evolving into an industry with a different structure. While questions remain as to the number of hubs, their role, and the reemergence of direct point-to-point service, a larger role for cost-conscious regionals seems assured.

Globalization of the airline industry is proceeding at a fast pace. Regional airlines are beginning to feel its impacts first hand, especially following the implementation by British Airways of a regional air service network across several countries in Europe.

There will be a need for continued consolidation by major and regional airlines, as well as the regional aircraft manufacturing sector, which is overburdened by competing products.

The general outlook for regional airlines is upbeat. Most have come through the slow economic with record traffic and profits, positioning them to build on their success in coming years. Nevertheless, doubts persist about the financial health of the majors, the structure of the airline industry, and the competitive environment here and abroad.

AIRCRAFT AND ENGINE MANUFACTURERS

The panel's consensus forecast was for world traffic growth of 4.5 to 5.5 percent annually for the next fifteen years. U.S. growth was estimated to be about one percentage point lower. A linkage of traffic growth to GDP growth was generally assumed, but there was some opinion that the relationship is becoming more tenuous over time.

Is the market mature, at least insofar as the United States and Western Europe are concerned? If *mature* is defined as a level percentage of GDP being devoted to the goods or service in question, then perhaps the answer is yes since a plateau of about 1 percent of GDP expended on air travel seems to have been reached. If this is the case, air travel can be expected to grow solely in proportion to the growth of GDP.

The consensus forecast of the panel predicted 8,550 aircraft deliveries over the next 15 years, or roughly 575 per year. The 1993-1997 period, however, was expected to see a lower than average number of deliveries. On average, the panel foresaw 3,875 retirements over the

next 15 years, a little over 250 aircraft per year. Admittedly, retirement volumes are one of the weakest links in the forecasting process.

The composite growth of the commercial aircraft fleet was expected to reach 13,500 aircraft by the end of 2007. However, there was wide variation among panel members on this question, with estimates for the worldwide fleet ranging from 10,500 to 16,500 aircraft.

There were a number of questions for which the panel had no answers, but which most felt would be of special significance in shaping the landscape of the industry in the years to come. These were:

- the composition of demand,
- retirements,
- regulation of noise and emissions,
- shifts in the fleet mix of large and small aircraft,
- productivity,
- financial constraints on the industry,
- excess aircraft capacity,
- teleconferencing technology, and
- introduction of new technology and return on investment.

It is perhaps an obvious, but nonetheless sobering conclusion, that the welfare of the manufacturing sector depends on the airlines' collective ability to manage their way back to sustained profitability -- no mean feat in today's environment.

AVIATION INFRASTRUCTURE

Significant changes continue to take place in the airline industry, which is becoming more dynamic and market driven. Air carriers are not tied to specific locations. They can and will redeploy assets in response to shifts in demand. Alliances, mergers and consolidations among carriers will require a more flexible supply of infrastructure.

While the panel believed there will generally be adequate infrastructure, some critical capacity constraints will remain, often in the most important air transportation markets. The use of pricing as a way to allocate resources and produce the funds necessary to develop infrastructure will therefore grow in importance, particularly in key high-volume markets. New types of pricing are already being employed on the landside of airports with good results. In some cases, new forms of organization will be needed to provide the infrastructure that will stimulate such changes, but much can be done in the existing organizational context through improved management practices.

The panel noted that the financial state of airlines will drive the need for lower cost and higher productivity in the provision of infrastructure. However, better and

more complete data on cost and productivity trends in producing air traffic control and airport services will be needed to demonstrate the potential benefits of change. There is support for institutional reform if it results in real improvements in productivity, costs, and customer satisfaction. The panel was concerned about privatization and other forms of leveraged buy outs of infrastructure facilities if the principal purpose is to raise funds for nonaviation activities.

Institutional reform may, in fact, also be necessary for cooperation and coordination to increase infrastructure productivity, especially in air traffic control, which is largely driven by advancing technology. The largest constraints and uncertainties surrounding future growth are likely to be in the environmental arena. These include the cost to remediate existing problems and, in some locations, even the ability to operate aviation infrastructure at its current levels of design capacity.

The panel ended with a sobering thought. It saw the potential for declining productivity improvement in air transport that could lead to an increase in the real cost of future air travel. As the industry comes to depend more on highly price-sensitive leisure travel, this could dampen traffic growth. TRB may want to explore the long-term trends in the cost and productivity of providing airline services and the supporting aviation infrastructure.

BUSINESS AVIATION

The panel discussed the key issues affecting fleet growth and utilization rates for business aircraft. Changes in attitudes toward owning aircraft in comparison with operating them through time-share or charter have taken place particularly among "reengineered" U.S. companies. Doing more with less has precipitated the sale of some company aircraft and corresponding increase in charter usage.

The lack of significant incentives aircraft as safe-haven assets (made possible by the investment tax credit of the 1970s and 1980s) has made company aviation departments focus on higher utilization, self-promotion, and self-justification. As companies drive costs down, inefficient aircraft and aircraft operating departments are under pressure.

The importance of international business to the profit and growth of U.S. firms has provided a strong counterforce to cost-cutting pressures on company aircraft. Sales of high-end intercontinental and global jets continues to be strong due to their major benefits in terms of productivity (time saved and responsiveness to opportunity).

The conclusion of the panel was that the mature U.S. market will continue to show relatively slow growth.

However, utilization may increase thanks to entrepreneurial service companies offering attractive time-share programs, new forms of charter service, and other innovative marketing arrangements.

VERTICAL FLIGHT

The panel expected growth in the vertical flight sector to be slight over the coming 10 years. If growth in GNP and corporate profits is greater than anticipated, the picture could change and stimulate new aircraft deliveries and increase use of corporate and private helicopters, but the prospects of this are uncertain at best. The future direction of the vertical flight sector will depend on a number of interrelated developments.

Substantial development of new center-city heliports equipped for IFR operation, along with significant decrease in operating costs and improvement in dispatch reliability would open a market for commuting by intracity helicopter.

Federal efforts to reform the health care industry could lead to a major increase in the number of emergency medical service (EMS) helicopters over the next decade. The strongest growth would be in the intermediate-size twin-engine helicopter fleet.

Public funding for improvements to private heliports that feed into central public heliports would dramatically enhance passenger service. At issue are local weather reporting and revamping the low-altitude IFR system.

Offshore service for oil and gas exploitation, where expansion drove the civil helicopter industry in the past, is now limited to a replacement market. The panel foresaw minimal growth in this sector worldwide and no significant change during the forecast period.

Fleet revitalization programs no longer exist. High acquisition costs and increased operator efficiency make new procurement prohibitive in some cases and unnecessary in others. Military R&D in recent years has focused on features such as combat agility and stealth that are of little value to the commercial fleet. New civil rotorcraft designs now on the market do not offer incremental performance value to civil operators and do not provide sufficient return on their high purchase cost to justify replacement of existing equipment.

Imports from nontraditional (former Eastern Bloc) sources could change the fleet mix but probably not fleet size. The release of surplus U.S. military helicopters will have an impact primarily on the public service and utility fleets, but with little change in fleet size overall.

A regulatory review by FAA to purge obsolete constraints on current-technology helicopters would increase fleet activity and probably fleet size as new markets open up. EMS helicopter technology, in particular, has advanced significantly beyond present regulatory limits.

LIGHT GENERAL AVIATION

The light general aviation segment (single and multiengine, piston-powered, fixed-wing aircraft) is mature or declining with respect to fleet size, flight hours, and shipment of new aircraft. The consensus forecast developed by the panel predicted annual decline in fleet size of 1.0 to 2.5 percent and in pilot population of 0.5 to 1.5 percent for 1994 through 1999.

Surveys conducted by the Aircraft Owners and Pilots Association (AOPA) point to several reasons for the expected decline: high product liability costs, lack of promotion of general aviation, government regulations, the high cost of new aircraft, and the shrinking number of general aviation airports. Over half (56 percent) of the owners and pilots surveyed described themselves as pessimistic about the future of general aviation.

A recent study by a U.S. Department of Transportation panel examined a parallel concern -- the supply and demand for pilots and aviation maintenance technicians. The panel concluded that there will be an adequate supply of pilots and technicians who meet minimum federal certification requirements in the foreseeable future. However, it is unlikely that enough of them will have the skills and experience to provide the industry with sufficient numbers of well-qualified personnel. Although basic certification requirements are adequate, the more sophisticated aircraft and missions of the future will dictate specialized training. The institutions and facilities to provide this training are not in adequate supply.

General aviation needs to reexamine and improve the methods of providing flight training. Aircraft manufacturers no longer support flight training and aircraft sales with national marketing, promotion, and training programs. The burden has fallen on Certified Flight Instructors to be teachers, marketers, and salespersons -- a role that they are not prepared to undertake. New institutions, marketing techniques, and training programs need to be developed.

There has also been a decline in the number of Fixed Base Operators (FBO). Of the 10,000 that existed in the late 1970s, fewer than 2,000 are expected to remain by the end of the century. Efforts to revitalize FBOs and to promote partnerships between FBOs and airport owners and operators need to be undertaken.

The general aviation sector, with cooperation and support from FAA, needs to address questions of safety, flight services, airport and airspace access, product innovation, and affordability if the present declining trend is to be reversed.

PRESENTATIONS

ECONOMIC FORECAST

Ross DeVol
The WEFA Group

U.S. Short-Term Outlook

Recent Developments

The Producers Price Index (PPI) for finished goods fell 0.2 percent in July. Following the 0.3 percent fall in June, the PPI numbers indicated that inflation remains under control. Energy prices, which fell 0.4 percent, and food prices accounted for much of the fall. Prices for finished consumer goods, however, fell 0.1 percent, indicating that consumer price inflation will likely remain moderate in the next few months.

The Consumers Price Index (CPI) rose only 0.1 percent in July. For the 12 months ending July, the consumer prices increased a moderate 2.8 percent, indicating that consumer price inflation remains under control. The core index (consumer prices less food and energy) also rose 0.1 percent, indicating that the moderate price movements are broad-based, and not the result of special circumstances. Prices of consumer services continued to rise more quickly than the average at 0.2 percent, while commodity prices were unchanged in July.

The merchandise trade deficit jumped to \$12.1 billion dollars in June, a rise of \$3.7 billion from May. There was no silver lining in the bad news: imports were up, and exports down, in all categories. Although such high import levels are unsustainable, this release sends a clear message that net exports will hurt economic growth until foreign economies turn around.

The August employment survey provided more bad news about the economy. The fall in the unemployment rate was entirely due to a 400,000 rise in household employment, which seems likely to be an artifact of the survey. Meanwhile, the more reliable establishment survey recorded falls in goods producing employment, including construction and manufacturing, and only a slight rise in service producing employment. Even the usually reliable retail trade sector, which has been good for 50,000 additional jobs per month this year, recorded no increase in employment. Hours and earnings did rise, but, if the economy does not resume creating new jobs, economic growth will remain painfully slow.

Industrial production rose a disappointing 0.4 percent in July, after falling, according to revised estimates, in May and June. Heavy electricity use because of hot weather in July pushed the utilities index up 3.3 percent, while the manufacturing index rose only 0.2 percent. The manufacturing rise was concentrated entirely in durable goods, despite a fall of 2.1 percent in automobile products. Low auto inventories will likely push up auto production in the future, but manufacturing prospects remain worrisome in light of the lack of growth in production registered so far this year.

Factors Weakening Growth

Defense Spending

Cuts in defense spending will hurt growth over the next several years. (Figure 1) Though the current Deficit-Reduction Bill allows for some leeway in discretionary cuts, the ax will fall hardest on defense spending. WEFA estimates that, from a baseline of 2 percent real growth in defense spending, about 400,000 defense-related jobs per year will be lost, given the outlook for 6 percent real declines in defense spending.

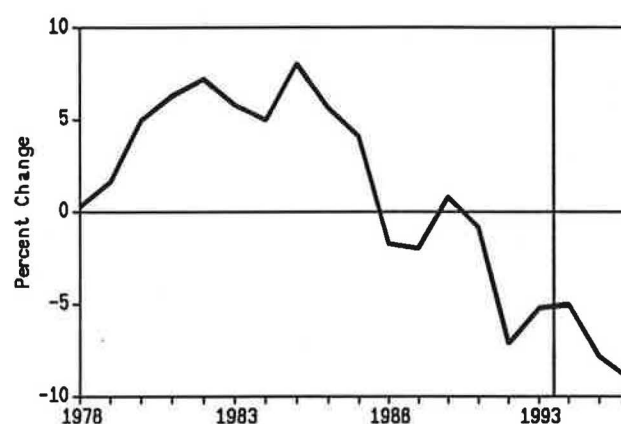


FIGURE 1 Real defense spending.

Tax Increases

The deficit reduction plan includes a number of tax increases. Personal income tax rates have been raised on the upper income groups retroactive to January of this

year, more Social Security benefits will be taxable, all wage and salary income will be subject to the 2.9 percent Medicare payroll tax (currently only pay below \$135,000 is subject to this tax), the gasoline tax will increase 4.3 cents in October, and the corporate tax rate was raised 1 percentage point to 35 percent, retroactive to January 1, 1993. These tax increases are not going to help the economy to grow in the short run. However, it is worthwhile to put these tax increases into perspective. Figure 2 shows the personal effective tax rate over the past thirty years. The currently legislated personal tax increases are very mild by historical standards. In fact, they will simply force the retracing of a fall in the effective rate from 1989 to 1992 due to the shifting of income from highly taxed to lower taxed types of income. The gasoline tax is unlikely to be noticed by consumers. It is not large, and falling oil prices will counteract much of the impact on retail gasoline prices. The Medicare payroll tax will only affect the 2 percent of the working population with wage and salary income over \$135,000 per year. Finally, the corporate tax increase is small. It is expected to raise receipts by about \$4 billion per year, capturing about 1 percent of before-tax profits. Thus, though the tax increases will not help the economy to grow, they are not a severe constraint on economic activity.

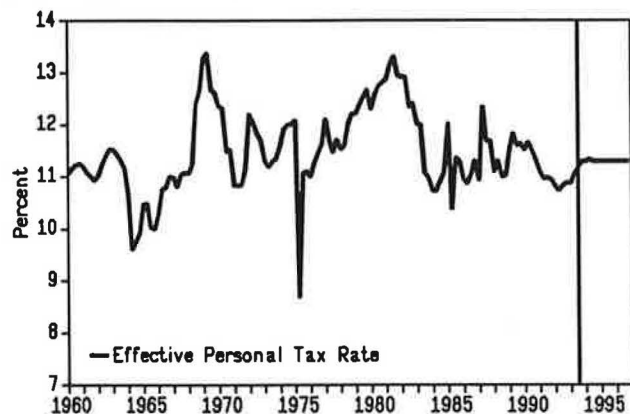


FIGURE 2 Effective federal personal tax rate.

Exports

Except for the United Kingdom, the major economies of Western Europe are still in recession. This is apparent from recent U.S. export performance to Western Europe. Through June, U.S. merchandise exports to Western Europe are down 4.3 percent and in June stood 10.2 percent below the year-ago level. Export performance to Western Europe has been worsening as the year progresses. This weakness is probably best

displayed by the deteriorating performance of U.S. exports of industrial supplies and materials which fell 5.4 percent in June from the same period in 1992. This category which has a broad range of industrial uses is experiencing falling demand due to the retrenchment in industrial output in Europe. Exports to Western Europe account for over 20 percent of total U.S. exports and probably are the most pervasive factor behind the weakness in a broad cross-section of U.S. industries.

The view that the Japanese economy has bottomed out appears to be supported by U.S. export statistics. Exports to Japan are up 1.0 percent through June over the same period last year and rose 4.3 percent in June from the year-ago level. However, some of this increase could be attributable to the surging yen against the dollar, lessening U.S. import prices in yen terms and making U.S. goods more competitive. Other weakness in U.S. export performance is seen in the year-to-date decline of 14.3 percent to OPEC, primarily due to the completion of Kuwait's rebuilding efforts. Exports to the NICS of Southeast Asia are still strong, up 7.7 percent through June. However, the stellar performance of U.S. exports to Mexico and the rest of Latin America witnessed in 1991 and 1992 is dissipating. During most of 1992, exports to Mexico were rising in excess of 20 percent from the same period a year-ago which offset the weakness in U.S. exports to the major industrialized nations. However, U.S. exports to Mexico and the rest of Latin America are up only 4.5 percent through June. The greatest success story for U.S. exports in 1993 is Canada, where exports rose 11.7 percent in the first half of 1993.

Rest-of-World Growth

There is now growing concern that Japan may be entering the second leg of recession with most recent readings on the economy displaying weakness. Many economists believe the Japanese economy contracted in the second quarter. Industrial production fell 0.3 percent in July from June and declined 4.5 percent from a year ago. Retail sales have now fallen in every month in 1993 from the previous years' levels; June witnessed a decline of 4.8 percent. Department store sales were down 6.2 percent in July from the same period last year. Even taking the unusual cold and rainy weather into account, the numbers were disappointing. Housing starts were one of the few positive statistics, rising 4.1 percent in June from last year.

Many economists are projecting that the Japanese economy will not hit bottom until late 1993 or early 1994. The 20 percent rise of the yen against the dollar this year is curtailing exports and hammering corporate

profits. Many Japanese manufacturing firms cannot compete with the yen at this level. Highly respected economists are now calling for a cut in interest rates below 2 percent and a new fiscal stimulus package to be implemented.

Germany's second quarter GDP figures are widely expected to rise at an annual rate of 2.0 percent. This is the first sign that the German economy has reached bottom. New orders are improving and industrial production has risen in recent months. The new data indicate that the German economy will decline near 1.5 percent during 1993. However, even as growth prospects seem to be improving in Germany, gloom is spreading throughout the rest of continental Europe. It was widely anticipated that the widening of exchange rate bands within the ERM would permit more accelerated interest rates cuts to promote growth. So far, European nations have not used their new-found monetary freedom to cut rates more aggressively. The authorities remain concerned that a more bold reduction in interest rates might cause a new run on their currencies. European nations will probably wait for the Bundesbank to initiate the next round of rate cuts, hoping they will be shielded from speculative pressure on their currencies. This will postpone the greatly anticipated stimulus from lower interest rates. The first installment payment was delivered by the Bundesbank on September 9 when it cut the discount rate and Lombard rate by 50 basis points. Modest decreases in rates followed across Europe. Nevertheless, the easing was substantially less than the full one percentage point that many European economists were calling for.

The forecast for the trade-weighted rest-of-world real GDP index has not been revised since last month. WEFA still expects growth in the second half of the year of 2.8 percent. Given the renewed concern about weakness in Japan and the postponement of interest rate cuts in Europe, we will be reviewing our projections for rest-of-world growth next month. Rest-of-world real GDP is expected to rise 1.5 percent in 1993, 3.1 percent in 1994, 3.3 percent in 1995, and 3.1 percent in 1996.

Imports

Import growth has been particularly strong for the past year and a half. The strength has centered on capital goods, primarily computer equipment, but also industrial equipment. Typically, imports grow at about twice the rate of U.S. income growth. In 1992, however, real GDP grew by 2.6 percent and imports grew by 8.7 percent — more than three times the rate of income growth. Figure 3 shows why import growth has been so much higher than real GDP growth. The share of imported capital

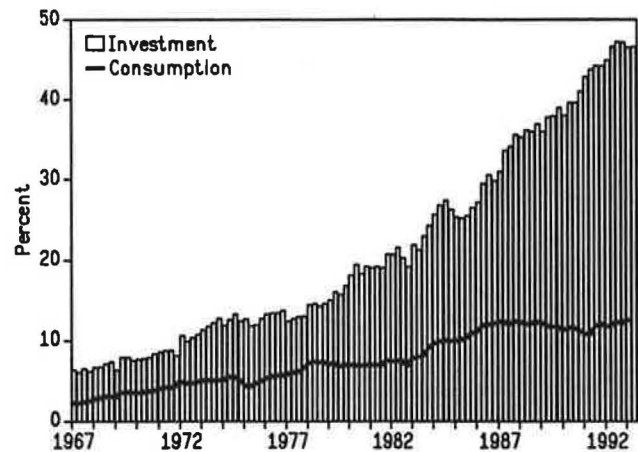


FIGURE 3 Import share investment and consumption.

equipment, including computers, has been rising rapidly. The strong growth in equipment investment — which grew by 6.9 percent in 1992 — is driving the abnormally high import growth. In addition, Japan and Germany, two of our major trading partners, remain in recession as Figure 4 indicates. Thus, real net exports will continue to be a drag on growth over the next year.

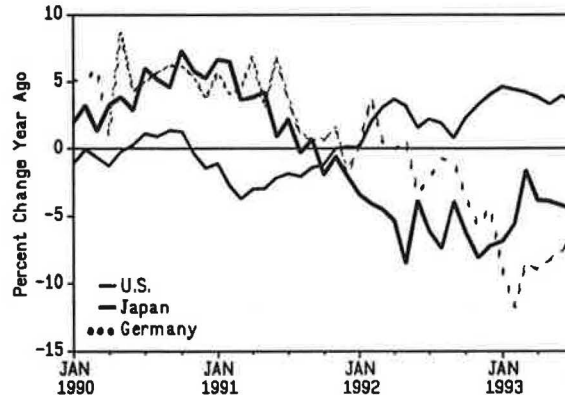


FIGURE 4 Industrial production: U.S., Japan, and Germany.

Commercial Construction

Vacancy rates, particularly for commercial structures, remain at very high levels. (Figure 5) This will continue to dampen construction of commercial buildings for some time. (Some analysts estimate it will take about five years). Although this is discouraging news, other areas of construction have finally begun to pick up the slack. For the past two quarters, real business fixed investment in structures has risen modestly. We expect no boom in this sector, but at least it appears to have

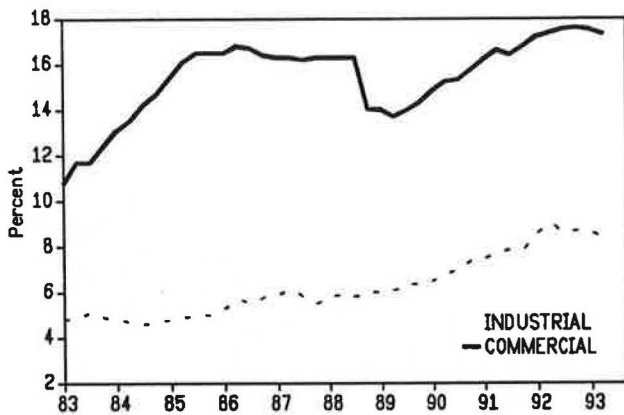


FIGURE 5 Vacancy rates.

bottomed-out and will no longer be a significant drag on overall growth.

Health Care Reform

It is very difficult to quantify the impact of health care reform on growth. However, the discussion of major reforms is creating enough uncertainty that some business decisions are probably being postponed. Until we know the specifics of health care reform, this uncertainty will restrain growth. If implemented properly, the health care reforms could alleviate some of the pressure on the government and private sector from rising health care costs. Figure 6) Reducing health care costs to the private sector would help to make U.S. business more competitive by lowering unit labor costs. It could also help to reduce future government deficits, by lowering Medicare and Medicaid expenditures. The Clinton Administration is now trying to construct a plan which primarily emphasizes reducing health care costs,

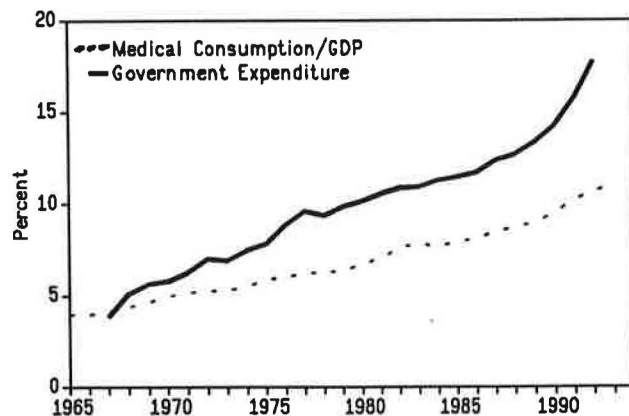


FIGURE 6 Medical expense shares.

rather than providing coverage for the uninsured. Theoretically, the large savings from cost reduction should be sufficient to support universal coverage, reduce the cost of health benefits to business, and lower Medicaid and Medicare expenditures. Realizing and capturing those potential health care savings, however, promises to be difficult.

Factors Fostering Growth

Low Interest Rates

As Figure 7 indicates, low interest rates tend to be correlated with high real GDP growth. The growth is primarily stimulated through increased business and residential investment. Auto sales and consumer durable purchases also tend to be influenced by low interest rates. In the current recovery, constant dollar business investment in equipment has responded strongly to low interest rates, growing by 14.7 percent from the second quarter of 1992 to the second quarter of 1993. Light vehicle sales are up 10.0 percent over the same period, while housing starts rose 8.8 percent and existing home sales rose 5.0 percent. Housing starts and home sales are very supportive of consumer durable purchases. After buying a home, the typical home buyer purchases furniture, appliances, carpeting, curtains and other new amenities, boosting consumption.

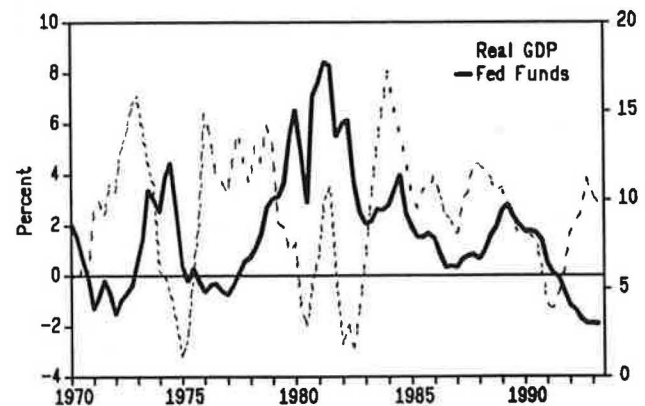


FIGURE 7 Real GDP growth and FED funds rate.

Though housing starts are rising, compared to previous recoveries growth in residential construction has been modest. (Figure 8) Instead, existing home sales seem to be responding much more robustly to the low mortgage rates. Existing home sales have reached a level comparable to the late 1970s, but housing starts are still far from their 1980s peak of 1.81 million units in 1986. The overbuilding of multifamily units in the 1980s ex-

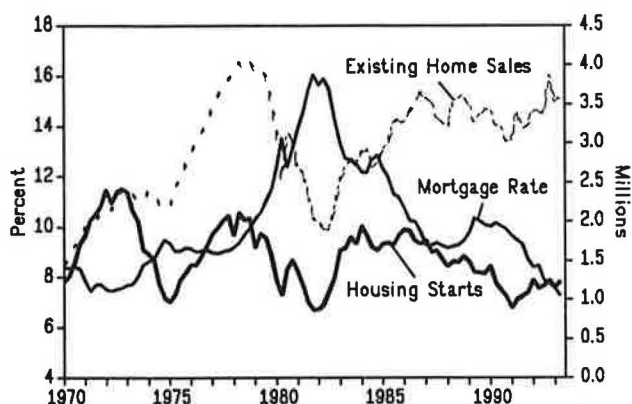


FIGURE 8 Housing starts, home sales, and mortgage rates.

plains much of the lack of a housing construction rebound. In 1986, single family starts accounted for 1.18 million units, while multifamily units accounted for 0.63 million units. So far this year, single family housing starts have averaged 1.05 million units per month, but multifamily units have only averaged 0.15 million starts. WEFA analysis indicates that much of the excess supply of housing has been sold off and, as a consequence, the housing recovery is expected to continue. However, because the weakness has been pervasive this year, our housing start forecast has been lowered this month, particularly for the remainder of 1993.

Consumption

Consumption continues to be strong, despite fairly anemic income gains. Real consumption in July was up 3.8 percent compared to July, 1992. Real disposable income grew only 1.8 percent over the same period. (Figure 9) (The large spike in income is due to the early payout of bonuses before the 1993 tax year.) This large discrepancy between consumption and income is typical in a recovery cycle. In the 1983 recovery, the percent change in consumption, compared to a year ago, outstripped income for 17 months in a row. Extra consumption over income is to be expected when many consumers are new home buyers, stretching themselves to make purchases to complement their new house. Also, many vehicles are being purchased these days to replace the aging fleet on the road. The entire value of these purchases is recorded as consumption in the quarter they are purchased, even though the payments are spread out over several years.

Another possibility, of course, is that the data are simply misleading and erroneous. Perhaps next year,

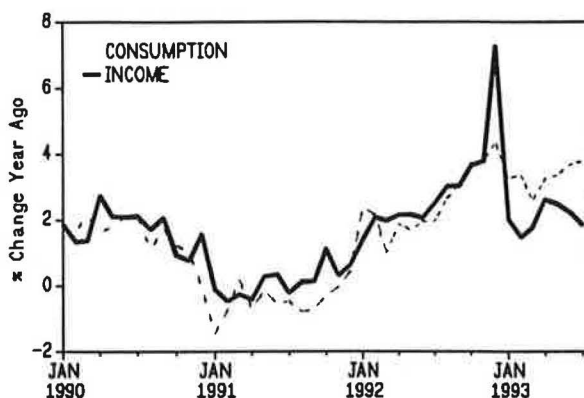


FIGURE 9 Real consumption and income growth.

when the income and consumption numbers for 1993 are revised, consumption and income growth will be closer together. The revisions for 1992 pushed nominal disposable personal income up by \$69 billion, but revised consumption upward by only \$44 billion, resulting in an improvement to the savings rate from 4.8 percent to a revised 5.3 percent.

Employment

Finally, it is worth pointing out that employment growth has generally been positive for the past 17 months. (Figure 10) Occasionally — as in August — it has slowed down, but so far in 1993, employment growth has been much better than in 1992. In addition, weekly claims for unemployment insurance have also been modest compared to this time last year. Last summer, weekly unemployment insurance claims averaged about 412,000. This summer they averaged about 341,000, implying a lower level of layoffs. Employment is up, layoffs are down, the unemployment rate has been dropping, and

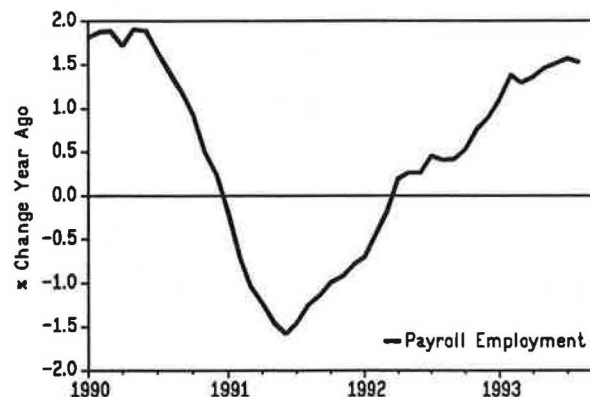


FIGURE 10 Employment growth.

inflation and interest rates are down. These factors explain some of the strength in consumption, despite reported weak income gains and weak consumer confidence.

Which Way Growth?

Many indicators show weakness in the economy. Certainly, the manufacturing sector is not showing signs of strength and manufacturing employment dropped another 42,000 in August. Also, the NAPM index has been below 50 for the last three months, indicating the manufacturing sector is contracting. Defense cuts continue, tax increases are on the horizon, imports remain strong while our trading partners are weak, vacancy rates are high and health care reform is creating uncertainty for business. On the other hand, interest rates are low, stimulating business investment and a modest housing recovery. Perhaps most significantly, employment growth — though off in August — has been fairly strong for much of 1993, fueling consumption. In our latest economic outlook, real GDP growth is expected to be lower in the last two quarters of 1993, averaging closer to 3.5 percent than to the 4 percent in last month's forecast. This revision is primarily due to a weaker outlook for housing starts, which have been marked down significantly in the current forecast.

Revisions to History: 1992 Stronger, 1993 About the Same

Perhaps the most striking feature of the NIPA revisions was how much strength the economy had in 1992. (Figure 11) In each of the four quarters of 1992, real GDP growth was close to, or above, 3 percent. From the fourth quarter of 1991 to the fourth quarter of 1992, real GDP grew by 3.9 percent — previously, this period had

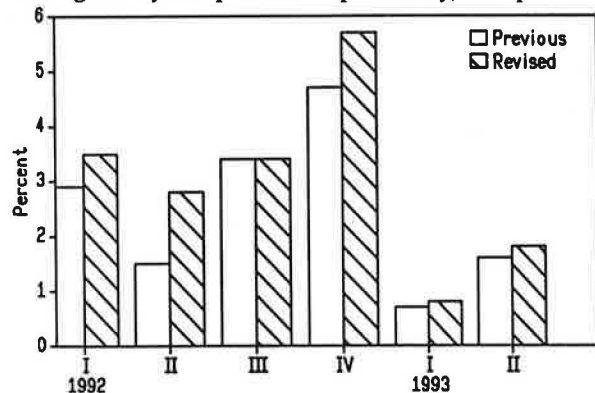


FIGURE 11 Real GDP growth: previous and revised.

been estimated to have grown by only 3.1 percent. At the time, the economy did not seem particularly strong — consumer sentiment was as weak as it is today, employment was not rising, and industrial production gains were modest. In fact, last year seemed much like the economy seems today — growing, but with much hesitancy.

Forecast Highlights

Real GDP

Consumption spending grew fast in July, suggesting that real GDP will show some strength in the next few quarters. WEFA predicts that GDP will grow 3.1 percent in the third quarter of 1993, and 3.4 percent in the fourth quarter. Growth will reach about 3 percent for the next three years as consumer demand and investment spending slow, but net exports start to contribute to growth by 1996. The somewhat weaker growth in the second half of 1993 than in last month's forecast is caused by a lower housing forecast.

Consumer Activity

Real consumer spending grew at a 20 percent annual rate in July, indicating that the third quarter of 1993 will show some strength. WEFA forecasts a 3.3 percent rise in consumer spending in the current quarter, slowing to a 2.7 percent rate in the fourth quarter of 1993. Consumer spending will then rise at 3.0 percent in 1994 and 1995, and slow to 2.7 percent in 1996.

Housing

The failure of housing to respond to this year's interest rate decline has caused WEFA to revise our housing forecast. Housing starts are now forecast to grow from an average of 1.23 million in 1993 to 1.48 million in 1996, for 40 thousand fewer starts this year and 70 thousand fewer starts next year than in last month's forecast. The failure of housing to respond to the interest rate decline of 1993 is now an important factor in preventing strong economic growth during this recovery. Residential investment is now forecast to grow 11.6 percent in 1994, decelerating to 5.0 percent in 1995 and 4.0 percent in 1996.

Investment

Indications are that business fixed investment, especially equipment investment, will continue to grow very quickly

in the near term. We expect investment in producers' durable equipment (PDE) to slow to an 9.5 percent pace in the current quarter, down from the second quarter's 17.4 percent growth, for an annual growth rate of 14.9 percent. PDE investment growth will then slow to an 11.8 percent rate in 1994, 9.2 percent rate in 1995, and 8.0 percent growth rate in 1996. Although investment in non-residential structures grew 6.4 percent in the second quarter, high vacancy rates suggest that this level of growth will not be sustained. Investment in non-residential structures will grow 1.7 percent per cent in the current quarter, and -0.1 percent in 1993, rising to rates of 2.8 percent in 1994, 3.7 percent in 1995, and 4.8 percent in 1996.

International Trade

The reform of the ERM will allow the currencies of several important trading partners of the United States to fall in the near-term. WEFA's exchange rate forecast has therefore been revised upward about 2 percent in the next few years, leading to slower export growth and faster import growth than in last month's forecast. Imports are now forecast to grow 9.0 percent in the current quarter and 10.1 percent in the current year, slowing to 8.9 percent in 1994, 7.7 percent in 1995, and 5.8 percent in 1996. We expect export growth to remain slow, at 4.7 percent in the current quarter, and 3.6 percent for 1993, then accelerate to 6.0 percent in 1994, 7.6 percent in 1995, and 7.9 percent in 1996. In 1994 the real net export deficit will total \$98.7 billion, rising to \$107.1 billion in 1995, and falling to \$98.6 in 1996.

Labor

Employment will continue to grow at an average rate of about 200,000 per month. Total employment will average 110.3 million in 1993, rising to 112.7 million in 1994, 115.1 million in 1995, and 117.5 million in 1996. The unemployment rate will fall slowly from 6.9 percent in 1993 to 6.5 percent in 1994, 6.4 percent in 1995, and 6.3 percent in 1996.

Inflation

WEFA's view of the underlying rate of inflation remains similar to last month's. We expect the GDP deflator to accelerate slightly from 2.9 percent in 1993 to 3.3 percent in 1994 and 3.4 percent in 1995 and 1996. The CPI will also accelerate from 3.2 percent in 1993 to 3.3 percent in 1994, 3.6 percent in 1995, and 3.9 percent in 1996.

Interest Rates

The Fed is now assumed to start raising short-term interest rates in February, after better economic news

gives it some room to maneuver. The Fed funds rate is forecast to average 3.0 percent for 1993, rising gradually as the Fed tightens monetary policy to 3.3 percent in 1994, 4.0 percent in 1995, and 4.7 percent in 1996. Faster economic activity will also start to push up long-term interest rates. The 30-year Treasury bond rate will average 6.6 percent in 1993, 6.3 percent in 1994, 6.7 percent in 1995, and 7.0 percent in 1996.

U.S. Long-Term Outlook

There are key differences in the methodologies employed to forecast short-run and long-run economic activity. Short-run economic analysis focuses on issues related to fluctuations in the level and composition of final demands and incomes, while long-run analysis is concerned with expansion of potential output or aggregate supply. The growth of aggregate supply or potential output is the fundamental constraint on the long-run level of economic activity.

In an environment free of exogenous shocks we assume that equilibrating dynamics tend to cause productive capacity to converge to its potential or fully utilized level. Consequently, the briskness in the expansion of output, real incomes, real expenditures, and the general standard of living of the population are determined by the growth rate of potential GDP. The long-range outlook is dominated by supply factors such as population growth and demographics, labor force participation rates, weekly hours, capital stock accumulation, productivity growth, fiscal and monetary policies, foreign developments, and internationally determined prices.

Actual GDP has now been below potential since the first quarter of 1989. The 1990-91 recession included the two negative quarters in 1990 and the first quarter of 1991. This is the longest sustained below-potential stretch in the post-war period. This suggests that economic activity could rise for a substantial period of time before bumping up against physical and financial constraints.

WEFA estimates that actual U.S. GDP was 3.5 percent below its potential in the second quarter of 1993. This explains much of the reduction in inflation as resources in product and labor markets are highly underutilized. The United States is not alone in experiencing a GDP gap; all the G-7 countries are operating below their potential to one degree or another. In fact, with the recessions in Japan and Germany deepening, the GDP gaps in those nations are rising. Real GDP will grow at an average rate of 2.8 percent through 2000 as the output gap is reduced. After 2006, annual real GDP growth will decline to 2.5 percent, slowing to 2.1 percent by the end of the projection period.

The August revisions to the National Income and Product Accounts (NIPA) indicate that the economy expanded by roughly 0.5 percent more than previously believed in 1990, 1991, and 1992. Real GDP was \$63.7 billion (1.3 percent) higher in 1992 than the previous estimate. This reduced the GDP gap, or the difference between actual and potential, and will limit the ability of the economy to grow between 1994 and 2002 as output will bump against effective supply constraints sooner.

Long-Term Forecast Assumptions

Population and Demographics

Population growth is a primary long-run determinant of the potential expansion path of the economy from both the supply and demand sides. The growth of the population and its composition have profound impacts on the labor force, demand for consumer durables (especially light vehicles) and housing, and demand for medical services. The WEFA Long-Term Service is basing its population projections on the Census Bureau's new middle series assumptions for fertility, life expectancy, and net immigration.

The Census Bureau released revised population and demographic projections last December. They have made significant upward revisions to fertility rates and net immigration. This resulted in a major increase in their population projections. The Census Bureau has now made their previous high series assumptions on immigration their middle series. Since WEFA was already using the Census Bureau's previous high series, this will not affect our population projections.

The upward revision to fertility rates did affect WEFA's population projections. We have reviewed the Census Bureau's assumptions and incorporated them beginning with our 1993 first quarter long-term outlook. The population projections are higher and resulted in an upward revision to the potential growth path of the U.S. economy.

U.S. population is projected to expand at an annual rate of 0.9 percent between 1992 and 2002, when the population is projected to reach 280.7 million. Population growth will taper off to an annual rate of 0.8 percent from 2002 to 2016, when population reach 315.1 million. (Figure 12) Population growth will not be distributed evenly over the population cohorts; growth in the older age cohorts will be stronger.

Productivity and Aggregate Supply

It is the economy's ability to increase supply in the long run which determines the potential growth path of the economy. Aggregate supply is dependent upon the increase in the labor force, the growth of the capital stock,

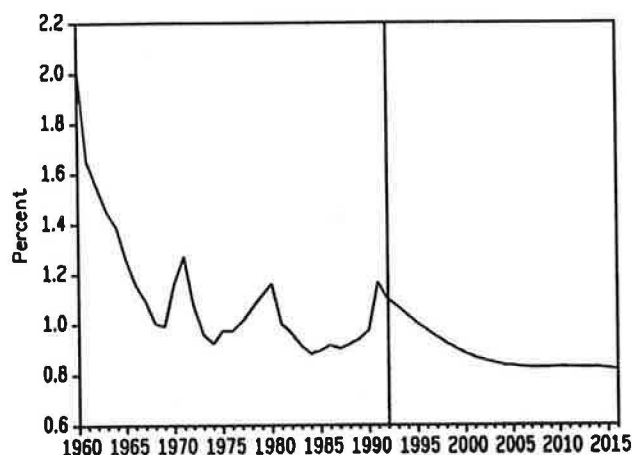


FIGURE 12 Population growth.

and productivity improvements. Potential GDP growth will slow in the projection period, expanding by 2.5 percent annually over the next decade and slowing to only 2.1 percent by 2016. This is in stark contrast to the potential growth path of the economy in excess of 3.0 percent that prevailed in the 1960s and has trended downward ever since.

The most comprehensive measure of productivity growth -- real GDP per employee -- should grow an average of 1.2 percent per year over the 25-year projection period. Output per hour in the nonfarm, private business sector is forecast to increase 1.5 percent annually over the 1992 to 2016 time frame. The 1960s witnessed stellar growth in output per man-hour averaging 2.4 percent per year. Productivity growth collapsed in the 1970s and 1980s, averaging only 1.2 percent during that period. WEFA believes productivity growth will quicken somewhat in the future. (Figure 13).

There is evidence to suggest that the productivity performance of the U.S. economy is improving relative to the recent past. A great deal of attention has been focused on the slow employment growth in this recovery,

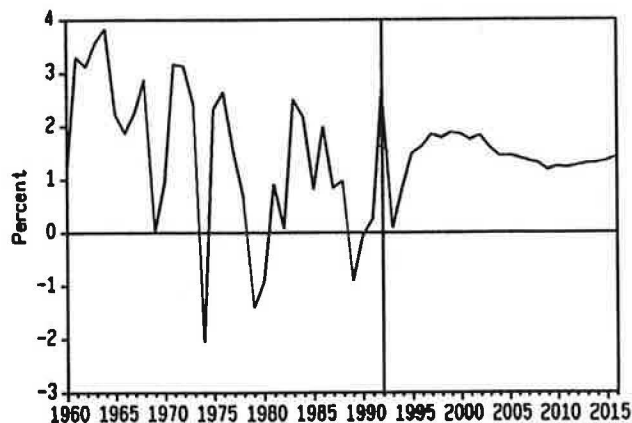


FIGURE 13 Productivity growth: output per hour.

although recent upward revisions show that it was not as bad as initially believed. However, the corollary to the weak job performance is a discernable improvement in productivity performance. Output per man-hour in the nonfarm business sector rose 2.7 percent in 1992, the highest performance in nearly 20 years. Due to the August NIPA revisions, it is likely that productivity growth in the nonfarm business sector will be revised to show an increase near 3.0 percent for 1992.

It is clearly premature to conclude that long-run productivity growth is recovering based on the limited number of observations. Nevertheless, there are other developments which bolster the case for a fundamental improvement in productivity growth. First, productivity growth in the manufacturing sector has averaged a solid 2.8 percent since the early 1980s — approaching the 3.2 percent average prior to 1973. Second, though service sector productivity was weak for most of the 1980s, it grew an estimated 2.6 percent in 1992. Finally, there is also evidence of a turnaround in the disaggregated service sectors where the Bureau of Labor Statistics believes it can more reliably measure productivity.

Although it is not yet certain that productivity growth will improve during the 1990s, the recent evidence supports an optimistic outlook, given the likely improvement in service sector productivity and continued manufacturing productivity growth.

Government Policy

The share of GDP flowing through the government sector will decline over the forecast period as taxes rise and spending will be slowly reigned in to reduce the size of the budget deficit. Total government purchases (including state and local) as a share of real GDP will decline from 19.0 percent in 1992 to 15.5 percent by 2002, and 14.5 percent by 2016. (Figure 14) This reduction in the government's share of the economy is concentrated in the federal sector. The shrinkage in federal spending as a percent of real GDP will be attributable to a declining defense share, a contraction in the federal interest payments share, and a slowing in the rate of increase in transfer payments. President Clinton believes it is necessary to reconfigure the military for the post-Cold War world. The scaling back of the U.S. defense posture will result in an average annual decline in real defense purchases of 4.9 percent between 1992 and 2002. This will reduce defense's share of real GDP to only 2.9 percent by 2000.

The federal budget deficit is projected to peak in 1992 at \$276.2 billion on a NIPA basis and at \$290.2 billion on a unified basis. Beyond 1992, the federal budget deficit will begin a gradual improvement as a result of an

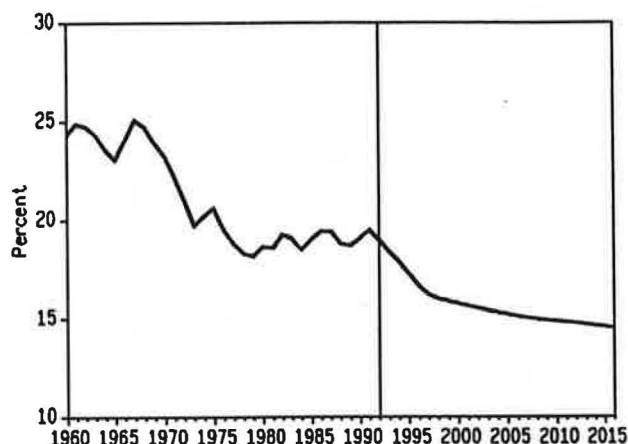


FIGURE 14 Government share of GDP.

increase in the average tax rate and spending restraints. On a NIPA basis, the deficit is gradually reduced and moves to a slight surplus in 2004. We are aware that deficit projections are inherently political rather than economic forecasts. Our projections are predicated on a belief that the public will not accept an escalating debt-GDP ratio indefinitely. Pressure will mount on politicians to take serious action to correct this long-run restraint on growth. This currently appears to be happening inside the Beltway.

Monetary and Financial

The Fed will pursue a monetary policy which maintains a vigilance against inflation and provides sufficient monetary aggregate growth to ensure output gains. A stricter monetary regime would lead to lower inflation, but at the expense of lost output. In order to achieve the "zero inflation rate" that some members of the Federal Reserve Board are advocating, it would require deflation in goods markets to offset rising prices in services in such areas as health care. The outlook for interest rates is tied to long-run inflation performance. Short- and long-term rates will rise modestly during the recovery period through the mid-1990s. (Figure 15) The recovery will mature by 2002, as actual GDP growth slowly recedes to its potential, permitting the Fed to gradually reduce rates in the long-run. The yield on the 30-year Treasury bond is projected to remain in a narrow range, peaking at 7.3 percent in 1999. Thereafter, it will begin a long-term descent to 6.4 percent by 2016. Real long term interest rates will decline from the 4.0 percent plus levels of recent years to near 2.8 percent by 2016.

Oil Prices

Real oil prices are projected to rise throughout the forecast period. (See Figure 16). Real oil prices in 1987

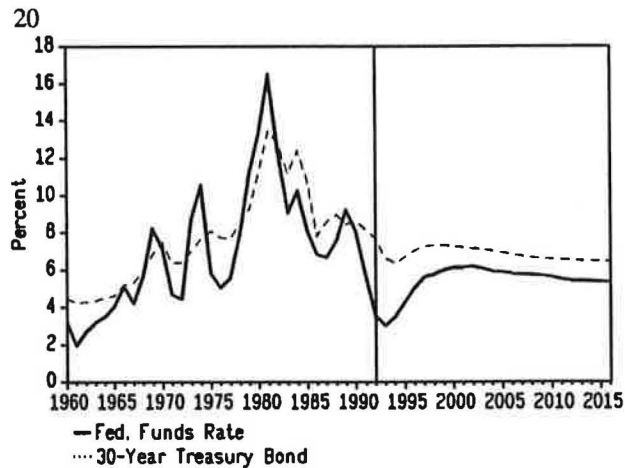


FIGURE 15 Short- and long-term interest rates.

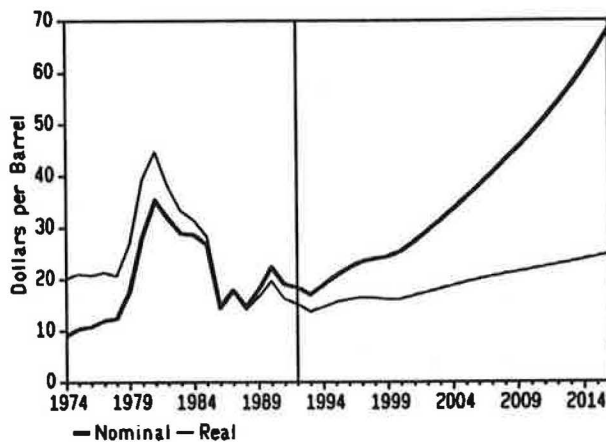


FIGURE 16 Refiners' acquisition cost of crude oil.

dollars are expected to rise 2.2 percent per year through 2016. The refiner's acquisition price for oil is projected to reach \$68.19 by 2016, but only \$24.70 in real terms. U.S. oil production will decline by 2.0 percent annually in the long-term and other non-OPEC reserves and production will fall increasing OPEC's market power. If conservation efforts intensify and further substitution away from oil occurs, this projection will be too high. This alternative is evaluated in our high growth scenario.

Foreign Assumptions

WEFA maintains a foreign real GDP index based on the bilateral trade weights used in the Morgan Guaranty dollar measures by applying them to the United States' largest 15 trading partners. Foreign GDP growth will outstrip U.S. growth over the forecast period as developing nations' output grows faster than U.S. output. Convergence of productivity levels between the United States and the rest of the world will play a key

role. Foreign growth will decelerate near the end of the projection period due to slower population increases. Nevertheless, foreign GDP grows by 0.5 percent greater than U.S. GDP growth through 2016. As foreign demand improves faster than U.S. demand, this will benefit U.S. export growth.

The Dollar

On the basis of the real Morgan Guaranty index of 15 trade-weighted currencies, the dollar fell 28.6 percent between its 1985 peak and 1991. We believe the bulk of the depreciation of the dollar is behind us. However, in order to service the interest payments on the debt we owe foreigners and reduce the current account deficit, the dollar must decline further. Many economists point to purchasing power parity theory which indicates that the dollar is undervalued by as much as 50 percent. This suggests the dollar may rise. We concede that the dollar may indeed rise at some point after the current account is eliminated. However, until that is accomplished it seems unlikely the dollar will rise. We are projecting the dollar to decline by an additional 15.3 percent between 1992 and 2016. (Figure 17)

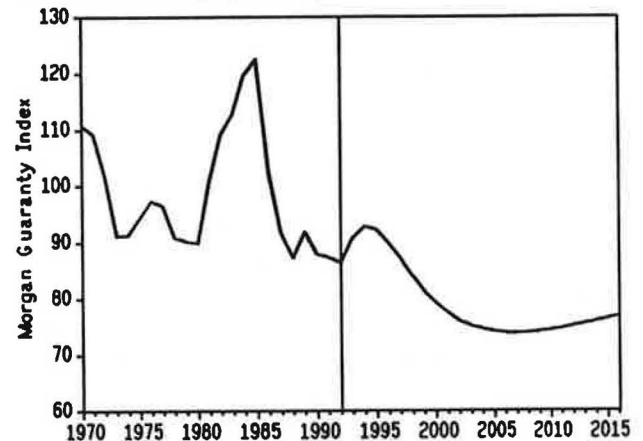


FIGURE 17 Value of the dollar (1980-82 = 100).

Long-Term Forecast Highlights

Real GDP

Real GDP will expand at a rate above its potential until 2002. Actual GDP is currently 3.5 percent below its potential and this gap will be closed. Between 1992 and 2002, real GDP growth will average 2.8 percent per year. After 2002, real GDP growth will average 2.4 percent, with growth tapering off to 2.1 percent near the end of the projection period. (Figure 18) Slower population

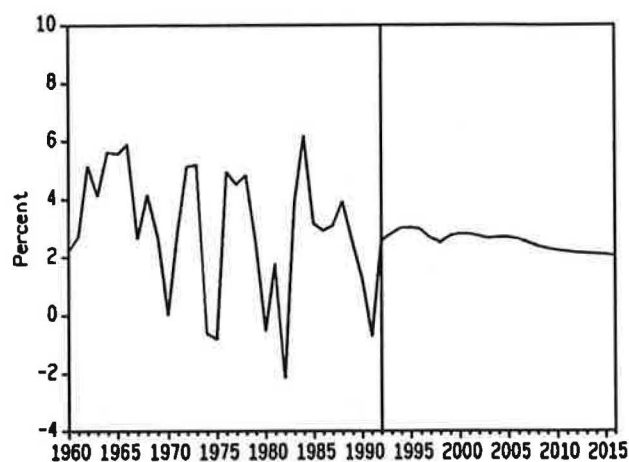


FIGURE 18 Real gross domestic product.

growth and its attendant lower labor force growth will reduce the potential expansion path of the economy. This will be partially offset by greater productivity growth.

Employment

Slower increases in the labor force mean that employment growth will moderate in the future. Total civilian household employment will rise at an average annual rate of 1.7 percent from 1992 to 2002, and moderate to a growth rate of 1.1 percent in the rest of the forecast period. (Figure 19) Total establishment employment will rise by 43.6 million from 1992 to 2016, an increase of 40.2 percent. The cumulative increase in employment between 1965 and 1990, another 25-year period, was 49.1 million, an astonishing gain of 80.9 percent. Manufacturing's share of total employment will continue to decline over the forecast period, falling to 11.4 percent in 2016. The service sector will generate an increasing share of employment growth in the forecast period, accounting for 83.0 percent of employment growth from 1992 to 2016.

Inflation

The outlook for inflation in the long-run faces a great deal of uncertainty. Inflation performance has improved in recent years after the two OPEC induced oil price shocks. WEFA believes inflation rates will stabilize in the long-run at a rate near 3.6 percent. (Figure 20) There is excess capacity in many commodity and primary processing industries in the world. This will act to place a ceiling on long-run inflation. The absence of a major exogenous shock, such as another oil price crisis,

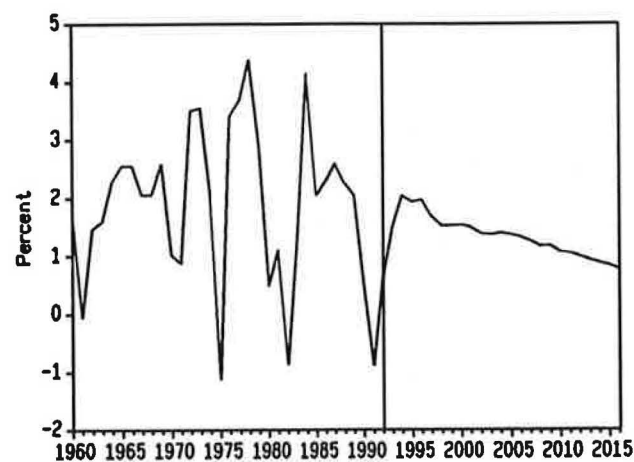


FIGURE 19 Civilian household employment.

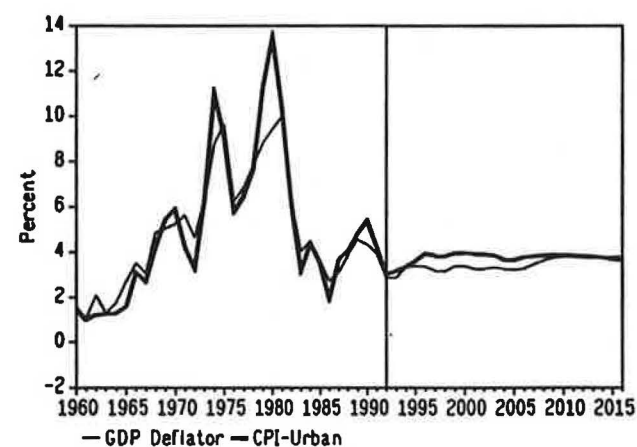


FIGURE 20 Measures of inflation.

should permit inflation to remain in check. In the long-run, inflation is primarily under the control of the central banks, which have become more committed to controlling inflation with many policy makers advocating a "zero inflation rate" as a long-term goal.

Consumption

Consumption expenditures are primarily predicated on the growth of real permanent income, demographic influences, and changes in relative prices in the long-term. The share of personal consumption expenditures relative to GDP will decline over the forecast interval. Consumer spending as a share of GDP peaked in 1986 at 67.4 percent after averaging about 63 percent over much of the post-war period. Consumption's share of aggregate output will decline to 65.0 percent by 2002 and 62.8 percent by 2016. Consumption expenditure

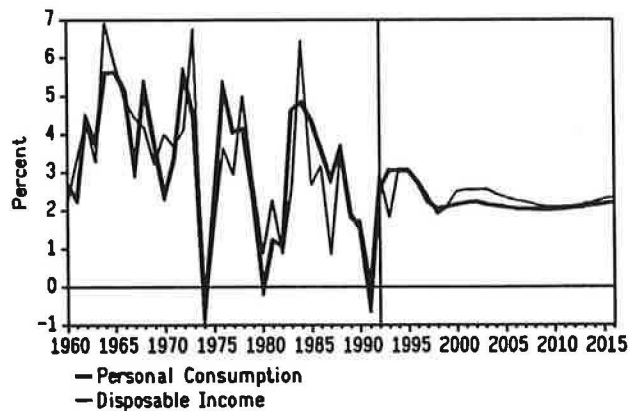


FIGURE 21 Personal consumption and disposable income.

growth will slow to 2.2 percent in 2002 and trends down to average annual increases of 2.1 percent near the end of the forecast period. (Figure 21). The share of consumption devoted to services will rise in the forecast while it falls for nondurable goods. The long-term outlook for auto and light truck sales is for a slowdown in the rate of increase relative to the past. Growth averages 0.8 percent in the long-term. Light vehicle sales will hit 19.4 million units by 2016. A key restraining factor for light vehicle sales in the long-term is that the United States is approaching a saturation point in the ownership rate of vehicles.

Business Fixed Investment

The prospects for business fixed investment in the long-run are very positive. The need to reduce the labor portion of total costs and enhance productivity growth in order to remain competitive in international markets is pressing. The continued expansion in exports and a modest advance in consumption expenditures will be further supportive of investment. Real business fixed investment is projected to rise by an average annual rate of 6.0 percent from 1992 to 2002 and 4.0 percent per year between 2002 and 2016. (Figure 22) The composition of investment will change fairly dramatically in the forecast period. The investment share of structures will decline while the equipment share rises. The fastest growing sector of the U.S. economy will be producers' durable equipment. The development of advanced electronics, which promise a high rate of return on investment, has led to a massive change in businesses' priorities for investment.

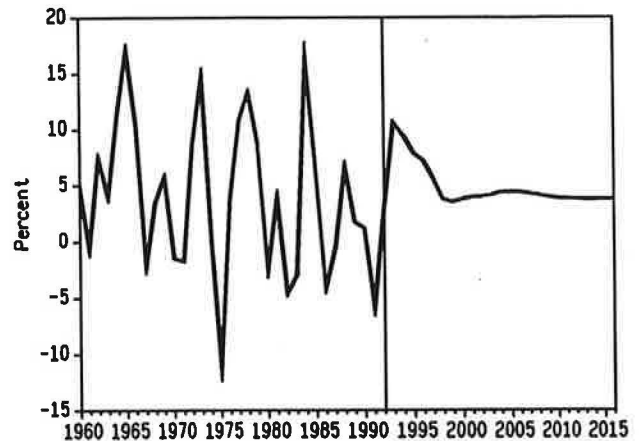


FIGURE 22 Business fixed investment.

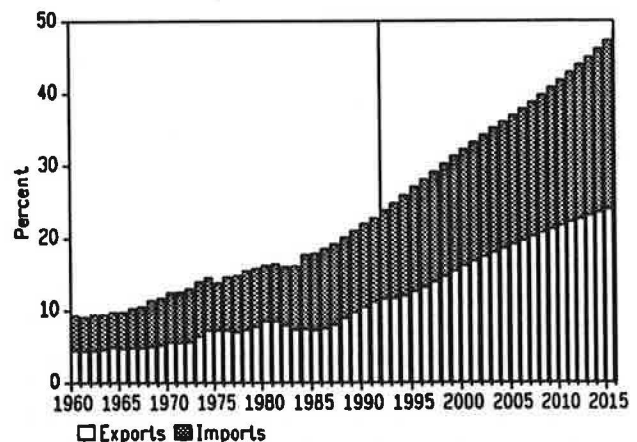


FIGURE 23 Trade's share of GDP.

International Trade

The decline in the value of the dollar and improvement in the real unit labor costs in the United States relative to the rest of the industrialized world will promote export expansion and a turnaround in the U.S. net export position. Further modest dollar depreciation and greater rest-of-world growth relative to the United States will make exports one of the fastest rising components of GDP. WEFA is projecting that real exports will expand at an average annual rate of 7.1 percent between 1992 and 2002. Export growth will average 4.7 percent after 2002. International trade in services has become increasingly important to the net export position of the United States. (Figure 23). Since 1974, the United States has run a surplus in real net exports of services in every year except 1985, the peak year in the real value of the dollar. Real service exports have grown as a share of

total exports of goods and services as well. In 1960, real service exports accounted for 19.4 percent of goods and services exports; by 1991 they represented 27.0 percent of the total. Real net exports of services are projected to rise from \$55.7 billion in 1992 to \$8.4 billion in 2002 and \$207.9 billion in 2016. The United States will become an increasingly open economy with international trade playing a larger role in relation to real GDP.

AVIATION INFRASTRUCTURE AND DEMAND AS COMPLEX ADAPTIVE SYSTEMS

Jonathan L. Gifford
Department of Public and International Affairs
George Mason University

Has the air transportation market reached saturation, or does it still have a way to go? What are the implications of the status of this market for the planning and design of air transportation infrastructure? The status of the market for air travel, and more fundamentally, how to think about the status of the market for air travel, are matters of great importance to the aviation community. Questions about market saturation are also important for other infrastructure systems.

The following remarks address these questions by reasoning from first principles about the nature of demand for derived goods and services like transportation and from exploring their implications for air transportation. They apply primarily to the aviation infrastructure sector, although they have some relevance to aircraft acquisition and carrier operations.

In reflecting on the significance of the degree of saturation for aviation infrastructure planning, it is essential to recognize how heavily planning relies on the predictability of the market. Predictability is a fundamental assumption of planning and design facilities. While this may seem obvious, it is well worth emphasizing. Of course, we predict demand when we invest in facilities that are going to last 25 or 30 years. But, it is important to recognize that predictability is an assumption, and as such, it may be correct or incorrect. Furthermore, it is an assumption that is fundamental to the business of aviation infrastructure planning. Not only do we assume predictability, we assume it over fairly long horizons. It is not uncommon to see forecasts to 2020 or 2025. Such predictions are very important inputs into decision making about the construction of airports, air traffic control systems, and other facilities and systems.

The specific nature of this assumption is that because facilities last 25 or 30 years, it must be useful to forecast their condition over the same time horizon. Furthermore, this assumption implies that, while we know the forecasts will be wrong (it is the nature of the business, after all) it is still useful to have them. That is, the forecasts are better than no information at all.

But it is an heroic assumption, nonetheless. Why do we make it? Because it is an essential rationale for those who believe in building long-term infrastructure. We are accustomed to providing for long term infrastructure, and we accept the concomitant assumptions. There may also be a little engineering conceit. Engineering materials will last for 25 or 30 years, after all. The world must be predictable enough for us to predict the conditions they will face over that horizon. Concrete and steel are fairly predictable materials under particular conditions; ought we not be able to predict the social and economic conditions that will affect them?

We have gotten very accustomed to this idea in making aviation infrastructure plans, and making infrastructure plans in other sectors. We might call it "the myth of predictability — the myth of assuming that the world is as predictable as the engineering materials we build with.

My second point follows directly from the first. The assumption of predictability is not very well grounded. Indeed, it is substantially at odds with the kinds of activities that generate air transportation demand. Part of the reason we believe in predictability is an extension of the Newtonian model of the universe. We can predict the location of the planets in the solar system. Social and economic forces ought to be equally as predictable.

But the Newtonian concept of the universe is now being widely questioned. The planets do move fairly predictably over the generations of man. But in astronomical time they are subject to highly unpredictable forces, such as the "Big Bang." We cannot trace back the trajectory of the universe very far in astronomical time, nor can we necessarily predict exactly where it is going to be a few astronomical generations from now.

Questions about the predictability of the universe in astronomical time are paralleled by questions about the predictability of systems and processes that are much closer to home: the economy, the stock market, technological innovation and progress. The widely used assumption of long periods of fairly predictable behavior punctuated by occasional "structural changes" is now in question. A structural change such as the entry of women into the labor force in the 1960s is coming to be seen not as an aberration, but as an inherent aspect of

the behavior of social and economic processes. Forecasts in the late 1950s of employment for the Washington, D.C., area in the 1980s were significantly below actual. Yet population forecasts at the same time were actually fairly accurate. What changed was one of those "fundamental constants" of forecasting, the labor force participation rate of women, which changed due to other economic forces that we were not really able to anticipate. A structural shift occurred, which we can explain in hindsight but which we did not anticipate at the time.

The emerging theory of "complex adaptive systems" does not pretend to be able to identify particular structural shifts in advance. Rather, it underscores the dubiousness of assumptions that social and economic processes will follow a fairly smooth trajectory over the medium to long term. The market can be fairly predictable over the short term, and remarks elsewhere in these proceedings provide some understanding of what is likely over the next three to five years. But the longer the horizon, the greater the likelihood of intervening structural change that moves events in a direction that we are not able to anticipate. Thus, the market is highly unpredictable in many respects.

The aviation sector has undergone major structural changes wrought by technological innovations, like the

DC-3 and the jet aircraft. These had a tremendous effect, and yet their occurrence and consequences were not predictable. The Arab-Israeli peace accord that was signed on the day of this conference has the potential to make enormous impacts on the international aviation market, but it, too, was not predictable. The entry and exit of powerful industry figures, like Frank Lorenzo, are highly unpredictable. What is more predictable in many respects is the behavior of the governmental systems and processes that are in charge of the planning, design, and development of aviation infrastructure.

To demonstrate this unpredictability, consider the development of U.S. domestic enplanements per capita starting from the 1920s through the early 1990s. This measure provides some perspective on market saturation since it focuses on the activity of the individual consumer of air transportation. Annual domestic enplanements per capita have grown from virtually zero in the 1920s to about 2 at present. (See Figure 24.)

What do these data suggest about market saturation? They appear to follow a logistic, or S-shaped, curve, which is frequently employed for explaining deployment processes. Figure 25 shows the realization of an S-curve based on the assumption that the process is symmetrical over time. Saturation appears to occur sometime in 2020 or 2030 at about 2.3 enplanements per capita.

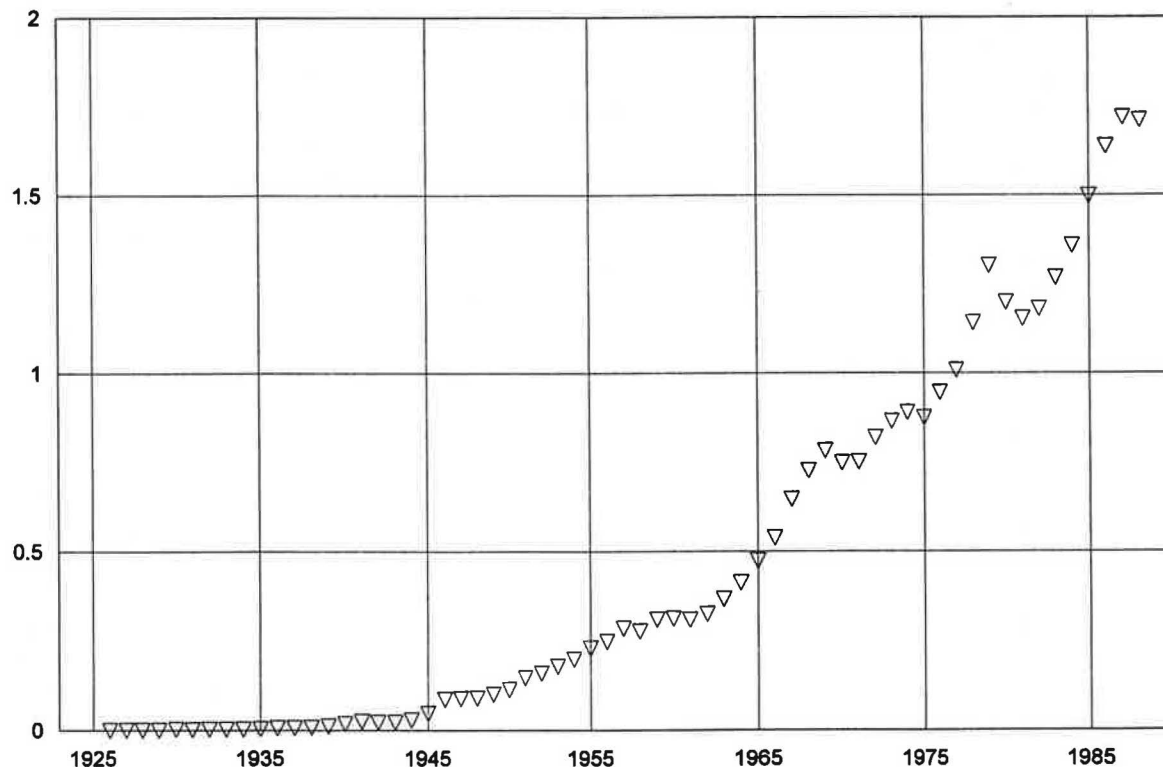


FIGURE 24 Enplanements per capita, 1926-1990.

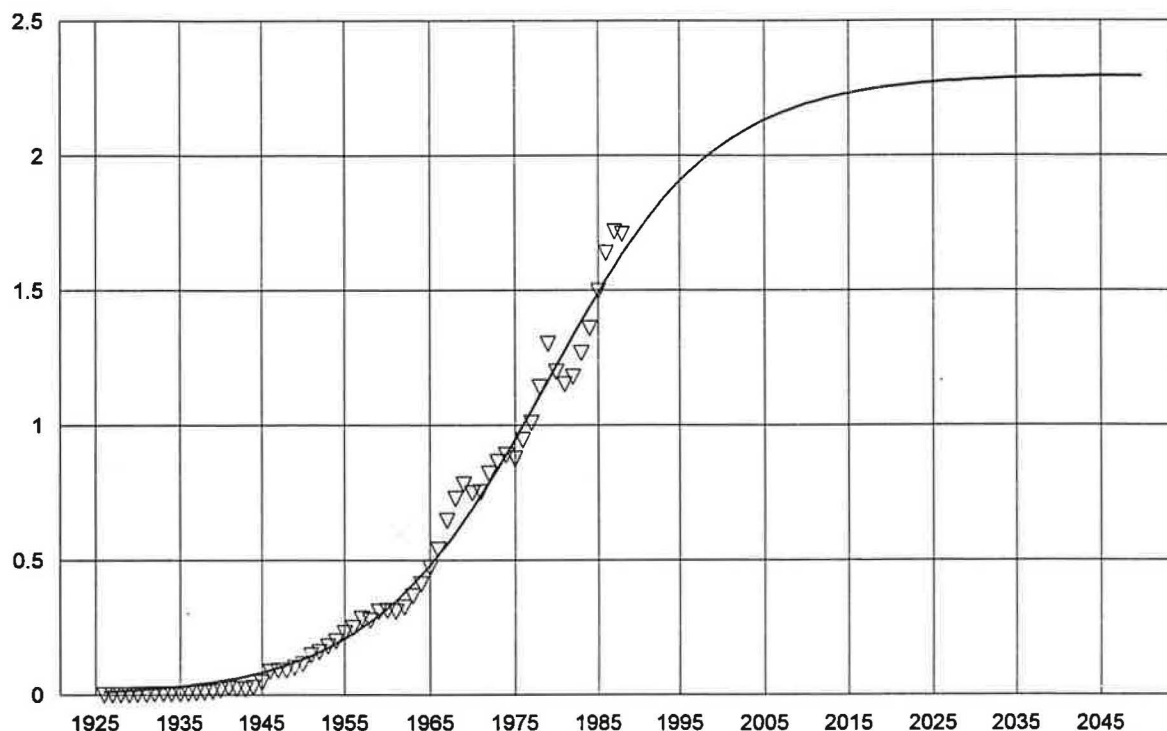


FIGURE 25 Enplanements per capita, 1925-2050, as a single S-curve.

Yet the same data suggest a very different future if we assume that they are not the realization of a single air transportation deployment process but rather a series of three successive processes corresponding to structural changes in the aviation sector. (Figure 26) The left S-curve in Figure 26 reaches saturation at about 0.4 enplanements per capita in the late 1950s, roughly corresponding to the end of the DC-3 era. The middle S-curve is realized over a much shorter period — the twenty years from the mid-1950s to the mid-1970s, roughly corresponding to the Boeing 707 era. The S-curve on the right suggests the beginning of a powerful and very broad scale deployment, perhaps motivated by the restructuring induced by deregulation in the late 1980s or the deployment of wide-body aircraft, leading to enplanements per capita on the order of 3 by the end of the century, with much rapid growth to follow. Yet the exact parameters of the right-hand S-curve are much more uncertain because much less of the process has occurred.

The point is not that Figures 25 and 26 are right or wrong. The point is that the nature of this market and the nature of the saturation and market penetration processes are highly unpredictable, and highly sensitive to events that are difficult to anticipate in any planning sense. A similar analysis for airborne hours per capita

-- another consumer oriented measure --demonstrates the same phenomenon.¹

What sources of structural change are at large that might affect future demand for aviation? We have already mentioned the recent Israeli Peace Accord and its potential effect on international demand. On a very different front, a recent business feature in *The New York Times* examined the changing nature of the work force at General Electric. Many of the upper level managers have been eliminated, and the ten or fifteen percent of the remaining upper level managers are working in cinder block cages out on the shop floor.² The nature of upper level management has changed significantly, and may be undergoing a structural shift. That has been a very rich market for the aviation sector for many years. What are the implications? We cannot really know at this point.

Telecommunications and its effect on transportation may also induce structural shifts. To what extent will it substitute for transportation; to what extent will it reinforce demand for transportation? After all, the first telephone call induced a trip, "Watson, please come here." Yet we do not know the extent to which telecommunications will reinforce or substitute for transportation in the future. Furthermore, major structural shifts are occurring elsewhere in the economy

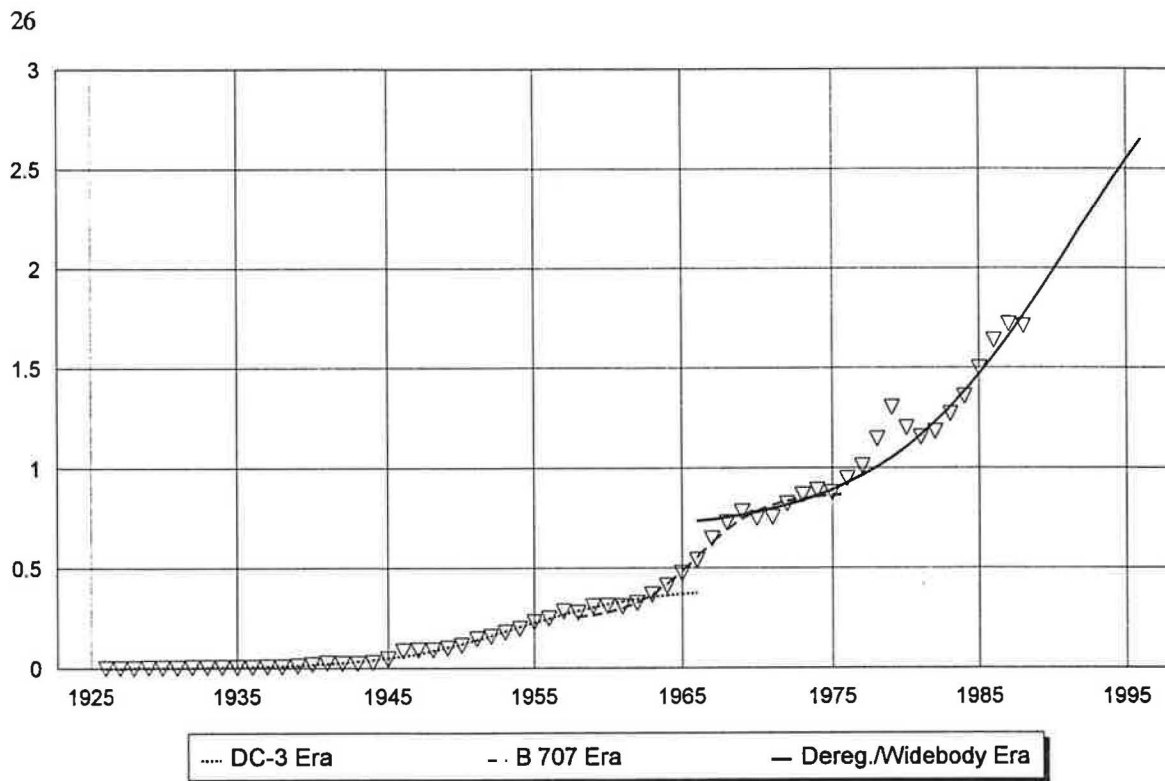


FIGURE 26 Enplanements per capita, 1925-1995, as three S-curves.

and in the work force that could have a significant effect on demand.

So that is the second point. The market is not very predictable. It behaves in unpredictable ways, and the assumption of predictability is ill-founded.

The third point is that points one and two, above, really matter. Assuming predictability is not a close approximation to what actually happens out in the real world. Accepting the myth of predictability leads us to build aviation infrastructure that is not necessarily well suited to the emerging form of markets. Buying into the myth of predictability has consequences. It is not just a little bit of random error.

We should not spend scarce resources today to build infrastructure that is supposed to come into service 20 years from now when we have near-term demand that is going begging for the lack of resources to serve it. What happens when you build infrastructure on the basis of this myth of predictability? First, technological obsolescence can set in. I think there is probably general agreement that, while we would rather have it than not have it at all, the current generation of the air traffic control system has lasted far too long. We should not be building an air traffic control system that lasts 30 years in this environment. We should have an air traffic control system that can evolve and take advantage of the

technological opportunities that are constantly being presented. A statically designed system, while it may be easier to procure and manage, is not necessarily the right kind of system for the technological marketplace and the technological capacity of the economy and the society.

Another effect, in addition to technological obsolescence, is underutilized facilities. Robert Crandall of American Airlines mounted an ambitious growth strategy of building new hubs in the 1980s. Two of those hubs, Nashville and Raleigh, are now closed. In one sense, this is just another failed business strategy -- history is littered with them. What is so different about American Airlines? In another sense, however, Crandall, along with officials in Nashville and Raleigh, assumed that the post-deregulation restructuring of the aviation industry had largely occurred and that the aviation market was settling down into a smooth trajectory that allowed them to forecast demand and build facilities accordingly. In fact, events have proved them wrong.

But more important than technological obsolescence and underutilized facilities is a third effect of accepting the myth of predictability: deploying infrastructure on the basis of the assumption of predictability distorts market development. Deploying one infrastructure

facility precludes the use of the same resources for deploying another facility elsewhere (or using the funds for an entirely unrelated purpose). And because households and firms try to take advantage of facilities that are built, the planned capacity for, say, 20 years is used up in only a few. Hence, the assumption of predictability ends up powerfully influencing the direction of economic development.

The result is that, rather than households and firms deciding how best to utilize social and economic resources, government officials (engineers like myself) powerfully influence the direction of social and economic development. Government officials and government conclusions about social and economic trends, based on this myth of predictability, actually take precedence over freely agreed upon, voluntary transactions in the economy.

So that is my third point, that making this assumption has serious consequences, and some of which may not be salutary.

My final point is that there is a better approach. The infrastructure planning profession will not go out of business if it acknowledges that long-term predictability is a myth. To be sure, forecasts are extremely useful in understanding what is happening now, or what has happened in the last few years in the economy. But the profession must turn its energies to the planning and design of flexible, adaptable facilities and systems.

Flexibility and adaptability are sort of like apple pie. The key question is how to operationalize flexibility and adaptability in an organizational and political setting involving the construction of facilities that have long term impacts? What does it actually mean? What is flexible infrastructure planning?

First, flexible planning emphasizes consumers, that is, households and firms. (See Table 1.) It does not emphasize things that make life comfortable for suppliers. That is a very important point. The assumption that consumers accept high aviation worker wages, for example, is currently being challenged by the "no frills" carriers. Planning that makes life comfortable for suppliers is probably not flexible planning because it is easy for professionals to tell themselves that, well, the world just has to be a particular way, and that this is what consumers really want. Ask consumers, ask households, and ask firms what they want. Offer them something that they can pay for or walk away from. Give them choices.

Second, flexible planning focuses on projects with a very rapid payoff. Avoid projects that will not pay off until the 25th or 30th year. It is simply impossible to predict out that far, and hence it is not a good use of resources. Instead, focus on the near term, and focus on

TABLE 1 FLEXIBLE INFRASTRUCTURE PLANNING

Emphasize consumers (households, firms), not suppliers.
Focus on projects with rapid payoffs
Preserve options for future development
Defer irreversible actions as long as possible

projects that can pay off quickly, thereby liberating resources to build better-attuned, better targeted facilities 10 or 15 years from now when these are worn out.

Third, flexible planning attempts to preserve options for future development. Take actions now that leave options open.

Fourth, flexible planning defers irreversible actions as long as possible. Once you have poured concrete, it is impossible to recover its value if you later decide it was a bad idea. If you defer pouring concrete for a year, you can always reverse that decision. You have lost a year's worth of benefits, but you may have gained a lot better information about where the economy is going and what is actually available.

And finally, flexible planning relies on good intelligence and market research. Focus on understanding what is happening in the current environment, and what has just happened, so that you can make intelligent short-term forecasts about where to invest resources.

Is flexible planning not excessively short-term, focusing on the near term and devoid of any long-term view? No. Flexible planning focuses on the most important long-term question: what kind of infrastructure will provide future generations as many options as possible from which they can choose those that will work in future conditions of production, consumption and distribution of goods and services. We cannot know today what will be useful for the production, consumption and distribution of services in 2020 or in 2025. A look back at the production, consumption and distribution processes of 30 years ago reveals miraculous differences that no one could have predicted. Thus, infrastructure planners should focus not on figuring out what kind of infrastructure future generations will need. Rather, we should focus on how to enrich and empower future generations by giving them as many resources and as many options as possible.

In summary, this paper has laid out four major points. First, the assumption of predictability is pervasive in infrastructure planning and design. Second, it is not an accurate or a supportable assumption given the nature of the economy and the society in which we live. Third, assuming predictability can lead to facility obsolescence, poor utilization, and excessive government influence on the direction of economic development. And finally, a flexible approach that is consumer-focused, oriented toward quick payoffs, avoids irreversible actions where possible, and utilizes good market research is a much more appropriate way to plan aviation infrastructure.

References

1. J.L. Gifford and W.L. Garrison, "Airports and the Air Transportation System: Functional Refinements and Functional Discovery," *Technological Forecasting and Social Change* 43(2) (March 1993): 103-23.
2. Peter T. Kilborn, "The Workplace After the Deluge," *New York Times* (9/5/93), sec. 3, pp. 1ff.

TELECOMMUNICATIONS AND BUSINESS TRAVEL: THE REVOLUTION HAS BEGUN

Ernest S. Arvai,
President, The Arvai Group

It is a great pleasure to speak to a group concerned with the future of transportation about a topic which we believe too little attention has been paid -- future advances in telecommunications substituting for business travel.

In the novel, *Jurassic Park*, a character named Dr. Ian Malcom, espousing "chaos theory", clairvoyantly states that "nature always finds a way" to make a stable situation unstable. Today, I would like to modify that notion and apply it to the business community -- "new technology and entrepreneurs will always find a way."

Many of you in the audience might say "Here we go again, another forecast of videoconferencing reducing air travel demand. We went through this in the 1980s, and it didn't happen. What is so different today?" Our research indicates that those pipe dreams of the 1980s are becoming possible as we approach 2000.

We believe that the business world will soon undergo a *revolutionary* change, as important as the introduction of the personal computer. These changes in the way we communicate, driven by technology, will affect how we work, how we communicate with others, and how often we will need to travel on business.

The results of our recent research into the impact of advanced telecommunications technology on business travel indicate that a significant substitution effect will take place as desktop videoconferencing becomes affordable and commonplace. (Figure 27)

- ◆ Telecommunications Will Compete with Air Travel through Desktop Videoconferencing
- ◆ It will Enhance Productivity and Substitute for Some Business Meetings
- ◆ Several Forces Will Drive a Fundamental Shift in the Market Dynamics of the Air Travel Industry

FIGURE 27 The revolution has begun.

What is desktop videoconferencing? Our vision of desktop videoconferencing is full motion video communications between individuals utilizing their personal computers as videoconferencing units from their desktops.

Imagine your office in 2005. Your PC will likely have a large, multi-window, flat-panel display, which could be mounted on your wall. It will be connected to the phone network, and through standard interfaces with your combination scanner, fax and printer, you can send and receive documents from almost any user anywhere through standard protocols developed in the late 1990s. You will also have a micro-camera to transmit video and audio of your conversations and the capability to connect into multiple videoconferences from your desktop.

You still even have full-motion video voice-mail systems; and when these connections are made, you will be able to judge the reactions, body language, and expressions of the other party, something that is impossible with plain old telephone service today. AT&T's commercial showing a mother tucking in her baby by remote videoconferencing indicates that we are not far away.

Desktop videoconferencing can be effective for many situations and could substitute for direct contact. Sales people with established relationships will use desktop videoconferencing to substitute for some (not all) in-person sales calls. Rather than call on the company once every two months, a salesperson could videoconference monthly and visit quarterly or semi-annually, providing double the contact at a lower price.

Many internal company meetings, such as introducing a new product to a geographically dispersed sales force, could be conducted by videoconferencing. With time-based competition, just-in-time delivery, and more to do in less time, it may make more sense to videoconference than to call large national or regional meetings.

In our view, the question is not whether substitution will take place. The process has already begun, as evidenced by the now ubiquitous fax machine. The key issue is how large will the substitution be, when it will occur, and the types of business trips which will be affected.

By examining several forces driving this change, we estimated the impact of desktop videoconferencing substitution for air travel to be substantial. (Figure 28)

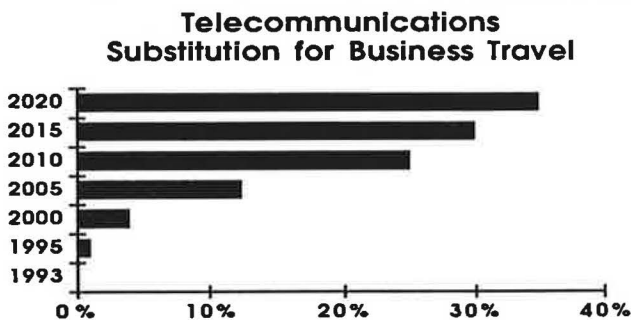


FIGURE 28 Our research projects significant substitution for air travel.

We project a 25-percent substitution for business travel by air by 2010, and potentially a 35-percent substitution by 2020. Desktop videoconferencing, now in its infancy, will become affordable by 1997 and achieve widespread adoption by 2005. By 2010, we believe desktop videoconferencing capability will be as common as a personal computer and telephones; virtually every office will have one.

Are these numbers realistic -- one in four business trips? Will companies really change the way they have done business for years? Some evidence has begun to emerge. A major Swiss bank has just ordered 75 videoconferencing units for its offices around the world. The real surprise, however, is that they have put them under the jurisdiction of their travel department, and a travel request will soon need to pass the "could it be done by videoconference" hurdle!

Take a look at some recent airline advertisements. One shows an executive complaining about the loss of 30-year customer and handing out tickets to his staff telling them to "visit every one of our customers", implying that reliance on the fax is not good enough. Another airline commercial shows a meeting and

emphasizes that there is no substitute for face-to-face meetings. Is there something for the airlines to be afraid of? We believe that there is. (Figure 29)

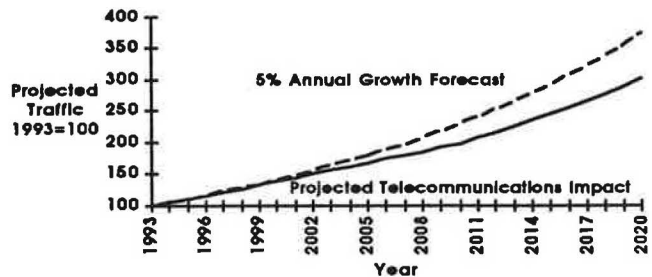


FIGURE 29 Telecommunications substitution for business travel.

The impact of these changes is significant. Telecommunications will have a dramatic impact on air travel demand. If we assume that 50 percent of the market is business traffic (a bit high today), our substitution estimates project the need for 2,000 fewer aircraft worldwide by year 2010. At \$50 million each in 1993 dollars, the impact on manufacturing and balance of trade alone is \$100 billion.

For the airline industry, substitution by their highest yield customers has significant implications for profitability and pricing. Because a 1-percent change in load factor can have a significant impact on the bottom line, maintaining the existing customer base will be a key priority. However, This will be an uphill climb.

Why do we believe this will happen? Four underlying factors are driving these changes. Telecommunications and computing technologies are advancing rapidly. Costs for air travel and advanced electronics are on markedly different paths. New technologies will be much more easily accepted by the next generation reared on Nintendo and virtual reality. And finally, demographics, life style and culture will also have an impact. (Figure 30)

- ◆ Telecommunications Technology Advances
- ◆ Relative Costs and Productivity Impacts
- ◆ Acceptance of New Technologies
- ◆ Demographics, Lifestyle and Culture

FIGURE 30 Several factors underly this coming structural change.

Where is technology going? Sematech, the semiconductor industry association, developed a forecast at its March 1993 technology workshop. (Figure 31)

Year	1992	2001	2007	% Change
Feature Size	.5μ	.18μ	.10μ	500%
Gates/Chip	300k	5M	20M	6,666%
DRAM bits/chip	16M	1G	16G	100,000%
SRAM bits/chip	4M	256M	4G	100,000%

k=kilobits, M=megabits, G=gigabits, μ=microns

FIGURE 31 Technology will drive telecommunications advances.

Some of the advances projected are astounding. Dynamic and Static Random Access Memory, which facilitate advanced computer applications, will increase 100,000 percent between 1992 and 2007. Three orders of magnitude provides a lot of computing power -- certainly enough for full motion video, which my portable Macintosh can play today.

How about the network? Like football, we seem to have a triple option:

- the telephone system with fiber optics and ISDN lines,
- cable companies which already bring high capacity infrastructure to both urban and rural areas, and
- direct airway transmission, via cellular or satellite communication, such as Motorola's Iridium network of communications satellites.

Combined with the Federal Government's interest in funding the "information superhighway", we believe the network will not be a limiting factor.

Airlines and desktop videoconferencing are at different places on the typical product life cycle cost curve. (Figure 32) Airlines are well down the curve, as

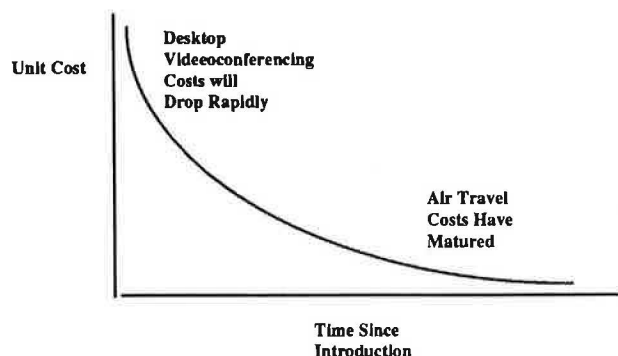


FIGURE 32 Airlines and telecom costs are headed in different directions.

the large, one-time gains in productivity from speed and aircraft size have slowed. With today's jets no faster than the 707, and new wide-bodies little larger than the original 747, productivity gains have resulted primarily from cost reduction, rather than rapid technological improvement.

Desktop videoconferencing combines several technologies -computing, data transmission, and their associated electronic components, which are still at early stages of development and on the high side of the cost curve. They will come down, rapidly, over the next decade. Air travel costs, by contrast, cannot fall much further; and the industry is looking to yield increases to restore profitability.

The IBM PC was introduced in the early 1980s -- only 12 years ago -- and changed the way we do business. Can any of us imagine preparing our routine forecasts without a spreadsheet program? How many of us have used a typewriter in the past year? It was not long ago that we had to. Perhaps in 20 years we'll look back in the same way at the telephone and "stand alone" PC. (Figure 33)

- ◆ **Pocket Calculators Moved from Initially Expensive to a Giveaway Item**
- ◆ **Personal Computers Have Become a Major Industry in 13 Years**
- ◆ **The Fax Machine is Becoming Ubiquitous**
- ◆ **Desktop Videoconferencing Will be the Next Area of Growth**

FIGURE 33 Market adoption of new technologies has been rapid.

For desktop videoconferencing, the cost curves demonstrated by the pocket calculator (\$200 for a four-function Bowmar Brain in 1972 to a giveaway item today), the fax machine (which has gone from expensive and slow to affordable and fast), and personal computers will soon be applied to desktop videoconferencing hardware. It will be extremely affordable for virtually every business.

Already the price of basic videoconferencing units has fallen from \$40-50,000 several years ago to about \$7,500 today. We project that desktop videoconferencing capabilities will be built into PCs and advanced telephones at only nominal cost within 10 years.

Demographics, life style, and culture will also influence the market. (Figure 34) My son is 8 years old and computer literate. He can play "Where in the World is Carmen San Diego", access drawing packages, and use other applications without me ever knowing he

- ◆ **The Next Generation is Growing Up with Computers and Video Games**
- ◆ **Desktop Videoconferencing Will Facilitate Telecommuting**
- ◆ **Videoconferencing is Well Suited to Certain Cultures**
- ◆ **Business Practices and Corporate Lifestyles are also Changing**

FIGURE 34 Demographics, lifestyle, and culture also influence the market.

was on my PC. Actually, that's a bit scary. But he is the type who would enjoy videotelephones and showing friends what he is doing. By 2010, he'll be out of graduate school and in the workforce, a part of the video generation.

Telecommuting has not yet emerged to its potential, despite the introduction of several telecommuting centers in California. It likely will, however, as life styles continue to change. I now carry my office computer with me on the road. It is a portable machine that allows me access to most of the information available in my office. With videoconferencing, I could join my colleagues for an office meeting from the road, whether I am at home in New Hampshire or here in Washington.

How many of us have done business with Japan? Their management style, which includes participation of virtually all departments of their organizations to build consensus, often results in meetings with more than a dozen people on one side of the table. Sending 12 people by air a business meeting is expensive. To have them participate in a videoconference is, on a relative basis, quite inexpensive. We believe that Japan may be an early adopter of desktop videoconferencing, just as they have been with conventional videoconferencing today. During the Gulf War, air traffic dropped and videoconferencing traffic between Japan and the U.S. increased 400 percent. That is not a surprise. The surprise is that it has remained at that high level while air traffic has not come back as strongly. Videoconferencing is gaining acceptance.

Business life styles are also changing. My recent "interrupted vacation" is evidence that time pressure is driving the executive life style. The fax, cellular phone and other mechanisms to "speed up" the business day are

here and real. If desktop videoconferencing removes a long and arduous trip by air, it will be another arrow in the executive's quiver of technological advances to enhance productivity.

Airlines may need to rethink their pricing policies for business and leisure travelers as they face new competition from telecommunications. While we foresee substitution impacts for both domestic and international air travel, the impact may be more significant for "short trips over long distances", in which travel time may be greater than the productive time spent in meetings. While some executives will enjoy "getting out of the office pressure-cooker" to take such a night, others may see such a trip as threatening to their level of productivity and instead videoconference. In either case, emerging communications technologies will likely allow the executive to be in touch wherever he or she may be, even on board an aircraft. (Figure 35)

- ◆ **Airlines Face Slower Growth and Loss of Highest Yield Customers**
- ◆ **Aircraft Manufacturers and Suppliers Face Reduction in Demand**
- ◆ **Telecommunications and Computer Companies Will Integrate Products**
- ◆ **The Manner in Which We Routinely Conduct Business Will Change**

FIGURE 35 The implications are tremendous.

Suppliers to the airline and aircraft industries may need to consider slower growth alternatives in their core businesses, or diversification into other areas for growth.

As telecommunications and computer technologies merge, who will become the leaders in desktop videoconferencing? How will the integration and standardization process evolve? Will the next PC operating system include videoconferencing capabilities?

Finally, how will we routinely conduct business 12 years from today. Will it be as different as 12 years ago, before we had personal computers?

Our research is continuing, and we have begun a survey aimed at identifying more clearly the specific functions most susceptible to substitution and the relative likelihood for such substitution.

The next few years will be exciting times, with dramatic change. I look forward to sharing them with you.

GLOBAL AVIATION ALLIANCES

David E. Raphael
President, Marcar Management Institute

There are three driving forces creating growth in aviation alliances: privatization, globalization, and concentration. According to the U.S. General Accounting Office, the privatization of 26 previously government-owned airlines was complete or in the process of completion, as of January 1992.. In addition, 20 other airlines, including Qantas, El Al, and Alitalia, are moving toward privatization. Recently the 20 airlines that form the Chinese group CAAC began to consider similar steps.

The benefits of privatization include 1) access to capital and foreign investment, 2) opportunities for career growth and profit-sharing for airline employees and managers, and 3) funds provided directly to governments (and reduction of government subsidies paid to airlines) as new organizations purchase shares.

Globalization is becoming a powerful force in fostering alliances as ownership of airlines moves across borders. DHL Airways, for example, has Japanese, German, British, Chinese, and American shareholders. Figure 36 illustrates the spectrum of ownership in airlines today. Iberia, Saudi Arabia, Olympus, TAP, and Aer Lingus are still 100 percent government-owned. The Italian government, on the other hand, has recently reduced its ownership in Alitalia to 21 percent. KLM, SAS, and Lex Air are in the 50-percent range of private

Airline Companies	Home Nation	Government ownership %
Iberia	Spain	100.
Saudia	Saudi Arabia	100.
Air France Group	France	99.
Sabena	Belgium	88.
Alitalia	Italy	79.
Lufthansa	Germany	59.
Singapore Airlines	Singapore	54.
KLM Royal Dutch	Netherlands	38.
Swissair	Switzerland	20.
Cathay Pacific	Hong Kong	13.
Japan Airlines	Japan	0.
British Airways	United Kingdom	0.
Air Canada	Canada	0.

International Aviation is regulated by Bilateral Agreements
For example, the U.S. has 72 bilateral agreements with
95 nations dealing with aviation.

FIGURE 36 Globalization.

ownership. Japan Airlines, British Airways, and Air Canada are wholly owned by a variety of private shareholders around the world.

Concentration of operations and assets has been a long-term factor favoring alliances. The traffic carried by the three largest airlines — American, United, and Delta — is more concentrated than six years ago. The Big Three accounted for 41 percent of passenger revenue miles in 1987. For the first six months of 1993, they accounted for 57 percent of the revenue passenger miles and 58 percent of the seat miles. A significant feature of concentration is purchase of routes. American's Airlines bought Eastern's Latin American routes for \$471 million and TWA's US-UK routes for \$445 million. Delta acquired several European routes from Pan Am for \$526 million. United acquired Pan Am's Pacific routes for \$716 million and its US-UK routes for \$400 million. These acquisitions pose a threat to other world airlines that are seeking alliances among themselves to protect their home markets and strengthen their competitive positions.

The global economy also plays an important role in the formation of aviation alliances. When times are poor, many airlines seek partners rather than acquisitions for a key reason: it is usually cheaper to develop and alliance than to pay the merger premiums.

According to *The Economist*, 12 of the largest nations are experiencing either negative or zero economic growth in 1993. Forecasts by the same economists now suggest that nine of these nations are likely to grow by only 1 or 2 percent in real terms during 1994. If the global economy recovers as slowly as predicted, aviation alliances may continue to multiply.

Alliances span continents and include equity investments or marketing arrangements such as codesharing. (Figure 37) Equity global alliances (Figure 38) are the most complex partnership agreements in that they involve transfers of cash, stock, assets, or debts among airlines. Equity roles range from the 5-percent share of Austria in the Alcazar alliance to the 51-percent stake of Deutsche Aerospace in Fokker and the 54-percent equity that KLM and Northwest have in Wings. The rationale for equity alliances is market access, production sharing, or cost sharing.

A primary reason for regional alliances is to strengthen or protect the home market. (See Figure 39.) Some alliances also seek a link to international markets. A case in point is Mexicana and Aeromexico. Mexicana plans to focus on the domestic Mexican market while its partner, Aeromexico, is seeking to build international markets linked to Mexico.

Alliances across continents include investments and marketing arrangements

<u>Americas</u>	<u>Europe</u>	<u>Asia</u>	<u>Scope</u>
Delta	Swissair	Singapore	5% each
	British Airways	Qantas	25% in Qantas
USAir	British Airways		\$300 m in US
Northwest	KLM		54% in Wings
DHL	Lufthansa	Japan Airlines	\$500 m in DHL
	British Aerospace	Taiwan Aero.	\$500 m in AVRO
General Electric	SNECMA, MTU (FRG)		turbofan engine
Delta	Swissair		code sharing
United	BMA of Brazil		code sharing
American	BMA of Brazil		code sharing
United	British Airways		code sharing FF
Aeromexico	France		code sharing FF

FIGURE 37 Global alliances.

Equity cross-border aviation alliances range from 5 to 55% investments

<u>Aviation Partners</u>	<u>Equity investments</u>	<u>Rationale</u>
Aeromexico, Mexicana	55% stake in Mexicana	Market access
KLM, SAS, Swissair		
Austria	30-30-30-10% in Alcazar	Market access
DHL-JAL-LH	\$500 m 25%-25%-5%	Express mail, freight
Air Canada, Continental	\$450 m 27.5% in CO	US, C market access
British, Taiwan Aero	\$500 m	Jet aircraft production
Deutsche Aero, Fokker	51% in Fokker	Regional jet production
KLM, Northwest	54% in Wings	Market access
Swissair, Singapore Delta Airlines	5% cross investments	Market access
British, Qantas	25% by BA in Qantas	Market access
AAL, Canadian Air Intn	\$195m 25% by AMR	Market access, tech ex.
British, TAT	49.9% in TAT	Market access
British, USAir	\$300 m, 21.8% in US	Market access

FIGURE 38 Equity global alliances.

Firms in regional alliances frequently seek to strengthen home markets.

<u>Partner</u>	<u>Partner(s)</u>	<u>Region/Nation</u>	<u>Goals</u>
Aeromexico	Mexicana	Mexico	Mexico, Latin America
KLM	Swissair	Europe	Alcazar in Europe
Austrian	SAS		
Lufthansa	Olympic	Europe	market penetration
	TAP		
Delta	Aeromexico	Mexico	market penetration
Delta	Varig of Brazil	Brazil	market penetration
American	Canadian Air Intn	Canada	25% in CAI
Aeromexico	Aeroperu	Peru	47% in Aeroperu
Deutsche	Fokker	Europe	regional jets

FIGURE 39 Regional alliances.

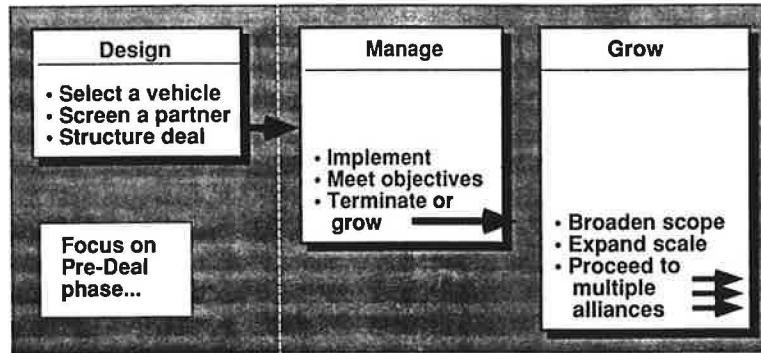


FIGURE 40 The critical phases in aviation alliances.

The formation of aviation alliances has three important phases, as shown in Figure 40. The critical phase is the first — the pre-deal agreement — which (in order of importance) consists of three steps: select the right partner, select the right vehicle, and agree on the right terms. About 80 percent of the problems encountered by alliances later on arise because some step in the pre-deal phase was neglected or ignored.

A current example of problems that develop in the pre-deal phase is the alliance of British Airways and US Air. The initial reasons for the partnership included the need for capital (US Air lost almost \$1 billion between 1989 and 1992), access to east coast cities in the United States and to Heathrow in England, and marketing power. Concerns about equal access of U.S. carriers to Heathrow and competitive rivalry caused the partners to consider a new vehicle (step 2) and to make key changes in the terms of the alliance (step 3). Thus alliance formation was significantly delayed and equity funding substantially reduced as a result of unexpected problems in the first phase. Initially, British Airways' investment was to comprise \$750 million, with a 44-percent equity stake and 20-percent voting role in US Air. This offer was withdrawn in favor of an investment of \$300 million, with a 24.6-percent equity role and a 19.9-percent voting share in US Air.

Management of an alliance is the second phase. The British Airways-US Air alliance is now (as of September 1993, ed.) in the first six months of phase two. The partners have added U.S. cities that connect directly to London: eight in July 1993 and two more as of September 1993. The alliance is also adding gateways, and soon 13 U.S. gateways and 65 cities will be served.

Growing an alliance is the third phase, which involves broadening the scope of the alliance. In the case of British Airways, this includes codesharing with United Airlines in the U.S. market, participation in the Galileo computer reservation consortium in Europe, and entering into a joint equity venture with Qantas in

Australia. Growth of an alliance can also involve expanding the scale of operation or moving into multiple relationships in different markets with other airlines.

The debate regarding cross-border equity alliances is likely to heat up in the years ahead. While foreign investment in U.S. airlines provides needed capital to carriers, increases the number of jobs, and costs less than a full merger, many analysts believe that global airline partnerships have drawbacks for the domestic carrier. They may dilute the power and control of the domestic airline in its own market, provide the foreign carrier with too much control, favor the foreign country's position in subsequent bilateral agreements, and provide a subsidy of foreign-government money to "free market" economies. None of these factors is likely to deter the management of airlines from considering cross-border alliances as long as the three driving forces are strong.

Market forces are more likely to influence the pace and size of alliances in the future. We have found in our research that six key premises will be important in forming future alliances.

1. It is imperative to select the right partner and the right vehicle before discussing the terms of an alliance.
2. The value created for each aviation partner is more important than alliance longevity.
3. We predict that most aviation managers will be involved in an alliance in the next five years, or be competing with one.
4. Aviation alliances will increase in number, regardless of failures and contrary to warnings.
5. Cross-border alliances will expand despite the difficulty in dealing with differences in culture, language, and performance measures. In fact, Murray Weidenbaum has found that alliances flourish where government restrictions on acquisitions and foreign investment are strict.
6. Alliances of the future will be separated into two groups: mega-alliances and business-unit alliances.

There will be a large number of business-unit alliances in airlines and aviation activities.

However, there are also tales from the dark side of alliances. In the past six years we have uncovered several pitfalls to be avoided.

- Most financial expectations fail to be realized in the first or even the second year of aviation alliances.
- Most alliances terminate because of competing services and selection of the wrong partner.
- Many alliances end up as acquisitions. It is a good idea to think about this in phase one and not wait until phase two.
- Virtually no alliance meets all its goals.
- It will take twice as long as expected to meet some of the original goals, three times as long to adjust to the new ones, and four times as long to deal with critical issues.
- "Have a good fight with your partner before you sign the deal" is advice from several experienced alliance partners who have developed useful ways to resolve conflicts.

AIRLINE CONSOLIDATION: CONSUMER WELFARE AND POLICY IMPLICATIONS

Dong Liu and Richard R. Mudge
Apogee Research, Inc.

An Economic Model of Airline Concentration

While at the University of Pennsylvania, one of the authors (Dong Liu) in collaboration with Elizabeth Bailey developed a model of airline concentration to address several key questions about the impact of airline deregulation on air service and the future of the airline industry.

- Why has the airline industry become increasingly concentrated since deregulation?
- What does this concentration imply for total consumer welfare?
- What are the implications for future public policy?

The central conclusion of the analysis using this model is that the airline industry is unlikely to have a large number of air carriers when it reaches a state of equilibrium. First we will discuss what this concentration

means with regard to airline prices and consumer welfare. Later we will examine the implications for future public policy.

The usual approach to these issues is to collect lots of data on prices, service levels, etc. and to analyze past trends. We call this the "data analysis approach." This approach is straight-forward, and it can be quite convincing. But, without an explicit economic model to provide a structure for the empirical analysis, this approach suffers at least two drawbacks.

First, this approach cannot tell whether or not the airline industry is in equilibrium. Without this information, an analysis of past trends tells little about the future of the airline industry. For example, just because the price of air transport is low this year does not mean the price will be low next year. Just because we have five major carriers this year does not mean we will have five next year, or six or four.

Second, this approach cannot tell whether the airlines are oversupplying or undersupplying air transport capacity and whether they are overcharging or undercharging for these services. As a result, many diverse interpretations can be made of the same descriptive data.

The approach that we will describe today is different. We call it compliments the data analysis approach. I call this approach a "radical equilibrium model." Basically, this model simulates rational behavior of airlines on one hand, and passengers on the other. The simulation describes behavior by the airlines and passengers that would be consistent with an equilibrium or stable economic state. The insights from this equilibrium modeling approach complements the data analysis method. We use this model to describe the airline industry's equilibrium states and the corresponding welfare implications. The following is a summary of the major findings. A full technical description of the model is in paper prepared by Elizabeth and Liu.¹

First we found that under the airlines' hub-and-spoke network structures, only a very small number of major carriers can coexist in equilibrium. In other words, the airline industry will remain concentrated no matter how large the total demand becomes. Later we will show how this small number of airlines in equilibrium varies under different conditions.

Second, we found that, as the industry approaches equilibrium through a series of consolidations and bankruptcies, total consumer welfare increases rather than decreases. This is true even if prices increase along the way. Why? The answer has to do with the travelling public's preference for frequent service — more precisely, frequent, single-carrier services to a

large number of places at low cost. It also has to do with use by major carriers of a capital-intensive hub-and-spoke network to meet such demands.

Since deregulation, investments in hub-and-spoke network systems has become the standard operational procedure for major carriers. If we look closer at this system, we will see that it has two major opposing effects on consumer welfare.

On the one hand, it has significantly improved service by allowing airlines to provide frequent flights to a large number of places — big cities and small cities — at low cost. This service-improving aspect of hub-and-spoke networks has brought great benefits to the flying public. This is the positive, or welfare-increasing effect of hub-and-spoke networks.

On the other hand, the hub-and-spoke network system has negative, or welfare-decreasing effects. Investments in large hub-and-spoke networks investments entail huge fixed costs, thus, allowing only a small number of competitors in equilibrium.

A small number of competitors means potentially high prices, and high prices mean a welfare-decreasing effect on the consumer. The question is, whether the service-increasing effect of a hub-and-spoke network outweighs the price-increasing effect.

We examined this question by establishing two regimes. One may be called a "consumer welfare maximization" regime, where the number of airlines and the services and prices are chosen so that the total consumer welfare is maximized, subject to the constraint that airlines receive market rates of return on investment. The second regime simulates a market where airlines compete freely with one another and where the number of airlines and the equilibrium prices and services are determined under free-market conditions.

The comparison demonstrates that under free competitive equilibrium, the welfare-increasing effect of hub-and-spoke network investments outweighs the corresponding welfare-decreasing (price-increasing) effect. This means that, as the airline industry approaches its equilibrium through consolidation and bankruptcy, consumer welfare increases rather than decreases.

The simulation model allows us to estimate what the airline industry should look like in a state of equilibrium. To do this, the model uses three factors. The first factor is a measure of degree of substitution among airlines. The second factor tracks the airlines, fixed network costs as a percentage of total costs.

The third factor is the overall price elasticity of demand.

TABLE 2 EMPIRICAL ESTIMATES OF THE NUMBER OF AIRLINES IN EQUILIBRIUM

A. Substitution Index (γ/β) = 0.6

Price Elasticity (ϵ_p)	Network Cost as a % of Total Cost (δ_i)					
	10%	12%	14%	16%	18%	20%
0.8	8.7	7.3	6.3	5.5	5.0	4.5
1.0	7.0	5.9	5.1	4.5	4.0	3.7
1.2	5.9	5.0	4.3	3.8	3.4	3.1
1.4	5.1	4.3	3.7	3.3	3.0	2.7
1.6	4.5	3.8	3.3	2.9	2.6	2.4

B. Substitution Index (γ/β) = 0.8

Price Elasticity (ϵ_p)	Network Cost as a % of Total Cost (δ_i)					
	10%	12%	14%	16%	18%	20%
0.8	3.9	3.4	3.0	2.7	2.5	2.3
1.0	3.3	2.8	2.5	2.3	2.1	2.0
1.2	2.8	2.5	2.2	2.1	1.9	1.8
1.4	2.5	2.2	2.0	1.9	1.7	1.6
1.6	2.3	2.1	1.9	1.7	1.6	1.5

Detailed Definitions:

γ/β = a measure of the degree of substitution among airlines
 δ_i = airline's fixed network cost as a percentage of total cost
 ϵ_p = price elasticity of air travel demand

ϵ_p : typical values: 1.0 to 1.4
 based on thirteen air travel demand studies surveyed by Oum, Waters and Yong (JTEP, 1992).

δ_i : typical values: 14% to 18%
 based on airline cost studies by Caves, Christensen, and Tretheway (RAND, 1984), and Kumbhakar (SEJ, 1990).

γ/β : typical values: 0.6 to 0.8
 based on econometric study of airline entry by Reiss and Spiller (JLE, 1989).

Based on a review of the historical ranges for these three parameters, we constructed a table where the entries in each cell refer to the number of airlines that can coexist in equilibrium. (Table 2) Note that these numbers have not been truncated into integers. This means, for example that there can be 3.8 airlines, which means three major airlines and a small major airline in equilibrium.

Implications for Future Public Policy

Table 3 presents three conceptual examples of the future structure of the airline industry. The first is an industry made up of large domestic hub-and-spoke carriers.

TABLE 3 THREE CONCEPTUAL EXAMPLES

Large domestic hub-and-spoke carriers:

Characteristics: relatively high substitutability, low price elasticity, and high capital.
 Result: three large carriers at equilibrium.

Non hub-and-spoke carriers (e.g., Southwest):

Characteristics: lower degree of substitution, higher price elasticity, and lower capital.
 Result: perhaps two more carriers at equilibrium.

International alliances:

Characteristics: lower degree of substitution, low or medium price elasticity, high capital.
 Result: perhaps four to six mega carriers.

Earlier we described three variables that shape future equilibriums: the degree of substitutability among the airlines, the price elasticity of the market, and the capital intensity of the industry.

The hub-and-spoke market is one with relatively high substitutability. There is no great difference between one hub-and-spoke network and another. The markets are fairly price elastic, and most airlines are high-capital industries. Looking at Table 2 presented earlier and using values that reflect today's market, the implication is that there should be roughly three larger carriers at equilibrium. This is a little scary as there are either five or six carriers today.

The second example in Table 3 is an airline industry made up non- hub-and-spoke carriers, such as Southwest Airlines. These airlines have a lower degree of substitution because they serve nonstop markets, focus on travellers with much higher price elasticity, and are much less capital-intensive. Under these circumstances, one could expect perhaps an additional two carriers at equilibrium, something close to a total of four or five surviving carriers, though these may not be the same ones we have today. One clear implication is that there is an opportunity for more Southwest-type carriers. The elegant thing about the model is that the underlying theory is independent of whatever market one considers and whatever country it is applied to.

Finally, let us examine international markets. These markets have a lower degree of substitution; that is, people tend to exhibit some loyalty to their national airline. These markets show a middle level of price elasticity and consist of relatively high-capital airlines. In this case, the model implies perhaps four to six megacarriers. Again, a number quite different from what you would expect from current U.S. market.

What are the near-term trends? Economists love to talk about equilibriums. They do not always mention

that we are never at equilibrium. Nevertheless, if we assume that market forces in the near term will move the industry toward the equilibrium shown by the model, the most obvious conclusion is that the transition to a more concentrated industry has not yet been completed. Mr. Crandall's recent statement that "American Airlines will never buy another airplane," supports this.

A second conclusion is that the transition toward a global industry is obviously just beginning. If one assumes that most of the surviving larger carriers will be global in nature, one would also expect that several of the larger U.S. carriers (especially those that now have extensive international routes) will be among them.

A third conclusion is that we will see tremendous growth of new entrants after a long period when no one came into the business and survived. Most of these new entrants will copy Southwest Airlines. Reno, Kiwi, Continental Lite, and all these other nonhub airlines are chasing that part of the market where, in theory, they should be able to survive.

This analysis has three major policy implications. First, we should encourage competition, but only in the places where carriers are most likely to succeed. That means encouraging the growth of differentiated carriers, ones that serve separate markets where there is a lower degree of substitutability among the airlines — the low cost, non-hub-and-spoke carriers.

Second, we should encourage the large U.S. hub-and-spoke carriers to form the core of global airlines. The analysis implies that in the long term maybe three major U.S. carriers will survive. This is cause for concern since we have five or six now. On the other hand, maybe five or six megacarriers could survive.

The third implication is that we need to track the changes in the industry. It is important to remember that the equilibrium and the underlying economic parameters are always changing. The price elasticity or capital intensity that exists today may not be the same four or five years from now.

In summary, the airline concentration model provides an economic framework that explains the changes that have taken place since deregulation and the development of the hub-and-spoke systems. It offers a more rational way to look at what has happened rather than saying that the airline industry is marginal cost with wings.

¹ Bailey, Elizabeth E. and Dong Liu, "Airline Consolidation and Consumer Welfare," The Wharton School of the University of Pennsylvania, unpublished paper, 1993.

DISCUSSION PANEL REPORTS

DOMESTIC U.S. AIRLINES

PANEL LEADERS:

Joseph P. Schwieterman
DePaul University

Mark Diamond
Mercer Management Consulting, Inc.

PANELISTS:

Paul S. Biederman
Trans World Airlines, Inc.

Francis P. Mulvey
U.S. General Accounting Office

Jan David Blais
Jan David Blais & Associates

William R. Nesbit
Aviation Consulting Services

Cameron Burr
Burr and Associates

Frank Spencer
Northwestern University

Rosalind Ellingsworth
AIRTRANS

John J. Smith
Federal Aviation Administration

Eric Gabler
Federal Aviation Administration

Steven Still
USAir, Inc.

Don Kern
Delta Airlines

Robert Windle
University of Maryland

Peter G. McGlade
Southwest Airlines

The U.S. airline industry is emerging from a tumultuous half decade of price cutting only to find itself confronted with a new set of issues: changing customer demographics, softening demand for business travel, and a pressing need to modernize their fleets. Adding to the uncertainty are potential policy initiatives in the wake of the 1993 report issued by the National Commission to Ensure a Strong, Competitive Airline Industry (the "Commission").

This panel of executives, government officials, consultants, and academics believed that, despite these changes, the industry will continue to follow the evolutionary pattern established during the 1980s. It will experience modest increases in concentration as one or more struggling carriers retrench or liquidate. Stimulated by declining average fares, it will enjoy steady growth of pleasure travel but disappointing demand for business travel. The panel was also bullish about the expansion opportunities of low-cost and niche carriers.

These developments will compel major carriers to develop cautious expansion strategies and to emphasize new risk-sharing financial arrangements, such as employee ownership and equity sharing with suppliers.

Financing Issues

Due to the airline industry's sagging financial condition, traditional financing tools, such as new equity and debt financing, will be unattractive alternatives. With debt-equity ratios already exceeding 4:1, major carriers must look to venture capitalists and industry "stakeholders," such as employees, foreign airlines, local governments, and manufacturers, for capital.

The panel expected both major and secondary airlines to develop equity-sharing schemes with company personnel akin to those already in place at American West and TWA. Employee ownership, already a

prominent source of capital, gives organized labor the impetus to participate genuinely in efforts to cut costs. It aligns labor interests with company interest, thus enhancing efforts to increase productivity. Foreign airlines are stakeholders because they depend on domestic carriers for access to U.S. markets. The panel expected foreign investment laws to be changed soon, giving foreign airlines the opportunity to participate more fully in managerial decisions. Most expected an increase in the foreign ownership allowance from 20 percent to 49 percent. However, with numerous marketing agreements already in place, the opportunities and rationale for additional investment may be limited.

State and local governments, including airport authorities, will assume more aggressive investment positions. The interest-free loan granted by the State of Minnesota and the favorable terms offered by airport officials in St. Louis to local hub carriers provide vivid, if controversial, illustrations of things to come. To promote local air infrastructure, growth-conscious public institutions are turning toward reductions in aeronautical fees, local tax abatement, and subsidized airport facilities. Some airport authorities are even expressing a willingness to directly subsidize money-losing flight operations. While there will be contrary examples (e.g., the recent fee increases imposed in Los Angeles), indirect public financing is on the rise.

Venture capitalists and major suppliers are stepping forward with new, if unpublicized, risk-management tools, particularly for start-up carriers. For example, a major "blue-chip" company, EDS, is offering technical and financial assistance to Reno Air in exchange for equity. Innovative leasing and sale-leaseback arrangements for new aircraft will also play a more direct role in industry expansion. Manufacturers and financial institutions, because they are more fundamentally stable, have greater access than the airlines to low-cost capital.

The panel, however, could reach no consensus about the nature or scope of such strategic partnerships. Manufacturing companies emphasize that the once-common practice of selling or leasing equipment at below-cost prices is unsustainable, rendering it an unreliable source of capital.

Commission Recommendations

While the troubled industry must confront new regulatory and tax policies, it would be unwise to radically adjust forecasting models on the basis of the Commission's proposed agenda. The panel did not

expect Congress to adopt those recommendations that could stimulate traffic or bolster industry profitability.

The panel expected the fuel tax reduction provision — one of the cornerstones of the commission's report — to face formidable legislative hurdles and, indeed, this provision was not passed. Similarly, the Commission's plea for an "advisory panel" to oversee airline activity is being received skeptically by Congress. The panel expects Congress to change the Federal Bankruptcy Code, limiting the time in which a carrier can operate under Chapter 11 protection to 12 months. However, this is likely to have only symbolic implications; the bankrupt carriers, such as Braniff Airlines and Eastern Airlines, which provoked industrywide fare cuts to raise cash are already out of business.

The Commission's report could inadvertently divert attention from the industry's competitive problems. For example, the biases and high fees associated with computer reservation systems are likely to remain low-profile policy issues. Travel agent commission overrides (TACO) and frequent flyer programs are also likely to escape regulatory attention. Weaker carriers will need to pioneer new technologies and distribution systems to overcome these competitive obstacles. It is likely that the Federal Government will be prodded to restructure parts of the Federal Aviation Administration. With few exceptions, however, this initiative will not significantly alter the character or performance of domestic airlines.

Structural Changes

The three megacarriers (American, Delta, and United) will remain the dominant forces in long-distance travel. While the era of industry consolidation appears to be drawing to a close, the share of revenue passenger miles (RPM) handled by these three carriers will remain near 60 percent through 2000. The panel was divided as to whether these carriers' market shares will continue their upward ascent.

On short- and medium-haul routes, startup carriers will enjoy brisk market-share growth. These startup carriers have learned from their failed predecessors, avoiding rapid expansion and head-to-head competition with major carriers. Their share is expected to rise threefold over the next decade to roughly 6 percent of RPMs.

Copying Southwest Airlines' model, these carriers emphasize low costs, high productivity, and high-frequency point-to-point operations. While majors are expected to match upstart fares, it is unlikely that

they will be able to eliminate upstart competition entirely as the majors' entrenched hub operations will make commensurate productivity improvements and cost reductions an extremely difficult task.

In contrast to past strategies emphasizing price discounts with capacity controls, major carriers may well respond by developing interline agreements with upstarts. They will use these low-cost carriers to handle traffic on short-haul routes previously operated by the majors, which will help feed the majors' more profitable long-haul routes. However, as demand increases, allowing for the operation of larger aircraft, major carriers are likely to resume service with their own aircraft on many of these routes.

It is uncertain what impact the expansion of megacarriers and upstarts will have on "second tier" carriers, such as America West, Continental, TWA, Northwest, and USAir. These carriers tend to be in poor financial condition, and the disappearance or merger/acquisition of one or more of them over the next three years is likely. Nevertheless, several of these carriers have emerged from Chapter 11 status, restructured with significantly lower costs or -- in the case of TWA -- turned to employee ownership. Such carriers may continue to pose a competitive threat to the dominance of the majors.

The exemplary success of Southwest Airlines will accelerate structural shifts in the industry. Considering that Southwest Airlines has earned healthy profits during the past three years -- a period in which the industry recorded \$6 billion in red ink -- it will serve as a valuable industry model for others to follow. Southwest's overhead is among the industry's lowest, and it achieves exceptional equipment utilization. The carrier strives for simplicity in its operational and marketing activities, emphasizing routes under 500 miles, point-to-point operations, and maximum aircraft utilization with minimal ground time (obviated by the lack of passenger connection requirements). Southwest has shown an increasing willingness, with its entry into the California market and the recent foray to the East Coast, to go beyond niche routes and directly challenge markets previously dominated by the majors.

Although Southwest-type carriers are unlikely to succeed in congested, high-cost airports or make a significant impact on longer-haul routes where differences in operating costs are less pronounced, these carriers are expected to participate in most major short-haul markets within a decade. The resulting price cuts could expand ridership on these routes by almost 300 percent, doubling market share for these carriers to about 10 percent of RPMs. Major carriers will selectively retaliate and harm some of the weaker

startups. However, on the whole, these tactics will only delay their growth slightly.

The panel urged forecasters to recognize that the Southwest model, while the dominant competitive force in many domestic markets, is not applicable everywhere. It is best suited for high-volume short-haul markets, which account for only 10 to 15 percent of total industry RPM. Moreover, that major carriers may well continue serving most of these markets, even at a deficit, to support their hub systems and feed more profitable longer-haul flight.

Amid these structural shifts, long-distance routes are expected to become the real profit centers for major hub operators. With many cost-cutting measures already in place, major carriers will turn their attention to labor salaries and productivity. They are already establishing high-productivity subsidiaries on short-haul routes. However, progress on this front is expected to be slow and may be delayed by labor resistance. It is unlikely that these spinoff carriers will replace the majors' traditional hub-and-spoke operations. Instead, they will merely supplement them.

Only those carriers experiencing severe fiscal stress are likely to succeed in efforts to create spinoff carriers. (That Continental Airlines, a troubled carrier, was the first major carrier to unveil a plan for a low-cost subsidiary is hardly a surprise). American, Delta, and United are not likely to enjoy similar success in cutting costs before the end of the century.

Capacity and Pricing Changes

Carriers are already committed to reducing their capacity in upcoming years. While carriers added 150 or more aircraft to their fleets during both 1991 and 1992, they will reduce their fleets by 45 and 24 planes, respectively, during 1993 and 1994. After retiring older Stage II aircraft, their fleets will increase by only 10 planes in 1995.

These reductions will encourage carriers to scale back services at secondary hubs and on unprofitable routes. Particularly vulnerable are smaller hubs such as Washington Dulles, Raleigh-Durham, Nashville, and Memphis. Low-price competitors will fill much of the void left by these cutbacks.

Low-cost competition and cash-flow problems cannot be blamed for the industry's recent pricing woes. Major carriers will continue to use pricing as a tool to generate incremental revenue. Little evidence suggests that carriers have learned from the price wars of the past. Currently, yields are lower than they were in 1981 (12.86 cents vs. 12.97 cents). Adjusted for inflation, real yields

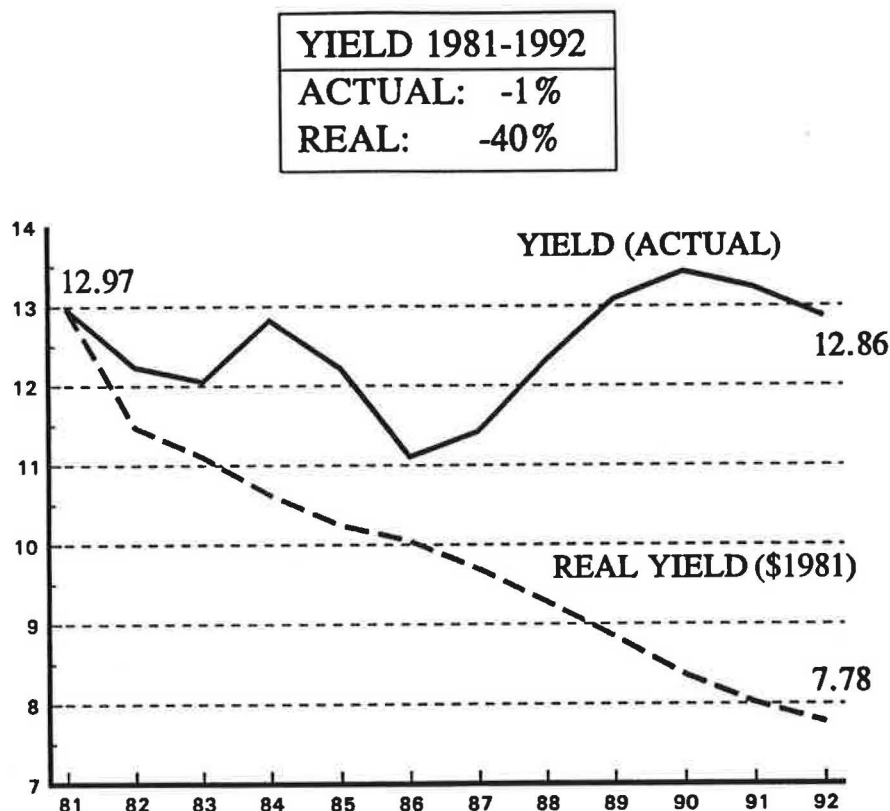


FIGURE 41 Domestic industry yields.

have declined for twelve consecutive years (Figure 41), a trend that panelists expected to continue in the years ahead.

The proliferation of corporate discounts and other specially negotiated prices will make long-lasting changes to yield management difficult. Adding to these problems are the recent court rulings that make upward pricing action more cumbersome and the expanding burden of frequent flyer programs. (Free trips are expected to rise from 8 to 10 percent of RPM by 1997.)

Cutbacks in capacity could provide temporary relief, slowing down these yield declines. (One panelist went so far as to predict that capacity reductions will significantly improve yields by early 1994 and that excess capacity would not be a significant pricing problem until 2000.) Also buttressing yields is the industry's recovery from the "simplified" Value Plan fare structure, implemented briefly last year, which slashed business revenue dramatically.

The panel could reach no consensus about the future structure of air fares. Several panelists asserted that simplified structures were destined to reemerge as carriers battled the proliferation of "unpublished" fares. Others maintained that these structures would not be viable because of their dilutionary effects on business revenues.

Air Travel: A Mature Industry?

As the millennium approaches, the U.S. air travel market exhibits the telltale signs of a mature industry. Firms are increasingly selling to experienced buyers; competition is shifting toward cost control; new products are becoming more difficult to develop; and overcapacity remains a perennial concern.

This phenomenon is illustrated statistically in Figure 42. Between 1950 and 1980 domestic air travel was a recession-proof sector of the economy, experiencing a rise from 0.2 percent of GDP in 1950 to 0.85 percent in 1980. Beginning in 1991 the industry began its inevitable descent.

As the industry matures, its growth will be roughly proportional to overall U.S. economic growth. Airlines will need to turn to price reductions to generate large numbers of new passengers. These price cuts could depress total industry revenues.

The business market is maturing most rapidly. Business traffic is expected to decline by roughly 0.5 percentage points per year (it currently accounts for about 40 percent of RPM). Advances in telecommunications will chip away at demand. The technology necessary for widespread "desktop video-

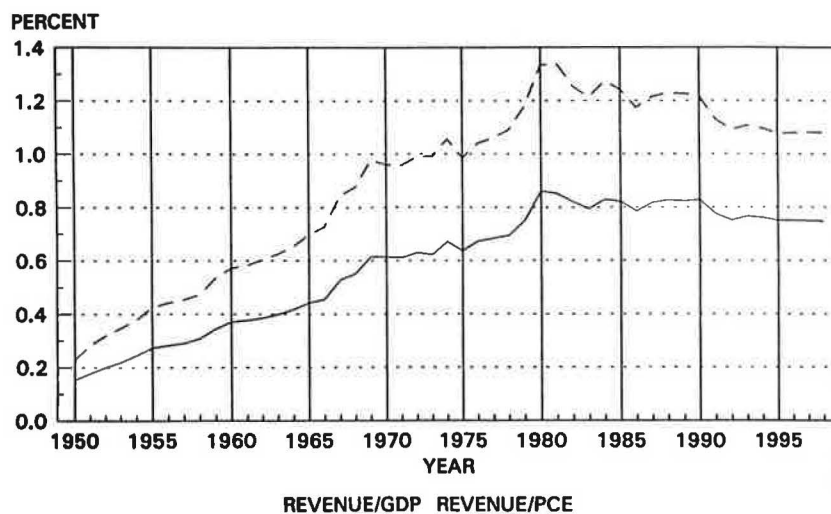


FIGURE 42 Domestic passenger revenue, as a share of the economy.

conferencing" (i.e., a visual system linked with personal computers) is only three to five years away. One panelist estimated that this technology could provide an effective substitute for as much as 33 percent of business traffic by the next century, although other panelists questioned this assertion.

In general, new technology will affect air travel in unpredictable ways. Conceivably, the growth in long-distance communication ushered in by advanced telecommunications could *stimulate* air travel. However, the technology is likely to render business travelers more price sensitive, eroding the base of full-fare traffic. The panel did not foresee high-speed rail services having a similar effect on air travel in the next decade, with the possible exception of Northeast Corridor services. In the

pleasure market, changing demographics will produce two offsetting effects. The aging of the "baby-boom" generation (a segment responsible for the recent explosion of pleasure travel) will lessen discretionary demand. Conversely, the expanding number of retirement-age travelers (a sector with the time and resources to travel extensively) will boost demand on leisure routes. Taken together, these countervailing forces suggest only modest growth in pleasure travel.

The wild card in long-range forecasts is the state of the macroeconomy. Rising State and Federal tax burdens could chip away at disposable income, particularly for upper income groups. However, this effect could be swamped by a general economic recovery, which appears finally to be taking hold.

INTERNATIONAL AVIATION

PANEL LEADER:

Bouke M. Veldman
INB-Pegasus B.V.

PANELISTS:

Robert L. Bowles
Federal Aviation Administration

Mike Hall
British Airways

Louise Congdon
Manchester Airport PLC

Barry K. Humphreys
UK Civil Aviation Authority

Jan Ernst de Groot
KLM Royal Dutch Airlines

Peter A. Kivestu
Northwest Airlines

Robert Duclos
Transport Canada

Henk Ombelet
International Air Transport
Association

Michael Ellis
UK Civil Aviation Authority

Oliver Sellnick
Lufthansa German Airlines

Vicki L. Golich
California State University,
San Marcos

Tove Titlow
Federal Aviation Administration

The panel focused on three topics:

- Multinational airlines,
- Open skies agreements between Europe and North America, and
- Intra-European liberalization.

The panel did not attempt to forecast trends in numerical terms. There was general acceptance that the market conditions are so uncertain that quantitative forecasting is very difficult. Instead, the panel focused qualitatively on external forces that will heavily influence the long-term outcome in international air transportation markets. In this context the panel also covered major areas of government regulation affecting international aviation.

There is general agreement that more and more government policies and regulations will come to be driven by market forces. Policy will be made as a tactical reaction to events and crises, rather than as a result of strategic planning.

General Market Developments

It is clear that the current state of the airline industry is the result of overcapacity in the market. This overcapacity is caused by regulatory exit barriers that not only prevent airlines from leaving markets, but also cause them to retain underutilized or unproductive aircraft and facilities. Aircraft are especially hard to retire. Somehow these exit barriers need to be decreased if market mechanisms are to operate. There was general agreement on the statement that U.S. deregulation has been successful in reducing exit barriers and affords a useful model for Europe and Asia.

Regional liberalization will come before globalization of the airlines. Liberalization creates uncertainty and insecurity for governments and airlines alike, and it will be easier to begin experimentation with free market approaches close to home before attempting to transfer them to a global scale.

Denationalization will precede regionalization, and the combined process will lead to a decrease in the number

of national airlines with global ambitions. As a result the number of international hubs will be limited. Even so, hub and spoke will remain the dominant form of service. There is room for development of nonstop service in some local markets, mainly by new entrants with operations characterized by low cost and high productivity of resources. These new entrants will create greater competitive pressure in the market.

Liberalization and open skies will affect the largest traffic markets first. However, many countries and markets are not mature enough to accept liberalization. Therefore, open skies will take place on a very selective basis.

Two trends can be distinguished. The first is concentration by global carriers in a limited number of profitable city pairs. Some of these city pairs will have a congested airport at only one end, but most of the time both of the airports in the paired cities will have capacity restrictions. This will limit the opportunities for foreign carriers to extend service beyond the hubs. For example, it is very difficult for European airlines to secure feeder traffic at Chicago O'Hare. All the current feeder routes are controlled by U.S. carriers, which also control gates, baggage handling, ticket counters, and service facilities at the hub airports. This will mean that in the limited number of city pairs where global carriers can effect a penetration and be profitable larger aircraft will be needed, both as a way to overcome congestion and as a way to lower their entry costs. This, in turn, will be a driving force to develop and introduce new aircraft with 800 or more seats.

On the other hand secondary cities that are not now hubs have a great potential for nonstop service using regional jets or turboprop aircraft that bypass the major hubs. Because these aircraft will probably have somewhat higher operating costs per seat, service will be provided by low-cost carriers, either new entrants or subsidiaries of the global airlines. British Airways Regional, offering long-haul service from Manchester, is a forerunner of this trend.

Although most of the discussion focused on European and North American developments, the panel recognized that the Pacific Rim still offers the largest growth potential. The difference between the North Atlantic and the Pacific Rim is that most Asian countries are not and will not be ready for liberalization for some time. Bilateral conflicts will have a limited impact as long as the total market is growing as it is in Asia. This is in sharp contrast with the North Atlantic, where the market is virtually mature and competition for market share is intense.

In the near term franchising of airline services will spread because it makes economic sense. Codesharing is essential in negotiation for route rights.

The panel thought it doubtful that new technology such as teleconferencing will negatively influence intercontinental traffic. First there is the problem of time difference. Second, language and cultural differences often require local presence to transact business. The panel did not expect that teleconferencing would have much effect on nonbusiness travel, which is a large and steadily increasing share of the international market.

Open Skies

Although the report of the National *Commission to Ensure a Strong and Competitive Airline Industry strongly advocates open skies, it is not clear how the Commission defines it. There are two problems. One is a difference of philosophy between the United States and Europe. The second is the question of how to resolve disagreements on particulars that may arise in negotiations between countries. Essential here is an effective and quick process to reconcile philosophical differences and to settle disputes. The problems are particularly acute on matters such as computer reservation systems, airport handling, security, and frequent flyer programs.

Even if there were international agreement on a definition of open skies, the panel remained skeptical about whether it could be implemented. At the heart of open skies is the question of free market access. If, however, that access is limited by infrastructure constraints on both sides of the ocean, it is doubtful that the principle can be put into practice. A key issue is the right of access to markets beyond the major hubs.

The plea of the airlines is for governments to shift from a comprehensive regulatory approach to a policy of selective intervention on a flexible, case-by-case basis when disputes arise. A rapid system of arbitration would certainly help promote more liberalized market conditions and offer each player equal opportunities. Harmonization of antitrust legislation among countries would be essential.

Because open skies is attractive to different countries for different reasons, the prospects of successful negotiations between blocs and conclusion of multilateral treaties are slight. Bloc negotiations would probably concentrate on protective measures intended to limit access to domestic

markets rather than to enhance opportunities. As a result, the present system of bilateral agreements will be around for a long time to come.

Given the increasing opportunities in the market, there was a general feeling of disappointment among panelists that airlines have so little information on passenger needs and preferences. The panel regretted the disappearance of the Gallup Poll formerly conducted for the U.S. Air Transport Association and strongly recommended a search for alternative methods of market survey.

Multinational Airlines

The motives for formation of multinational airlines are much the same as those for open skies. Barriers to market access due to government regulation is forcing airlines to buy equity in foreign carriers. Remarkably, the interest in multinational ownership is one-directional. European airlines are seeking to invest in U.S. airlines, but not vice versa. The financial state of the airlines on either side of the Atlantic is frequently cited as the reason, but it also appears that U.S. carriers have fewer problems in Europe than European carriers do in the United States.

Equity in itself is not that important. Even a small equity share provides some measure of control over the majority owner. The panel felt that uncertainty of government policies with respect to foreign ownership is a bigger problem than equity participation rules.

The likelihood that a large number of multinational airlines would come into being was considered low, mainly because mergers are difficult to manage successfully. Experience here and in Europe has shown that total integration of two or more airlines gives rise to many unforeseen problems.

There is need for clearer criteria for foreign ownership and more good economic research on the effects that transnational airlines have on national economies. The main focus up to now has been on negative effects (such as loss of employment). The positive effects also deserve attention.

Intra-European Liberalization

The panel thought that the European approach to free markets will be different from that of the United States, largely because of geography. In the United States population densities are highest on the borders of the continent, a distribution that favors hub-and-spoke route structures. In Europe the population is centered in the middle of the continent. Average stage lengths are smaller, and there is strong competition from other modes of transport. As a result formation of new hubs in Europe will be limited, and airlines there will tend to prefer alliances.

Conclusion

The panel agreed that international aviation has great growth potential. However, regulatory barriers will come down slowly. Exit barriers are chiefly responsible for the overcapacity that currently characterizes the industry. Governments will continue to play an important role in the market, but for international aviation to grow government approaches will have to become more flexible and more responsive to market conditions. Regulators will have to learn to follow the market rather than attempt to dictate how the market will develop.

REGIONAL AVIATION

PANEL LEADER:

Steven M. Horner
Bombardier Regional Aircraft

PANELISTS:

Doug Abbey
AvStat Associates

Deborah C. McElroy
Regional Airline Association

Michael Ambrose
European Regional Airline Assn.

Charles Moles
Federal Aviation Administration

David M. Behrman
AMR Eagle, Inc.

Amit Rikhi
Apogee Research

Gus Carbonell
Mesa Airlines, Inc

Grady Stone
USAir

Pierre Herron
Pratt & Whitney Canada, Inc.

Richard Van Balen
Consultant

Steven W. Johnson
Honeywell, Inc.

Karl Zaeske
Collins, Rockwell International

Introduction

The panel was comprised of experts in regional aviation from North America and Europe. The task of the panel was, through the use of specifically assigned discussion topics, to attempt to determine the long-term issues confronting regional aviation over the next 10 to 12 years. Approximately half of the panel members researched and presented information relevant to the future of regional aviation.

Regional airlines have been one of the fastest growing and most profitable segments of the air transportation system for several years. However, their fate and success continue to be inextricably tied to that of their marketing partners (almost always major airlines).

Regional airlines are currently at a crossroads, with record growth and new opportunities brought on with revolutionary aircraft in many size categories. Despite the recent success, there is uncertainty concerning the long-term prospects for the industry considering the world economic malaise, the financial condition of major airline partners, and doubt about the future structure of the air transport system (hub-and-spoke networks, airline

industry concentration, and competition from alternative modes such as high-speed rail and teleconferencing)

Short-term changes in the major airline arena, such as another round of new-entrant airlines in the United States, add uncertainty to an already dynamic environment. Since the regional airlines are so closely linked to major airlines, any move by major airlines to change the operating structure would affect regional airlines. Frequent fare adjustments, usually downward, during the past two years illustrate this relationship.

General Economic Environment

Very few factors have such a profound influence air transportation as the economic environment, which affects both business and leisure travel. As long as worldwide economic recovery is slow, or perceived as such, airlines will experience mediocre growth. This situation benefits regional airlines, in that they can pick up routes than might otherwise be served by major airlines, but it also directly affects the operational and planning psychology of the regional airlines. Although

most regional airlines are profitable while major airlines are not, there remains an uncertainty about the economic recovery worldwide and the level of sustained growth which will follow. Any uncertainty, despite current success, leads to doubt in the minds of regional airlines.

With the current *en-vogue* position of Southwest, Morris, and other successful low-cost, low-fare airlines, questions have arisen about the maturity of the market for air travel at a constant yield. Is the market mature or can volume be stimulated by fare elasticity? All theories are probably correct under different circumstances. What ever the answer, regional airlines are adversely affected by the instability caused by industry restructuring and experimentation.

Hand in hand with this is concern about the continuing threat of new-entrant airlines that focus on short-haul, rather than long-haul, services.

These three factors combined produce a high-level of uncertainty despite facts the historic success of regional airlines and their potential to serve small markets.

Major Airline Operating Philosophy

Unlike the profitable regional airlines, major airlines continue to be troubled with unhealthy balance sheets, aging aircraft, and higher than acceptable costs. This situation has forced major airlines to speed up the process of transferring short-haul routes to their regional partners. However, this process has been sporadic and without a strategic rationale and regard for long-term impacts. It is shocking to see how many short-haul markets are currently served by major airlines with cost structures and equipment that are not suited to the short-haul mission.

Data presented to the panel to indicate the ongoing presence of major airlines in short-haul markets is shown in Table 4.

These data clearly show that, despite the trend of route transfers from major to regional airlines, there is still much progress to be made. Why do major airlines continue to operate such a large number of obviously unprofitable routes at a time when costs, traffic, and the need for revenue are creating such pressure? There appear to be four factors used by major airlines to justify their continued presence in markets that could be better and more economically served by regional airlines:

- market, competition, and passenger acceptance,
- yield,
- fleet utilization, scheduling, and maintenance, and
- political considerations and "sacred cow" routes.

TABLE 4 MAJOR AIRLINE SHORT-HAUL HUB SEGMENTS (<400 MILES)

<u>Segments with Load Factors Under 50%</u>			
Short-Haul			
<u>Major Airline</u>	<u>City Pairs</u>	<u>Number</u>	<u>Percent</u>
American	59	28	47
Continental	32	19	59
Delta	84	48	57
Northwest	52	27	52
TWA	21	6	29
United	39	2	5
USAir	186	100	54
	—	—	—
TOTAL	473	230	49

The economic pressure of the past two years is catching up with the major airlines on their short-haul routes. Major airlines are beginning to reevaluate their short-haul services, the structure of their hubs, and cost containment. In some cases point-to-point services are under consideration. These responses can be viewed as a double-edged sword: advantageous to regional airlines if transfers increase or disadvantageous if there are rapid structural changes that affect the business philosophy of regional feed services.

Panelists expressed a certain amount of frustration with the evaluation processes now under way at the major airlines. With the majors considering low-cost subsidiaries or other solutions to the short-haul problem, they are ignoring a readily available solution: increasing services with a regional partner with whom they already have a relationship. This lack of communication is prevalent in most of the major-regional relationships, with a few notable exceptions.

In an attempt to clarify and explain the structural relationship among major, national, and regional carriers over the past eight to ten years, the panel suggested that it might be helpful to consider the shift of a route from a major to a regional carrier not as a transfer but as a route return. In many cases the routes turned over to a regional airline are routes that were operated by a local service carrier prior to deregulation. The local service carriers had structurally different philosophies and cost

levels. During the consolidation phase, when majors bought or merged with smaller national airlines, the majors brought along with them a long-haul operating philosophy and a cost structure that were inappropriate to these short-haul routes. Return of routes such as these to a regional partner will provide a carrier that is properly structured to operate them profitably.

Evolution of Regional Airlines

The short-haul airlines are evolving into an industry with a different structure. While questions remain as to the number of hubs, their role, and the reemergence of direct point-to-point service, a larger role for cost-conscious regional airlines seems assured.

This evolution and growth will undoubtedly challenge regional airlines in a way many of them have never experienced. A notable aspect of this change will be the general transfer of the 75- to 100-seat class aircraft to large regionals by the middle of the next decade. This, in turn, is likely to result in the transfer of the smallest category of regional services to a new class of commuter-regional carriers specifically adapted to operating 19- to 25-seat aircraft. (Table 5)

TABLE 5 STRUCTURAL CHANGES IN AIRLINES BY 2000

	<u>Major</u>	<u>National</u>	<u>Regional</u>
Average Aircraft Seats	135	130	44
Stage Length (nautical miles)	885	453	338
Percent Growth in Available Seat Miles, 1993-2000	3.5	8.0	20.5

Source: BRAD prediction, *Regional Airlines in the Year 2000*

During this evolutionary process it will be of utmost importance that regional airlines give full attention to the issues of maturation in their fleets, cost, structure, and operating practice if they are to survive and prosper.

Globalization

Partnerships resulting from the ongoing trend toward globalization trend will probably take longer to implement than planned, and may not meet expectations. Regional airlines are beginning to experience the globalization process first hand, especially following the implementation by British Airways of a regional air service structure across several countries in Europe. Mike Ambrose of the European Regional Airlines Association gave the panel a valuable overview of the European environment that explained the inherent reasons for present and future difficulties.

The primary obstacles are cultural, but differing operating environments, planning philosophies, and airport capacities also play a part. The multiplicity of European regulatory authorities is a prime example:

<u>Regulatory Authorities</u>	<u>Member Countries</u>
European Community	12
ECAC (ICAO)	32
Eurocontrol (air traffic control)	18
Joint Airworthiness Authority	18
National Airworthiness Authorities	32

The United States is lucky that it has a common language, currency, and data reporting requirements. As U.S. airlines begin or continue their move toward globalization, they will encounter these types of issues head on.

Closer to home, NAFTA could present similar challenges to aviation, and business in general. Information presented to the panel suggested that the impact of NAFTA on air travel demand would be slight—fewer than 10 new regional aircraft added to the three-nation fleet and only a small increase in load factors over a period of several years.

Consolidation

There will be a need for continued consolidation by major and regional airlines, as well as in the regional aircraft manufacturing sector, which is overburdened by competing products. Although there has been some corporate consolidation with the Bombardier acquisition

of de Havilland and the DASA acquisition of Fokker, the of products offered remains about the same. In the short term, the hope of product rationalization is slight; all manufacturers are investigating additional products. While some of these announcements are believed to be simply political posturing, new products are a dangerous proposition until the total number of product offerings is reduced.

Conclusion

The general outlook for the regional airlines is upbeat, perhaps even more so than at the TRB Future Aviation Activities Workshop two years ago. Most regional carriers have come through the slow economic recovery with record traffic and profits, positioning them to build on their success in the coming years. Success, however, remains inextricably tied to the fortunes of the major carriers with which they are marketing partners. Doubts about the financial health of the majors, the structure of the air transport industry, and the competitive environment here and abroad cloud the skies ahead.

AIRCRAFT AND ENGINE MANUFACTURERS**PANEL LEADER:**

Vernon F. Thomas
GE Aircraft Engines

PANELISTS:

Alain Buttaud
SNECMA

Anders Nilsson
Volvo Flygmotor AB

Steve Charters
Rolls-Royce PLC

Manfred Otersen
Deutsche Aerospace MBB

Ludwig Erlebach
Motor-und-Turbinen-Union

Pravin M. Parmar
Northrop Corporation

Eric Frankenberg
Douglas Aircraft Co.

Giovanni Ronchetto Salvana
Fiat Avio S.p.a.

Gary Ives
Hurel-Dubois UK, Ltd.

Kei Sozuka
IHI Aero Engine & Space Operation

Billie Jones
Pratt & Whitney

Paul Steggerda
Honeywell

Peter Jost
Airbus Industrie

Leonard A. Theroux
International Aero Engines

Mary Pat Kanalas
GE Aircraft Engines

Dirk J. van den Berg
Fokker B.V.

Mike Lee
Dowty Aerospace Group

Thomas J. Vild
Consultant

Penny L. Mefford
Federal Aviation Administration

John Walsh
Rohr Industries, Inc.

Steve Murray
BAe Airbus, Ltd.

Alfred J. Whittle
Martin Marietta

Quantitative Issues*Traffic Demand and Growth*

The panel's consensus forecast put worldwide traffic growth at about 5 percent per annum for the next fifteen years, with individual estimates ranging between 4.6 and 5.6 percent. (Figure 43) The panel estimated that U.S.

growth would be about one percentage point below the world average. Linkage of traffic growth to GDP growth was generally assumed, but there was some opinion that the relationship would become more tenuous, especially toward the end of the 15-year forecast period. Does this indicate a mature market insofar as insofar as the United States and Western Europe are concerned? If mature is defined as a market in which a static percentage of GDP is expended for the goods or service

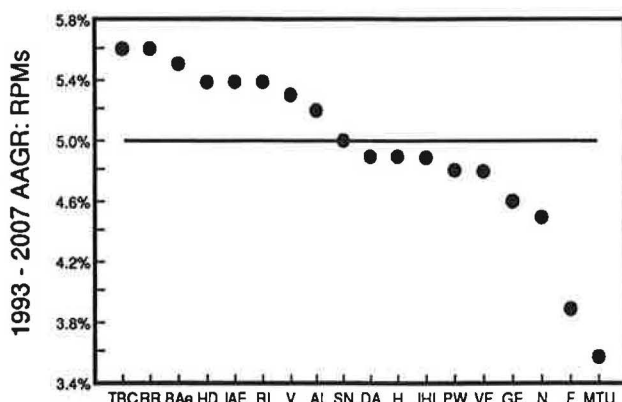


FIGURE 43 15-year traffic growth forecast (dispersion around consensus forecast: 5.0%).

in question, then perhaps the answer is yes. In both the United States and Europe the expenditure for air travel seems to have reached a plateau of about 1 percent. If so, one would expect air travel to grow only as much as the rise in GDP. The panel also observed that external constraints, primarily environmental concerns, might reduce the growth of air travel to a level somewhat less than the growth of GDP.

Unit Deliveries

The panel's consensus forecast projected 8,550 aircraft deliveries over the next 15 years, or about 575 per year. (Figure 44). The 1993-1997 period, however, was expected to see a lower than average delivery volume. A corollary to the linkage between *GDP growth and RPM growth* is that RPM growth and the number of aircraft deliveries are correlated. However, there is some

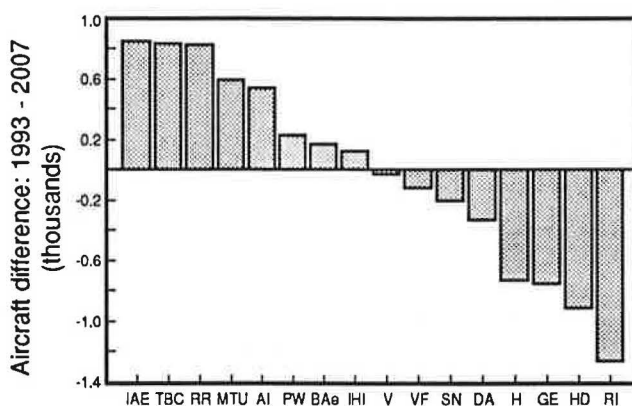


FIGURE 44 15-year aircraft delivery forecast (dispersion around consensus forecast: 8,550).

evidence that the assumption of a synchronous relationship may not be valid. If, indeed, we are in the midst of a structural change in the industry that we cannot yet adequately describe or quantify, our current views on future equipment deliveries may come to grief. Some possible indicators of such a change are discussed later in the section entitled "Defining Issues".

Another major concern of the panel was that equipment forecasts are largely predicated on the availability of capital. That assumption, however, is likely to founder if the airlines are unable to generate funds internally or to attract external investment at desirable rates and in sufficient quantity to meet their needs.

Aircraft Retirements

The consensus view of the panel was that about 3,875 aircraft would be retired over the next 15 years, which is to say slightly over 250 aircraft per year. (Figure 45) Even granting phase-out of the Stage 2 fleet on the current schedule, this is still a somewhat optimistic estimate. The number of retirements is admittedly one of the weakest links in the forecasting process due to our collective lack of experience. There are simply not enough data points. One of the imponderables is the 1,000 or so aircraft that are currently parked. How many of the 300 to 400 now inactive Stage 3 and newer Stage 2 aircraft will be returned to service as the economy and the demand for air travel recover? Another imponderable is the life expectancy of modern aircraft. Some of the panelists' research indicates that the economic life of modern airplanes may be longer than previously assumed, perhaps as long as 30 years or more.

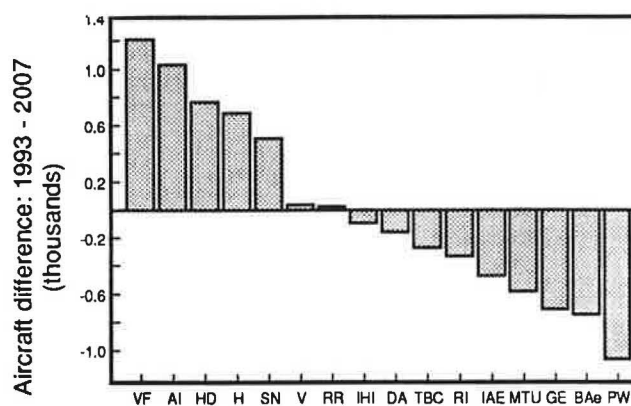


FIGURE 45 15-year aircraft retirement forecast (dispersion around consensus forecast: 3,880).

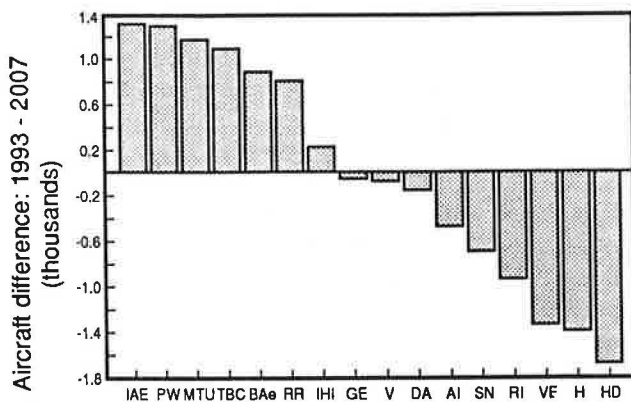


FIGURE 46 2007 fleet forecast (dispersion around consensus forecast: 13,632).

Fleet Growth and Mix

Adding forecasted aircraft deliveries and subtracting retirements gives a composite worldwide growth to a commercial aircraft fleet of some 13,500 aircraft by the end of 2007. The range of panel estimates, however, was substantial — almost 3,000 aircraft, or 11 percent above and below the average. (Figure 46) This dispersion indicates the need to monitor more closely the number of aircraft by seating capacity. A suggestion was that it might be well to restate forecasts in terms of seats in service since the fleet mix can dramatically affect aircraft size and productivity assumptions.

The panel raised two particularly pertinent questions concerning aircraft types in the fleet mix. First, will demand growth justify introduction of the much-talked-about New Large Aircraft (800+ seats), Ultra High Capacity Aircraft (1,000+ seats), or some form of advanced narrow-body passenger aircraft? Will slackening of demand effectively act as a brake on model proliferation? Second, are current airline industry difficulties severe enough to reduce short-term aircraft production rates or to threaten the economic viability of new aircraft models such as the Airbus A330 and A340, the McDonnell-Douglas MD 90, and the Boeing 777?

Qualitative Issues

Short-Term Issues (1993-1997)

A listing of the issues that the panel considered either most important in determining future aircraft deliveries or most difficult to forecast within the next five years are presented in Table 6. A graphic depiction of the four

most critical issues in terms of their combined difficulty and importance is shown in Figure 47.

Long-Term Issues (1998-2007)

The complete list of important and difficult issues for the 1998- 2007 time period is detailed in Table 7. The panel that are highest with respect to their combined difficulty and importance. Figure 48)

TABLE 6 ISSUES DURING THE NEXT FIVE YEARS

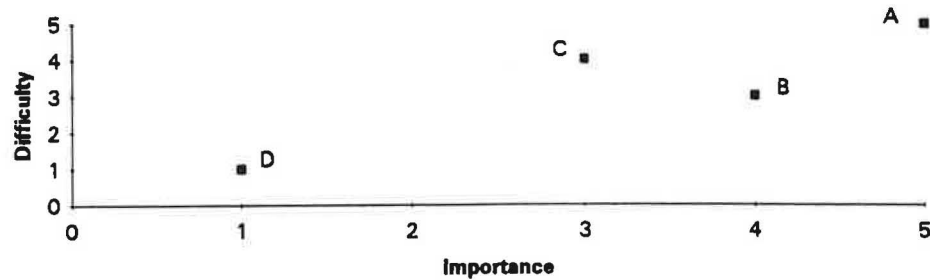
<u>Important issues in determining future aircraft deliveries</u>	<u>Scores</u>	
	<u>Raw</u>	<u>Weighted</u>
• Order cancellations/delivery deferrals	20	78
• Availability and/or affordability of capital	17	54
• Yield management/pricing policies	12	39
• Noise legislation	7	20
• Hub-and-spoke vs. point-to-point operations	6	15
<u>Difficult issues to forecast</u>		
• Order cancellations/delivery deferrals	14	51
• Yield management/pricing policies	12	43
• Availability and/or affordability of capital	11	34
• Re-engining/hush kitting	9	25
• European liberalization of airlines	9	25
• Hub-and-spoke vs. point-to-point operations	7	16
• Wider intro. of western aircraft into CIS	4	16

TABLE 7 ISSUES, 1998-2007

<u>Important issues in determining future aircraft deliveries</u>	<u>Scores</u>	
	<u>Raw</u>	<u>Weighted</u>
• Congestion as a growth constraint	12	41
• Noise legislation	11	35
• Globalization of airlines	9	30
• Availability and/or affordability of capital	8	26
• "Ageing"/high-cycle aircraft concerns	7	23
<u>Difficult issues to forecast</u>		
• Congestion as a growth constraint	10	36
• Globalization of airlines	10	31
• Oil/fuel price trend	10	28
• Wider intro. of western aircraft into CIS	9	26
• Hub-and-spoke vs. point-to-point operations	8	23

Defining Issues

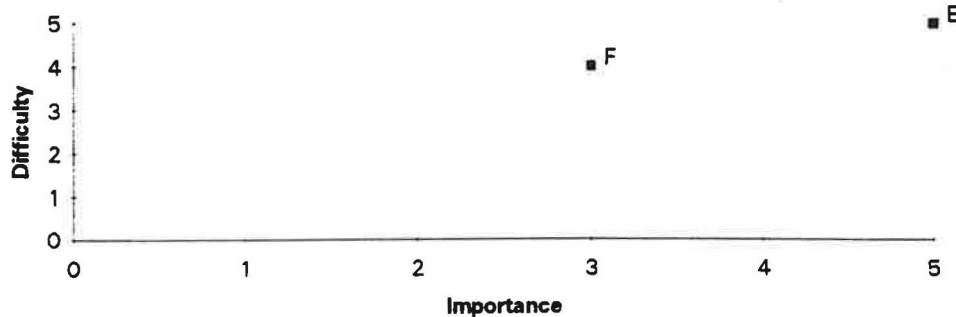
Under this heading, the panel brought together the issues for which they had no definitive answers, but which most panel members felt will be of special significance in shaping the landscape of the industry in the years to come. It is not that the panel did not wrestle, nor that they had no opinion on them. Quite the contrary. It is simply that these issues were far from as easily quantified than most and consideration of the



KEY:

- A. Order cancellations and delivery deferrals
- B. Availability and/or affordability of capital
- C. Yield management and pricing policies
- D. Hub-and-spoke vs. point-to-point operations

FIGURE 47 Critical short-term issues.



KEY:

- E. Congestion as a growth constraint
- F. Globalization of airlines

FIGURE 48 Critical long-term issues.

discussion elicited a very wide variety of answers. They are perhaps best thought of as primary fuel for scenario-building exercises. Many of these issues have a quality about them that leads one to think (or fear) they could become defining issues in the future of the commercial aviation industry. These issues are itemized below.

- *The composition of demand:* How does money get spent in the travel market? Is Asian growth likely to be as robust as everyone assumes? Are we building too many Cadillacs (full service airlines) when the world is clamoring for more Chevrolets (airlines like Southwest)?

- *Retirement realities:* Where does money for new aircraft come from? When will Stage 2 aircraft be fully retired?

- *Noise and emissions:* How important are the "green" issues? How do we pay for the seeming inevitability of accommodating these concerns?

- *Bigger or smaller aircraft:* What direction will average aircraft size take? What is the linkage of

aircraft size to the question of hub-and spoke vs. point-to-point service?

- *Productivity:* Will the airlines be able to control cost and learn to do more with less? Will a significant increase in airline productivity severely depress demand for new equipment?

- *Industry financial constraints:* Are they as grim as they appear? (A model commissioned by one panel member suggests they are, perhaps even more so.)

- *The current overcapacity situation:* What will be the long-term effects on the financial picture for airlines, company strength, and viability? How will this affect the rate of developing and introducing new technology, aircraft delivery volumes, the success of new programs, and industry employment?

- *Video-conferencing technology:* What will be the impact of desk-top capability on the growth rate of the high-yield business travel sector?

- *Technology vs. return on investment:* Is there a reluctance on the part of airlines accept technology that

does not offer a short-term payoff? Simultaneously, is there is a reluctance on the part of the manufacturing sector to invest in new technology without assurance of an adequate return on investment. The obvious and sobering conclusion is that the welfare of the manufacturing sector depends on the airlines' collective ability to manage their way back to sustained profitability — no mean feat in today's environment.

AVIATION INFRASTRUCTURE

PANEL LEADERS:

Richard S. Golaszewski
Gellman Research Associates, Inc.

Lloyd A. McCoomb
Transport Canada

PANELISTS:

Tom Browne
Air Transport Association

Laurence J. Kiernan
Federal Aviation Administration

Jean-Marie Chevalier
Aéroport de Paris

James Muldoon
Federal Aviation Administration

James C. De Long
Stapleton International Airport

Clinton Oster
Indiana University

Richard de Neufville
Massachusetts Institute of Technology

Kenneth W. Peppard
Federal Aviation Administration

Kevin Dopart
Office of Technology Assessment

John S. Strong
Harvard Institute for
International Development

William A. Fife
Port Authority of New York
and New Jersey

Erwin von den Steinen
International Transport Policy
Analysis

David Gillen
Wilfrid Laurier University

James A. Wilding
Metropolitan Washington Airports
Authority

Gordon Hamilton
Sypher Muller International, Inc.

Thomas Windmuller
IATA Centre

Tom Henry
Federal Aviation Administration

Steven Zaidman
Federal Aviation Administration

Overview

The panel on aviation infrastructure addressed the question of whether the availability and/or costs of infrastructure would be a limiting factor in achieving aviation activity forecasts over the next twelve years. The scope of the panel included both airport and air traffic control (ATC) infrastructure issues.

On the whole, the panel concluded that the availability of infrastructure will not likely constrain aviation activity or aviation system growth. Improvements in infrastructure both for airports and air traffic control are

necessary, but it is most probable that they can be made as and when needed. Since costs are passed on to users, it is important that investment strategies be prudent and realistic because of the poor financial condition of the airline industry. (Airlines pay the largest share of user costs for airport and ATC infrastructure.)

This is not to say that in some locations all demand will be accommodated at the facility or time of first choice. In locations such as London, Los Angeles, New York, Tokyo, and elsewhere, there will be site-specific ATC and airport capacity problems. Some facilities cannot be expanded for either physical or environmental

reasons. In addition, at some times of the day, the demand for some facilities well exceeds the available capacity even in good weather conditions. Therefore, there will be a need to allocate scarce capacity by either administrative or economic means.

The panel also noted that aviation was becoming more like other industries. Projects which provide a return on investment can be financed on a commercial basis through user fees or other means. Airports have shown the capability to access financial markets to raise funds for sound projects. It is likely they will be able to do so in the future. Airports are becoming less reliant on airline guarantees of long-term debt. (in fact, airports are likely to be more creditworthy than their principal customers the airlines.) The panel believed that using market principles to develop and operate aviation infrastructure and to allocate scarce infrastructure resources would reduce the likelihood that infrastructure will become a critical constraint. Market disciplines should do much to prevent the development of speculative projects, i.e., projects where there may not be sufficient demand to warrant the level of investment.

Dr. John Strong, in a presentation in the aviation system in the Russian Republic and Independent States, noted that there was significant upheaval in the air transportation markets in this region. (Appendix A contains Dr. Strong's presentation.) The introduction of market prices for aviation fuel has resulted in large price increases for air travel. As such, demand for domestic air travel has been reduced by about 70 percent over the last two years. It may take up to 10 years for traffic to return to 1990 levels. The ability to invest in airport and ATC infrastructure in Russia and the Independent States requires stability in the airline market as well as a separation of the large regional aviation companies which control airlines, airports and ATC within the a single organization.

While projected growth rates in aviation activity vary among regions of the world, there is still absolute growth projected for all regions of the world. Dr. Oster's presentation on growth projections looked at this in detail. (See Appendix B.) Those regions with lower rates of growth tend to be those with the highest bases of traffic and will have the largest absolute growth in numbers of passengers or cargo shipments. Hence there will be a continuing need for infrastructure development in nearly all regions of the world. The planning and permitting cycles for major projects such as a new airport or a new runway can run from 10 to 20 years. Planning must begin even if it is not possible to determine exactly when a new facility will be needed. (Once planning and permitting are done, there is some

ability to vary the date on which the new facility becomes operational.

Ground access may be a particular problem in infrastructure development, and it could limit the growth of specific facilities. The aviation industry cannot ignore the necessary intermodal connections which take a traveler or cargo from door-to-door. It does no good to have a modern efficient airport and ATC system if the highways leading to the facility are oversaturated.

Changing Institutions

Organizational and institutional change in the airline industry may spur airports and air traffic control to operate on a more commercial basis. Airlines are reducing costs, increasing productivity, and redeploying capacity in order to improve financial performance. It is likely they will demand the same from those firms that provide support or supply inputs to the airlines. Over the forecast horizon, we are likely to see a more corporate orientation in the provision of infrastructure, with cost, service quality, productivity, and customer satisfaction becoming more important considerations. Not all aspects of this trend will be necessarily welcomed by the airlines as communities seek greater consideration in bilateral negotiations and greater freedom in decision making on infrastructure investment.

Corporatization may be a means for improving infrastructure, but there are little comparative data on airport and ATC cost and productivity trends on which to base intelligent decisions about new organizational forms for providing infrastructure. Many observers think operating infrastructure on a more businesslike basis will make things better for both infrastructure providers and users. (In fact, a number of independent airport authorities are introducing market pricing for retail concessions.) However, there are concerns about a leveraged buyout or asset-sale mentality in the privatization of infrastructure. The panel expressed concerns about the potential exploitation of infrastructure monopolies as sources of cash to support other governmental activities. There is a clear need for improved measurement tools on airport and ATC cost and productivity to support institutional reform. The lack of cost, performance, service quality and other comparative data for aviation infrastructure may be a worthwhile area of research for the Transportation Research Board.

There are other types of institutional reform which can take place in the context of existing organizations. For example, demand management through pricing

mechanisms provides efficiency benefits in that it tells what users value and what they are willing to pay for access. In addition, it provides signals on when and where to invest in additional capacity. The presentation by Dr. David Gillen provides a useful discussion of these benefits (See Appendix C.) The panel generally recognized the potential for improvements in pricing infrastructure. They noted that there are many new tools that will promote the "smart" pricing of infrastructure. These include advanced communication and positioning technologies in particular.

Activity Measures

The panel concluded that there are requirements for better information on the future composition OF air travel demand. In particular, the following distinctions were believed to be important:

- Business vs. pleasure travel,
- Short-haul vs. long-haul travel, and
- Domestic vs. international travel.

Especially in the case of airports, different facilities may be needed to serve different types of passenger movements.

The panel noted that there was a particular need for better data on air cargo in addition to the typical metrics such as ton-miles or ton-kilometers produced. There has been a revolution in the air cargo industry including the emergence of package express carriers, and the development of just-in-time inventory systems. Air cargo is becoming increasingly more integrated into a multimodal, multiservice product offering total distribution services. Measures that embody the total value of the cargo moved or the total revenue generated from the complete distribution activity (not just the air segment alone) may be better indicators of growth in this sector than the more traditional measures of available and revenue ton-miles or ton-kilometers. The new integrated form of air cargo transportation also has different facility requirements than the more traditional belly cargo on passenger flights.

Global alliances among carriers also can have an effect on terminal facilities. Carriers in an alliance need to collocate to hand traffic off to their partners. As airline markets change, airport roles are also likely to change and may become more specialized. Infrastructure must be built for user needs, but also it must be built with the flexibility to respond to changing markets and the changes occasioned by airline alliances.

The panel noted that, if security needs for domestic flights become equivalent to those for international flights, there will be large cost and facility implications as well as potential downward effects on air travel

demand. This is an issue that is not treated in existing forecasts.

Air Traffic Control

In air traffic control, the institutional side is starting to fall behind the capabilities of ATC technology. Modern ATC technology requires networks that cover large geographic areas to allow users to fully exploit the economies available in user-preferred flight profiles. When ATC is operated as a government entity, these types of networks are difficult to achieve because of sovereignty issues. While sovereignty issues cannot be disregarded, they can be accommodated in a modern ATC system. Technology can be used to control access to specific airspace without relying on national borders or other artificial boundaries.

Satellite technology will make the efficient supply of communication, navigation, and surveillance services feasible everywhere in the world if institutional barriers can be overcome. Such barriers are becoming a particular problem in Asia because there is little cooperation among the states in the region regarding ATC development and operation. There are few multilateral institutions in this area to promote cooperation in the development and operation of a regional ATC system. Asian states would be well-advised to look at the European experience where uneven development and a wide variety of systems and standards led to very inefficient ATC systems that reached crisis proportions and sparked the present effort to harmonize European ATC systems.

There is also a need to look at the benefits and costs of the future air navigation system (FANS) and how such systems must be organized to achieve their potential. There may be a need to operate air traffic on a more business-like basis to produce the necessary savings for users. In turn, it may also be necessary to make fundamental organizational changes so that large integrated ATC can evolve. In particular, the satellite-based ATC systems operated by Fiji and the Seychelles point to the large potential benefits of new technology for oceanic ATC services.

Constraints to Growth

Environmental problems could be the largest constraint on the growth and development of aviation infrastructure. Aircraft noise will continue to be an important issue, but it will be joined by other concerns such as air and water pollution. These matters will have an increasing effect on aviation and other industries as well. The pressure for environmental reform may move to the national and international arena instead of

remaining a local matter as has been case with aircraft noise. All segments of the aviation industry need to take a proactive approach to environmental problems. The industry must promote sensible solutions including continued vigorous efforts to reduce noise levels at the source in order to avoid having inefficient solutions imposed upon them. The industry must determine how aviation can be a good environmental neighbor because it is the right thing to do. In turn, the industry must demand that environmental regulations be reasonable, and that sufficient time be allowed for compliance.

New Technology

Some airports may find it difficult to accommodate the new large aircraft, which may have from 600 to 800 passenger seats. Because of the long life of aviation infrastructure, facilities must be designed today to accommodate these new aircraft that may enter service over the next decade or two. If provisions are not made in the planning and design stages, aviation infrastructure may have to undergo expensive modification before its useful life is complete. The panel thought that it would be worthwhile to take a comprehensive look at the costs of the new large aircraft including research and development, the changes in infrastructure necessary to accommodate them, and basic costs to produce and operate such vehicles.

Some infrastructure providers are already beginning to plan for accommodating intelligent vehicle highway system (IVHS) technology in their access road networks. Major improvements made today to airport road systems are likely to last well beyond the introduction of IVHS. It is necessary to provide for new surface transportation technology in current airport investment programs.

Summary

Significant changes are taking place in the airline industry. It is becoming more dynamic and market driven, and carriers are not tied to specific locations. They will redeploy assets as demand dictates. Alliances,

mergers, and consolidations among carriers will require a more flexible supply of infrastructure.

While it is believed that infrastructure will be adequate generally, there will remain some critical capacity constraints, often in the most important air transportation markets. The use of pricing as a way of allocating resources and producing the funds necessary to develop infrastructure will therefore grow in importance, particularly in these major markets. There are already new types of pricing being employed with good results in the area of landside access to airports. In some cases, there may be a need for new organizational forms for infrastructure provision to stimulate such changes, but much can be done in the context of existing organizations through improved management practices.

The panel noted that the financial state of airlines will drive cost and productivity improvements in aviation infrastructure. There is a need for data on the cost and productivity trends in providing air traffic control and airport services in order to demonstrate the potential benefits of change. The panel supported institutional reform if it results in real improvements in productivity, cost, and customer satisfaction. The panel was concerned about privatization or other forms of leveraged buyouts of infrastructure facilities if the principal purpose is to raise funds for nonaviation activities.

Institutional reform may, in fact, also be necessary for cooperation and coordination to increase infrastructure productivity especially in air traffic control. This is largely driven by technology. The largest constraints and uncertainties to future activity growth are likely to be in the environmental arena and include the cost to remedy existing problems and, in some locations, even the ability to operate aviation infrastructure at its current levels of capacity.

The panel ended with a sobering thought. If there are not productivity improvements in air transport, the real cost of air travel in the future could rise. As the industry comes to depend more on highly price-sensitive leisure travel, this could dampen the growth in aviation activity. TRB may want to explore the long-term trends in the cost and productivity of providing airline services and aviation infrastructure.

BUSINESS AVIATION

PANEL LEADER:

Ralph A. Aceti
Learjet, Inc.

PANELISTS:

Andrew Callen
Boston JetSearch, Inc.

Wilson Leach
Aviation International News

Dong Cho
Wichita State University

Gerald S. McDougall
Southeast Missouri State Univ..

James Christiansen
KC Aviation, Inc.

Richard Van Gemert
KC Aviation, Inc.

Alan Hause
Allied Signal Aerospace

James Veatch
Federal Aviation Administration

Steve Hines
Cessna Aircraft Company

Karl Zaeske
Collins, Rockwell International

The Business Aviation panel discussed a wide range of issues affecting the growth in demand for business aircraft and utilization of the existing fleet. Particular attention was paid to shifts in attitudes and priorities among corporations as they "reengineer" themselves to be more competitive.

Historically, the use of business aircraft has been dominated by corporations that place an extremely high value on the productivity and efficiency of its top managers. "Time saved" in air travel was seen as a multiplier of the productivity of senior management. Companies without aircraft were felt to be at a disadvantage, and so unit sales increased and the industry grew.

During the late 1970s quieter, more efficient, and more capable aircraft were introduced. They provided added rationale for purchase at a time when many companies were broadening the use of a corporate plane to include marketing and other new uses. Even midsize companies were expanding flight departments so they could handle "high priority" travel requirements throughout the company as opposed to just for the head office.

Further justification for purchasing new aircraft included a company's expansion into new markets. As corporations recognized the importance of international business, particularly in the 1980s, they sought more

range and cabin space to accommodate longer trips. Some of these new aircraft were acquired with the added benefit of replacing older technology aircraft, which also reduced maintenance downtime and operating costs. In some cases, a concern about the effects of aging on safety affected the purchase. Some flight departments stated that their CEOs felt the aircraft should be replaced after 10 years to remove any doubt.

Rarely was an aircraft put up for sale for lack of return on investment (ROI). Usually, any downsizing or reduction in the corporate fleet followed other company cutbacks and/or a severe drop in company revenue.

During the late 1980s and early 1990s, more and more firms started applying demanding ROI measurements to the flight department. Management of air travel was put under the same magnifying glass as other processes such as management information systems, food service, security, and graphics. For some companies, the true cost of the flight department was an unpleasant surprise. Business seminars on managing the flight department became popular. Ways were found to cut costs including putting pressure on manufacturers to expand warranty coverage.

In more conservative companies, the value of time saved was withdrawn from the ROI equation causing a direct comparison between airline seats and cost for a

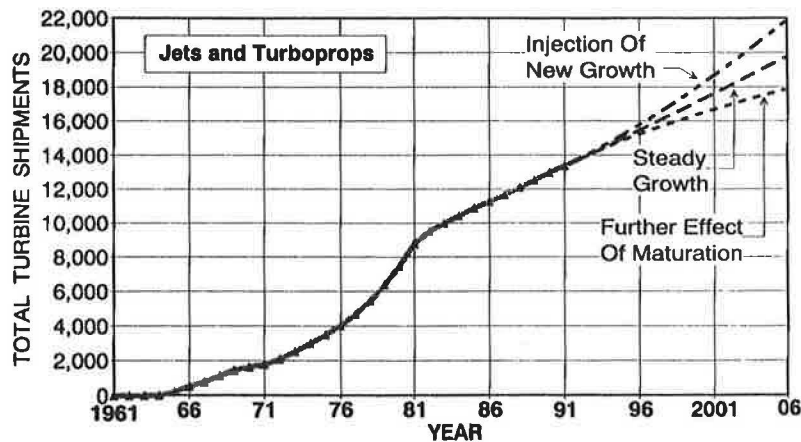


FIGURE 49 Turbine aircraft market, cumulative growth.

flight aboard the corporate aircraft. Since the cost of airline seats was held in check by oversupply, the cost of a new corporate aircraft (which escalated each year) became increasingly harder to justify.

It was said that the ratio of fixed costs to total costs of corporate aircraft in 1980 was 50 percent. Today it has moved to 75 percent because there are fewer tax benefits and inflation is at 2-3 instead of 10-15 percent.

Additionally, companies are now looking for cost reduction in nonstrategic services on the order of 50 percent. In order for travel services departments to gain those savings, major changes will have to take place across the board.

In summary, it took about 30 years for the business aircraft industry to exhibit the classic behavior patterns that are characteristic in other industries. (Figure 49) The 1960s marked the beginning of the industry, the late 1970s represented vigorous growth, the late 1980s modest growth sparked by new technology and new levels of need. The market of the 1990s is a mature market, especially in the United States, which accounts for over 70 percent of turbine aircraft sales.

Three things happen during a mature market:

- There is a shake-out of manufacturers and thinning out of product lines. Niche marketing prevails.
- New, innovative efforts are implemented to reduce operating costs and increase utilization.
- International markets are explored as new centers of growth.

A good deal of shake-out has already taken place. Most of the aircraft companies started by entrepreneurs are now owned by large conglomerates. New aircraft are being aimed at niches that could spur growth. In every case, the new product provide a reduction in cost of

operation and/or a substantial increase in productivity (range times cabin volume times speed divided by cost).

New efforts are being made to increase utilization by lowering costs. Charter companies have begun setting up alliances with companies that own underutilized aircraft. In this way the charter company acts as a broker of available time. Costs are lower since a charter company does not have to carry the asset on the balance sheet. The company owning the aircraft benefits by receiving a portion of the charter proceeds. By working together, they have made chartering more economical, and thus more competitive with airline seats. One charter company has signed up over 80 aircraft owners and reports that business is booming. Another charter organization reports a 10-percent growth in activity between 1992 and 1993 due to a new approach in marketing whereby time is packaged according to corporate needs. 17 percent of this company's business is made up of clients that are new to aircraft chartering.

NetJets is a company that has found success by selling quarter shares of jet aircraft. NetJets buys enough aircraft from one manufacturer to acquire them at an attractive price. They then market flight time in packages that represent as little as an eighth of a share and gives the shareholder asset value and depreciation rights. All aircraft are painted and furnished similarly so they can be put in a pool. Owners are guaranteed to have an aircraft when they need it, flown by NetJets pilots. The owner may be flown to his destination in one aircraft and picked up by another. This allows NetJets to increase aircraft utilization to over twice the norm of the typical corporate jet owner, thus lowering costs per hour. Today the company manages about 30 aircraft that fly missions for about 120 owners. The concept allows everyone involved to gain simply by increasing utilization of assets.

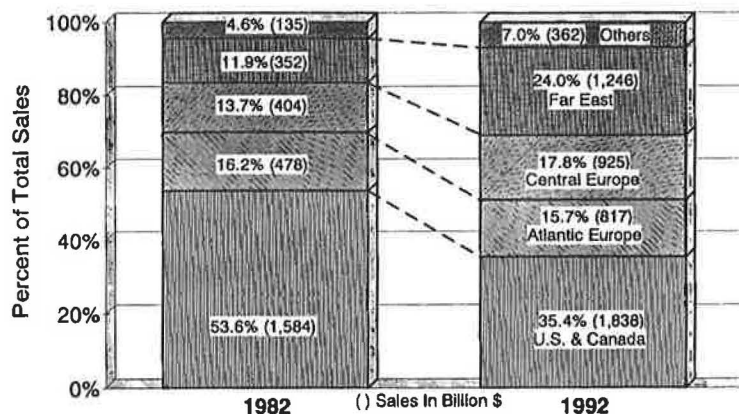


FIGURE 50 Geographic distribution of Fortune Global 500.

To help with the process of increasing utilization, the FAA might find it beneficial to look into making the switch from corporate to charter simpler. If operators under FAR Part 121 could switch to Part 91 or Part 135 depending on requirements, an increased number of aircraft could be adapted to a variety of roles.

While the business aviation market in the United States appears mature, new markets in Asia and Pacific Rim countries combined with the vast potential in Mexico and Brazil offer the industry hope for growth. (Figure 50) There is market demand for aircraft capable

of global flights such as New York to Tokyo. This new segment will overlap airline capabilities, but on a time-sensitive basis. The market forecast for this new segment ranges from 400 to 1,000 units in the next ten years.

Taking advantage of the innovative marketing concepts to lower costs in North America cited earlier and applying them internationally promises new business opportunities for those with the vision and resources to make it happen.

VERTICAL FLIGHT

PANEL LEADER:

David S. Lawrence
Sikorsky Aircraft

PANELISTS:

Vern Albert
Petroleum Helicopters, Inc.

Don Guffy
Federal Aviation Administration

Thomas L. Bosco
Port Authority of NY & NJ

Deborah C. McElroy
Regional Airlines Association

Pamela K. Charles
Helicopter Association International

Deborah Peisen
SCT, Inc.

Chuck Dennis
Federal Aviation Administration

Bruce Stoehr
BSA Company

Kenneth Flick
Council of Governments

The Vertical Flight Panel, by design, included only one original equipment manufacturer and one commercial operator, but it was enhanced by a broad cross-section of key people from industries and communities that influence the use of vertical flight aircraft. The objective of the panel was agreed to make a nonnormative projection and assessment of conditions during the next 10 years that might determine the strength of current and new markets for rotorcraft and would influence their supply and demand. Numerical forecasts were neither requested nor offered, and criticisms of existing or projected constraints on industry growth were discussed only in the context of possible changes in those constraints that might affect the FAA forecast.

Growth of Fleet Size and Activity

The panel agreed that zero to moderate growth in fleet size and activity would continue for the 10-year forecast period, except that significant changes might derive from the following developments.

Greater than anticipated growth in GDP and corporate income would stimulate new aircraft deliveries and the use of corporate and private helicopters. It was felt that the continued lethargy in the markets for corporate and private helicopters reflected lingering fears of perceived executive arrogance during hard economic times and that apparent firming of demand for

fixed-wing business aircraft might presage a turn in the helicopter market back toward its theoretical potential.

Stricter redundancy requirements (and related safety issues) for aircraft operating over water would stimulate sales of newer technology and twin-engine helicopters to the offshore fleet as older aircraft are phased out or diverted to overland missions. Offshore fleets would also grow in response to any new U.S. efforts at energy independence.

However, new redundancy requirements would also tend to reduce the total helicopter fleet by eliminating some single-engine aircraft in marginal markets where twin-engine replacements could not be justified.

Substantial development of new city-center heliports equipped for IFR operations, along with significant improvements in operating costs and dispatch reliability, would open a market for commuting by intracity helicopter. This market is defined as metropolitan area flights of 15 minutes or less, predominantly between city centers and their fixed-wing airports. The lack of appropriate heliports, failure to achieve the dispatch reliability levels of the fixed-wing airlines they serve, and inability to break even at competitive yields were felt to be the only obstacles to success in the development of future helicopter commuter air service. This assumes that the issues of safety, convenience, and public acceptance have been resolved.

Federal efforts to overhaul the health care industry could significantly increase the number of emergency

medical service (EMS) helicopters in the time period. The trend toward fewer special-care hospitals offset by helicopter transportation between secondary hospitals and the remaining special-care centers has proved economical and practicable, and it is expected to accelerate. The strongest growth would be in the intermediate-size twin-engine helicopter fleet.

Other Observations

Private Heliports

Public funding for improvements to private heliports that feed in to central public heliports would dramatically enhance service. This would increase fleet activity significantly and fleet size modestly. At issue are local weather reporting and revamping the low-altitude IFR system. The problem is the definition of "public" which, for purposes of funding eligibility might be expanded to include private facilities with high amounts of origin-destination traffic feeding into public heliports.

Offshore Service

The offshore service industry, where expansion drove the civil helicopter industry in the past, is now largely limited to a replacement market. The panel foresaw minimal growth worldwide and no significant changes during the forecast period.

Oversupply of Rotorcraft

In all service markets, continued equipment overcapacity dictates that most new growth will be accommodated by increasing the average flight hours on existing equipment. It was observed that a substantial portion of the "active" fleet is, in fact, idle but not identified as such.

Fleet Revitalization

Fleet revitalization programs no longer exist. High acquisition costs and increased operator efficiency make new procurement prohibitive in some cases and unnecessary in others. Military R&D in recent years has focused on parameters of little value to the commercial fleet (e.g., combat agility and stealth). New civil rotorcraft designs now on the market do not offer much incremental value to civil operators and do not provide a return on the substantial incremental cost adequate to

justify replacement of existing equipment with new models.

For this reason, easing the fleet into appropriate new technology that does exist, and thus stimulating a renaissance of fleet growth, would require a massive infusion of funding to address such matters as reduction in operating cost, increased reliability, and transitioning into Health Usage Monitoring Systems (HUMS).

Intercity Commuter Service

Intercity commuter service by rotorcraft is not likely to affect fleet size or activity during the forecast period. The panel felt it highly improbable that the constraints on development of civil tiltrotor technology (acquisition cost, operating cost, and market viability) could be resolved before the end of the century. Beyond that, it was felt that the logical users of tiltrotor aircraft, regional airlines that provide feeder service to major airlines, would be disinclined to undertake a competing city-center service.

Other Modes

Competition from other transport modes is not likely to change during the period. For example, short-haul aircraft, and particularly rotorcraft, are less vulnerable than long-haul airlines to erosion by teleconferencing.

Alternative Sources of Rotorcraft

Imports from nontraditional (former Eastern Bloc) sources could change the fleet mix, but probably not the fleet size. Some missions might be served more efficiently with the larger Russian helicopters, and some new markets may be opened by such equipment capable of lifting very high gross weights.

The release of military surplus helicopters will have an impact primarily on the public service and restricted-ticket utility fleets, with little change in fleet size overall. However, the change in fleet mix is a serious concern.

Regulation

A regulatory review to purge obsolete constraints on current-technology helicopters would increase fleet activity and probably fleet size as new markets became viable. Emergency medical service (EMS) aircraft technology, in particular, has advanced significantly beyond its regulatory limits.

LIGHT GENERAL AVIATION

PANEL LEADER:

Ronald L. Swanda
General Aircraft Manufacturers Association

PANELISTS:

Fletcher Aldridge
Aircraft Bluebook

Jim Haynes
The FBO Resource Group

Patricia Beardsley
Federal Aviation Administration

Don Johnson
Aircraft Owners and Pilots Association

Ruth Chambers
Learn to Fly Promotional

Edward Scott
National Association of State Aviation Team, Inc. Officials

Paul Fidiccia
Small Aircraft Manufacturers
Association

John Sheehan
Phaneuf Associates, Inc.

Ken Fleming
Federal Aviation Administration

John Theim
Federal Aviation Administration

Ron Green
U.S. Department of Commerce

Michael D. Wolf
Textron Lycoming

Overview

The light segment¹ of the U.S. general aviation industry is mature or declining. At the end of 1992, the Federal Aviation Administration (FAA) estimated the size of the U.S. fixed-wing, piston-powered fleet to be 162,000 active² airplanes, down 7 percent from 1991 fleet of 175,000 airplanes (Figure 51). FAA also estimated that the U.S. piston-powered fleet flew 21.3 million hours in 1992, down 12 percent from the 24.1 million hours flown in 1982 (Figure 52).

Shipments of new piston-powered airplanes have declined dramatically in recent years. In 1978, the industry shipped 17,032 new factory-built piston-powered airplanes. (Nearly 20 percent of these were exported). In 1993, the industry shipped only 555 new piston-powered airplanes, a decline of over 95 percent, a record low. Over 30 percent of these airplanes were exported. (See also Appendix D for the perspective of an aircraft engine manufacturer.)

Consensus Forecasts

The panel developed a consensus forecast for the light general aviation fleet and the pilot population over the period 1994-1999. Because reform of product liability

laws applying to general aviation could greatly influence these forecasts, two scenarios were used.

	<u>No P.L. Reform</u>	<u>P.L. Reform</u>
Growth in Aircraft Fleet:	-2.5%	-1.0%
Growth in Pilot Population:	-1.5%	+0.5%

Chief factors in this forecast are the average age of a piston-powered airplane (27 years) and the decline in business use of piston airplanes. It was also believed that, because the existing fleet of piston airplanes is so large, the significant, positive impact of product liability reform in the size of the fleet would be felt more in the longer term than in the short term. Small changes in the overall growth rate equated to large numbers of new airplanes entering the fleet.

Pilot Perceptions of the Future of General Aviation

Over the past few years, the Aircraft Owners and Pilots Association (AOPA) has conducted a number of statisti-

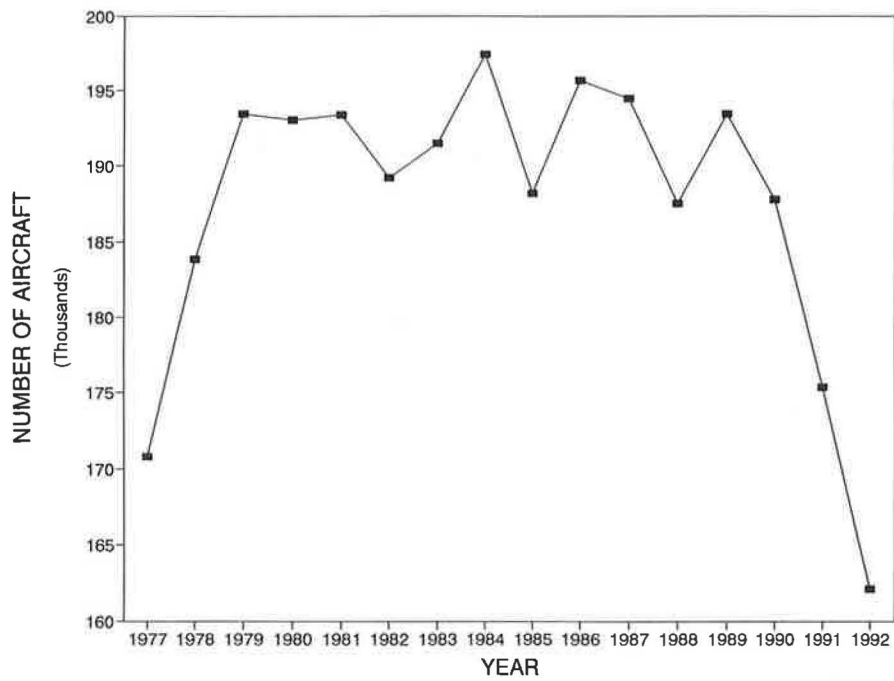


FIGURE 51 Active piston-engine aircraft fleet.

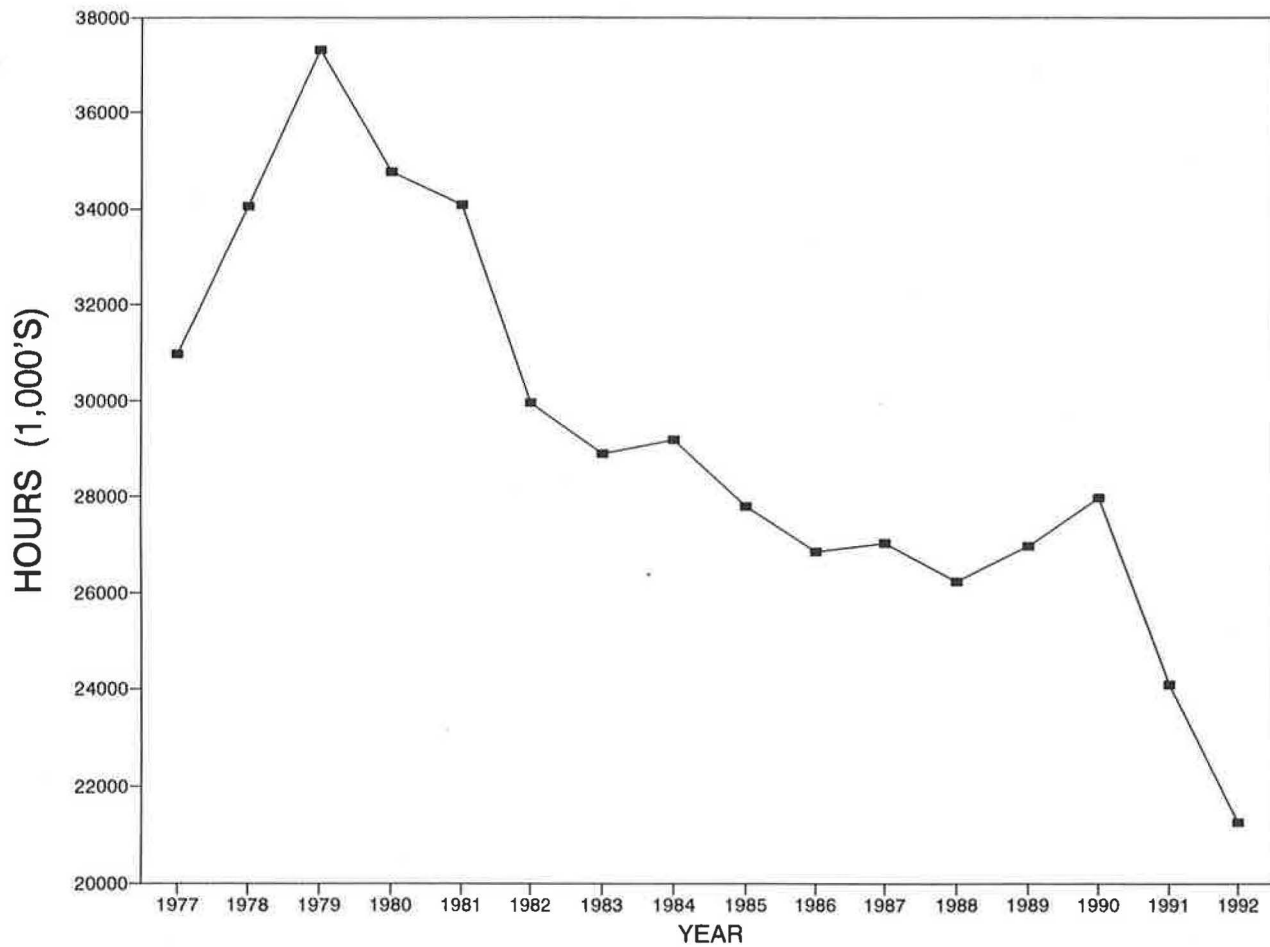


FIGURE 52 Piston-engine airplane hours flown.

cally valid membership surveys designed to collect information about how AOPA members view both the current aviation environment and the future of general aviation. However, a word of caution is in order. The results presented are based on the perceptions of AOPA members, not necessarily the perceptions of the total pilot population. References to "pilots" and "AOPA members" are somewhat interchangeable. However, the data actually represents AOPA member opinions, not the opinions of all pilots.

AOPA represents around 40 percent of the total pilot population. It is conjectured that the opinions collected from AOPA members would be similar to those of the pilots in general, if this population had actually been surveyed. However, if a bias does exist in the AOPA sample, it is toward the more serious and committed general aviation pilot. Most of the results presented are very definitive and opinionated, suggesting that the distribution of responses might be somewhat more diverse if the total pilot population were surveyed.

Current Issues Facing General Aviation

In survey after survey, it is apparent that the biggest problem facing the industry today -- from a pilot's (AOPA member's) perspective -- is aircraft product liability reform. 50 percent of the pilot members listed this as the major problem, followed by 25 percent who feel the "high cost of flying" is the biggest problem, and 9 percent who feel that "excessive government regulation in aviation" is the biggest problem.

- Nine out of 10 member pilots believe that new aircraft manufacturing is dying off primarily because of high product liability costs.

- 87 percent of member pilots think that product liability is the major reason prices for new aircraft are as high as they are.

- 93 percent of pilots would be willing to give up their legal right to sue an aircraft manufacturer for production or design defects in aircraft more than 20 years old, in order to reduce the industry's product liability burden and stimulate the aircraft manufacturing industry.

- Two-thirds of pilot members think that if aircraft product liability legislation were passed by Congress and signed into law by the President, additional new general aviation aircraft would become available to the flying public within a relatively short period of time at a reasonable cost.

- An overwhelming majority of pilots (92 percent) think that Congress should pass a 20-year statute of

repose for general aviation aircraft to alleviate the aircraft product liability problem in this country.

Almost eight out of 10 member pilots think that the general aviation industry in this country is in serious trouble and that general aviation needs an economic stimulus at this time to promote the industry. A like percentage of pilots feels that FAA is primarily hindering, rather than fostering the growth of general aviation.

- 90 percent feel that FAA is not doing enough to promote general aviation in this country.

- 81 percent of member pilots do not think that the Federal Government is doing enough, both financially and politically, to stimulate airports to build more runways to help reduce congestion.

70 percent of member pilots report that governmental regulations and requirements have noticeably reduced the amount of flying they have done over the past year. On the other hand, two-thirds of respondents think that FAA has become less confrontational over the past year and more willing to work with pilots concerning individual regulatory compliance and enforcement problems, procedures, and issues.

- Two of three member pilots feel that there is too much positive control airspace (e.g., TCAs, ARSAs, etc.) in this country at this time.

- Three of four 4 pilots think that noise, rather than air quality, is the biggest environmental concern facing general aviation today.

Almost three quarters (72 percent) would seriously consider purchasing a relatively well-known homebuilt design completely put together by a kitplane manufacturer if they were in the market to purchase a new aircraft, as long as the price and performance of the aircraft were comparable to well known production aircraft.

The Government Role

90 percent of the respondents do not think that general aviation is better off now under the Clinton Administration than it was under the Bush Administration. Only 18 percent of pilots think that the Clinton Administration is a friend of general aviation. Only 17 percent of member pilots think that Congress is a friend of general aviation. Respondents' opinions of government agencies are more favorable. 43 percent of

pilots think that FAA is a friend of general aviation. Three of four think that their state aviation agency is a friend of general aviation.

Aviation Taxes

80 percent of pilots are not willing to pay moderately higher aviation taxes to further improve the aviation system in this country. They think the current aviation taxes are already too high. A majority of pilots feel that the Federal Government should cut services, rather than raise taxes, to reduce the federal deficit. 93 percent feel that aviation taxes should not be raised to help reduce the federal deficit and that general aviation will be hurt more than it will be helped if general aviation taxes are increased to help fund programs designed to stimulate the industry.

Three of four pilots would not be willing to pay moderately to significantly higher aviation fuel prices to fly general aviation aircraft in order to lessen the environmental impact of burning aviation fuel.

More than two-thirds would be willing to pay a modest increase of 1 or 2 cents per gallon in higher state taxes on aviation fuel if they knew the money would be used to improve general aviation airports in their state.

General Aviation Airports and Landing Facilities

Two-thirds of the members surveyed think that their local community views their home airport as an asset. On the other side of the coin, one-third think that their local community considers their home airport a liability. A majority of pilots thinks that the Federal Government, rather than municipalities, should have the ultimate authority to decide or resolve aviation noise problems. 40 percent of aviators feel that their home airport is threatened because of inadequate zoning and encroaching development. 75 percent of member pilots do not think that a peak-hour landing fee is an appropriate way to reduce congestion at busy hub airports.

General Aviation Safety

Only 4 percent of pilots think that the general aviation aircraft they currently fly could be mechanically or structurally safer with more extensive government regulations. 94 percent of member pilots think that current government aircraft inspection requirements are adequate to ensure the safety of general aviation aircraft

-- even older general aviation aircraft. 80 percent of pilots do not think airworthiness inspections need to be increased as general aviation aircraft get older. Three quarters of member pilots think that FAA is already doing enough to ensure that general aviation is safe.

Aviation Weather Briefings

Slightly over three quarters of member pilots normally get their aviation weather briefings from a Flight Service Station (FSS). 19 percent of the member pilots normally get their weather briefings from DUAT, while 5 percent get them from some other source.

77 percent of pilots think that it is either "very important" (40 percent) or "somewhat important" (37 percent) that FAA continue funding the DUAT weather briefing program.

Three of five members would object to being charged a fee to use DUAT to obtain a weather briefing. 9 of 10 would object to being charged a fee to for an FSS weather briefing.

The Future of General Aviation

A majority of member pilots -- 56 percent -- would describe themselves as generally "pessimistic" about the future of general aviation; 44 percent of pilots would describe themselves as generally "optimistic" about the future of general aviation.

63 percent of the member pilots think that it is either "very likely" (24 percent) or "somewhat likely" (39 percent) that people will still be able to pilot general aviation aircraft for business or pleasure 25 years from now. Just over one quarter think that it is "somewhat unlikely" that people will be able to fly general aviation aircraft 25 years from now, while 9 percent think that it is "very unlikely."

One of three pilots who own an aircraft not currently equipped with LORAN C plan to install LORAN C within the next 2 years. Three of five pilot members who own an aircraft not currently equipped with GPS satellite navigation equipment plan to install GPS in their aircraft within the next five years.

What Pilots Want for the Future

What should be made of all this information? What can government and industry do with these results? What do pilots think should be done in the future? According

to the survey results, this is what pilots would like to see happen.

Solve the product liability problem. While this is easier said than done, pilots feel that it is the most important problem facing the industry today. Without a solution, or at least some relief, many feel their ability to fly will be in jeopardy.

FAA should promote the industry to a much greater extent than it does at this time. Also, FAA should not overregulate the industry to make it risk-free -- that would be counterproductive.

FAA should continue to be less confrontational and more willing to work with general aviation interests as partners, rather than adversaries.

The government should do what it can to stimulate the industry by reducing or eliminating unneeded regulations and requirements, cutting unnecessary government spending, and reducing burdensome taxes that do more damage than good. Aviation taxes should not be increased. The industry is in poor shape and cannot afford it. In fact, the Federal Government should look for ways to reduce the tax burden on general aviation by cutting government spending, rather than raising taxes to fund new or larger programs.

Give the Federal Government, rather than local agencies, ultimate authority to resolve aviation noise problems.

Government and industry should better promote the value of airports to local communities.

General aviation, as it is now structured, is basically safe. Additional regulations or requirements designed to improve the safety of general aviation will have only marginal impact and might not be worth the investment. Current regulations designed to ensure that general aviation aircraft are safe are more than adequate. Do not increase safety regulations or requirements in this arena.

Do not charge a user fee to obtain aviation weather services.

Continue to fund DUAT.

The Future Supply and Demand for Pilots and Aviation Maintenance Technicians³

The U.S. air transportation industry employs approximately 135,000 pilots and 143,000 aviation maintenance technicians (AMTs). These individuals are employed by airlines, air taxis, flight schools, repair stations, and corporate flight departments. Employment opportunities fluctuate in this cyclical industry because of the vagaries of the economy and the attendant demand for air transportation. A recently completed study,

"Pilots and Aviation Maintenance Technicians for the Twenty-First Century: An Assessment of Availability and Quality" addresses this issue. This study is the product of an advisory committee, the Pilot and Aviation Maintenance Technician Blue Ribbon Panel (the Panel), sponsored by the U.S. Department of Transportation.

In the latter part of the 1980s, the airlines began heavy hiring of pilots and AMTs. Congress became concerned that this hiring trend was depleting the supply of military aviation personnel and that this drain of military aviation personnel would affect the overall supply of trained personnel available to meet future transportation needs. The Panel was created in response to these concerns.

The Panel organized a series of public hearings and conducted background research to investigate occupational demand, current training methods, emerging training techniques, the capacity of pilot and AMT training schools, hiring standards, and the impact of technology and air transportation trends. The Panel also investigated the quality of basic academic and aviation training, military personnel availability, and industry-government cooperation. Industry and Federal Aviation Administration (FAA) forecasts were then used to project personnel requirements and supply.

The current demand for trained and experienced professional pilots is approximately 10,000 per year. This demand will increase to approximately 15,000 annually by 2004. (Table 8) Similarly, the current annual demand for AMTs is 12,000, and is expected to rise to 16,000 by 2004. (Table 9) Significant changes in the national economy will markedly affect these projections.

The Panel concluded that there will be an adequate supply of pilots and AMTs who meet minimum federal certification requirements for the air transportation industry for the foreseeable future. However, it is unlikely that enough of these personnel will have the skills and experience to provide industry with sufficient numbers of well-qualified personnel. Although basic certification requirements are adequate, the more sophisticated aircraft and missions require specialized training. The key to increasing the supply of well-qualified personnel is to create an industry-government coalition that will define needs, develop standards, and create oversight for training and qualifying pilots and AMTs.

Understanding the Flight Training Market

Over the past 15 years the light aircraft segment of the general aviation industry has been in decline. The

TABLE 8 PROJECTED PILOT DEMAND

YEAR	MAJOR AIR CARRIERS			COMMUTER AIR CARRIERS			OTHER PROFESSIONAL		TOTAL PILOTS	TOTAL NEW-HIRES
	Aircraft(1)	Pilots(2)	New-Hire Pilots(3)	Aircraft(1)	Pilots(4)	New-Hire Pilots(5)	Pilots	New-Hire Pilots(6)		
1988	3,671	50,476		1,684	13,472		62,830		126,778	
1989	3,870	53,212	3,480	1,782	14,256	2,922	61,266	4,563	128,734	10,965
1990	4,017	55,233	2,927	1,819	14,552	2,479	65,722	11,028	135,507	16,434
1991	4,252	57,529	3,297	1,896	15,168	2,891	63,625	4,266	136,322	10,453
1992	4,206	55,981	(322)	1,960	15,680	2,864	62,860	5,521	134,521	8,063
1993	4,265	55,828	1,226	2,018	16,144	2,886	63,360	6,836	135,332	10,948
1994	4,311	55,482	1,222	2,066	16,528	2,863	63,995	7,035	136,005	11,120
1995	4,387	55,495	1,600	2,116	16,928	2,939	64,753	7,233	137,176	11,773
1996	4,496	55,885	2,123	2,152	17,216	2,870	66,056	7,909	139,157	12,902
1997	4,553	55,592	1,489	2,171	17,368	2,757	66,964	7,604	139,924	11,851
1998	4,690	56,233	2,628	2,195	17,560	2,826	67,917	7,745	141,710	13,198
1999	4,843	57,002	2,997	2,225	17,800	2,910	69,002	7,985	143,804	13,892
2000	5,016	57,934	3,215	2,255	18,040	2,946	69,987	7,984	145,961	14,145
2001	5,180	59,828	4,052	2,287	18,296	3,000	70,922	8,027	149,046	15,079
2002	5,381	62,150	4,430	2,323	18,584	3,076	71,971	8,246	152,705	15,751
2003	5,566	64,287	3,895	2,359	18,872	3,119	73,070	8,406	156,229	15,420
2004	5,747	66,377	3,641	2,381	19,048	3,033	73,969	8,296	159,394	14,970
1993-2004 TOTALS			32,519			35,226		93,306		161,050

Historical
Projected

- (1) Obtained from 1993 FAA Aviation Forecast Data.
- (2) The number of pilots for the major air carriers is equal to the number of aircraft multiplied by the size of the crew (steadily decreasing from 2.5 in 1990 to 2.1 in 2000) and the number of crews per aircraft(5.5).
- (3) The number of new-hire pilots is equal to the growth over the previous year plus attrition (.5 percent) and retirements (obtained from ALPA data) for the year.
- (4) The number of pilots for the commuter air carriers is equal to the crew size (2) multiplied by the number of crews per aircraft (4).
- (5) The number of new-hire pilots is equal to the growth over the previous year plus attrition (15 percent) for the year.
- (6) The number of new-hire pilots is equal to the growth over the previous year plus attrition (10 percent) for the year.

** Note: New-hires for the major air carriers include transfers from the commuter air carriers, other professional pilot positions, and the military.

TABLE 9 PROJECTED AMT DEMAND

YEAR	MAJOR AIR CARRIERS			COMMUTER AIR CARRIERS			GENERAL AVIATION			OTHER		TOTAL NEW HIRE
	Aircraft(t)	AMTs(2)	New Hire AMTs(3)	Aircraft(t)	AMTs(4)	New Hire AMTs(5)	Aircraft(t)	AMTs(6)	New Hire AMTs(7)	AMTs(8)	New Hire AMTs(9)	
1988	3,671	51,394	6,350	1,684	6,736	994	202,000	30,300	2,625	43,000	3,870	13,838
1989	3,870	54,180	5,495	1,782	7,128	1,105	195,500	29,325	1,958	43,860	3,930	12,488
1990	4,017	56,238	4,870	1,819	7,276	876	204,400	30,660	4,401	44,737	4,009	14,155
1991	4,252	59,528	6,266	1,896	7,584	1,066	197,400	29,610	1,911	45,631	4,088	13,332
1992	4,206	58,884	2,300	1,960	7,840	1,040	198,400	29,760	3,126	46,543	4,170	10,636
1993	4,265	59,710	3,812	2,018	8,072	1,039	198,700	29,805	3,026	47,473	4,253	12,129
1994	4,311	60,354	3,662	2,066	8,264	1,018	199,700	29,955	3,146	48,422	4,339	12,164
1995	4,387	61,418	4,135	2,116	8,464	1,046	200,800	30,120	3,177	49,390	4,425	12,784
1996	4,496	62,944	4,673	2,152	8,608	1,005	202,400	30,360	3,276	50,377	4,513	13,467
1997	4,553	63,742	3,985	2,171	8,684	944	203,600	30,540	3,234	51,384	4,604	12,767
1998	4,690	65,660	5,201	2,195	8,780	974	205,000	30,750	3,285	52,411	4,696	14,156
1999	4,843	67,802	5,532	2,225	8,900	1,010	206,400	30,960	3,306	53,459	4,790	14,638
2000	5,016	70,224	5,933	2,255	9,020	1,022	207,600	31,140	3,294	54,528	4,886	15,135
2001	5,180	72,520	5,922	2,287	9,148	1,043	208,900	31,335	3,329	55,618	4,983	15,277
2002	5,381	75,334	6,581	2,323	9,292	1,073	210,100	31,515	3,332	56,730	5,083	16,069
2003	5,566	77,924	6,486	2,359	9,436	1,088	211,200	31,680	3,333	57,864	5,184	16,091
2004	5,747	80,458	6,557	2,381	9,524	1,040	212,300	31,845	3,350	59,021	5,288	16,235
1993-2004 TOTALS		62,479				12,303			39,086		57,045	

Historical

Projected

- (1) Obtained from 1993 FAA Aviation Forecast data.
- (2) The number of AMTs for the major air carriers is equal to the number of aircraft multiplied by the number of technicians per aircraft (14).
- (3) The number of new-hire AMTs is equal to the growth over the previous year plus attrition (5 percent) per year.
- (4) The number of AMTs for the commuter air carriers is equal to the number of aircraft multiplied by the number of technicians per aircraft (4).
- (5) The number of new-hire AMTs is equal to the growth over the previous year plus attrition (10 percent) per year.
- (6) The number of AMTs for general aviation is equal to the number of aircraft multiplied by the number of technicians per aircraft (15).
- (7) The number of new-hire AMTs is equal to the growth over the previous year plus attrition (10 percent) per year.
- (8) This includes federal technicians and technicians employed by manufacturers and repair stations. (Assumes 2 percent growth rate.)
- (9) The number of new-hire AMTs is equal to the growth over the previous year plus attrition (7 percent) per year.

downturn in aircraft deliveries and general aviation support services goes far beyond the cyclical influences seen from the 1940's to the 1970's. Fundamentally, the industry has changed. Of the many economic, social, political and regulatory influences, one stands out as having the most significant impact on the flight training industry: the decision by aircraft manufacturers to abandon the single-engine piston market due to litigation on product liability litigation and low gross profit margins in comparison with turboprop and jet engines.

This decision abruptly changed the way that providers of flight training providers were accustomed to doing business. The most obvious was the loss of revenue from aircraft sales, but there were other consequences as well. Aircraft manufacturers no longer supported flight training and aircraft sales with national marketing, promotion and employee training. Aircraft sales personnel, who had traditionally been the "shepherd" for the new business person or student pilot, was no longer a part of the organization.

As a result, the burden now fell on the Certificated Flight Instructor (CFI) to be teacher, marketer, and salesperson—a role that CFIs were not prepared to undertake. Proactive marketing became almost non-existent by the mid to late 1980s. Most nonaviation career customers who did learn to fly "walked in off the street".

The industry continues to have a marketing and sales problem. Not only have providers of flight training not embraced the marketing role, they have not kept pace with the sophistication and demands of the most prized customer, the business person and other nonaviation professionals. Unfortunately, other competitive industries have attracted the business person's attention and discretionary dollars.

However, there are effective marketing approaches that are suited to the realities of the GA marketplace. The industry is very well suited for the use and implementation of direct marketing approaches. What follows is an outline of some basic direct marketing tactics that are well suited to the light general aviation industry.

- **Targeting:** Focus on your most desirable customers. The first step is understanding the demographic and psychographic profile of the most favored customer. General aviation appeals to only a small percentage of the total population. Approaches that use mass media techniques will be ineffective, and they are expensive. FBOs have a well defined, specific type of customer. With advances in information technologies, the industry can now afford to reach this type of customer. If an advertising and promotional campaign were undertaken

today, the aircraft manufacturer would not follow past approaches, direct marketing would be used instead.

- **Consultative Selling:** Once the most desirable customer has been profiled and identified, a sales presentation can incorporate both the logical and emotional motives for buying. Front line employees, although currently the weak link, have the education to understand this type of "consultative" sale. Further, they are better educated than most employees in competitor industries. Also, in a presentation an employee can communicate his or her own honest enthusiasm for the industry.

- **Customer Service:** Once the customer's interest is understood, FBOs can offer special or tailored services that meet the targeted customer's needs and expectations. General aviation products have always had a high service content. The industry does not have to convince its employees that it offers service. Services can be custom tailored without adding additional cost. However, FBO's do tend to have a rather myopic view of flight training offerings.

- **Developing Long-Term Customer Relationships:** With the use of computer database technology, FBOs can develop a cost-effective, personalized, on-going dialogue and relationship that does not depend on one individual. Also, information recorded on one good customer helps with the next. Traditionally the industry has encouraged a culture that values the on-going relationship with a customer. Attitudes do not have to change. Computer-based tools will allow employees to implement cost effective methods and build a base of knowledge.

Implementation will require an investment in front-line people. Industry must teach employees about the needs and expectations of the most favored customer. Interpersonal skills must be enhanced and made part of employee training. A new way of thinking must be instilled. Not every course offering has to be keyed to FAA regulation. Current programs must be repackaged so they are easier to buy. Further, flight training courses and services must be customized to customer needs and expectations.

The industry is facing a major challenge. Environmental concerns that have had a negative impact on general aviation are not going away. Moreover, the industry has fallen short in understanding the needs and expectations of the most valuable customers. Direct marketing offers a cost-effective approach and fits well with the industry's strength, culture, and tradition. The problem is a marketing problem, and it requires a marketing solution.

FBO'S, The Foundation of Light General Aviation

The FBO industry grew in number from less than 2,000 at the end of World War II to over 10,000 by end of the 1970s. Because of a variety of factors, such as exposure to environmental liability, cost of skilled labor, and overcapacity, the industry has evolved to a point where the ability of an individual FBO to remain a viable financial entity is predicated almost entirely upon fuel sales (primarily retail fuel sales). The FBO Resource Group projects that, if current trends continue, there will be approximately 2,000 economically viable FBOs by the end of the century. FBOs are the foundation of light aviation and are viewed by some as the leading indicator for the recovery of the industry.

After World War II many FBOs added flight training as a profit center. Some of this was carried over from contract flight training for the military during the war. It may be here, at this grass-roots level, that the stirrings of a rebirth of the industry will occur. However, before this can occur, major fundamental infrastructure changes need to take place in other segments of the general aviation industry.

As the number of FBOs diminish, the customer service level at many airports declines. Many third-tier regional and local municipal airports, some with limited air carrier service and some without any type of commercial airline service, are losing their FBOs because it is no longer possible to make a profit while offering the level of service expected by general aviation. Every community with an airport wants to be able to welcome a Fortune 500 company's business jet with appropriate service and facilities. How is that service going to be provided or paid for in the future?

A part of the solution, is developing partnerships between FBOs and the public-use airport owners and operators to create the most cost-effective and operationally supportive structure possible to support the community's general aviation requirements. This will assist in increasing the survival rate of the FBOs and preserve the crucial service capabilities necessary to foster growth in light general aviation.

FAA'S Plans To Stimulate Light General Aviation

General aviation faces many challenges in the 1990s. The main challenges are in the areas of safety, certification processes and services, product innovation and competitiveness, airspace access and capacity, and affordability. The FAA Flight Standards Service believes there are opportunities to address these problems creatively, in partnership with the general aviation community, to foster and promote safety and growth.

The *General Aviation Action Plan* was developed as a framework for accomplishing this and is now being implemented by the Flight Standards Service and key elements of the general aviation community.

FAA's plans to stimulate light general aviation will focus on:

- **Safety:** to protect recent gains and aim for a new threshold;
- **FAA services:** to provide the general aviation community with responsive, customer-driven certification, air traffic, and other services;
- **Product innovation and competitiveness:** to ensure the technological advancement of general aviation;
- **System access and capacity:** to maximize general aviation's ability to operate in the National Airspace System; and
- **Affordability:** to promote economic and efficient general aviation operations, expand participation, and stimulate industry growth.

The strength and diversity of general aviation depends largely on how available it is to the public and how affordable it is to the user. Through simplified certification standards for aircraft and airmen, joint industry-FAA ventures such as the accident prevention program, and timely rulemaking initiatives, wider interest and participation in general aviation can be stimulated.

Using Econometrics To Estimate General Aviation Relationships

Econometric models have been developed to estimate aircraft operations at general aviation airports. Other relationships such as demand for aircraft or cost models for product can be estimated using the same approach. This type of analysis is important for general aviation airport and aircraft management, planning, marketing and financing. Some methods of analysis are analogy, forecasting, and causal models. This section focuses on a causal model. While it is more difficult to use and gather data for such a model, it is more accurate and gives more information than alternative methods.

The causal model describes aircraft operations with a number of explanatory variables. These include 1) distance in miles to nearest airport, 2) average income in the county, 3) runway length, 4) presence of a tower, 5) presence of a military base, 6) presence of avionics service, 7) presence of flight interaction, 8) presence of charter flight services, and 9) presence of aircraft repair service.

The model was tested using a cross-section of 83 general aviation airports in the State of Georgia in 1991.

The results were quite good and gave a good fit, with 65 percent of the variation in the dependent variable explained by the independent variables. The most powerful explanatory variable in quantitative terms was income, although the statistical significance of this variable was not substantial. By far the variable with the greatest statistical significance was runway length followed closely by the presence of a control tower. The only insignificant variables were the presence of a military base and a flight training school. The model can be used to predict aircraft operations for regional and statewide planning.

¹ Light general aviation, for the purposes of this workshop, was defined as all piston-powered airplanes (single and multi engine). Although piston-powered helicopters are a significant part of the U.S. fleet, they are discussed in a separate section of this Circular.

² An active aircraft is defined by the FAA as one that flew at least one hour during the survey year.

³ Presentation to the panel by John J. Sheehan, Phaneuf Associates, Incorporated.

APPENDIX A

COMMERCIAL AVIATION IN THE CIS, 1992-1993¹

John S. Strong
Harvard Institute for International Development
Harvard University, and
School of Business Administration
College of William and Mary

Civil aviation in the CIS has declined even more than the precipitous decline in the economies of the former Soviet Union. While overall economic activity has declined by about 35-40 percent from 1989 peaks, air traffic has fallen by 50-70 percent in total. Some purely domestic markets have suffered even greater declines, with some markets losing service altogether while others are experiencing traffic at one-fifth the level of four years ago.

The relatively worse performance of aviation is a function of both income effects through economic declines and inflation, as well as relative price effects. Under the old regime, fuel prices were subsidized even more than bread, with the result that Aeroflot paid less than 5 percent of world market prices for jet fuel. With increasing price deregulation, fuel prices had reached about 25 percent of world levels by late 1992. Administrative allocations at "old" prices have made this problem worse, as an active two-tier fuel market has arisen. Eventually, fuel prices will rise to world levels. When these adjustments are complete, forecasts are that the CIS will not achieve 1989 air traffic levels again until 2010-2015. In short, the restructuring associated with the transition to a market economy has produced a 20-year recovery period.

Aeroflot

Under the old system, Aeroflot was a vertically integrated air monopoly that provided the full range of civil air traffic control, airports, air carrier, and regulatory activities. There was substantial explicit and implicit influence from the Defense Ministry. Aeroflot was geographically organized as spatial monopolies, in which each region ran not as a separate airline (as in China in 1993), but rather as a pure operating base. There was no marketing or commercial functions to speak of, and accounting was used for transactional rather than information purposes.

With the dissolution of the USSR, Aeroflot has fragmented. Aeroflot Russian International Airlines has inherited the international bilateral responsibilities, but in general the former operational bases have become de facto integrated aviation conglomerates, with captive airports, airlines, and ATC. At the same time, there has been a great deal of entry, as startup airlines leased planes from western sources, eastern Europe or within the CIS. By mid-1992, it was estimated that there were 213 airlines providing scheduled service. Compared to 1990 levels, average 1993 fares are up about 18 times, which is still below the increase in all consumer prices of about 25 times. Operating costs, even with continuing fuel subsidies, are up 30-36 times, and the financial situation has become dire. Much consolidation is ahead, and the degree to which airline activities will be effectively separated from aviation infrastructure remains an open issue.

Air Traffic Control

Russian airspace is about 2.5 times the size of Canadian airspace. Currently, the CIS traffic involves about 12 million flights per year over about 1 million kilometers of air routes. Including overflights, the ATC system handles about 100,000 flights per day, roughly 36 million per year. Large areas of airspace are not available for security reasons and the lack of radar and navigation aids.

In mid-1993 Rosaeronavigatsia (which provides air traffic control for the Russian Republic only) operated 103 ATC centers, with plans to consolidate these to 30 centers by the end of the 1990s. Russian airspace is divided into 67 Flight Information Regions. Many short legs and heading changes are required. It has been estimated that 20-25 percent of flight times could be saved if efficient resectoring was undertaken. The present air navigation system is largely based on non-directional beacons and RSBNs. There is no provision for high level tracking. Most of the 130 national airports and the 3,000 local and regional airports are limited to ICAO Category I operations. However, the major airports all have Category II approaches, and the equipment, while technologically obsolete, appears to be in satisfactory working order in the major centers. Radar control is spotty, especially secondary surveillance radars. This is a particular problem for the heavily traveled R-22 and R-30 Trans-Siberian routes, which carry much of the Europe-Asia traffic. Implementation

of the GLONASS satellite positioning system for civil use has been delayed from its original 1995 target because of issues involving standards and coverage levels, as well as the ability to operate on an integrated basis with western systems, especially the US Global Positioning System (GPS).

Modernization of air navigation in the Russian Republic centers around modernization of air traffic control. The early modernization efforts were led by Westinghouse, which was eventually joined by other American, European, and Japanese suppliers, forming the GATSS consortium in 1992. However, in early 1993 Thomson CSF put forth an alternative proposal, and the Russian authorities have asked both GATSS participants and Thomson to jointly work out a proposal through the new RADUGA consortium.

Cost estimates for the Russian air navigation project have risen to \$12-15 billion over a 15-20 year period. The western project participants claim that the hard currency portion of the project can be financed through overflight charges, although there is some skepticism about how much additional airspace usage will result.

In the other republics, air traffic control modernization has proceeded in somewhat fragmented fashion due to the small volume of airspace in these regions. For example, Kazakhstan and Belarus have developed their own plans; Ukraine has moved toward awarding a contract to Siemens; and the Baltic states have chosen to operate independently of each other. In short, air traffic control faces a large task of integration, both within the CIS and with Europe and Asia. The latter task will be made more difficult given English language deficiencies (the ATC language) and the ongoing uncertainties as to harmonization programs in western Europe.

Organization of Civil Aviation Activities

The other major problem of the fragmentation of civil aviation is that CIS-wide institutional structures are either not in place or are ineffective. There was an initial attempt to create a multilateral Interstate Civil Aviation Committee (MAK), with safety and regulatory responsibilities, but it never got off the ground. Rosaeronavigatsia has taken the lead in air traffic control in Russia; and the Aeroflot operations in Moscow, St. Petersburg, and Kiev are beginning to develop into commercial structures. The unresolved issues in these and other regions relate to control over airports and associated terms of access (landing fees, gate facilities, etc.) for other carriers both from the CIS and abroad. Planning studies have been started for the restructuring of the four Moscow airports, with debate

over whether they should be under a single authority or in a more autonomous structure which might introduce greater competition among the airports.

Overall, three broad, but related, tasks face civil aviation in the CIS. First, there are major needs for upgrading and modernization, although much basic capacity (airports, runways) is already in place and can be cost-effective given the levels of traffic which can be expected in a market environment. Second, there is a need to reestablish the aviation network in the wake of post-1989 fragmentation. Much can be achieved by developing integrating air traffic control, developing clearinghouses, reservation systems, and interline agreements, and establishing safety and regulatory structures that apply to the entire network. Third, the organizational and institutional aspects of corporatization and privatization must be sorted out in the civil aviation sector. There is a need to separate airlines, airports, ATC operations, and safety regulation. This would serve not only to ensure safe operations, but also to put in place an institutional structure that does not merely convert a government monopoly into private spatial monopolies.

¹ This summary is based on the author's work as part of a project on CIS transport reform undertaken by the European bank for Reconstruction and Development (EBRD). This summary draws heavily from the CIS aviation sector study financed by EBRD and conducted by Aerodev Consultants of Canada, with Walter MacLeish as principal author; and from the World Bank's CIS Transport Sector Analysis, May 1993.

APPENDIX B

AIRLINE INDUSTRY OUTLOOK AND INFRASTRUCTURE NEEDS

Clinton V. Oster, Jr.
School of Public and Environmental Affairs
Indiana University

The worldwide airline industry has become accustomed to strong growth in both passenger and freight traffic throughout the jet era. Spurred by productivity gains from rapid technological advances in aircraft, navigation, and air traffic control, the cost of air travel has declined an average of 2.2 percent per year in real terms throughout the 1960 to 1990 period. The combination of falling real fares and increasing Gross Domestic Product has lead passenger airline traffic to grow at an average annual rate of 9.5 percent and scheduled freight traffic to grow at an average annual rate of 11.7 percent over the same period.

Growth, however, has not been uniform throughout this period. Figure B-1 shows the growth rates of passenger and freight traffic in each decade since 1960. The figure also contains the growth rates for the 1990 to 2001 period forecast by the International Civil Aviation Organization (ICAO)¹. For both passenger and freight, the growth rate in each decade has been smaller than in the previous decade. Similarly, the forecast growth rates are smaller than those seen in the 1980s. Passenger-kilometers are forecast to grow at an average of 5 percent per year whereas they grew at an average of 5.7 percent in the 1980s. Similarly, freight tonne-kilometers are forecast to grow at 6.5 percent per year where they grew at 7.3 percent in the 1980s.

Part of the growth in passenger-kilometers throughout the 1960 to 1990 period has been because of increasing average trip length. Passenger trip length is expected to continue to increase in the 1990s, so that the number of passengers carried will not increase as much as passenger-kilometers. In considering infrastructure needs, the number of passengers carried is more likely than passenger-kilometers to indicate the need for terminal facilities. ICAO forecasts an increase in passengers carried of 4.0 percent, a drop from the 4.5 percent average rate of the 1980s. Similarly, the number of passengers per plane has increased throughout the 1960 to 1990 period, both because of a move to larger aircraft in the 1960s and 1970s and more recently because of an increase in average load factor in the

1980s. Average aircraft size is not expected to change much in the 1990s, but average load factors are expected to increase about 2 percentage points. Because of the increase in average passengers per aircraft, aircraft departures have not increased as fast as passenger kilometers in the past, nor are they expected to in the future. Aircraft departures are forecast to increase by an average of 2.0 percent per year in the 1990s, a drop from the average of 3.1 percent per year in the 1980s.

Both the growth rates and the size of the airline market vary substantially by region of the world. Figure B-2 shows the growth rates for 1980-1990 and the forecast growth rates for 1990-2001 in the major regions of the world. These regional figures exclude airline activity in the former Soviet Union. The economic turmoil and political uncertainties in this region make airline forecasting an almost purely speculative activity.

Two strong patterns are evident in Figure B-2. First, just as overall worldwide growth is expected to slow, growth rates are forecast to decline in Latin America and the Caribbean, North America, the Middle East, and Europe. The largest rate declines are forecast for North America and Europe. Growth rates are expected to remain about the same in Asia/Pacific and Africa. Second, Asia/Pacific had by far the highest growth rate in 1980 to 1990 and is forecast to continue to have by far the highest growth rate in the next decade.

Growth rates, however, are only part of the story because the size of the airline markets across these regions. Focusing only on rates can make it easy to miss where the largest absolute growth in traffic will occur. Figure B-3 shows the passenger-kilometers in each region in the 1980 to 1990 period and those forecast for the 1990 to 2001 period. As might be expected from the sustained high growth rate, Asia/Pacific is expected to show a substantial increase in passenger traffic. However, because both North America and Europe are such large airline markets, they are expected to have substantial growth despite the declining growth rates. Indeed, the increase in passenger-kilometers in North America is forecast to be larger than the increase in Asia/Pacific. In examining infrastructure needs and potential shortages, both the absolute increase and the rate of increase need to be considered.

Throughout the world, in every region, international traffic is expected to grow faster than domestic traffic. Worldwide domestic traffic is forecast to grow at 4.0 percent per year whereas international passenger traffic is forecast to grow at 6.0 percent. Similarly, worldwide domestic cargo traffic is forecast to grow at 3.6 per year

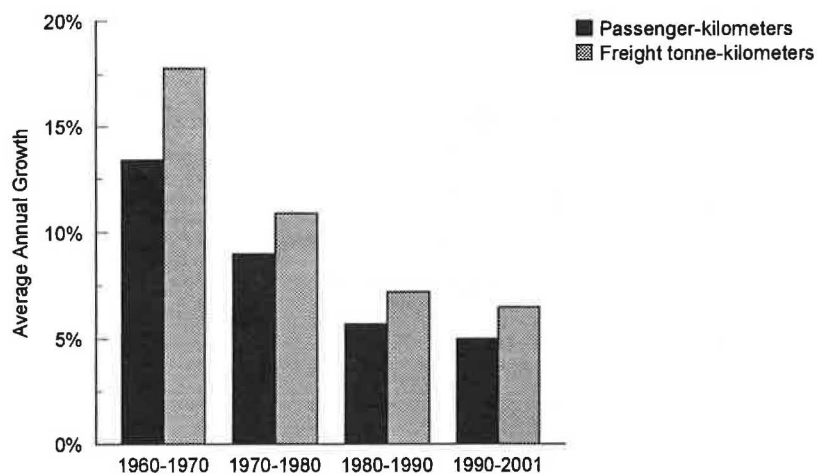
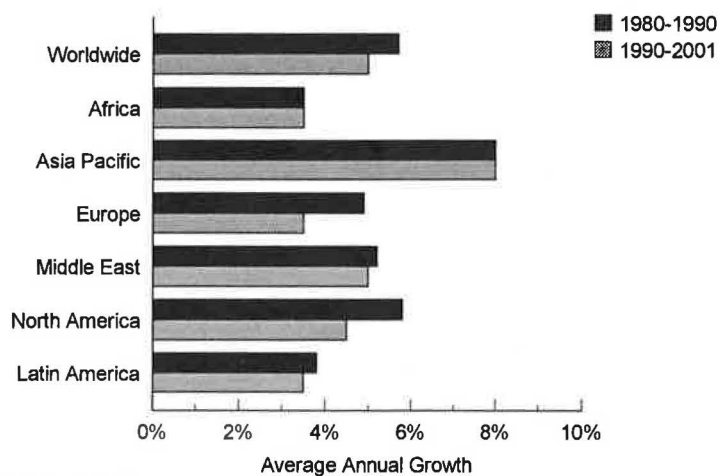
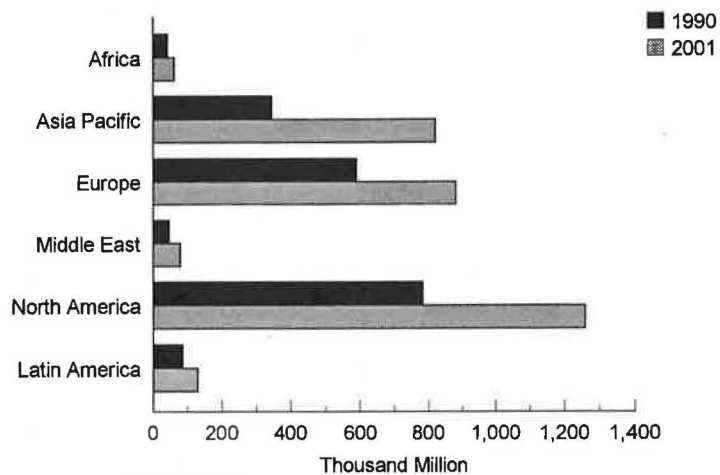


FIGURE B1 Worldwide growth of passenger and freight traffic.



Latin America includes the Caribbean

FIGURE B2 Average annual growth in scheduled traffic.



Latin America includes the Caribbean

FIGURE B3 Passenger-kilometers, actual and forecast.

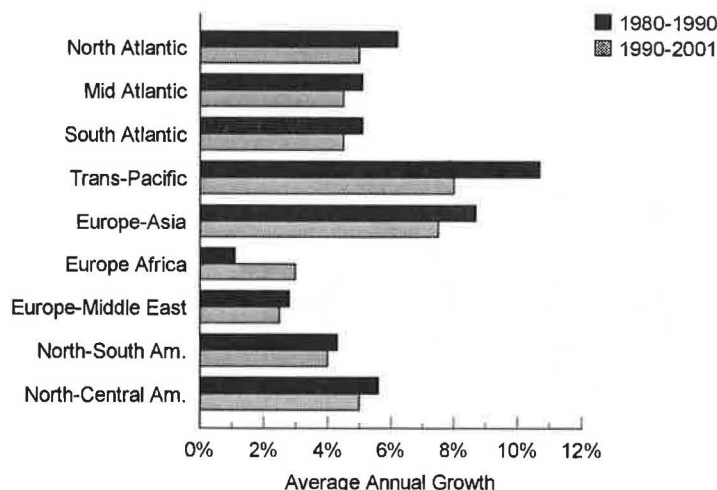


FIGURE B4 Average annual growth in international scheduled service.

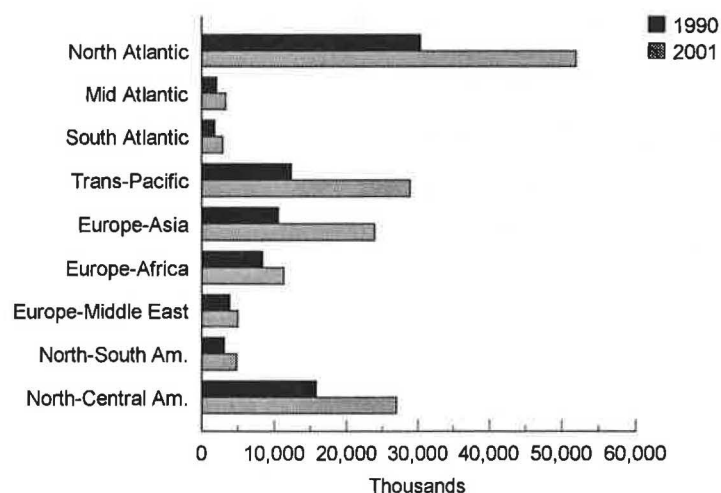


FIGURE B5 Passengers carried in international scheduled service.

percent while international cargo traffic is forecast to grow at 7.5 percent.

Growth rates in passenger service vary across the major international markets. Figure B-4 shows the average annual growth rates in nine major international market areas for the 1980s and the forecast for the 1990s. As is evident in the figure, growth rates are forecast to decline in each of these areas except one, the market between Europe and Africa. However, as Figure B-5 shows, a declining growth rate is still growth and total traffic is expect to grow in all nine markets. Indeed, the North Atlantic market which is often regarded as a "mature" market is forecast to have the largest increase in traffic growth of any major market. The Trans-Pacific market is forecast to have the next highest growth followed by Europe-Asia, and North

America-Central America. Growth increases in the remaining markets are all forecast to be much smaller in absolute terms than these four large markets.

These forecast growth patterns, should they actually occur, would mean important shifts in the relative sizes of markets in different regions of the world. As can be seen in Figure B-6, North America would remain the largest market in the world, but its share of world traffic would decline. Similarly, Europe's share of world traffic, which already declined between 1980 and 1990 is forecast to decline further. Asia/Pacific, on the other hand, is forecast to continue to increase its share of world traffic. Indeed, its increase coupled with Europe's decline would leave Asia/Pacific almost as large as Europe by 2001, a dramatic change from their relative shares in 1980.

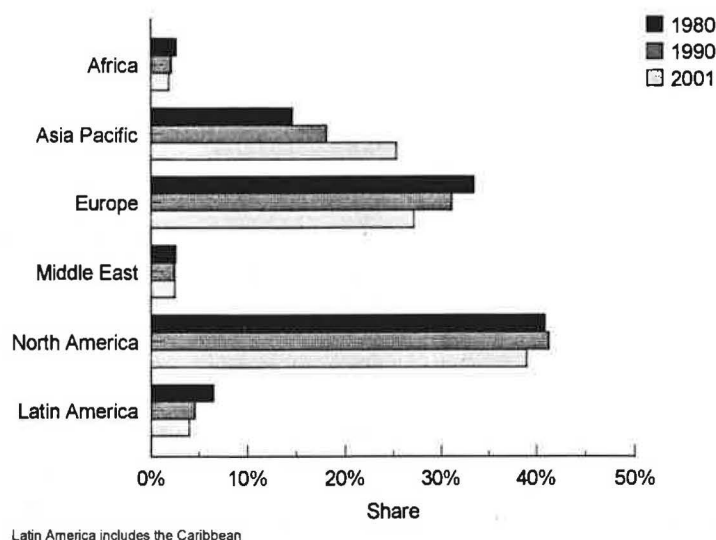


FIGURE B6 Regional share of total traffic.

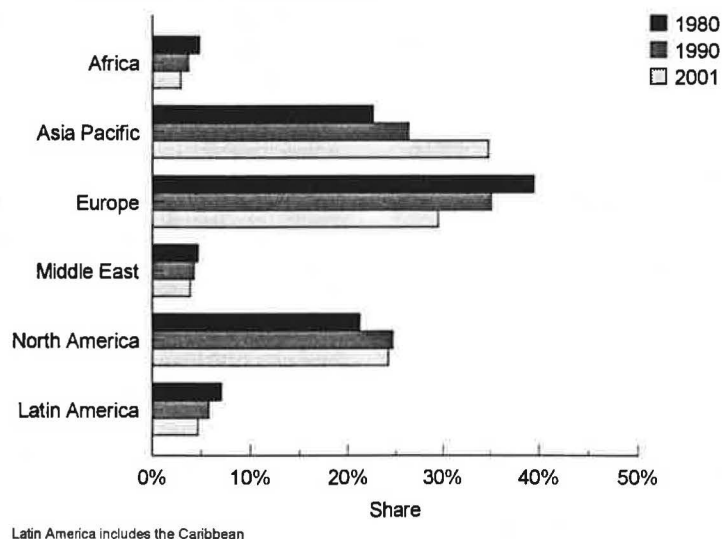


FIGURE B7 Regional share of international traffic.

The regional shares of international traffic are forecast to change even more sharply, as can be seen in Figure B-7. In 1980, Europe was the dominant region with Asia/Pacific and North America about the same size. By 2001, Europe's steady decline coupled with Asia/Pacific's steady increase result in Asia/Pacific becoming the dominant region for international traffic.

These forecasts for both domestic and international passenger and freight traffic share a common assumption that may call their accuracy into question. Throughout the growth of commercial aviation, infrastructure in the form of airport and air traffic control capacity has generally been provided in sufficient amounts to allow growth to proceed with few if any restrictions. True, during the past decade there have been a small but growing number of instances of capacity shortages, but

by and large, they have not been so severe as to constrain growth on a regional basis. Rather, the airlines have been able to adjust with larger aircraft and altered route patterns so that the effects have been largely to alter development patterns within a region slightly. Because the forecasts for the coming decade are based on the experiences of the past three decades, an explicit assumption in the forecasts is that airport and air traffic control capacity will continue not to be a constraint to growth at the regional level.

There are at least two reasons why this may not be a good assumption and why capacity shortages could begin to constrain growth in the coming decade. The first reason is the interaction between capacity constraints and competition policy. The second is the changing nature of environmental impacts on aviation.

The typical posture of airline managements has been to support additions to aviation infrastructure capacity. After all, if the infrastructure does not grow, neither can the airline industry. Indeed, in the United States at least, complaints from airline managers about infrastructure capacity shortages have been common. Airline support, however, depends on both cost and competitive factors. To the extent that airport additions are becoming more costly, airline support for these additions may decline. Widespread and severe airline losses have eroded the carriers capacity to absorb additional infrastructure costs. To the extent these costs are passed through to passengers, the resulting fare increases could erode passenger traffic, again hurting carrier profits.

Even if airline profits recover and airport capacity costs are kept low, carriers may still oppose specific capacity additions. A capacity shortage makes new entry of a new carrier into a market more difficult and thus can confer an advantage to the incumbent. Slot sales at capacity-constrained airports give some idea of the economic rents earned by the holders of those slots. Were capacity

added to these airports, these rents would be dissipated. Thus an incumbent carrier at an airport must consider only the cost of the capacity addition and the new traffic that might be carried

were the constraints lifted, but also the loss of rents from the existing capacity shortages. It may often be the case that airport expansion favors those who want to enter markets at that airport at the expense of the incumbent carriers. Incumbent carriers frequently have considerable influence over airport expansion decisions, either formally through contractual or lease arrangements such as Majority in Interest clauses, informally through long standing relationships, or when both the airport and the principal incumbent carrier are both partially or wholly owned by the same government. In an increasingly competitive airline market, grandfather rights can be an important competitive weapon that the airlines will be reluctant to see weakened.

Even where there is agreement about the need for airport expansion, the changing nature of aviation environmental considerations may increase the cost of expansion, hinder it, or even prevent it. For years, the aviation community has considered noise to be the primary, indeed typically the only, environmental problem. Noise considerations have reduced airport capacity in some locations by curtailing the hours the airport can operate or by curtailing the use of certain runways even when the airport was open. Noise considerations have also increased airport costs in the absence of expansion by forcing airports to buy nearby land that is affected by airport noise. Indeed, land

acquisition and real estate expertise are increasingly important skills needed by airport management. Noise will continue to be a major problem at an increasing number of airports, particularly as runway additions are considered.

Recently, air emissions have been added to noise as an environmental problem confronting aviation. Ground-level emissions from surface transport to and from the airport and from aircraft ground operations are already a problem at some airports in metropolitan areas with high air pollution levels -- the so-called "non-attainment" areas in the United States. As the major industrial polluters and coal-fired electric power plants clean up their emissions, airport-related emissions are likely to command increasing attention from environmental officials and the public. A second potential emission problem is high-altitude emissions from aircraft. Growing concern about ozone destruction and global warming has lead to increased attention to the possible contribution of aircraft emissions to these problems.

Still more recently, water pollution from airport operations, notably runoff from aircraft and runway deicing, has become the target of new regulations and increased environmental concern. It is hardly surprising that aviation is an increasing focus for environmental concerns, if anything, it is surprising that it has taken so long. For example, for years Chicago's O'Hare airport has put the equivalent of over 1,000,000 gallons of untreated pure ethylene glycol into a single river each year. O'Hare is by no means alone in this problem. How many industrial factories could get away with that sort of a waste stream for this long? Clearly aviation is no longer immune to the full range of environmental concerns and will have to face the environmental consequences of its actions just as other industries have for years. As with other industries, preventing or mitigating environmental damage will add to the cost of operations and to the cost of constructing new facilities.

For aviation, the change from considering only noise to facing a full range of environmental concerns will be dramatic. Virtually all of the industry's experience with environmental concerns has been with noise, which is essentially a local issue. A small number of people who live close to the airport are affected by noise. In addition, while these people may be hurt by airport noise, the city in which they live benefits from the airport's activities so that the communities involved face tradeoffs in attempts to alter or curtail airport activities. With the array of environmental concerns broadening, the arenas in which these new battles will be fought could be much different. Airports will increasingly face opposition from national or international environmental groups who are better organized with considerable

experience in such battles and with more resources and more talented advocates than has typically been the case with noise local battles.

Taking another lesson from other industries, airports may also increasingly find themselves in battles where the "tool" used to fight the battle is not the real issue at all. With the Tellico dam in Tennessee, the snail darter was not really the issue and with lumbering in Oregon, the spotted owl is not really the issue. In these and many other cases, the goal is to stop a particular project or activity, and laws like the Endangered Species Act are simply the tool judged most effective to achieve that goal. This is an important distinction because it means that resolving the stated issue will not necessarily clear the way for continued operation or a new project. Resolving the stated issue may simply mean that a new and different issue will emerge to take its place.

Confronting national environmental problems will also require a different sort of proactive behavior. Many airports now realize that waiting until a project is proposed to work on noise issues and develop good community relations is far too late. Similarly, with national or international environmental regulation, waiting until the laws are passed to see the potential impacts for aviation is too late. As many other industries have learned, it is far more effective to monitor and help shape environmental laws and regulations as they are being developed than to try to reverse or change them after they begin to take effect. Increasingly, aviation will simply be included in laws and regulations developed for a broad array of industries, as was the case with the stormwater runoff regulations that now govern runoff of deicing fluid in the United States. The danger is that rules which seem reasonable for other industries may have unforeseen adverse consequences for aviation. Unless aviation interests are represented in the rulemaking process, such situations may not be discovered until considerable unnecessary damage has been done, at which point change may be extremely difficult.

The airline industry may also be facing a different world in the future because of an emerging fundamental change in its underlying economics. Throughout its history, the industry has had strong productivity growth because of dramatic technological improvements in aircraft and navigational aids. While aircraft and navigational aids continue to improve and grow more sophisticated, there seems little likelihood of further technological changes so dramatic as to lower the cost of air travel substantially. Indeed, whereas the price of air travel has fallen steadily in the past three decades (with the exception of a couple of brief periods where fuel prices increased dramatically), the ICAO forecasts call for an average increase of 0.5 percent per year in real

yields during the 1990 to 2001 period. Capacity constraints and increased environmental costs could increase the price of air travel even more.

For an industry to come to the end of a long period of falling costs as productivity gains gradually slow while regulatory and other costs increase is not a phenomenon unique to the airline industry. Other industries that have gone through such a transition have found it difficult and disruptive. One example is the U.S. electric power industry. Throughout most of its history this industry had falling costs as productivity improved and economies of scale in electricity generation were exploited. By the late 1960s most of these gains had been achieved and in the early 1970s, the combination of slow productivity growth, rising oil costs, and emerging environmental regulations lead to a reversal of the falling cost trend and the onset of a period of rising electricity costs. The electric power industry was slow to realize what had happened,

underestimated the effect of rising electricity prices on consumer demand, overestimated future demand for electricity, and found itself with too much generating capacity on line and under construction. Moreover, utilities found that the new capacity they were bringing on line was higher cost capacity than the plants they were replacing. The result was near chaos in the industry and a rash of financial problems and project cancellations. Business strategies that had proven successful when costs were falling, proved disastrous when costs were rising. To be sure the airline industry is different from the electric utility industry in many important ways. Nevertheless, the conditions that caused such problems for electric utilities appear to be coming to the airline industry and, indeed, may already be here. While these conditions will not likely pose the same problems for airlines they posed for utilities, it is almost certain that these changing conditions will cause the airlines problems that they have not yet had to face.

In sum, the airline industry faces the coming decade with the expectation of continued strong growth, but growth at a slower rate than in the past. To realize that growth, the industry will have to overcome potential infrastructure constraints where the consensus to add capacity may be increasingly difficult to achieve, to face a full range of environmental problems, and adapt to a new underlying economic environment where strong productivity growth from technological progress can no longer be counted on to lower the cost of air travel.

¹ International Civil Aviation Organization, *Outlook for Air Transport to the Year 2001*, ICAO Circular 237-AT/96, Montreal, Canada, 1992

APPENDIX C

THE MARKET AND AVIATION INFRASTRUCTURE: PRICING, PRODUCTIVITY AND PRIVATIZATION

David Gillen
University of California, Berkeley, and
Wilfrid Laurier University

The Airport Capacity Enhancement Plan (1989) forecasted that delays in the U.S. will continue to grow. In 1987 21 airports each exceeded 20,000 hours of airline flight delays and by 1997, the report claims, this can be expected to rise to 39 airports, assuming no improvements in the system. Three airports are forecasted to exceed 100,000 hours of aircraft delays by 1997. This document and many others which speak to the growing congestion in the U.S. aviation system note that these delays are what can be expected "if no increases in capacity are carried out". Those concerned with delay are not the only ones calling for investment in capacity, those advocating public physical infrastructure spending also argue for investment but for somewhat different reasons: to revitalize America and increase the Nation's productivity and competitiveness. These groups are joined by governor's task forces and joint economic committees, all calling for public spending on transportation, including aviation, infrastructure.

Making airports and the aviation system bigger is not necessarily the route to take. Making the system and its components smarter is most certainly the way to go. But why, what is the problem? Is the system too small, are there too many flights, too many airplanes, too many airlines and passengers? Let's double the size of O'Hare, Newark, Los Angeles, San Francisco, and Boston Logan. What would we expect? Immediately upon completion, benefits will flow from this investment as travel costs will have been lowered, less time will have been wasted, and airline will have lower costs as a result of less fuel, capital, and crew time wasted. Lower costs with lots of capacity will stimulate demand, new businesses will spin off, land use will expand, the economy will grow, and 20 years hence our children will wonder why they have flight delays and congestion and ask what they can do to fix the system.

The Nation's aviation system will not and should not be immune to the rethinking and structural changes that are taking place in the private sector and beginning to filter into the public sector. The catch phrase, "getting

more out of less", echoing through the halls of corporate America does not mean not to invest in capacity. It means something quite different: demand management must be used to improve the efficiency (productivity) of the system; any investment in capacity must involve *smart* capacity; and the institutional structure must create the right incentives for long-term decisions. As a fourth point led me add that public spending on aviation infrastructure does not guarantee a solution to recession or improved productivity.

I would like to consider each of the three points raised earlier. First, what does it mean to improve productivity with demand management? Very simply, pricing and investment policies must reflect the true social costs of building and using aviation capacity. Efficiency in this context goes beyond an elementary output per unit of input measure. It means that if we use prices to signal what it costs our economy to produce and use our aviation system, users will reveal the amount of aviation service they would like to have. It makes little sense that a decision to expand the system is based on the conclusion that there is excess demand when the use of airports is not priced to reflect the costs of production. If a subsidy is being paid, is it any wonder there is some excess demand? Efficient prices are those that result in the greatest economic welfare to the community (broadly defined) from the use of capacity and in the optimal investment in capacity to ensure this welfare optimum is maintained over the longer run.¹ Therefore, to improve productivity means to put in place use charges that lead to the highest level of economic welfare per unit of input. This includes consideration for externalities such as noise and air pollution.² Efficient pricing and investment, as Winston (1991) claims, could generate approximately \$11 billion in annual benefits (1988 dollars). The vast majority of these benefits are in the form of reduced traveler delay and lower airline operating costs. The political cost is that such a scheme would result in considerable redistribution from travelers to airports and higher costs to some general aviation (GA) users.

Why has there been such reluctance to use economic measures. There are a number of reasons. First, there is the misconception that since pricing will not eliminate congestion it is not worth introducing. The problem here of course is the failure, particularly on the part of academics and other experts, to convey the fundamental idea that the optimal amount of congestion is not zero. It would be impossible to provide sufficient capacity to eliminate congestion. Rather there is an amount of

congestion that which is worth just what it costs. Second, in past decades there has generally been sufficient excess capacity in our airport system that congestion was not a problem. However, this has led to an attitude among policy makers and the general public that excess capacity is a public good.³ It is somehow deemed desirable to build runways and air traffic control systems to satisfy the maximum demand thereby leaving large amounts of excess capacity at other times. Third, the public and airlines (and GA users) argue they have paid for the runways why should they have to pay for them again. While there is considerable debate as to who has picked up the bill for the infrastructure, this attitude fails to distinguish the allocation of runway use from the payment for the capital stock and it clearly indicates people are myopic regarding their contribution to the congestion problem. Fourth, proponents of runway pricing have presented it as a demand management tool independent of other policy decisions. This has unfortunately led to criticisms by those users who may be priced off a facility who legitimately ask, "what am I supposed to do"? Without question, pricing must be introduced in conjunction with other policy tools as a management package. Fifth, the proponents of economic management have in the past failed to provide some measure of the benefits arising from the use of this tool rather than some other. They have traditionally tried to sell runway pricing on the basis of economic efficiency yet the public has no understanding of the concept. It does not provide a meaningful measure of benefits in their eyes. It is only recently that the sizable welfare gains have been quantified and that the real economic benefits arising from efficient pricing and investment in transportation infrastructure, have been made known to a broader public audience. Winston (1991) has estimated welfare gains nearly \$11 billion annually from efficient pricing and investment. Massport has proposed a new peak hour pricing program at Boston Logan Airport and claims such a pricing scheme could cut peak hour activity by near 10 percent which would lead to a 20-percent drop in average flight delays. Finally, and perhaps the strongest argument used against pricing is the claim that it is inequitable, that it discriminates against the outlying regions and reduces access to larger centers. There is no clear evidence that this will, in fact, be the case.

Second, what does it mean that an investment in capacity must involve "smart" capacity? Smart capacity incorporates new technology and uses it to manage. It is not enough that airports or ATC systems are bigger. New technology allows investments in capacity to monitor, time, and direct aircraft on the ground and in the air. It can be used to charge for the use of runways,

airspace and navigational aids with little additional cost and no slowdown.

This smart capacity is not only useful for introducing economic measures to manage capacity but also for refining them and collecting information on usage to develop superior investments in the future. New technology can also be used to increase the capacity of the system without investing in new infrastructure that would simply enlarge the system. Third, what does it mean to have the institutional structure provide the right incentives for long-term decisions? In a word, privatization or corporatization. Aviation system infrastructure is for the most part publicly owned. The ideal view of privatization is that it enhances individual freedoms, encourages and improves efficiency, makes industry more responsive to the demands of the customer, decreases the public debt, and reduces the potential stranglehold of labor by forcing management to face the realities of the marketplace.⁴ The argument is made that, when projects meet private investors' profit return expectations, only economically sound projects will be undertaken. Furthermore, the operation of infrastructure facilities by private operators is claimed to result in lower costs than if it were run by the public sector. The cost savings are said to be real efficiency gains and not simply transfers from one sector of the economy to another.⁵ The private sector also represents a source of financing for development, expansion, and improvement of infrastructure at a time when governments are meeting increasing taxpayer resistance and are reluctant to further increase their debt. Finally, there is an argument that a public firm would have less incentive to charge socially efficient prices. This is based upon the notion that public firms will be used for general government purposes such as promoting regional economic development, and that allocative inefficiencies would arise from a government firm and provide the wrong mix of outputs.⁶ This means that with public ownership there is some likelihood that infrastructure will be financed out of general revenues rather than through user charges.

Opponents charge that privatization would lead to monopolies, loss of service, reduced flexibility, and unfairness among users as well as between modes. They view private ownership as a return to the mean market mentality of the nineteenth century, to the elevation of private greed over public interest, and a shortsighted policy that sells valuable state assets in order to finance tax cuts and converts public monopolies into private ones with no adequate safeguards for the consumer or worker. (Veljanovski 1987)⁷

Advocates of privatization or liberalization base their arguments upon three bodies of economic literature:

property rights, transaction cost, and principal agency. Property rights literature focuses upon the non-transferability of ownership claims in the public sector. Transaction cost literature analyzes the decision by an economic agent, such as a firm, to make or buy a product or service. Principal-agent literature is concerned with the problem of information and incentives and addresses the question of what is the optimal incentive scheme for the principal to lay down for the agent. (Vickers and Yarrow, 1989) This refers to a situation in which a shareholder of a firm (the principal) has interests that differ from those of the manager. The shareholder hires the manager (the agent) to represent him or her and to manage the firm to achieve the best rate of return for the principal. The problem is that the principal cannot control what the agent does and thus must try to develop incentive schemes that will lead the agent to act on the principal's behalf.

Transaction cost literature (Williamson, 1985) focuses upon the make-or-buy decision by government. The three options available to the government are to have the product or service provided and marketed by the private sector, to have it produced by the private sector through contracts and purchased by the public sector for allocation and distribution, or to have it provided by the public sector. The decision will rest upon the ability of government to have private sector production and to extract the rents from the more efficient production of the private sector. Interestingly this is the same behavior as a private firm. Economic welfare is enhanced if the private sector produces the product or service, and it is more efficient if the private sector also appropriates the rents.

Much of the debate over privatization has focused upon the greater efficiency of the private sector and the potential cost savings. It is also seen as attractive for financing much needed capacity increases that the public sector cannot or will not undertake. Herein lies the real rub. The public sector has failed to price what it owns and operates in an efficient manner. The end result is not only excess demand but also inefficient levels of investment. It is not that the public sector is unable to price efficiently, it is simply unwilling, because with its historical operating measures and procedures, it has left the impression with the public that there is community fairness and value in underpricing, uniform pricing, and excess capacity.

Perhaps the most important outcome of corporatization and privatization is removing investment and pricing decisions from the hands of politicians and bureaucrats, who have some grand notion that building airports, ports, roads, and railways will somehow provide the panacea for economic ills of a region or nation. What has generally happened is government has not only provided the capacity but underpriced it as well. It

should be remembered that transportation is a derived demand and neither investments in capacity nor policy initiatives will alter economic activity in a substantive way. This simple notion seems to be lost to proponents of public ownership. In their view, privatizers fail to see the need for the government to provide public services in the event the private sector fails to provide them. The publicizers see government as wise, disinterested, and technically competent. The evidence is far from compelling for this view particularly when governments intervene to direct markets. Government failure has done more harm than market failure and privatization. Or, at the very least, corporatization, provides a superior solution.

Finally let me address the claims of the group that argues for investment of public funds in public transportation infrastructure to end the recession and increase productivity. There is nothing new in the current clamor for greater public investment. It is an example of what some have termed the "grand transportation mystic": the belief (or hope) that investment in roads, bridges, airports, canals, and harbors provides an elixir for economic ills that face any town, city, region or nation.

When community leaders are asked about the value of a proposed new airport, they typically use a standard economic impact study to project numbers of jobs created, tax revenue generated, income created, and generally just how much a contribution public investment makes to the local economy. However, standard economic impact studies usually stress employment and purchases during construction, which undoubtedly represent a shot in the arm for the economy in the short term. The typical studies say nothing about long-term assistance to the economy and ignore the activity created by the investment funds in their alternative use. Often the jobs in transit systems or airports once built are counted as benefits while, in fact, they are costs to be paid and not a measure of the contribution of infrastructure to economic growth and development.

No one would deny that investment in transportation and other public infrastructure can have some impact on private productivity, costs, profitability, and economic growth. However, this has been a conclusion based on an intuitive acceptance rather than any clear or convincing analysis. Over the last five years, some researchers have been engaged in a statistical crusade to establish an association between public spending on infrastructure and private sector productivity. The result has been a voluminous literature. However, we simply have not been able to establish the linkage analytically. There certainly seems to be a relationship, but there has yet to be a clear statement of cause and effect.

Growth in an economy depends upon its ability to be competitive in world markets and to have a rising level of productivity. Researchers have, therefore,

concentrated on the public investment-productivity link as the focus of their investigations. Almost every study has indicated that public capital investment makes a positive contribution to private productivity. The results, however, have a wide variation. The 1988 paper which stimulated this literature claimed that each dollar of public capital investment would lead to approximately 60 cents in additional output for the economy. This represented a return to public capital exceeding the return to private capital by a factor of approximately 3 or 4. Critics quickly pounced on this figure, claiming it was too high. Volumes of paper emerged. Recently, a comprehensive review published by the Federal Highway Administration refined the estimate and stated that there is a "weak positive effect on private economic activity." Although empirical studies have established a statistical relationship between private productivity and public investment, they do not provide any additional understanding of how the transportation infrastructure or other public investment affects private productivity or what the mechanism is.

Proponents of public investment in infrastructure contend it will move the country out of the lingering recession and help to turn around the downward slide in productivity growth which began in approximately 1970, just about the same time investment in public infrastructure also declined. A number of academics also argue that such spending will cure the malaise of the American economy. This view contrasts sharply with the policy being followed in some other countries. In Canada, for example, the Royal Commission on National Passenger Transportation in its recently released final report recommended against any large public investment in infrastructure at this time. One reason for the decision was the lack of any convincing evidence of how such investment would lead to long-term economic growth and development. Instead, the Commission's recommendation was to first get the pricing of infrastructure right.

References

- Borcherding, T.E., W.W. Pommerchene and F. Schneider (1982), "Comparing the Efficiency of Private and Public Production: The Evidence from Five Countries" *Zeitschrift fur Nationalokonomie Journal of Economics*, Suppl. 2, p. 127-156.
- Gillen, D. and Tae Oum (1992) "Transportation Infrastructure Policy: Pricing, Investment and Cost Recovery" in *Directions: The Final Report of the Royal Commission on National Rail Transportation*, Volume 3, pp 503-613 (with Tae Oum).
- Gillen, D. (1992), "A Pricing Paradigm" *ITS Review* (May), Vol. 15, No. 3, pp. 2-6.
- (1993) "Airports and Seaports in Canada: An Assessment of Privatization of Ownership & Operation" (forthcoming in F. Palda [ed.] *Transportation Infrastructure and Operations in Canada*, Fraser Institute).
- (1993) "Peak Pricing Strategies In Transportation, Utilities And Telecommunications: What Lessons Do They Offer For Roadway Pricing" forthcoming in *TRB Special Report*, National Academy of Sciences, Washington, DC.
- (1993) "Investing in Infrastructure: Will it really Yield a More Competitive Nation", *ITS Review*, Vol. 16, No. 3 (May) 2-4.
- Gillen, D. and T.J. Levesque (1993) "A Socioeconomic Assessment of Complaints about Aircraft Noise" (forthcoming in *Transportation Planning and Technology Journal*).
- *Golaszewski, R. (1990), "Aviation Infrastructure -- A Time for Perestroika?" (draft) paper presented to the Conference on the Global Airline Industry: Future Directions, Future Policies" College of William and Mary, Williamsburg, Virginia (November).
- Swann, Dennis (1988), *The Retreat of the State: Deregulation and Privatization in the U.K. and U.S.* (University of Michigan Press) Ann Arbor.
- Veijanovski, Cento (1987), *Selling The State*, Weidenfield and Nicolson, London.
- Vickers, J. and G. Yarrow (1989), *Privatization: An Economic Analysis* (MIT Press) Cambridge.
- Williamson, O. (1985), *The Economic Institutions of Capitalism*, Free Press.

¹ Economists have long argued that prices perform two functions. In the short run they ensure capacity (capital) is used in the most efficient way possible and in the longer run that capital flows into those types of investment that yield the highest return.

² The TRB Special Report 226, Airport System Capacity: Strategic Choices, devotes all of four pages to consideration of economic measures to distribute

demand. The report concludes that the principal disadvantages of economic measures would be increased air fares for peak travelers (yes, precisely what one wants), reduced airport access for new entrants and financially weak carriers who would be unable to afford costly peak-period slots (no, just the opposite would occur; since all costs are now averaged, there are entry barriers because these slots cannot be purchased and they carry a high value/rent precisely because the peak is not priced), and the potential loss of some regional air service (again, not all bad, and there are other solutions).

³ Winston makes this point. See Winston, C. (1991), "Efficient Transportation Infrastructure Policy", *Journal of Economic Perspectives*. Vol. 5, No. 1 (Winter) 13-127.

⁴ The major objectives of privatization were perhaps best spelled out by Great Britain's then Financial Secretary to the Treasury, John Moore, in 1983 and augmented by a subsequent government White Paper. They are: 1) to reduce government involvement in the decision making of industry; 2) to permit industry to raise funds from capital market on commercial terms without government guarantee; 3) to raise revenue and reduce the public sector borrowing requirement; 4) to promote wide share ownership to create an enterprise culture; 5) to encourage workers to share ownership in their companies; 6) to increase competition and efficiency; and 7) to replace ownership and financial controls with a

more effective system of economic regulation designed to ensure that benefits of greater efficiency are passed on to consumers. (Veljanovski 1987)

⁵ See Gomez-Ibanez, John Meyer, and Luberoff (1991), "The Prospects for Private Infrastructure: Lessons from U.S. Roads and Solid Waste", *Journal of Transport Economics and Policy*, Vol. XXV, No. 5 (September) 259-279.

⁶ In the absence of these two arguments there is no strong theoretical argument that a more efficient form of, and base for pricing is more likely with private operation than with public operation.

⁷ If there are positive externalities which convey benefits by virtue of public ownership or efficiency gains from cost savings arising, from scale economies attributable to public ownership or regulation, public provision or standards are economically justified. Similarly, if there are network externalities resulting from the fact that all parts of the network are complements, government intervention may provide efficiency gains. Another legitimate basis for public intervention is when people make a decision whereby the marginal social cost exceeds the marginal private cost and private markets cannot be developed to internalize these effects. However, to use public ownership simply as a means to redistribute income does not constitute a legitimate public policy objective.

APPENDIX D

PISTON AVIATION ENGINES: A MANUFACTURER'S PERSPECTIVE

Michael D. Wolf
Textron Lycoming Reciprocating Engine Division

Textron Lycoming Reciprocating Engine Division has been producing piston aviation engines for 64 years at its Williamsport, Pennsylvania plant. Over 260,000 engines have been produced in radial and horizontally opposed configurations. Of these, there are estimated to be 175,000 still active around the world.

With the depressed state of the industry, there are only about 1,500 new, certified aircraft being produced per year (excluding any produced in Russia or China that are not powered by Western engines). The survival of the engine business in this market is only due to the support of the fleet of aircraft (approximately 300,000 including Lycoming and Continental). The OEM business (engines for new aircraft manufacturing) has been reduced from over 30,000 engines in 1978 to only 1,500 in 1992. The spare parts and rebuilt engine business now accounts for over 75 percent of the revenues of the engine manufacturers.

The aircraft manufacturers are mostly small and fragile in this market, and there are few multiproduct companies left. The largest companies are Beech and Robinson. Beech still produces several variants of the Bonanza and Baron in large quantities, and Robinson produces about 200 of its R22 helicopter and are growing their production of the larger R44. No other producer is building more than a few dozen aircraft, and this is a long way from the production line quantities built by Cessna, Beech and Piper in the late 1970's.

With Piper in Chapter 11 and several other companies moving in and out of production as the order books fluctuate, the industry is in critical condition. It may be that consolidation of companies will be necessary since there are over 50 companies around the world producing these 1,500 aircraft per year — an average of only 30 units per company. Most of these companies produce fewer than 20 units per year, and this is not going to provide any efficiency in the production process. Consolidation of companies with noncompeting products would allow for consolidating sales and administrative staffs. If this does not take place, many of these companies will likely fail in the next few years. This may allow the remaining companies to survive.

One new wrinkle in the market is the probable entry of certified versions of kit planes from the largest and most sophisticated of these companies. There may also

be new certified engines that will enter the market below the traditional horsepower threshold of 100 horsepower. These new products will come into the market without the product liability tail that burdens the old-line producers. They may be able to produce aircraft with new features for more affordable prices.

The market could also be flooded with cheap imports from Eastern Europe, where labor costs are much lower. Tort reform could get through Congress and help lower the cost of flying.

However, these possibilities are not without risk. Maybe the new kits will not be easily certified or will become more expensive when meeting the requirements of certification. The Eastern European products may prove to be unmarketable in the West due to real or perceived product feature inadequacies or poor designs. Tort reform may languish in committee for many more years, as it has for the past decade. If all of these eventualities come about, the market is likely to remain small or even shrink further.

Simply stated, flying is too expensive, too much work, and too hard to do anymore. Part of this is due to the average worker's loss of disposable income and leisure time in a more competitive worldwide market. And government policies are affecting the industry through increased taxes and the end of GI-Bill flight instruction benefits.

In summary, Textron Lycoming is aware of most changes in the general aviation sector due to high levels of involvement in all phases of the market. These are very difficult times, and cost control will remain one of the best methods of surviving. Thus, forecasts should be realistic and take into account all of the negative influences on the market. A slow growth forecast, as all recent forecasts have been will not be realistic in forecasting production of new aircraft, fleet size, or flight hours. Better methods of estimating flight hours will help establish more accurate trend data, and more timely reporting will help the industry adjust to changes in demand in a more responsive manner. The present government and industry forecasts are too optimistic and not in line with the current reality.

APPENDIX E

LIST OF PARTICIPANTS

Participants Key

DAV - Domestic Aviation	VFL - Vertical Flight
INT - International Aviation	BUS - Business Aviation
REG - Regional Aviation	CHM - Chairman
INF - Aviation Infrastructure	SPK - Speaker
MFG - Aircraft & Engine Manufacturers	M - Panel Moderator
GEN - Light & General Aviation	SPL - Special Guest

Doug Abbey
AvStat Associates
2501 K Street, N.W. 6A
Washington, D.C. 20037
202/338-1727 FAX 202/337-1477
REG

Ralph Aceti
Vice President, Marketing Services
Lear Jet, Inc.
P.O. Box 7707
Wichita, KS 67277-7707
316/946-2296 FAX 316/946-2204
BUS

Vern Albert
Vice President & Chief Pilot
Petroleum Helicopters, Inc.
230 Steiner Rd.
Lafayette, LA 70508
VFL

Fletcher Aldridge
Editor
Aircraft Bluebook
P.O. Box 12901
Overland Park, KS 66282-2901
913/967-1719
GEN

Michael Ambrose
Director General
European Regional Airline Assoc.
Fair Oaks Airport
The Baker Suite, Chobham
Woking, Surrey GU24 8HX
UNITED KINGDOM
44 276 85 64 95 FAX 44 276 85 70
38
REG

Ernest S. Arvai
President, The Arvai Group
P.O. Box 468
Windham, NH 03087-0468
SPK

Charles M. Barclay
Executive Vice President
American Association of Airport
Executives
4224 King Street
Alexandria, VA 22302
SPK

Patricia Beardsley
Statistics and Forecast Branch
(APO-110)
Federal Aviation Administration
800 Independence Ave., S.W.
Washington, D.C. 20591
202/267-8032
GEN

David M. Behrmann
 Manager, Route Planning
 AMR Eagle, Inc., MD 5494
 P.O. Box 619616
 Dallas/Fort Worth Airport, TX 75261-9616
 817/967-3936 FAX 817/967-3931
REG

Paul Biederman
 Director, Economic Analysis and
 Forecasting
 Trans World Airlines, Inc.
 110 S. Bedford Road
 Mount Kisco, NY 10549
 914/242-3478
DAV

Jan Blais
 Jan David Blais & Associates
 63 Elm Road
 Newton, MA 02160
 617/244-5918 FAX 617/244-2562
DAV

Thomas L. Bosco
 Sr. Airport Engineer
 Port Authority of NY & NJ
 One World Trade Center, 65E1
 New York, NY 10048
 212/435-3694
VFL

Robert Bowles
 Mgr., Stats. & Forecast Br. (APO-110)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3359 FAX 202/267-3324
INT

Tom Browne
 Managing Director, Airports
 Air Transport Association
 1201 Pennsylvania Ave., N.W., Suite 1100
 Washington, D.C. 20004-1707
 202/626-4100 FAX 202/626-4149
INF

Cameron Burr
 Burr and Associates
 P.O. Box 682306
 Park City, UT 84068
 801/645-7570 FAX 801/645-7226
DAV

Alain Buttaud
 Market & Aircraft Analysis
 Manager
 Dir. du Developpement Civil
 SNECMA
 104, Avenue du Kennedy
 75016 Paris, FRANCE
 (33-1) 44.14.54.05
 FAX (33-1) 44.14.55.51
MFG

Andrew Callen
 President
 Boston Jet Search, Inc.
 Hanscom Field
 Civil Air Terminal
 Boston, MA 01730
 617/274-0074 FAX 617/274-0028
BUS

Gus Carbonell
 Director, Planning & Scheduling
 Mesa Airlines, Inc.
 2325 East 30th Street
 Farmington, NM 87401
 505/326-4406 FAX 505/326-4485
REG

Ruth Chambers
 Learn to Fly Promotional
 Team, Inc.
 c/o Atlantic Aero
 6423 Airport Parkway
 Greensboro, NC 27409
 919/668-0411 Ext. 1300
GEN

Pamela K. Charles
 Director of Heliports
 Helicopter Assn. International
 1619 Duke Street
 Alexandria, VA 22314-3239
 703/683-4646 FAX 703/683-4745
VFL

Steve Charters
 Market Research Manager
 Rolls-Royce plc, Civil Engine Group
 P.O. Box 31
 Derby DE2 8BJ
 UNITED KINGDOM
 44-332 248482 FAX 44-332 248288
MFG

Jean-Marie Chevalier
 Vice President, Planning & Engrng.
 Aeroport de Paris
 291 Bd. Raspail
 75675 Paris Cedex 14 FRANCE
 FAX 011 33 1 4975 1240
INF

Dong Cho
 Department of Economics
 Wichita State University
 Box 78
 Wichita, KS 67208-1595
 316/689-3220
BUS

James Christiansen
 KC Aviation, Inc.
 7440 Aviation Place
 Dallas, TX 75235
 214/902-7500
BUS

Louise Congdon
 Gen. Mgr., Market Strategy
 Manchester Airport PLC
 Manchester M22 5PA
 UNITED KINGDOM
 44-61-4893798 FAX 44 61 4893812
INT

Jan Ernst de Groot
 KLM Royal Dutch Airlines
 Manager Foreign Relations and
 Cooperation
 Amsterdamseweg 55
 1182 GP Amstelveen
 THE NETHERLANDS
 31 20 6494632 FAX 31 20 6492431
INT

James C. De Long
 Director of Aviation
 Stapleton International Airport
 Room 3227, Terminal Building
 Denver, CO 80207
 303/270-1203 FAX 303/270-1060
INF

Richard de Neufville
 Chair, Technology & Policy
 Program
 Room E40-252
 Massachusetts Institute of
 Technology
 Cambridge, MA 02139
 FAX 617/253-7140
INF

Ross De Vol
 The WEFA Group
 401 City Avenue, Suite 300
 Bala Cynwyd, PA 19004
 215/660-6336
SPK

Chuck Dennis
 Manager, Strategic Planning
 Branch (APO-120)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3220
VFL

Mark Diamond
Associate
Mercer Management Consulting, Inc.
33 Hayden Avenue
Lexington, MA 02173
617/861-7580 FAX 617/862-3935
M-DAV

Kevin Dopart
Congress of the United States
Office of Technology Assessment
Washington, D.C. 20510-8025
202/228-6937 FAX 202/228-6098
INF

John Drake
Transportation Consultant
3909 Somerset Place
West Lafayette, IN 47906-8855
317/463-5882 FAX 317/463-4610
REG

Martin Dresner
Assistant Professor
College of Business & Management
University of Maryland
College Park, MD 20742
301/405-2204
DAV

Robert Duclos
Chief, Aviation Forecasting
Transport Canada
Tower C, Place De Ville
Ottawa, Ontario K1A 0N5
CANADA
613/990-3820 FAX 613/957-3280
INT

Rosalind Ellingsworth
AIRTRANS
1916 North Daniel Street
Arlington, VA 22201
703/524-0630
DAV

Michael Ellis
Head of Forecasts Section
Civil Aviation Authority
Room T 422, CAA House
45/49 Kingsway
London, WC2B 6TE
UNITED KINGDOM
71-832-6379
INT

Ludwig Erlebach, Dipl.-Ing.
Dir. Market Research
MTU Motoren-und-Turbinen
Union
Postfach 50 06 40
80976 Munich GERMANY
49 (89) 1489-3731 FAX 49 (89)
1489-6342
MFG

Paul Fiduccia
Small Aircraft Manufacturers
Association
1400 L Street, N.W., Suite 800
Washington, D.C. 20005
202/842-8101
GEN

William A. Fife
General Manager
Aviation Planning Div., Rm. 65-E
Port Authority of NY and NJ
One World Trade Center
New York, NY 10048
212/435-3800
INF

John W. Fischer
Head, Industry Analysis and
Transportation
Congressional Research Service
Economics Division
Library of Congress
Washington, D.C. 20540
202/707-7766 FAX 202/707-7388
CHM

Ken Fleming
Operations Research (AOR-100)
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591
GEN

Kenneth Flick
Council of Governments
777 North Capitol Street, N.E.
Suite 300
Washington, D.C. 20002
202/962-3295
VFL

Eric Frankenberg
Market Assessment
Douglas Aircraft Co.
3855 Lakewood Blvd. M/C 7-82
Long Beach, CA 90846
310/593-8862 FAX 310/982-8967
MFG

Eric Gabler
Economic Analysis Branch (APO-220)
Federal Aviation Administration
800 Independence Ave., S.W.
Washington, D.C. 20591
DAV

Jonathan L. Gifford
Assistant Professor
George Mason University
Department of Public affairs
4400 University Drive
Fairfax, VA 22030-443
703/993-1395
SPK

David Gillen
School of Business & Economics
Wilfrid Laurier University
75 University Avenue West
Waterloo, Ontario
CANADA
FAX 519/884-0201
INF

Richard S. Golaszweski
Executive Vice President
Gellman Research Assoc., Inc.
115 West Avenue, Suite 201
Jenkintown, PA 19046-0231
215/884-7500 FAX 215/884-1385
M-INF

Vicki L. Golich
Associate Professor, Political
Science
California State University
San Marcos, CA 92096-0001
619/752-4144 FAX 619/752-4030
INT

Ron Green
Room 2122
Office of Aerospace
U.S. Department of Commerce
Washington, D.C. 20230
GEN

Don Guffy
Airport Capacity & Development
(ASC 110)
Federal Aviation Administration
800 Independence Ave., S.W.
Washington, D.C. 20591
202/267-5831 FAX 202/267-5767
VFL

Mike Hall
British Airways
Head of International Relations
Government & Industry Affairs
P.O. Box 10 (S234)
Heathrow Airport (London)
Hounslow, Middlesex TW6 2JA
UNITED KINGDOM
44-81-562555 FAX 44-81-5622512
INT

Gordon Hamilton
 President, Sypher Muller Int., Inc.
 220 Laurier Ave., West
 Ottawa, Ontario K1P 5Z9
 CANADA
 FAX 613/236-4850
 INF

Alan Hause
 Allied-Signal Aerospace
 2525 W. 190th Street
 Torrance, CA 90509
 213/512-1902
 BUS

Jim Haynes
 The FBO Resource Group
 201 Liberty St.
 Leesburg, VA 22075
 703/777-4142 FAX 703/777-3840
 GEN

Tom Henry
 Stats. & Forecast Branch (APO-110)
 Federal Aviation Administration
 800 Independence Avenue, S.W.
 Washington, D.C. 20591
 202/267-3103
 INF

Pierre Herron
 Senior Market Research Analyst
 Pratt & Whitney Canada, Inc.
 Box 10 (1000 marie-Victorin Blvd. East)
 Longueuil, Quebec J4K 4X9
 CANADA
 514/747-3934
 REG

Steve Hines
 Manager, Marketing Research
 Cessna Aircraft Company
 Citation Marketing Library
 P.O.Box 7706
 Wichita, KS 67277
 316/946-6867
 BUS

Steven M. Horner
 Manager, Market Planning &
 Development
 Bombardier Regional Aircraft
 MS N16-10, Garrett Blvd.
 Downsview, Ontario M3K 1Y5
 CANADA
 416/375-3229 FAX 416-375-4403
 M-REG

Barry K. Humphreys
 Head of Air Services Policy
 and Industry Affairs Branch
 Economic Regulation Group
 Civil Aviation Authority
 Room T518, CAA House
 45-59 Kingsway
 London WC2B 6TE U.K.
 071 832 5586 FAX 071 379 4047
 INT

Gary Ives
 Market Research Manager
 Hurel-Dubois UK Ltd.
 P.O. Box 31, Bancroft Road
 Burnley, Lancashire, BB10 2TQ
 UNITED KINGDOM
 44-282 414400
 FAX 44-282 412219
 MFG

Don Johnson
 Aircraft Owners and Pilots Assoc.
 421 Aviation Way
 Frederick, MD 21701
 301/695-2067
 GEN

Steven W. Johnson
 Business Planning Manager
 Honeywell, Inc.
 Business and Commuter Aviation
 Systems Division
 P.O. Box 29000
 Phoenix, AZ 85038-9000
 602/436-8820 FAX 602/436-8101
 REG

Billie Jones
 Manager, Market Planning
 Pratt & Whitney
 400 Main Street M/S 132-15
 East Hartford, CT 06108
 203/565-6574 FAX/565-1403
MFG

Peter Jost
 General Manager, Market Planning
 Airbus Industrie
 1 Rond Point Maurice Bellonte
 31707 Blagnac Cedex
 FRANCE
 33-61.93.33.21 FAX 33-61.93.31.01
MFG

Mary Pat Kanalas
 Mgmt. Info. & Mkt. Research Analyst
 GE Aircraft Engines
 1 Neumann Way (Mail Drop F-87)
 Evendale, OH 45215
 513/243-3766 FAX 513/243-5659
MFG

Don Kern
 System Mgr., Domestic Route Dev.
 Delta Airlines, Dept. 663
 Hartsfield International Airport
 Atlanta, GA 30320
DAV

Laurence J. Kiernan
 Office of Airport Plans & Programs
 Federal Aviation Admin. (APP-400)
 800 Independence Avenue, S.W.
 Washington, D.C. 20591
 202/267-8784 FAX 202/267-5383
INF

Peter A. Kivestu
 Director, Corporate Planning
 Northwest Airlines, Dept. A1140
 5101 Northwest Drive
 St. Paul, MN 55111-3034
 612/727-1119 FAX 612/726-0618
INT

David Lawrence
 P.O. Box 1439
 Fairfield, CT 06430-1439
 203/259-9500 FAX 203/259-3800
VFL

Wilson Leach
 Publisher
 Aviation International News
 81 Kenosia Avenue
 Danbury, CT 06810
 203/798-2400
BUS

Mike Lee
 Market Information Manager
 Dowty Group
 Arle Court, heltenham
 Gloucestershire GL51 OTP
 UNITED KINGDOM
 44-242 533838
 FAX 44-242 533199
MFG

Dong Liu
 Project Manager
 Apogee Research, Inc.
 4350 East West Highway
 Suite 600
 Bethesda, MD 20814
 301/652-8444 FAX 301/654-9355
SPK

Lloyd McCoomb
 Director General, Airport
 Marketing
 Transport Canada
 Place de Ville
 Ottawa, Ontario
 CANADA K1A 0N8
 613/990-1424 FAX 613/957-4260
M-INF

Gerald S. McDougall
 Dean, College of Business Admin.
 Southeast Missouri State University
 One University Plaza
 Cape Girardeau, MO 63701-4799
 314/651-2122 FAX 314/651-2200
BUS

Deborah C. McElroy
 Vice President
 Regional Airline Association
 1101 Connecticut Ave., N.W., Suite 700
 Washington, D.C. 20036
 202/857-1170
REG/VFL

Peter G. McGlade
 Director, Schedule Planning
 Southwest Airlines
 P.O. Box 36611
 Love Field
 Dallas, TX 75235-1611
 214/903-4121
DAV

Penny Mefford
 Mgr., Planning Analysis Div. (APO-100)
 Federal Aviation Administration
 800 Independence Ave.
 Washington, D.C. 20591
MFG

Gene Mercer
 Consultant
 5528 Yorkshire St.
 Springfield, VA 22151
 703/978-8705
SPL

Charles Moles
 Industry Analyst
 Federal Aviation Administration
 Off. of Aviation Policy & Plans (APO 110)
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3358
REG

Richard Mudge
 President
 Apogee Research Inc.
 4350 East West Highway,
 Suite 600
 Bethesda, MD 20814
 301/652-8444 FAX 301/654-9355
SPK

James Muldoon
 Special Assistant
 Office of Energy and
 Conservation (AEE-5)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 FAX 202/267-5594
INF

Francis P. Mulvey
 Assistant Director for
 Transportation
 U. S. General Accounting Office
 901 D Street, S. W., Suite 802
 Washington, D. C. 20024
 202/401-4643
DAV

Steve Murray
 Mgr. Market Analysis
 BAe Airbus Limited
 P.O. Box 77
 Bristol BS99 7AR
 UNITED KINGDOM
 44-272 693831
 FAX 44-272 362828
MFG

William R. Nesbit
 President
 Aviation Consulting Services
 620 Elmore Avenue
 Park Ridge, IL 60068-3441
 708/698-9662 FAX 703/823-4685
DAV

Anders T. Nilsson
 Manager, Marketing
 Volvo Flygmotor AB
 S-461 81
 Trollhattan, SWEDEN
 46 520 946 07 FAX 46 520 28645
MFG

Henk Ombelet
 Manager, Economics
 International Air Transport Assn.
 3rd Floor, Sceptre House
 75-81 Staines Road
 Hounslow, Middlesex TW3 3HW
 UNITED KINGDOM
 44 81 5723348 FAX 44 81 5722214
INT

Clinton Oster
 Indiana University
 SPEA 410
 Bloomington, IN 47405
 812/855-0193 FAX 812/855-7802
INF

Manfred Otersen
 Senior Market Research Analyst
 Deutsche Aerospace, MBB
 Hunefeldstrasse 1-5
 P.O. Box 107845
 D-2800 Bremen 1
 GERMANY
 49-421 538-28 30 FAX 49-421-538-3320
MFG

Pravin M. Parmar
 Mgr., Comm'l Business Development
 Northrop Corp., Aircraft Division
 One Northrop Avenue
 Hawthorne, CA 90250
 310/332-4921 FAX 310/332-3715
MFG

Deborah Peisen
 Sr. Systems Engineer
 SCT, Inc.
 1611 North Kent St., Suite 910
 Arlington, VA 22209
 703/243-3633
VFL

Kenneth W. Peppard
 Office of System Capacity
 (ASC-203)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-7375
INF

David Raphael
 President
 Marcar Management Institute
 Suite 214, 10 Scenic Way
 San Mateo, CA 94403
 415/571-6116 FAX 415/574-3392
SPK

Amit Rikhi
 Manager, Airports
 Apogee Research
 4350 East West Highway
 Suite 600
 Bethesda, MD 20814
 301/652-8444 FAX 301/654-9355
REG

Giovanni Ronchetto Salvana
 Mgr., Marketing Strategic Plng.
 Fiat Avio S.p.A.
 Corso Ferrucci, 112
 10138 Torino, ITALY
 39-11 3302 405
 FAX 39-11 3302 883
MFG

Joseph P. Schwieterman
 Assistant Professor
 DePaul University
 243 South Wabash Avenue, #805
 Chicago, IL 60604-2302
 312/362-5322 FAX 312/362-5322
M-DAV

Edward Scott
 Executive Vice President
 National Association of State
 Aviation Officials
 8401 Colesville Rd., Suite 505
 Silver Spring, MD 20910
 301/588-0587 FAX 301/588-1288
GEN

Oliver Sellnick
 Director, Corporate Strategy
 Lufthansa German Airlines
 FRA CE
 Lufthansa Base
 60549 Frankfurt 75
 GERMANY
 49-69-696-8990 FAX 49-69-696-8959
INT

John Sheehan
 Marketing Director
 Phaneuf Associates, Inc.
 1212 New York Ave., N.W.
 Suite 1100
 Washington, D.C. 20005
 202/898-1410
GEN

John J. Smith
 Forecast Branch
 Office of Aviation Policy &
 Plans (APO-110)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3306
DAV

Kei Sozuka
 Manager, Civil Aviation and
 Marketing Department
 IHI Aero-Engine & Space
 Operations
 Shin-Ohtemachi Bldg.
 2-1, Ohtemachi 2-Chome,
 Chiyoda-Ku, Tokyo 100 JAPAN
 81 (33) 244-5985
 FAX 81 (33) 244-5668
MFG

Frank Spencer
 Professor Emeritus
 Northwestern University
 Transportation Center
 1936 Sheridan Road
 Evanston, IL 60201
 312/492-5017
DAV

Paul Steggerda
 Manager, Business Planning
 Honeywell-Comm'l. flight Systems
 Group
 P.O. Box 21111
 Phoenix, AZ 85036
 602/436-1263 FAX 602/436-24
MFG

Steven Still
 Senior Director of Corporate
 Planning
 USAir, Inc.
 2345 Crystal Drive
 Arlington, VA 2227
DAV

Bruce Stoehr
 President
 BSA Company
 739 Willow Lake Road
 Charleston, SC 29412
 803/795-0266
VFL

Grady Stone
 Manager - USAir Express Planning
 USAir
 2345 Crystal Drive
 Arlington, VA 22227
 703/418-7060 FAX 703/418-7312
REG

John S. Strong
 Visiting Scholar
 Harvard Institute for Int'l. Development
 One Eliot Street
 Cambridge, MA 02138
 617/495-3748 FAX 617/496-4840
INF

Ronald Swanda
 Vice President, Operations
 General Aircraft Manufacturers Assoc.
 1400 K St., N.W., Suite 801
 Washington, D.C. 20005
 202/393-1500 FAX: 202/842-4063
M-GEN

John Theim
 Flight Standards Service (AFS-803)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
GEN

Leonard A. Theroux
 Manager, Market Planning
 International Aero Engines
 Corporate Center II
 628 Hebron Avenue
 Glastonbury, CT 06033-2595
 203/652-1811 FAX 203/659-8549
MFG

Vernon F. Thomas
 Mgr., Mkt. Analysis & Mgmt. Information
 GE Aircraft Engines
 1 Neumann Way (Mail Drop F-87)
 Evendale, OH 45215
 513/243-4032 FAX 513/243-5659
M-MFG

Tove Titlow
 Program Analyst (ASA-100)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C.
 202/366-6590
INT

Richard Van Balen
 P.O. Box 59381
 Potomac, MD 20854
 301/299-2424 FAX 301/299-2932
REG

Richard Van Gemert
 KC Aviation, Inc.
 7440 Aviation Place
 Dallas, TX 75235
 214/902-7500
BUS

Dirk Vandenberg
 Market Research
 Fokker B.V.
 P.O. Box 12222
 1100 AE Amsterdam-Zuidost
 THE NETHERLANDS
 31-20-605-7140
 FAX 31-20-605-7978
MFG

Jim Veatch
 Stats. & Forecast Br. (APO-110)
 Federal Aviation Administration
 800 Independence Ave.
 Washington, D.C. 20591
BUS

Bouke M. Veldman
 INB-Pegasus B.V.
 Aviation Advisory Group
 Mauritskade 27
 2514 HD The Hague
 THE NETHERLANDS
 31-70 346 97 77
 FAX 31 70 365 88 50
M-INT

Thomas J. Vild
 Management Consultant
 3815 Falls Road
 Chagrin Falls, OH 44022
 216/247-0183 FAX 216/247-0183
MFG

Erwin von den Steinen
 President
 International Transport Policy Analysis
 518 North Madison St.
 Arlington, VA 22203
 703/527-8476 FAX 703/527-3429
INF

John F. Walsh
 Director, Corporate Relations
 Rohr Industries, Inc.
 Post Office Box 878
 Chula Vista, CA 92012-0878
 619/691-2808 FAX 619/691-6632
MFG

Alfred J. Whittle
 Manager, Market Analysis
 Martin Marietta Aeronaval Systems
 103 Chesapeake Park Plaza
 Baltimore, MD 21220
 410/682-0976
MFG

Jack P. Wiegand
 Forecast International
 22 Commerce Road
 Newton, CT 06470
 203/426-0800 FAX 203/426-1964
CHM

James A. Wilding
 General Manager
 Metro. Washington Airports Authority
 22 Canal Center Plaza
 Alexandria, VA 22314-1562
 FAX 703/549-5796
INF

Robert Windle
 Assistant Professor
 College of Business &
 Management
 University of Maryland
 College Park, MD 20742
 301/405-2187
DAV

Thomas Windmuller
 IATA Centre
 Route de L'Aéroport, 33
 P.O. Box 672
 CH-12 15 Geneva 15 Airport
 SWITZERLAND
INF

Michael D. Wolf
 Vice Pres., Marketing and Sales
 Textron Lycoming
 Reciprocating Engine Division
 652 Oliver Street
 Williamsport, PA 17701
 717/323-6181
GEN

Karl Zaeske
 Mgr., Econ. & Market Analysis
 Prog. Mgmt. & Business Planning
 Rockwell International
 Collins General Aviation Div.
 400 Collins Rd., N.E.
 MS 107-153
 Cedar Rapids, IA 52498
 319/395-1817 FAX 319/395-2194
REG

Steven Zaidman
 Director, Research and
 Development (ARD-1)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3557 FAX 202/267-5418
INF