BUSINESS AND EXECUTIVE GENERAL AVIATION

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Introduction

In response the travel demands of business and commerce, business and executive general aviation provides flexible point-to-point air service.[1] Although every type of general aviation aircraft supports business air travel, this discussion focuses on general aviation turboprop and jet aircraft. This seemingly narrow focus is appropriate because turbine aircraft are expected to play the pivotal role in establishing the path for future business and executive general aviation activity. General aviation piston aircraft and helicopters are considered later in this Circular, and many of the issues discussed in the context of business and executive air travel are intertwined with the future prospects for light general aviation and business helicopters. In fact, each segment of general aviation; e.g., light, business and executive, and helicopters, provides a valuable link in the complex chain defining our air transportation system.[2] Improved system efficiencies are possible through market research, new product development and additional investment in air transportation infrastructure in the context of a progressive and comprehensive national transportation policy that encourages and supports access by all users.

For purposes of this discussion EGA activity is described by several measures, including shipments of new general aviation turboprop and jet aircraft by domestic and foreign manufacturers, the size of the U.S. active turbine fleet, and use of this fleet in terms of total flight hours. The thinking behind the consensus forecast emphasizes economic factors, incentives, and possible or potential constraints affecting these indicators of EGA activity: (1) the changing character and organization of participants, (2) prices and costs, (3) the private pilot pool, (4) new product development and technology, (5) infrastructure and access, and (6) general economic background conditions. Each is discussed below.

The forecast period extends through 1995, a period that embraces the much talked about economic integration of Europe, as well as any reasonable probability of a domestic or world economic downturn.

The absence of accurate information and data can quickly turn a forecast into bare speculation. Speculation and wishful thinking were avoided in this instance, but the EGA forecasting exercise did identify some critical data needs and deficiencies. These data issues are listed in summary form in the final section. Parenthetical reference to this list is made in other parts of this report.

Consensus Forecast

The consensus forecast based on workshop discussion and analysis points to continued growth in EGA activity through 1995. Combined, the factors thought most relevant favor a 3-percent to 5-percent annual growth in the turbine fleet (see Table 1), with an equal proportionate increase in total hours flown (see Table 2). A growth forecast for new turbine shipments was not developed because year-to-year swings can be significant and mislead the casual or uninformed observer about the health of general aviation

TABLE 1. THE EXECUTIVE GENERAL AVIATION FLEET
(General Aviation Turboprop and Jet Aircraft)

Year	Historic Fleet Size
1969	2229
1970	2408
1971	2483
1972	2632
1973	3271
1974	3699
1975	4295
1976	4424
1977	5167
1978	5610
1979	6232
1980	7082
1981	7831
1982	9182
1983	9351
1984	10129
1985	9782
1986	10394
1987	9612
1988	9446

Forecast

	5%		3%	
	Fleet Size	Change	Fleet Size	Change
1989	9918	472	9729	283
1990	10414	496	10020	291
1991	10934	520	10321	301
1992	11481	547	10631	310
1993	12055	574	10950	319
1994	12658	603	11278	328
1995	13291	633	11616	338

Historical data and forecasts refer to the U.S. active fleet.

1. Business and executive general aviation air travel complements the mass-market, hub-and-spoke, air services provided by commercial airlines. For simplicity business and executive general aviation will be referred to as EGA in the remainder of this discussion.
2. The air transportation system is an increasingly important component of our national transportation, comprised of air, water and land subsystems. Many comments emphasized the need to understand how these subsystems are interrelated.

TABLE 2. EXECUTIVE GENERAL AVIATION FLIGHT HOURS
(Total Turbine Fleet Hours)

Year	Total Hours (000's)
1969	1047
1970	1444
1971	1439
1972	1500
1973	1829
1974	2053
1975	2200
1976	2327
1977	2714
1978	2800
1979	3130
1980	3572
1981	3542
1982	3797
1983	3646
1984	4072
1985	3702
1986	4535
1987	3705
1988	4048

	Forecast			
	5%		3%	
	Total Hours	Change	Total HOurs	Change
1989	4250	202	4169	121
1990	4462	212	4294	125
1991	4685	223	4423	129
1992	4919	234	4556	133
1993	5165	246	4692	136
1994	5423	258	4833	141
1995	5694	271	4978	145

Historic data and forecasts refer to total flight hours for the U.S. Active Fleet

not developed because year-to-year swings can be significant and mislead the casual or uninformed observer about the health of general aviation manufacturing. Nonetheless, the recent improvements in new turbine shipments should continue, commensurate with the projected growth in the domestic turbine fleet and EGA flight hours and with the continued vitality of export markets. For reference, data on recent new turbine shipments are presented in Table 3.

It is expected that shipments of new general aviation turboprops and heavy jets will be relatively flat over the forecast period, with shipments of new general aviation light and medium jets showing the greatest proportionate increase and fueling continued recovery among general aviation manufacturers. This mix of shipments implies that new jets will continue to outsell new turboprops, worldwide. Nonetheless, there appears to be a sustainable new turboprop market, albeit smaller than in the past.[3] Confidence and capacity to support expected new sales and turnover of existing aircraft exist in the financial sector.

Exports have contributed to the recent improvement in new general aviation turbine production (see Table 4), accounting for 31 percent of total turboprop shipments and 39 percent of total jet shipments reported by General Aviation Manufacturers Association (GAMA) members. Though recent movements in the dollar on international exchange markets are making U.S. exports, including general aviation aircraft, more expensive, it is anticipated that foreign markets will continue contributing to new aircraft demand. In part, export markets are expected to remain active, as central bank intervention keeps the price of the dollar within reasonable trading bounds.

Because the domestic fleet can be augmented or depleted through international flows of used turbine aircraft, growth of the domestic EGA fleet may not exactly mirror the changes in new turbine sales (Data Issue #3).

There is reason to assign a high level of confidence to the forecast presented. On this point there was very little disagreement among the panelists, who were made up of representatives of manufacturers, suppliers, fixed base operators, charter and fleet management companies, financing organizations, and the academic community. The factors supporting continued growth and expansion of EGA through 1995 are outlined in the following section.

Factors Leading to the Consensus Forecast

Participants. Major industry participants affecting the course of future EGA activity include business corporations as consumers of EGA air travel, general aviation manufacturers as suppliers of aircraft, air charter companies and fleet management companies, fixed base operators, airport managers, and the Federal Aviation Administration as the steward of the air transportation system. Business corporations are the predominate owners and operators of general aviation turboprop and jet aircraft, and their perceptions about EGA greatly influence its growth and development (Data Issue #6). Two trends in corporate America portend expansion of EGA activity

3. In 1978, approximately 1.6 turboprops were sold for every jet. Today (1988), nearly two jets are sold for every turboprop. Despite the relative decline in new turboprop shipments, it would not be appropriate to extrapolate into the future and conclude the turboprop market is disappearing.

TABLE 3. EXECUTIVE GENERAL AVIATION SHIPMENTS

Year	Turboprop	light and Medium Jets	Heavy Jets	total Turbine
1968	200	147	48	395
1969	210	122	46	378
1970	137	108	24	269
1971	118	70	13	201
1972	239	130	21	390
1973	305	227	20	552
1974	308	263	14	585
1975	335	263	21	619
1976	378	224	25	627
1977	449	258	36	743
1978	566	326	28	920
1979	659	348	49	1056
1980	798	432	51	1281
1981	898	456	91	1445
1982	423	300	114	837
1983	292	184	62	538
1984	202	214	63	479
1985	217	149	36	402
1986	128	140	60	328
1987	125	141	89	355
1988	117	130	84	331

Includes GAMA members and foreign manufacturers

TABLE 4. TURBOPROP AND JET EXPORTS

Year	Turboprop Units Exported	% of Total Shipments	Jet Units Exported	% of Total Shipments
1972	55	30	29	21
1973	58	23	66	33
1974	75	30	70	34
1975	122	40	66	34
1976	114	31	52	27
1977	126	29	56	24
1978	166	30	82	35
1979	181	28	98	34
1980	245	31	110	33
1981	259	28	102	26
1982	135	29	82	31
1983	66	20	30	21
1984	25	09	31	18
1985	49	15	28	19
1986	68	27	32	26
1987	78	29	49	40
1988	91	31	62	39

Source: GAMA (Data refer to GAMA members, only)

through 1995: (1) the restructuring of corporate America and (2) the emerging presence of general aviation fleet management companies.

With the discipline that comes from an economic recession and the threat of increased international competition in domestic and world markets, corporate America has restructured itself to be more efficient, resilient, and quicker in reacting to changed conditions. In large part the restructuring is measured by the shrinking layer of middle management and the offsetting increase in span of control and responsibilities for those remaining to direct business and commerce. Today, there are fewer managers with more work to do, less time to do it, and greater responsibility for increasing corporate (i.e., shareholder) earnings and wealth. The corporate return from managerial and executive time has increased, and time has consequently become more valuable. These changes have transformed a manager's calendar into a strategic corporate resource, to be managed like skills , production facilities, and

raw materials.[4] A natural outcome of this transformation is broader and increased awareness that executive aircraft are productive assets, with a return measured by time-savings and responsiveness, that should be maximized like the returns gained from other productive corporate assets.

Along with a better understanding that the acquisition of EGA aircraft is an investment has come the tendency to out-source corporate fleet management. This trend is reflected in an expected 5- to 15-percent annual growth in charter and fleet management operations over the forecast period.

Owners of corporate aircraft expect their fleets to be managed both operationally and financially, and fleet management firms provide the professional expertise to accomplish this. From the corporation's perspective out-sourcing provides knowledge in the purchase, maintenance, and use of executive business aircraft. The subcontracting arrangement provides flexibility over in-house flight departments by allowing for easy "in-and-out," time sharing, and charter applications. At the same time, costs are reduced by spreading start-up costs over a larger number of users, by providing fleet purchasing leverage, and through economies of scale in operation. Additionally, costs are made more certain and easier to plan for, through service and maintenance contracts.

Managerial and executive time has become more valuable and out-sourcing can reduce costs of EGA. This two-edged sword means current corporate owners can increase the use of, return on, and investment in their executive fleet, while the low-flight-hour corporate user (e.g, the corporate user demanding 100 hours per year) can gain access to aircraft and take advantage of executive aviation's contribution to increased productivity and competitiveness.[5]

Costs. Growth prospects for EGA are affected by purchase prices of new and used aircraft and the costs of aircraft operation. The 1979-1985 general aviation downturn clearly demonstrated the sensitivity of new turbine markets to price increases. Today, it appears that manufacturers have gained control over production costs by rationalizing production capacity and working closely with suppliers, while at the same articulating pricing strategies more conducive to orderly market development. The latter change is especially significant since study has shown that during the 1979-1985 market downturn price changes for new turbine aircraft dominated over changes in interest rates and changes in used turbine prices.

Average real prices for new turboprop aircraft have begun to level off after substantial real increases between 1980 and 1985, and average real prices for new jet aircraft have shown little upward trend since 1981 (see Table 5).[6] It should be noted that these data overstate actual price increases because prices are weighted by units sales: top-of-the-line turboprops and heavy jet aircraft have carried the industry through the recent market downturn and this has pushed up average price calculations.

While new turbine prices have stabilized, the availability of high quality (e.g. low-hour) used turbine aircraft has diminished, causing used aircraft prices to increase substantially. Since the middle of 1987, prices of used jet aircraft have increased approximately 35 percent, and prices of used

TABLE 5. WEIGHTED AVERAGE REAL TURBOPROP AND JET PRICES

Year	Turboprop $	Jet $
1968	452810	1108281
1969	509623	1133428
1970	565949	1229623
1971	544598	1312641
1972	607367	1126347
1973	628608	1079276
1974	662865	1248634
1975	740254	1513007
1976	821771	1633842
1977	859862	1899882
1978	909180	2165017
1979	1018607	2156291
1980	1145997	2850178
1981	1382214	3753639
1982	1554368	4747423
1983	1735063	4997813
1984	1915794	5628671
1985	2106568	5223196
1986	2170791	6030813
1987	2399451	9267786
1988	2560800	11871183

Prices expressed in current dollars

4. In the words of R. E. Allen, Chairman, AT&T, "Markets and production systems are becoming global. Restructuring mergers, and acquisitions are forcing companies to link diverse organizations... And the need for constantly rising efficiency is leading every company toward "just-in-time everything." (AT&T Technology, Vol. 4, no. 3:1989) Executive General Aviation provides "just-in-time" personal contact and involvement for executive management.

5. Additionally, there is evidence that the General Aviation Market Expansion Plan (The GAME Plan) is stimulating management and executive interest in air charter services.

6. These are weighted average figures, with weights reflecting shipments of the various turbine models.

turboprop aircraft have increased approximately 26 percent.[7] With these increases in used turbine prices and stabilization of new turbine prices, parity has been reestablished between the new and used turbine markets, making new aircraft purchases more attractive than in the recent past.

Throughout the late 1970s, prices of a used three-year-old turboprop aircraft were approximately 25 to 30 percent below new turboprop prices. This discount fell to approximately 50 percent by 1985. Today, used turboprop prices are approaching 80 percent of new turboprop prices. A similar phenomenon occurred in the new and used jet markets. For example, during the late 1970s prices of used three-year-old medium jets were approximately 30 percent below new jet prices on average, and the discount dipped to approximately 55 percent by 1984-85. Today, used jet prices are approaching 80 percent of new jet prices.[8]

Because historic price parity between new and used turbine aircraft has been reestablished, sales of new general aviation turbine aircraft are expected to show continued improvement over the levels observed during the mid-1980s. However, year-to-year variations will continue to reflect the idiosyncrasies of turbine markets and the timing of specific purchasing decisions.

No dramatic changes in operating cost of EGA aircraft are expected over the forecast period. Fuel prices, in particular, are expected to show modest growth, reflecting the persistent softness in world oil markets. It should be noted, however, that recent fuel price increases at the fixed base operator (FBO) level appear excessive, given conditions in world energy markets and the prices commercial operators are paying for jet fuel.

The Pilot Pool. Increasing the number of student pilots and, thereby, the flow of new pilots into the private pilot pool is especially critical to recovery in light general aviation activity. EGA, however, is less constrained by the current pool of qualified pilots (private and commercial pilots) and is competitive in attracting pilots, especially those choosing to leave military flying (see Table 6). An executive-pilot bottleneck, therefore, is not anticipated over the forecast period, and pilot availability should not constrain or inhibit growth in EGA fleet size or hours flown.

TABLE 6. PRIVATE AND COMMERCIAL PILOTS

Year	Private Pilots	Commercial Pilots	Total
1975	305863	189342	495205
1976	309005	187801	496806
1977	327424	188763	516187
1978	337644	185833	523477
1979	343276	182097	525373
1980	357479	183442	540921
1981	328562	168580	497142
1982	322094	165093	487187
1983	318643	159495	478138
1984	320086	155929	476015
1985	311086	151632	462718
1986	305736	147798	453534
1987	300949	143645	444594
1988	299786	143030	442816

Source: FAA

Nonetheless, there is a continuing shortage of qualified maintenance and ground-support technicians, and deficiencies in these skill areas need to be addressed from a system perspective since they adversely affect general aviation, regional operators, and commercial airlines.

New Product Development. Neither technological advances nor new technology applications underlie the consensus forecast, and neither is expected to have a significant impact on the projected growth paths for turbine shipments, fleet growth, or utilization. There will be new models built, but these new products will incorporate evolutionary rather than revolutionary changes. It is unlikely the new turboprop market will show substantial improvement without new technologies (for example, new engine designs applying ceramics), but these do not appear on the forecast horizon. New turboprop sales over the forecast period will be driven by replacement and turnover demand, especially among short-haul business flyers, creating a sustainable but smaller new turboprop market, compared to the late 1970s.

Composite aircraft will soon be flying, but their availability is not expected to significantly enlarge the turboprop market. Instead, these new types of aircraft likely will appeal to a thin market niche between the upper end of the turboprop market and the light jet market. Because of their new technologies, price, and performance characteristics, they will perhaps define a new category of EGA aircraft.

7. These percentages are based on used prices reported in MarketLine, Vol. 1, no. 2.

8. These price-ratio comparisons are based on specific vintages, but they illustrate a general tightness in used turbine markets. There is also evidence that used aircraft prices are starting to level off, as have new aircraft prices. This suggest the parity ratio of 80 percent may sustain itself.

The general aviation jet market will continue to grow on the basis of derivative aircraft, especially in the medium and light classes. An entry level business jet in the $2-million range would have an immediate additional positive impact on jet shipments. The consensus forecast does not included this effect, however.[9]

Although it is clearly outside the forecast range, and highly speculative in nature, there appears to be embryonic interest in a supersonic executive business jet. The interest is being nurtured by the increasing internationalization of business and commerce, the continuing and impressive economic development of second tier countries in the Pacific Basin, anticipation of an integrated European economy and Perestroika, and increasing concern among some corporate executives about convenience, personal and flight safety.[10] Though a supersonic executive aircraft would be very costly to develop and expensive to purchase (possibly in the range of $50 million to $100 million), it may be cost-effective to operate if managed under the umbrella of a fleet management organization or some other type of time-sharing arrangement.

Background Conditions. A variety of background conditions may influence the path or direction of EGA activity, including legislation to bring liability costs under control, changes in the certification process, and -- foremost for EGA -- the performance of the national and world economies. With respect to the overall economic climate, it appears that general aviation manufacturers are in a position to weather either a "soft landing" of the domestic economy or mild world recession, if one should occur within the forecast period.[11]

Three factors provide confidence that general aviation manufacturers will not soon experience another dramatic downturn in production, sales, and employment, even if the national or world economies falter. First, an abundant supply of high quality used aircraft does not exist. Second, price parity has been reestablished between used and new turbine aircraft as a result of the reduction in the supply of used aircraft, and this makes the purchase of a new general aviation turboprop or jet aircraft more attractive. These two points already have been discussed. Third, a replacement-demand bubble containing 10-year-old aircraft will be feeding new aircraft sales in the early 1990s. This replacement bubble was put in motion by the 1979-1981 sales spurt. Liability costs continue to be the most serious problem confronting general aviation aircraft manufacturers, and liability expenses are now the largest single expense in manufacturing piston driven aircraft. A bill limiting product liability for general aviation manufacturers has been introduced in Congress, but passage is uncertain. Eventually, however, the problems with manufacturer's liability exposure must be addressed at the Federal level. Until that time, the general aviation fleet will continue to grow and age, placing upward pressure on already substantial liability costs.

As the issue of aging aircraft intensifies because of publicity focused on commercial airline accidents and aircraft maintenance, it becomes important to distinguish between commercial aircraft and general aviation aircraft (Data Issue #7). Aging and aged commercial and general aviation aircraft have very different use and stress profiles; and it would be imprudent to impose universal or blanket inspection, replacement, or maintenance requirements on all aircraft reaching a specific age. A 20-year-old business/executive jet is in much better condition than a 20-year old commercial airliner. The business jet most likely has flown an average of 300-400 hours per year and has an expected future life of at least an additional 10 years (Data Issue #5). On the other hand, the commercial jet airliner has flown many more hours, gone through a significantly larger number of cycles, and is approaching average retirement age.[12]

Infrastructure, Access, and Executive General Aviation. Probably the most important determinant of the health of EGA is its of level access to the air transportation system, especially airports. Any pronouncement or policy that curtails or denies access to the air transportation system by executive aircraft will have a commensurate negative effect on growth and expansion of this segment of general aviation. In the longer term, not only is EGA damaged by such constraints, but cities and communities that prohibit or constrain access by EGA may do harm to their local and regional economies, as corporations factor such

9. It is unlikely an entry level jet would incorporate new technologies; rather it is more likely costs would be controlled through new organizations of production.

10. See "Airlines Skid on Bad Moves, Bad News," The Wall Street Journal, September 10, 1989, p. B1.

11. The current economic recovery is approaching its eighth year and it is probably unrealistic to think it can continue uninterrupted for another six. Nonetheless, at this time, there are no warning signals pointing to an immediate downturn in the U.S. economy. Inflationary pressures seem to be under control of the Federal Reserve, and the economy is growing at a 2.5-percent rate. The "soft landing" scenario is still valid.

12. Some studies suggest that commercial aircraft are retired after approximately 22 years, on average

prohibitions into corporate location and expansion decisions (Data Issue #1). The chance that a city or community will attract or retain a corporate headquarters or major production facility is reduced if firms are denied use of EGA.

The issue of airport access can quickly turn into an emotional debate ignoring the fact that denying access to EGA will neither eliminate the demand for premium, point-to-point air transportation services nor appreciably reduce congestion at major airports. In formulating an airport and airspace access policy as part of a larger national (air) transportation policy, some important distinctions need to be made.

First, it is important to recognize that airports are public facilities, built and maintained with public resources to promote the common good. This "merit good" aspect explains why public monies and public subsidies have supported the development of the airport system over the years.

Second, the monopoly position of airports in the air transportation system needs to be recognized. Arguments favoring deregulation of airports and the encouragement of profit-maximizing airport management not only overlook the "merit good" argument for their existence, but also overlook the potential monopoly power any airport has in its region and the entire system. This potential monopoly power exists because airports are able to control entry, exit, and throughput. Market solutions can be efficient when there are no spill-over effects (positive or negative) and when competition exists or potential competitors can be identified. Such preconditions do not describe airports in the air transportation system.

Third, it is important to talk accurately about the effect general aviation has on airspace and airport congestion (Data Issue #4). Only rarely will a small, single-engine piston aircraft fly into a hub airport or other major landing facility. Smaller general aviation aircraft are not tied down at major airports, and the complex flight and landing procedures controlling air traffic around them dissuade the recreational flyer from considering such an intrusion.

Fourth, EGA aircraft do use major airports, including the most important commercial hubs. Hub locations are not only transportation nodes; they also tend to be centers of business and commerce, locations which business executives and managers must have timely and efficient access. EGA provides this kind of high-value, premium air travel that is unavailable elsewhere and cannot be provided by a commercial air operation based on a hub-and-spoke structure and mass market demands. Fortunately EGA aircraft are flown by professional flight crews, knowledgeable in proper flight procedures and practices and sensitive to the limits of the air transportation network.

Fifth, denying access to major airports by general aviation aircraft will not solve the congestion problems plaguing the air transportation system. The congestion and inefficiencies that exist today are the result of the investments not made yesterday from the funds earmarked to maintain, expand, and enhance the air transportation infrastructure. The congestion in our air transportation system also results from the uneven distribution of commercial air traffic, characteristic of a hub-and-spoke arrangement. Because the hub-and-spoke structure has become the industry standard, it is possible for a few very clogged airports to disrupt and, at times, bring to a standstill the flow of traffic through an entire branch of the system.[13]

The questions involving infrastructure and congestion in the air transportation system are paramount. But, it also is important to realize that answers need to evolve from a national perspective that recognizes the legitimate place of all categories of users and accepts the responsibility to undertake prudent investments that enhance and expand the infrastructure (e.g., the development of reliever airports) to support the increasing demands for commercial, regional, and general aviation air travel.

Data Needs

To some extent any forecast is speculative because it is based on historical trends and the presumption that the forecaster (or forecasting group) understands the present. Better or more complete data can improve forecasts by bringing the past into clearer focus while improving understanding of present conditions. The forecasting exercise summarized herein has identified several important data issues, including:

1. The need for a more integrated data base that allows for a better understanding of how the parts of the air transportation fit together, including ground transportation systems that feed and nourish the air transportation system.

2. A data base sponsored or supported by TRB that would allow researchers to work from a common analytical foundation. In particular, this data base should include a consensus forecast of national economic variables based on a common set of data definitions.

13. One can only imagine the reductions in congestion (and in social costs) that would result if coast-to-coast commercial air travel were evenly distributed among intervening airports.

3. A more detailed tracking of general aviation exports and imports by type of aircraft. Such data should track exports both of new and used aircraft, by type: single-engine piston, multi-engine piston, turboprop, light jet, medium jet, and heavy jet. These data would allow for better planning to accommodate fleet size and use and assist in monitoring international competitiveness.

4. A reporting or tabulation of general aviation flight plan data supporting origination-destination analysis. This would provide a basis for analyzing the nature of EGA activity in support of a more reasoned planning effort.

5. More timely reporting of current general aviation activity such as flight hours and general aviation operations. Currently released data are out of date and not very useful in trying to anticipate turning points in general aviation activity.

6. Information on the actual operators of general aviation aircraft that would allow for better FAA communications and provide more useful information on who is actually using general aviation aircraft. The latter would be important to more accurate modeling and forecasting of general aviation activity.

7. A broader distribution of information on the number of active and inactive aircraft, perhaps with a more stringent criteria for defining active aircraft. Currently defined active aircraft could be categorized and reported by a simple classification according to hours flown during the year. These kinds of data would support identification of growth spots, especially the types of aircraft flown and the uses to which they are put.