

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 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

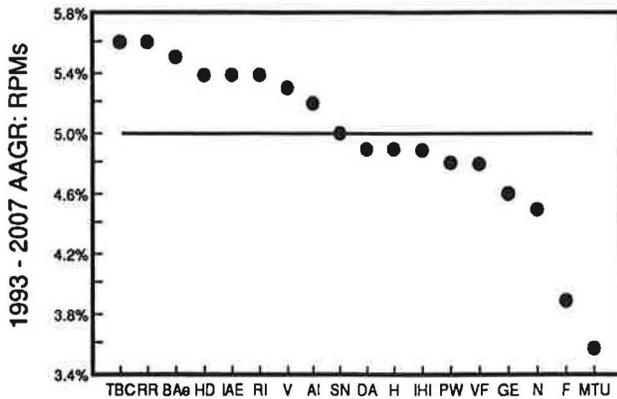


FIGURE 43 15-year traffic growth forecast (dispersion around consensus forecast: 5.0%).

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

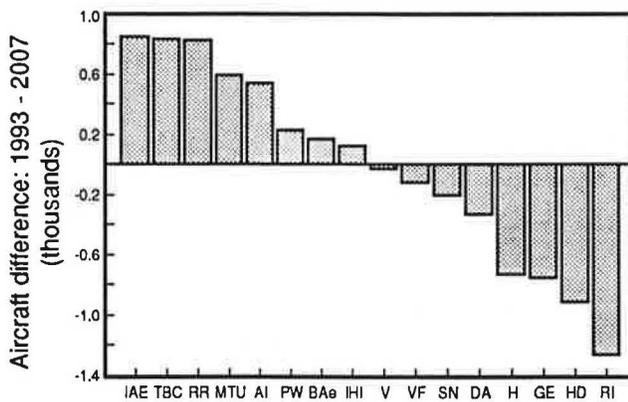


FIGURE 44 15-year aircraft delivery forecast (dispersion around consensus forecast: 8,550).

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.

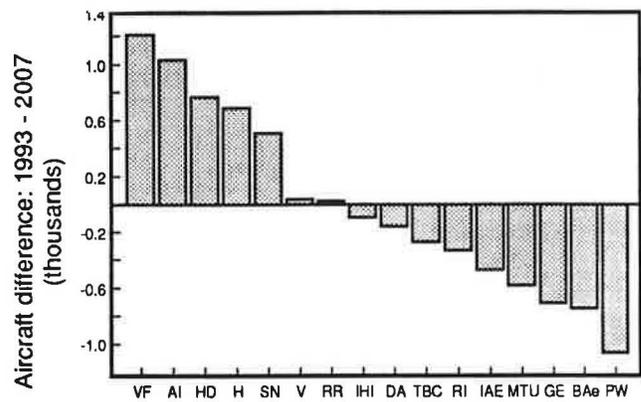


FIGURE 45 15-year aircraft retirement forecast (dispersion around consensus forecast: 3,880).

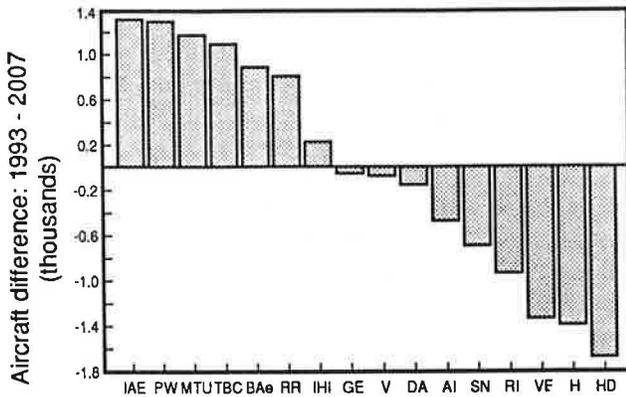


FIGURE 46 2007 fleet forecast (dispersion around consensus forecast: 13,632).

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

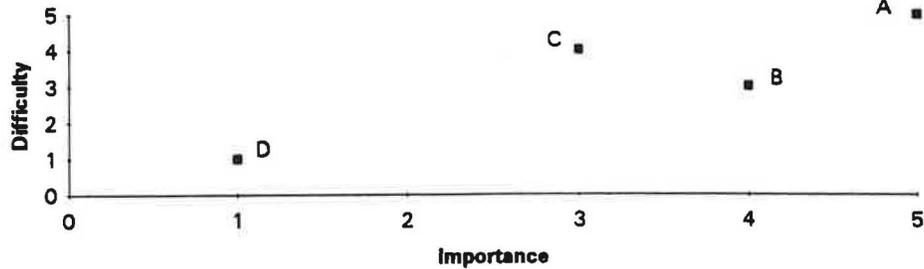
<u>Important issues in determining future aircraft deliveries</u>	<u>Scores</u>	
	<u>Raw</u>	<u>Weighted</u>
• Order cancellations/delivery deferrals	20	78
• Availability and/or affordability of capital	17	54
• Yield management/pricing policies	12	39
• Noise legislation	7	20
• Hub-and-spoke vs. point-to-point 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

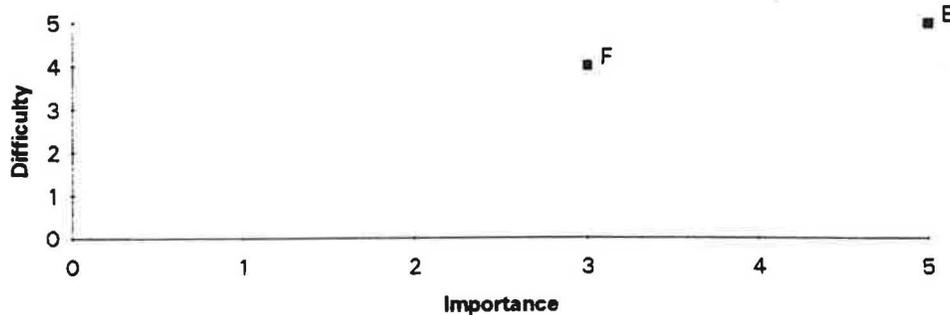
Under this heading, the panel brought together the issues for which they had no definitive answers, but which most panel members felt will be of special significance in shaping the landscape of the industry in the years to come. It is not that the panel did not wrestle, nor that they had no opinion on 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.