PART 3: AIR TRAFFIC CONTROL

THE CRISIS OF EUROPEAN AIR TRAFFIC CONTROL

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THE PRESENT SITUATION

Today's air transport system is characterized by a rapidly increasing traffic volume which in certain areas is approaching or has already exceeded the capacity of the air navigation infrastructure, especially the capacities of airports and the air traffic control system. This is particularly true for Western Europe. To understand the current problem and the shortcomings Europe's air traffic control has to cope with, it is necessary to consider the particular conditions which prevail in this part of the world. The possible ways and means to resolve these problems must be seen in the same way.

To underline the complexity of the problem it should be born in mind that air traffic control itself is only one element of the air transport system and that it is influenced by other elements of the system. (Figure 31)

The rapid growth of the air traffic in Europe was unexpected. All traffic forecasts in recent years have been considerably lower than the actual growth rates experienced. The forecast for 1985 to 1990 showed an average increase in aircraft movements of 2.4 percent. The actual increases in total aircraft movements were 5.2 percent in 1986, 7.8 percent in 1987 and 8.5 percent in 1988. (Figure 32)

To handle this traffic demand requires that the capacities of the most important elements of the air transport system -- the airport capacity, the airspace capacity, and last but not least the air traffic control capacity -- should be increased accordingly.

What does it mean for Europe? The 24 major airports in Europe risk becoming capacity-limited by the turn of the century. (Figure 33) These airports today handle 55 percent of all commercial air transport movements in Europe. Their present maximum runway capacity is on the order of 4.6 million movements per year. In 1988 these airports already handled almost 4 million movements. This leaves only marginal opportunities for future increases in aircraft movements with the present airport infrastructure.

Assuming a 20-percent capacity improvement by early next century, achieved through better use and organization of resources, movements could increase 1.9 percent annually. (Figure 34)

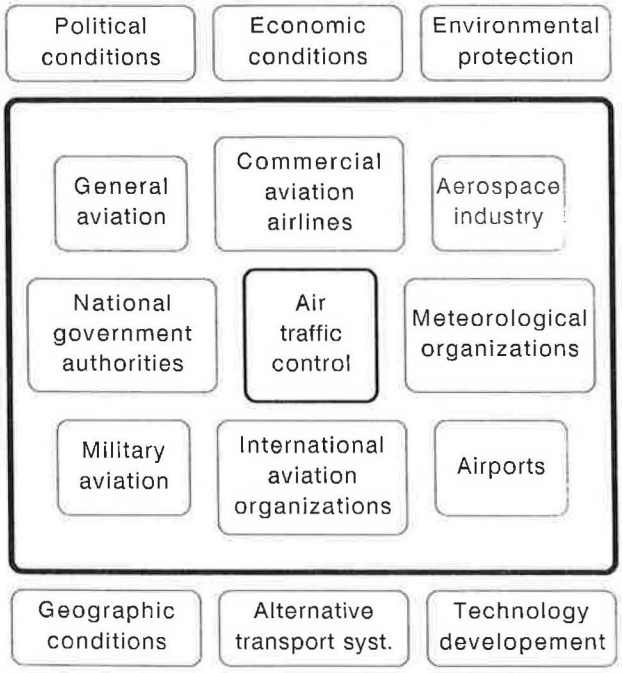

FIGURE 31 The air transport system.

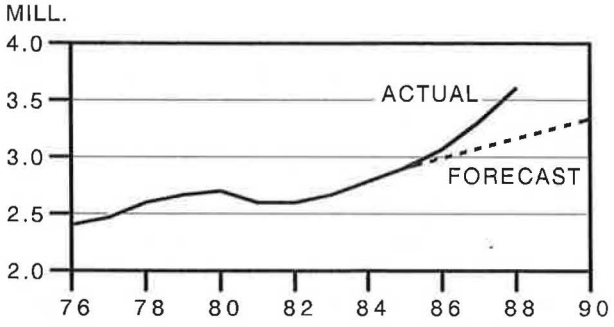

FIGURE 32 Today's air traffic situation in Europe.

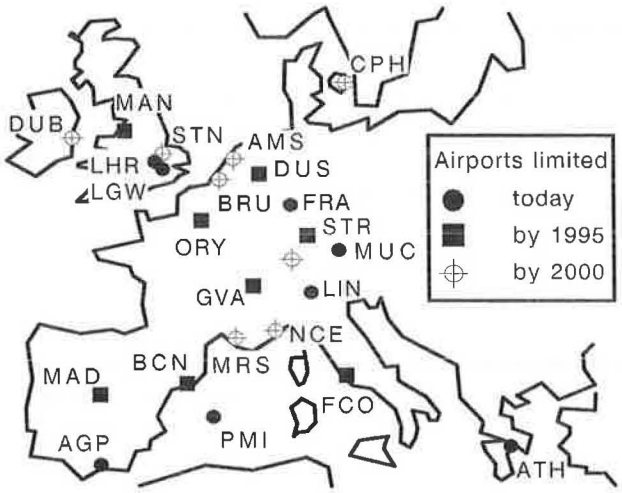

FIGURE 33 Airports and their problems.

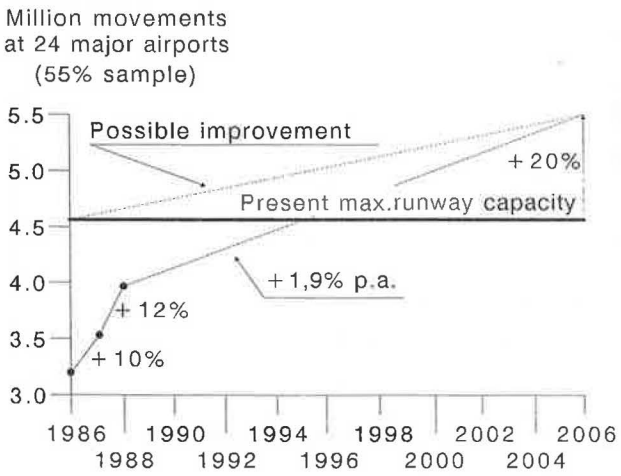

FIGURE 34 Airport congestion in Europe.

EUROPEAN AIR TRAFFIC CONTROL

Europe's airspace is divided horizontally into flight information regions along national rather than functional lines.(Figure 35) The airways structure is not designed for optimum regional traffic flow. Its alignment results in unnecessary additional mileage and flight times, which reduce the capacity of the available airspace. (Figure 36)

For example, a flight from Amsterdam to Frankfurt is about 40 percent longer than it needs to be. A flight from Brussels to Zurich requires 45 percent more miles than it would if it could be flown directly from point to point.

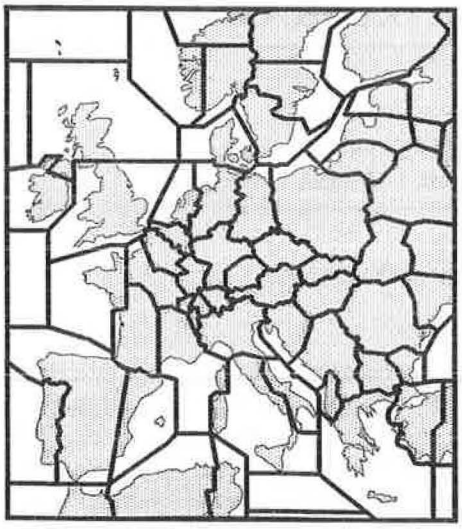

FIGURE 35 Structure of upper European airspace.

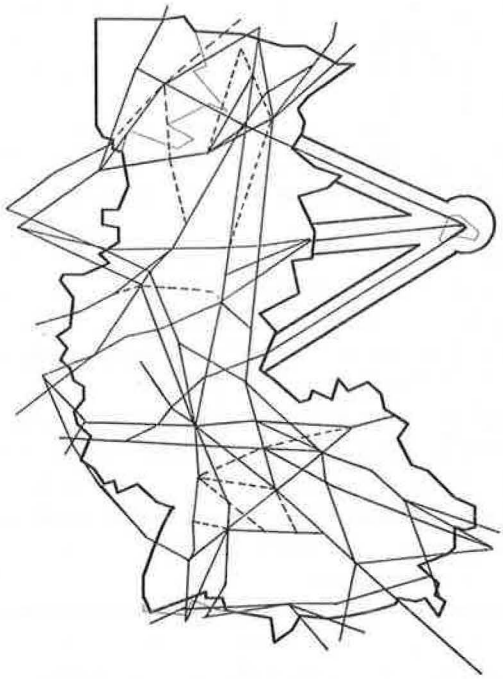

FIGURE 36 Route structure in the lower airspace of Germany.

Europe does not have a unified air traffic control system designed to serve it as a region. Instead, the Western European air traffic control system is a patchwork of 22 different systems. (Figure 37) Each of the 22 European States that form the European Civil Aviation Conference (ECAC) has individually and independently developed its own ATC system according to national rather than international needs. This is another basic reason for the difficulties encountered today.

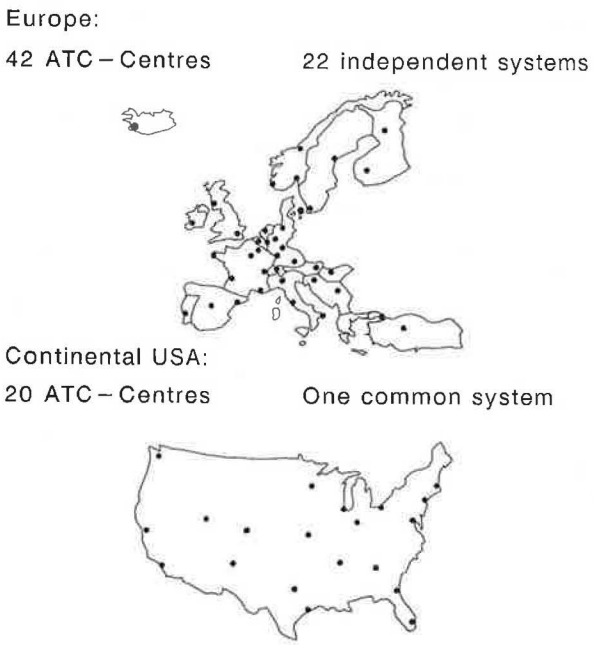

FIGURE 37 The patchwork of the European ATC system.

The ECAC member states cover a total of 4,643,000 square kilometers. This relatively small area is served by 42 air traffic control centers which comprise 22 separate and independent systems. Differences in methods, procedures, and functions call for cumbersome ATC coordination, which limit air traffic controllers productivity in handling traffic. The full potential of automation often cannot be exploited because of incompatibilities between the various systems in use. On the whole, the overall capacity is less than its potential, and a lot of resources are wasted. By contrast, the continental United States controls nearly twice the airspace of Europe with a single system consisting of only 20 ATC centers.

What are the consequences of the division of airspace and of different methods and procedures in daily airline operation? For example, during a flight from Boston to Chicago (distance: 751 nm) the pilot of an aircraft has to contact three ATC centers; from Frankfurt to Madrid (distance 767 nm) he has to contact seven. This example serves to illustrate that the physical organization of the European airspace is outdated.

Another example is ATC sectorization. The airspace of the Federal Republic of Germany (lower and upper airspace) is divided into 52 radar sectors. (Figure 38) The flight time through a sector is approximately 5 to 10 minutes, depending on the aircraft type, flight level, etc. The principles on which the European airspace is organized were established to cope with the problems that arose 30 years ago with the introduction of jet aircraft. Already at that time the need was seen for creation of an upper airspace structure that would be served by a limited number of ATC centers, with sector boundaries determined solely by operational and technical considerations.

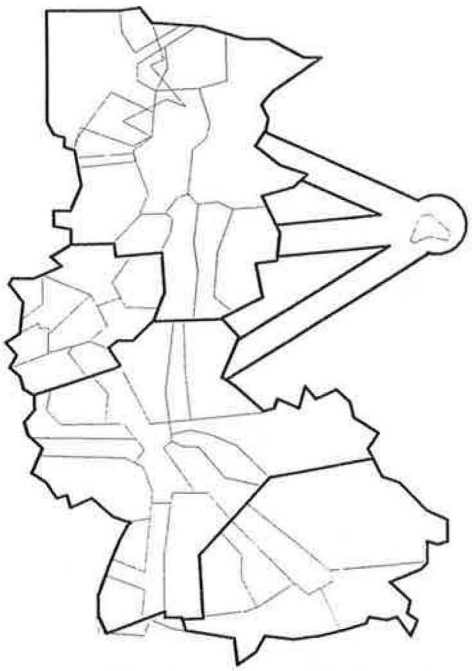

FIGURE 38 Physical organization of European airspace.

While the planned vertical division of the airspace was accomplished, national boundaries have been retained to define the horizontal division. Political rather than operational factors determine boundaries between ATC centers, thus preventing the optimum use of resources, i.e, equipment, workforce and the airspace itself.

Large parts of European airspace are reserved for military use. (Figure 39) This is not only a problem of airspace utilization, it is also a problem of air traffic control. The division between military and civil airspace

is at times ambiguous. Therefore, a concrete quantification of airspace reserved for military and civil use is impossible. The large parts of reserved military airspace (and in many places the division of airspace) places considerable constraints on civil air traffic.

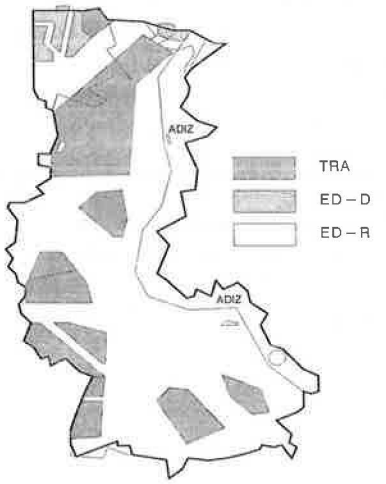

FIGURE 39 Restricted military areas in the upper airspace of Germany.

In the Federal Republic of Germany approximately 20 percent of the airspace is reserved for exclusive use by the airforces of NATO Member States. The involvement of such a large number of airspace users renders civil-military cooperation and coordination extremely difficult.

DEVELOPMENT OF EUROCONTROL

The idea of transferring ATC functions from national authorities to an international European agency was born 30 years ago. It was an important part of the first Eurocontrol Convention in 1960,which charged Eurocontrol with the common organization of air traffic services in the upper airspace. The second Convention called for coordination of national plans in order to establish a common, medium-term plan, for both upper and lower airspace.

Success has been slow in this area; the first edition of the Common Medium-Term Plan was adopted by the Euro-control Permanent Commission in November 1988, 28 years after the establishment of the agency. Some national authorities have refused to coordinate their ATC plans with Eurocontrol. Eurocontrol has, by itself, no final authority. The board, the Permanent Commission, is composed of the Transport Ministers of the Member States and has not proved to be the vehicle for coordination and harmonization it was set up to be. (Figure 40) Most of the deficiencies of the today's system are based on the way, decisions are made in Europe.

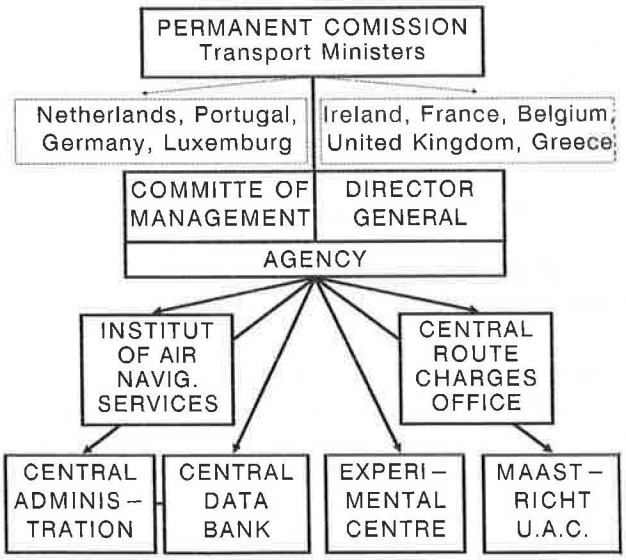

FIGURE 40 Eurocontrol organization.

The European Air Navigation Planning Group (EANPG) works under the auspices of ICAO. The Future European Air Traffic Services System Concept (FEATS) group set up by EANPG was to develop the framework for a common air traffic management system for the European Region taking into account the results of the ICAO Future Air Navigation Systems (FANS) Communique and work undertaken in this field by Eurocontrol. Both these groups however have no executive powers.

The European Civil Aviation Conference (ECAC) is the Conference of the Directors General of Civil Aviation of 22 Western European States. The conference as such has not involved itself in ATC matters in order not to duplicate ICAO work. However, in 1988 the Conference established a task force to monitor ATC developments in Europe. ECAC also has no executive powers, and the decision to follow the recommendations of the Conference is at the discretion of each of its Member States.

Last but not least, the European Parliament adopted a resolution in the summer of 1988 calling for the centralization of ATC in the European Community.

Past experience has shown that the advice and recommendations of ATC experts have so far not been followed by most of the national administrations.

KEY PROBLEMS AND ISSUES

Major traffic flows over Europe necessitate that all European States provide the same high level of air traffic services. They cannot do so, because of the various ATC systems are independent, the area they serve is relatively small, and bottlenecks can have repercussions throughout the whole area. (Figure 41) In some cases these bottlenecks can only be of such a nature that they can only be removed by installing expensive equipment. In others they can be removed by changing ATC procedures or opening up new routes, including the use of area navigation.

Seasonality in traffic volume is an inherent feature of air transport. The peaking of traffic, whether during a day or a year, is not caused by airlines' eccentricities but by customers' demands. Airlines accommodate these fluctuations by flexible use of their resources. The same should apply to the air navigation infrastructure.

In any commercial enterprise investment decisions are usually based on rate of return, which can be expressed in either quantitative or qualitative terms. The odds are that an enterprise that does not know its present capacity will either over-or-under invest. In the case of ATC systems in Europe the latter has been the case. It must be a prerequisite for the present and future management of European air traffic control that its capacity is accurately assessed. Only by comparing capacity and demand can present and future bottlenecks be identified and measures taken to resolve any imbalance. Efficient future planning also depends on knowing the capacity of today.

Another bottleneck is caused by the inadequate radar coverage. (Figure 42) Radar coverage is an important element in deciding the capacity of air traffic control. Minimum en route separation in a radar covered area is 30 nm. In areas where there is no radar surveillance, as is the case in parts of Southern and Eastern Europe, the separation is doubled and equals approximately 60 nm. Where radar coverage is adequate aircraft can be spaced as close as 5 nm. Lack of adequate radar coverage results in different separation minima being applied in daily operation, with these minima generally the increasing from the north to the south of Europe.

Air traffic control is, to a large extent, dependent on the availability of qualified air traffic controllers. Some European countries are experiencing a serious lack of controllers. A qualified air traffic controller can work at full capacity only after 4 to 5 years training. A speed-up in recruitment and training is therefore necessary both to make up for the shortage of today and to prevent a more serious shortage in the future.

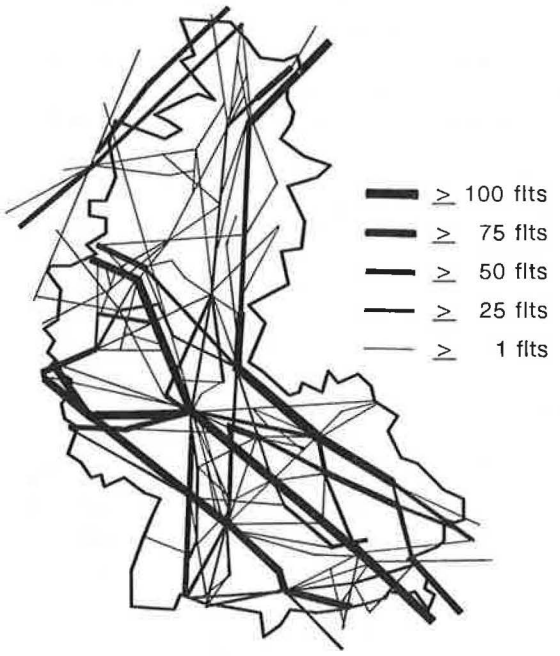

FIGURE 41 European air traffic control system bottlenecks.

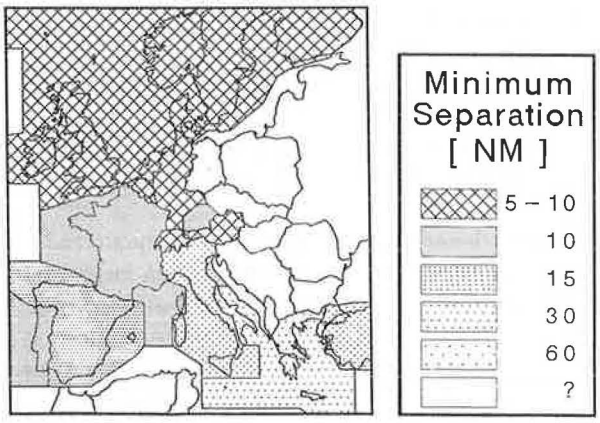

FIGURE 42 Separation minima in European airspace.

The technical standards of the different European air traffic control systems vary, and an important element missing in Europe is the setting of standards for equipment and procedures. The setting of standards has been recommended but not realized. The European Community, which has set standards in many other fields to prepare their Member States for the single market, has not touched on the subject of aviation. Common standards for equipment and procedures are essential for the future of European air traffic control. Standards for equipment and software should be based on the most up-to-date technology and automation.

Air Traffic Flow Management (ATFM) in Europe is today operated by 12 independent centers (11 in Western Europe, 1 in Moscow). It has been decided to set up a centralized ATFM system consisting of two self-contained ATFM units responsible for executive functions in Eastern and Western Europe, respectively. Today's ATFM is a slot system that at times causes underutilization of the airspace instead of optimal utilization.

Political decisions will form the basis for capacity improvement and overcoming the ATC crisis. The fact that air traffic control is part of national budgets does not facilitate these decisions. Air traffic control is low on the priority lists of most Governments and may be even more so in those European countries where the air traffic problem is most acute. The removal of air traffic control funding from national budgets, therefore, merits further examination. In the Federal Republic of Germany interested parties have proposed a semi-privatization of the air traffic control system.

A Eurocontrol feasibility study made in 1981 compared the upgrading of the national ATC systems of Belgium/Luxembourg, The Netherlands and the northern part of West Germany individually with the alternative of upgrading them to one system and one center to control all en route traffic. The cost advantage of the centralized alternative was around 30 percent. Therefore, long-term savings in a system consisting of a few large centers would be considerable in comparison with the cost of today's system of many small centers.

What are the consequences of the air traffic control crisis in daily airline operations? 1986 was the last year with a reasonably punctual performance record. The trend reversed in 1987, and the delays during 1988 reached a level far above the poor performance in the early 1980s. (Figure 43)

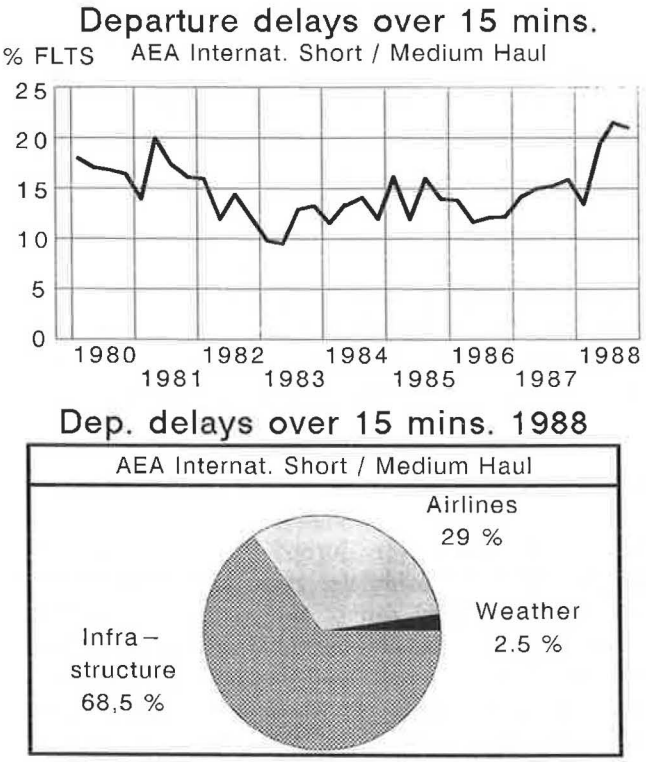

FIGURE 43 Consequences of the ATC crisis in Europe.

In 1988 68.5 percent of delays were due to inadequate infrastructure, 29 percent were caused by the airlines themselves, and 2.5 percent were due to adverse weather conditions. The present delay situation is costly both to passengers and to airlines. In 1988, some 4.6 million passenger-hours and almost 70,000 aircraft-hours (the annual workload of 28 aircraft) were lost on international short- and medium-haul routes and on departure delays exceeding 15 minutes. In 1988 members of the Association of European Airlines lost a total of around 150,000 aircraft-hours due to insufficient infrastructure capacity and an inefficient route system.

This equals the annual productivity of 60 aircraft, or the entire fleet of airlines like Alitalia, KLM or Swissair.

What do the airlines do to counter delays? Airlines have changed their schedule block times to attain better on-time performance; additional aircraft are being operated; crew scheduling has been changed; and airlines are accepting lower flight levels and longer routings. The total cost of this lost productivity was $200-300 million (US) in 1989.

FUTURE STEPS

The measures required to resolve the air traffic control crisis in Europe can be summarized as follows:

1.The Heads of State or Government should make the political decision to integrate Europe's fragmented air traffic control systems. Europe's new air traffic control entity should be a mixed public-private system with government and industry sharing in decision-making.

2. A flexible, coordinated reorganization scheme for Europe on airspace should be developed and implemented by the Transport and Defense Ministers of European countries.

3. Basic common air traffic control standards should be adopted for:
- operating procedures and performance
- software and equipment compatibility
- qualification and training of controllers.

4. The European Community should arrange financing to achieve the European wide computer compatibility and adequate radar coverage needed in the short run.

References

1) The German Airspace Users Association
The Crisis of European Air Traffic Control: Cost and Solutions, 1989
2) Association of European Airlines, Air Traffic Control in Europe, 1989
3) Airbus Industrie Toulouse, Forecasting Traffic and Capacity Growth in Europe, 1989