ARCHIVED REPORT

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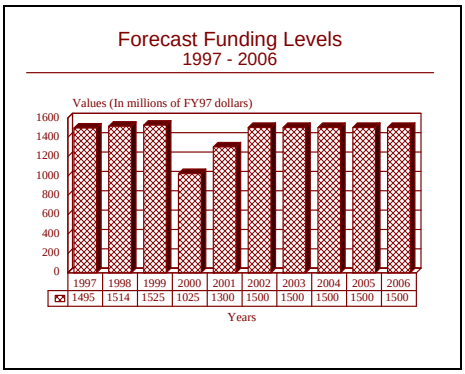
EURO - ATC - Archived 6/97

Outlook

- Intended to develop single integrated ATC system
- Existing system short on capacity
- Funding expected to return to previous levels after the turn of the century



Orientation

Description. Pan-European air traffic control integration program

Sponsor. Various

Contractors. Various

Licensee. No production licenses have been granted

Status. Continuing development

Total Produced. The program objective is to develop a single homogenous European air traffic management system.

Application. European airspace planning, operation and control

Price Range. Indeterminate

Technical Data

Characteristics. Today the European Air Traffic Control System (ATC) is comprised of 23 member states which support 51 separate ATC centers. These centers rely on 31 different ATC systems to accomplish air traffic control in Western Europe. Computers supplied by 18 manufacturers, 22 different operating systems and 33 different programming languages are employed in the overall mechanization. When combined with the nationalistic segregation of these facilities, the net result is a loosely sewn patchwork quilt which has difficulty communicating, both functionally and electronically.

Design Features. Eurocontrol, formally entitled The European Organization for the Safety of Air Navigation, is currently the primary organization actively engaged in the development/implementation of a unified European ATC network. It is an international organization sponsored by the European Civil Aviation Conference (ECAC) with membership comprised of representatives from participating European nations. The organization grew from an initial nine countries to a roster of 17 states (Note: Total ECAC membership is 31 nations).

The Eurocontrol charter is to provide air traffic services to member states at their request. In more specific terms, its primary functional objective is to provide leadership and international coordination in a multi-step, time-phased program to establish a unified ATC system within greater Europe.

Current specific responsibilities include: 1) Analysis of future air traffic needs and the means to meet them, 2) Development of common long-term air navigation objectives, 3) Coordination of medium-term national plans, 4) Study and promotion of measures to improve air navigation efficiency, 5) Work cooperatively with the

International Civil Aviation Organization (ICAO) and other aviation organizations, 6) Assist members and non-members in establishing and operating air traffic flow management systems, 7) Distribute results of air navigation tests and trials, 8) Serve as the navigation charges clearing house for participating members, and 9) Execute measures requested by member states.

Major Eurocontrol facilities include:

Headquarters - Brussels, Belgium (Operations and engineering directorates)

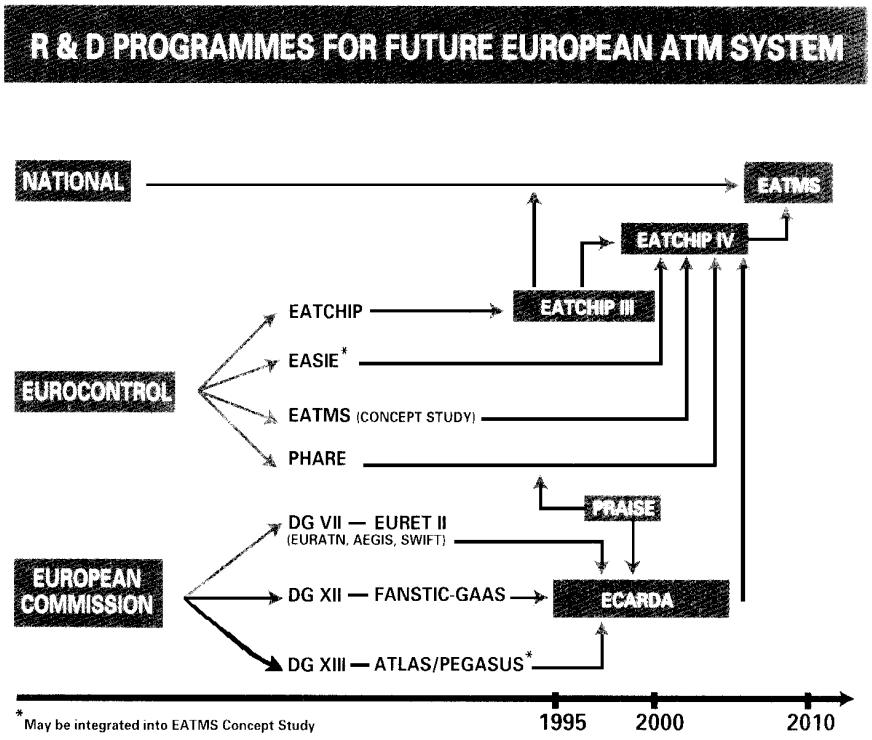
ATC Centre - Maastricht, The Netherlands (Controls airspace over Belgium, Luxembourg, The Netherlands and the northern half of the former West Germany)

Experimental Centre (ECC) - Bretingny-sur-Orge, France (Simulation and research center for testing air traffic plans and systems prior to service entry)

Institute of Air Navigation Services - Luxembourg (ATC personnel training and research center)

Central Flow Management Unit - Brussels, Belgium. (Responsible for balancing demand and available airspace to reduce congestion in ECAC member states)

Central Route Charges Office - Located at Headquarters. (Clearing house for en-route navigation charges for member states plus Austria, Spain and Switzerland)



An EC decision to merge its R&D projects into a single programme goes part of the way towards meeting the airline industry's desire for a single coordinated ATM research effort.

Variants/Upgrades

In order to provide an easily assimilated analysis of the extensive European ATC market, Forecast International has elected to divide this topic in succeeding reports into the following convenient categories based on the relative current size and activity levels within primary areas of interest:

1) European ATC System Analysis (Overview, including Eurocontrol and European Commission activities).

2) Western European Individual Country Programs.

3) Central European Programs (Individual countries and regional integration, as appropriate).

4) Russian Programs (Individual and regional integration, as appropriate).

Program Review

Background. Inefficiencies and potential bottlenecks in the European Air Traffic Control System have been recognized since the 1960s but little or no positive action has been taken to remedy the impending problems. For example, as documented by the Association of European Airlines (AEA), delays of 15 minutes or longer in short and medium haul flights increased from 12.5 percent in 1986, to 15 percent in 1987, and 19 percent in 1988. Seventy percent of these delays were caused by ATC problems. As an indicator of the economic penalty caused by delays, in 1988 alone, Lufthansa reported added fuel costs of US$56 million. The corresponding overall penalty to the 1988 European economy was valued at between US$4.2 billion and US$5.0 billion as estimated by the US firm, Gellman Research, with estimates of growth to US$10.0 billion annually by the year 2000.

The catalyst for action occurred in the summer of 1988 when large numbers of irate holiday vacationers experienced extensive delays as the result of years of air traffic under forecasting. Both national/international political and airline organizations responded to highly negative media exposure with a parallel series of studies and plans. In retrospect these were largely ineffective due to an unwillingness of European countries to surrender national control or sovereignty of their air space to a multinational higher level authority. France and the United Kingdom were particularly adamant in this regard citing military airspace security needs and the necessary interaction of military and civilian ATC systems in the limited airspace available as reasons.

Initial players in the 1989 time frame included the Association of European Airlines (AEA), the European nation Transport Ministers sponsored European Civil Aviation Conference (ECAC), the International Air Transport Association (IATA) airline clearing house, the International Federation of Air Traffic Controllers Association (IFATCA), and the International Civil Aviation Organization (ICAO). (More recently, the European Commission (EC) has entered the picture and is taking an active role in top level coordination and management activities.)

The ECAC responded to popular criticisms by funding an organization operating under its auspices, Eurocontrol, to perform an in depth analysis of the situation and develop recommendations for solution. Eurocontrol's selection appeared the logical choice as it was originally founded in 1960 for the specific purpose of promoting cooperation and harmonization within the European ATC system. The organization was never given the executive power or resources, however, to accomplish these objectives due to nationalistic concerns. Eurocontrol has since gained authority and now has one of the major roles in defining, developing and administrating the implementation of improvements to the Western European ATC system.

Similar independent and somewhat competitive studies conducted in this time frame include a 1989 award by the Executive Committee of the IATA to the British consulting group, SRI International, and a study performed by the AEA. The ICAO Future Navigation Systems (FANS) committee also responded in 1990 by establishing a working group on the Future European Air Traffic System (FEATS).

Criticisms of these efforts were mutually exchanged as flight delays continued to increase. For example, in May 1991 the AEA reported that 15-minute or greater delays increased to 21 percent, a 62 percent increase over the previous year while total air traffic increased by only eight percent.

Faced with these growing delays and the lack of a mutually agreed upon global plan and/or a central governing agency with effective authority or resources (i.e. funding), individual countries sought independent, standalone, typically incompatible solutions to the problem. This practice, despite current centralized efforts by Eurocontrol and the European Commission (see below), continues to some extent today.

The Transport Ministers in the ECAC got the message and in a 1991 London meeting finalized a two phased approach, to be administered through Eurocontrol, for European ATC improvement which had initially been presented in April 1990. Phase 1 provides for the harmonization and integration of the various existing ATC systems; Phase 2 for the creation of a fully unified ATC system for the next century.

Phase 1, titled the European Air Traffic Control and Harmonization Programme (EATCHIP), is well under way, with the study and initial planning phases (Internal program Phases I and II) having been completed on schedule by 1993. Procurement of key equipment items/systems to permit ATCs to be incrementally integrated (Phase III) was also begun in 1993 and participating countries correspondingly began to upgrade their systems/equipment to be compatible with Eurocontrol standards.

Initial operational deployment of these elements is now beginning to demonstrate ATC performance improve-

ments. Quantitatively, in 1994, European air traffic delays increased by 7.8 percent during the year while air traffic increased by 4.8 percent. While still unacceptable, this represents a considerable improvement over previous years. This has been attributed to several Eurocontrol programs coming on-line as summarized below.

Radnet - In 1993 Eurocontrol introduced the Radar Data Network (Radnet) as part of its EATCHIP Four State Integration program. Radnet is an integrated network of radars located in The Netherlands, Belgium, Germany and Luxembourg which permits air traffic controllers in these countries to access radar data across the system. The system uses a Eurocontrol developed interface which translates dissimilar radar data into a common user format. As of 1994, the network ties together nine civil en route centers, five military centers, and approach systems in Luxembourg and Germany.

CFMU - Elements of Eurocontrol's EATCHIP Central Flow Management Unit (CFMU) have been on-line since 1991. The CMFU facility, located in a central Eurocontrol facility in Brussels analyses flight traffic requirements, and global and local operating environment data to provide long-term six-month (strategic) route planning, near-term 48-hour preflight (pre-tactical) planning and real-time (tactical) air traffic flow management functions. The objective is to model long-term air traffic structure/trends, and to identify near and short-term anomalies in a system which provides global dynamic corrections to maintain cost effective use of the European airspace.

The strategic and pre-tactical elements of this system have been in place for more than three years and have demonstrated their effectiveness. The final tactical phase, the Integrated Flight Planning System (IFPS), was slated to come on-line April 28, 1995. Achievement of CFMU full operational status took place in the time frame between April 1995 and summer 1996.

Despite these initial successes, the overall schedule for Phase III completion is expected to slip from 1998 to 2000. Correspondingly, the Phase IV EATMS integration activity (see below) is expected to slip to the 2003-2005 time frame, causing fears of both increasing air congestion problems and possible competitive advantages for US industry as perceived by European manufacturers.

Precise cost and funding strategies for the latter phases of the EATCHIP Phase III Implementation and Phase IV EASTMS Integration efforts have yet to be determined. The scope of the requirement can be established, however, by a parallel comparison with the US FAA Capital Investment Plan, which has identified $12 billion as its estimate for the US ATC modernization program.

The Eurocontrol Phase 2 ATC modernization effort, currently in the concept study phase, is designated the European Air Traffic Management System (EATMS). Its concurrent implementation with the EATCHIP effort is the result of a 1992 German member proposal to provide adequate time to research, develop and establish European community common agreement on the technology and operation of a unified ATC system in order to proceed with equipment upgrades without interruption when the EATCHIP effort is completed.

The objective of EATMS is to utilize a combination of advanced technologies and operating procedures to achieve a quantum jump in air traffic capacity. The concept as currently envisioned encompasses three major operational features: 1) integrated air-ground air traffic functions, 2) improved ground-based communication to ensure instant distribution of data, and 3) hierarchical traffic planning (Re: CFMU) to optimize carrier operating costs and minimize traffic delays. A key technical requirement of this approach is significantly improved instantaneous knowledge of aircraft position which will permit aircraft en route separation distances to be reduced, arrival times to be predicted with one-minute accuracy and flight profiles to be managed along a best trajectory in four dimensions.

A recent key development in bringing EATMS (or an equivalent advanced technology ATC system) to reality is the June 1994 decision by the European Commission (EC) to include an air traffic management (ATM) system, airports and a global navigation satellite system (GNSS) as components of the Trans-European Network (TEN) approved under the Maastrich Treaty.

Increased EC participation and near-term financial commitment has generated confidence in the successful execution of selected elements of both the EATCHIP and EATMS (particularly En-Route and Airport strategies) programs. Overall confidence in advanced elements of these programs remains guarded, however, since overall total cost and full funding support have not as yet been identified.

As of this writing, the European ATC system remains very much in the midst of a comprehensive evolutionary growth process with elements of its original patchwork composition still visible. The currently forecast activity/trend scenario includes the following:

1) Continuing individual national expansion/upgrades of existing ATC facilities and procedures. This is particularly true in lesser developed nations in Central and Eastern Europe and the former Soviet Republic.

2) Increased acceptance and participation in the international integration of ATC facilities, beginning in limited regional areas with gradually expanding boundaries. Areas in which initial integration is either in progress or is being seriously considered are Western

Europe, Central Europe and Russia. Within this definition, Western Europe is by far the most advanced through the EATCHIP midterm solution (with growth provisions) program which is being administered by Eurocontrol.

3) Applied research, selection and the conceptual/ technical definition of a fully integrated European ATC system which, in turn, will be a compatible element of a higher order future global ATC network. Again, Western Europe is the current lead in this area. In this case, however, at this time and aside from independent country efforts, activities/responsibilities remain divided between Eurocontrol and directly supported EC initiatives; with limited coordination existing between the various programs.

Eurocontrol's central effort is the above described EATMS program which is being complemented by its EASIE (Mode-S) and PHARE (Programme for Harmonized ATM Research within Eurocontrol) programs.

Phase one of the PHARE program was centered on producing the basic components of the en-route system and subjecting them to ATC testing. The second phase focused on testing and evaluating terminal area operations. This phase was initiated in Germany in the fall of 1996. The final phase combines the systems tested in phases one and two and integrates them into a fully functional air-ground ATC system. Testing for this phase should be complete around the end of 1998.

Existing European Commission directorate initiatives are being combined into a single program designated ECARDA (European Coherent Approach to Research and Development in Air Traffic Management). The combining existing elements consist of Euret II (DG VII), Fanstic/GAAS (DV VII) and Atlas/Pegasus (DG XIII). ECARDA which is expected to last until at least 2005 will support EATCHIP by developing and demonstrating new operational concepts using advanced ATM technologies in association with European Space Agency (ESA) initiatives and Eurocontrol's PHARE program. The estimated total cost of ECARDA is US$300 million which will theoretically be funded on a 50-50 EC/industry split.

Funding

This is a European-sponsored program. Financial details are incomplete; however, the following funding information has been documented.

Feb	1987	US$2.75 billion ECAC five-year budget to modernize European ATC facilities. (US$540 million in 1989)
Fall	1988	US$160 million ECAC increase of Eurocontrol budget for 1989 ATC study
July	1989	US$64.2 million European Transport Ministers four-year budget to set up Eurocontrol, Brussels, ATC centralized information system
Sept	1989	US$5-10 billion AEA estimate for initial start up of 17-year ATC modernization/ integration program
Mar	1992	US$3.6 billion ECAC budget for EATCHIP Phases II and III
Mar	1992	US$612,000 ECAC aid for new Eastern Europe members
June	1993	US$28 million EC budget for development of approach for standardizing European ATC system
June	1996	US$123 million for PHARE program to be spread over 10 years: Eurocontrol is providing 50 percent of the total with the partners sharing the rest

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Comsoft	1.9	March 1989. Development and supply prototype Radar Message Conversion and Distribution Equipment (RMCDE)
Ferranti	13.6	March 1989. Five-year EQUATOR Computer program to study time dependent Systems reasoning Knowledge Based Systems (KBS) for ATC application. Funded under ESPRIT.
SRI		April 1989. IATA sponsored European International ATC study by British consulting group.

Martin Marietta	.657	June 1991. System Engineering support for Eurocontrol Phase I (Planning) EATCHIP program.
Thomson CSF, et al		April 1992. SWIFT study of European ATC system.
Hughes Aircraft	.380	May 1993. Study for use of commercial data bases/management technologies in future ATCs.
Thomson CSF		June 1993. Development and manufacture of Advanced Radar Tracker and Server (ARTAS).
Thomson CSF/	50	Sept 1993. Supply 281 Operator-Input Display Systems (ODS) Siemens Plessey for use in Eurocontrol and German facilities.

Timetable

Feb	1987	ECAC in Paris meeting announces budget/schedule to modernize European ATC facilities.
Fall	1988	ECAC increases Eurocontrol 1989 budget for European ATC study.
Nov	1988	European air navigation planning group (GEPNA) endorses ECAC move but recommends more global approach.
Nov	1988	AEA states lukewarm response to ECAC plan in Athens meeting. Recommends EC extend unified ATC system to non EC countries, notably Norway and Sweden.
Nov	1988	Airspace and Traffic Management Group (ATMG) recommends one Air Traffic Flow Management (ATFM) unit be provided for Western Europe and one for Eastern Europe with close coordination between the two.
March	1989	Italy and Turkey join Eurocontrol group, bringing membership to 10 countries. ECAC/Eurocontrol set up short-term traffic congestion working group. AEA decides to fund its own European ATC study.
April	1989	Moscow based Flight Information Region (FIR) applies for International Federation of Air Traffic Control Associations membership.
April	1989	IATA funds independent European ATC study.
July	1989	European Transport Ministers commit to set up centralized information system for air traffic controllers located in Brussels and managed by Eurocontrol.
	1989	Eurocontrol authorizes construction of Central Flow Management Unit (CFMU) facility.
Sept	1989	AEA proposes three layer authority consisting of Eurocontrol, a new Central Holding Company (CHC) and individual national ATC systems. Identifies short/ intermediate-term (eight-year) and long-term integrated (17-year) programs. (Rejected by Eurocontrol)
Nov	1989	UK endorses European ATC integration.
April	1990	Western European nations approve ECAC, a 23 member state plan for multi-step harmonization and integration program. Completion dates set from 1991 through 1998. Funding provided by individual countries.
Dec	1990	ICAO Future Air Navigation Systems (FANS) committee sets up Future European Air Traffic Systems (FEATS) working group.
Oct	1991	First of five CFMUs goes on-line.
Dec	1991	Schedule leapfrog of Phase IV EATMS program proposed by Germany and accepted by Eurocontrol.
Jan	1992	Eurocontrol calls for decision on who should have overall responsibility for lead of European ATC effort.
Mar	1992	ECAC transport ministers meet to resolve EC/Eurocontrol responsibility differences. Ratify EATCHIP Phases II & III. Also agree to include Bulgaria, Czechoslovakia, Hungry, Poland and Romania in EATCHIP.
April	1992	EC awards SWIFT (Specifications for Working Position In Future Air Traffic Control) study to Thomson CSF led consortium.

Aug	1992	EC backs Eurocontrol proposal for ATC integration.
May	1993	Austria joins Eurocontrol as 15th member.
June	1993	EC allocates funds for development of approach for standardizing the European ATC system. Program to be performed by a consortium of European aerospace and electrical industries, and universities.
July	1993	EC sets Eurocontrol documentation as common technical standard for future hardware/software procurement.
Sept	1993	Combined contract for Eurocontrol/German Operator-Input Display Systems (ODS) awarded to Thomson CSF/Siemens Plessey. Marks first time Eurocontrol directly involved in member nation major procurement.
Oct	1993	EC announces plans to unify three EC R&D activities in ATC under the European Coherent Approach to Research and Development in Air Traffic Management (ECARDA) program. The activity will also monitor Eurocontrol and various other EC research institutions.
Nov	1993	Eurocontrol's Radar Data Network (Radnet) successfully integrated ATC radars in The Netherlands, Belgium, Luxembourg and Germany.
Apr	1995	Eurocontrol scheduled to start final (i.e. third) stage (Integrated Flight Planning System (IFPS)) of conversion to CFMU in Brussels. Phases I and II have been operating for more than three years.
Jan	1996	Eurocontrol called for bids for the development of two Pre-Operational Mode S (POEMS) radar ground stations (to be completed mid-1999 for T&E) The radar would help implement Mode S enhanced surveillance across Europe.
2nd Half	1996	Phase 2 of the PHARE program demonstration trials were initiated (included testing and evaluation of terminal area operations). Trials held in Germany.
	1998	Phase 3 of the PHARE program demonstration to be completed (will include the integration of en route and terminal area operations).

Worldwide Distribution

The scope of this program is restricted to the greater European community.

Forecast Rationale

Despite the fact that the operational and technical paths of the future European ATC system remain to be finalized, it is clear that there is definitely room for improvement. Poor performance and increasingly high costs are two of the commonest complaints against the current European ATC systems.

Apparently, air traffic control charges have more than doubled in the past few years, but the quality of service across Europe has remained the same or worsened. Airport congestion, delays and union troubles are all consequences of the present mode of operation.

It is evident that this need represents a multibillion-dollar evolutionary growth market opportunity which spans several decades. The potential of this market has been recognized and is being aggressively pursued by suppliers worldwide.

Unfortunately, with so many countries (and egos) involved in building a seamless and efficient ATC system across Europe, many of the existing problems have their basis in a combination of organizational, political and economic factors. The threat that the window to avoid unacceptable delays and crippling financial impediments within the new open European community is rapidly closing has spurred recent progress.

Uncertainties far outnumber finalized decisions, and while all agree that something must be done, reaching a consensus that will satisfy every country involved in the effort appears to be a Herculean task.

In addition to these problems there are several factors which may delay or preclude the development of a single fully integrated European ATC network:

1) The need to implement immediate national solutions to existing problems based on a history of previous

frustration with slow progress on the part of intracountry ATC development organizations.

2) Pressure from equipment suppliers who are marketing established or currently in-development product lines.

3) Failure to overcome nationalistic interests and/or establish an effective central governing agency.

Whether national interests, the biggest stumbling block to a global solution, can eventually be put aside remains to be seen. Notwithstanding, several important trends can be identified. New equipment will be required to meet increasing air traffic volume demands, replace aging high-maintenance-cost systems and/or achieve compatibility with newly adopted systems.

The need to establish and adhere to universal ATC operating and equipment standards within Europe has been acknowledged and will ultimately influence future procurements. Also, some degree of consolidation and integration of existing ATC system elements is needed just to maintain safety and improve productivity in the face of increasing air traffic demands.

The air traffic community cannot afford a single-step final solution to a modernized ATC system. Initially, currently marketed systems will continue to be procured to meet immediate demands, particularly in developing areas. As an interim solution to establishing a fully integrated European ATC network, equipment is being procured that will allow the equipment of a limited set of nations in the European community to operate regionally as an integrated system.

The final selection of an advanced solution ATC system architecture will require a yet-to-be-finalized decision on which advanced technology(s) is to be used to best achieve desired performance levels. In this regard, Europe will most likely be strongly influenced/driven by the US FAA advanced development effort, which represents the most focused, best financially supported R&D activity in this arena.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR FUNDING ($ in millions)

			High Confidence Level				Good Confidence Level				Speculative		
Designation	Application	thru 96	97	98	99	00	01	02	03	04	05	06	Total 97-06
EURO-ATC	AIR TRAFFIC CONTROL (VARIOUS)	6885.00	1495.00	1514.00	1525.00	1025.00	1300.00	1500.00	1500.00	1500.00	1500.00	1500.00	14359.00