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THE CONCEPTUAL GUIDELINES FOR INTEGRATION OF CROATIA INTO THE EUROPEAN AIR TRAFFIC MANAGEMENT SYSTEM

SUMMARY

Full implementation of the final phase of EATCHIP is planned for the beginning of the 21st century. It will re-define the European system of air traffic regulation and control. The integration of a great number of ATC systems into a unique operative network is supported by the technical modernisation and standardisation of the communication, navigation and radar devices. Integration of Croatia into the European air traffic control system assumes its active participation in the current projects, implementation of relevant technical standards and the national air traffic development strategy within the context of Euro-atlantic integration.

1. INTRODUCTION

The recent intense growth of air traffic in the European dimensions has resulted in an insufficiency of the conventional flight control systems both regarding organisation and technology, as well as in repercussions on the safety aspect of exploitation. Negative effects due to the differences in technical and technological concepts and the lack of cooperativeness of a great number of air traffic control systems in a relatively small air space of Europe¹, have resulted in the increased traffic density (congestion of air routes) and delays, especially during the summer season.

The predictions of the further tendency of traffic growth by approximately 5% annually have indicated the need to co-ordinate the air traffic control systems, i.e. to implement a unique European "management" for the air space flight regulation. At the ministerial meeting of ECAC in 1988 in Frankfurt, the project of establishing a centralised flight regulation in the European air space was accepted, and in 1990 the strategy was adopted in Paris for the program of co-ordinating and integrating of the air traffic control system in Europe (ATC-operatives).

The integration program plans, among other things, the consolidation of the regional control centres in the technological sense, using the instrument connected programs - CIP², for each country, defined correction standards, such as for instance decrease in aircraft separation³, and automatic transfer of flight plans and other relevant data.

2. EVALUATION OF THE NATIONAL FLIGHT CONTROL SYSTEM

2.1 Institutional organisation

During the war in these regions (1991/1992), the Croatian flight control system has suffered direct and indirect damage due to destruction and misappropriation of navigational, communication and radar equipment, devastation of infrastructure, control towers and other facilities, estimated between 50 and 80 mill. US dollars, excluding the loss of more than 50% of qualified personnel.

Due to the centralised air-management and the inferior position of Croatia within the flight control system of the ex-country, the tasks of the newly founded Croatian Flight control management regarding planning and development were made additionally difficult. Acceptance into the membership of ICAO⁴ and ECAC⁵ (1992) as well as EUROCONTROL⁶ (1997), meant also accepting the obligation to co-ordinate the national air-craft regulations.

The flight control management has realised a successful co-operation with the majority of neighbouring countries both in multi-lateral and bi-lateral activities. The contract on flight control co-ordination - LoA⁷ - as operative document regulating the air navigation and control of air space between the appropriate regional flight control centres of the neighbouring countries, was signed with all the neighbouring Flight control managements except with SRJ.

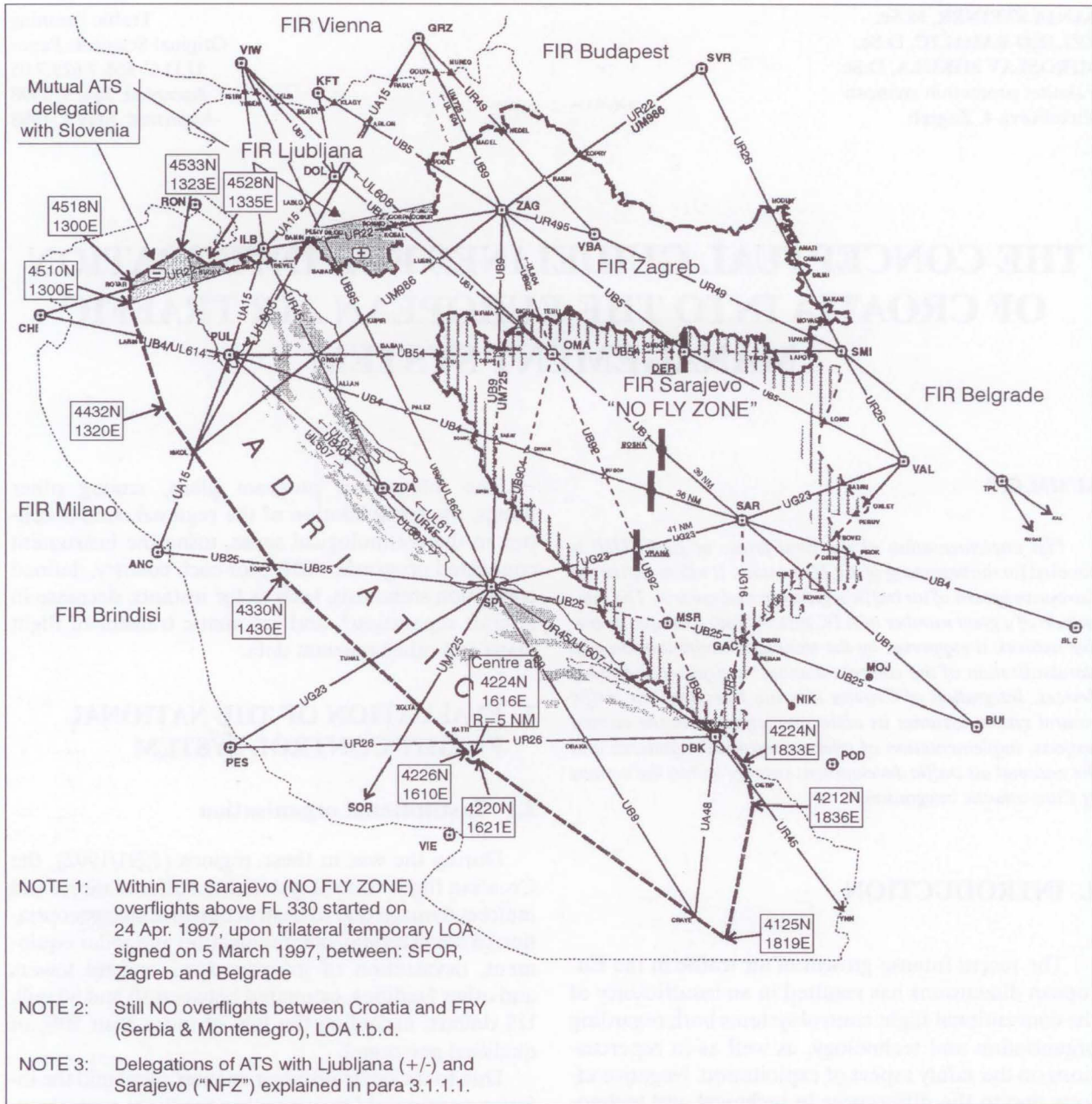


Figure 1 - A map of air routes within FIR Zagreb

In January 1996 ICAO even formally confirmed full airspace jurisdiction of Croatia in flight information - FIR⁸ (EUR Air Navigation Plan - Doc. 7754) i.e. the jurisdiction of the Zagreb flight control region for flights in the Croatian air space and over a part of the open Adriatic sea.

2.2 Technical and technological status

Before the international air traffic over Croatia and Bosnia and Herzegovina, i.e. within FIR/UIR⁹ Zagreb was discontinued (October 1991), the flight control was divided into 10 sectors (radar control), in-

cluding the military sector and the approach control - APP¹⁰ Zagreb.

The structure of traffic in the pre-war period was 75% overflights and 25% of other traffic categories. The regional flight control Zagreb had, conditionally speaking, an intermediary role in connecting two, conceptually different (institutionally and technologically) flight control systems of the Western and Eastern Europe with busy air routes (an average of 1000, and a peak of 1600 operations daily).

By gradual realisation of the CAN¹¹-project, the flight control system in Croatia has been mostly reconstructed and modernised and it is ready to accept the

Table 1

Year	Type of traffic		Overall traffic	% annual traffic increase	
	Overflights	Arrivals/ departures		Overall traffic	Overflights
1986	158859	68548	227407	+7.28	+8.78
1987	172322	73202	245524	+7.97	+8.46
1988	181006	73446	254452	+3.64	+5.03
1989	204128	71687	275815	+8.39	+12.77
1990	217514	70388	287902	+4.38	+6.56

Air traffic within the regional flight control Zagreb from 1986 to 1990.

pre-war traffic volume, which has over the recent six years been re-directed to the jurisdiction of the neighbouring flight controls, mainly Hungary.

By active participation at the ICAO-RAN¹² meeting held in 1994 in Vienna, Croatia joined ICAO-EANPG¹³, a body authorised for air planning, development co-ordination and regulations in the regions of Europe and the countries of the former USSR (ICAO EUR/NAT Region).

By installing the necessary equipment and by educating the personnel, the regional flight control Zagreb has been integrated into the efficient European operative system of the EUROCONTROL Centre for air traffic flow regulation in Europe - CFMU.¹⁴

The service for flight control procedures (airport, access and route) is organised with the appropriate equipment and personnel profile in accordance with the highest international standards. Also, the project of transition of geodetic measuring to the global system WGS 84¹⁵ is in its final phase, as a precondition for the development of internationally acknowledged air-maps and procedures.

End 1997, the integration process into the EUROCONTROL accounting system and charging for the flight control services - CRCO¹⁶ was completed. Also, the first issue of the Croatian Aeronautical Information Publication (AIP) is being prepared.

3. ESTIMATES REGARDING TRAFFIC GROWTH

The precondition for the increase in the international aviation traffic i.e. return of overflights to the air routes which are under the jurisdiction of the FIR Zagreb, is the signing of the Contract on Flight control co-ordination with SRJ. The absence of this co-ordination, from today's point of view, is a formal and operative hindrance to the re-integration of the international air traffic (overflight) flows and implies huge damage to the Croatian flight control system, but also to the international operators, whose exploitation

costs are much higher due to longer flying times. The annual loss is estimated at between 25 and 30 million US dollars based on the real service prices and the expected number of operations.

There are also the aggravating circumstances as a result of the interests of those countries in the region which have, due to the re-direction of the international air flows into the jurisdiction of their flight controls, substantially increased their profits and improved their own flight control systems by developing new centres with the latest equipment (the Czech Republic, Slovakia, Hungary, Romania) and by significant investments into communication, radar and navigation equipment or, on the other hand, into appropriate educational, training centres (Austria, Italy).

Adverse effects on the re-integration of the international air traffic flows are conditioned, therefore, by the political and institutional problems in the region and partly by the operative and technical advantages of using the services of the neighbouring flight controls.

Positive predispositions of the re-integration of the international air traffic flows result from the favourable geo-traffic position of Croatia, i.e. the option of the shortest air traffic routes between the North-western and South-eastern Europe.

Basic criteria for predicting the air traffic in Croatia is the traffic growth rate in the post-war period, evaluation of the existing operative and technical possibilities of the flight control system and the potential development of the re-integration processes.

4. PRIORITY PLANS AND PROJECTS

4.1 CAN - project (Croatian Air Navigation Project)

During 1994/1995 the European Bank for Reconstruction and Development - EBRD - granted a loan to the Flight Control Management for the reconstruction and development of a national flight control sys-

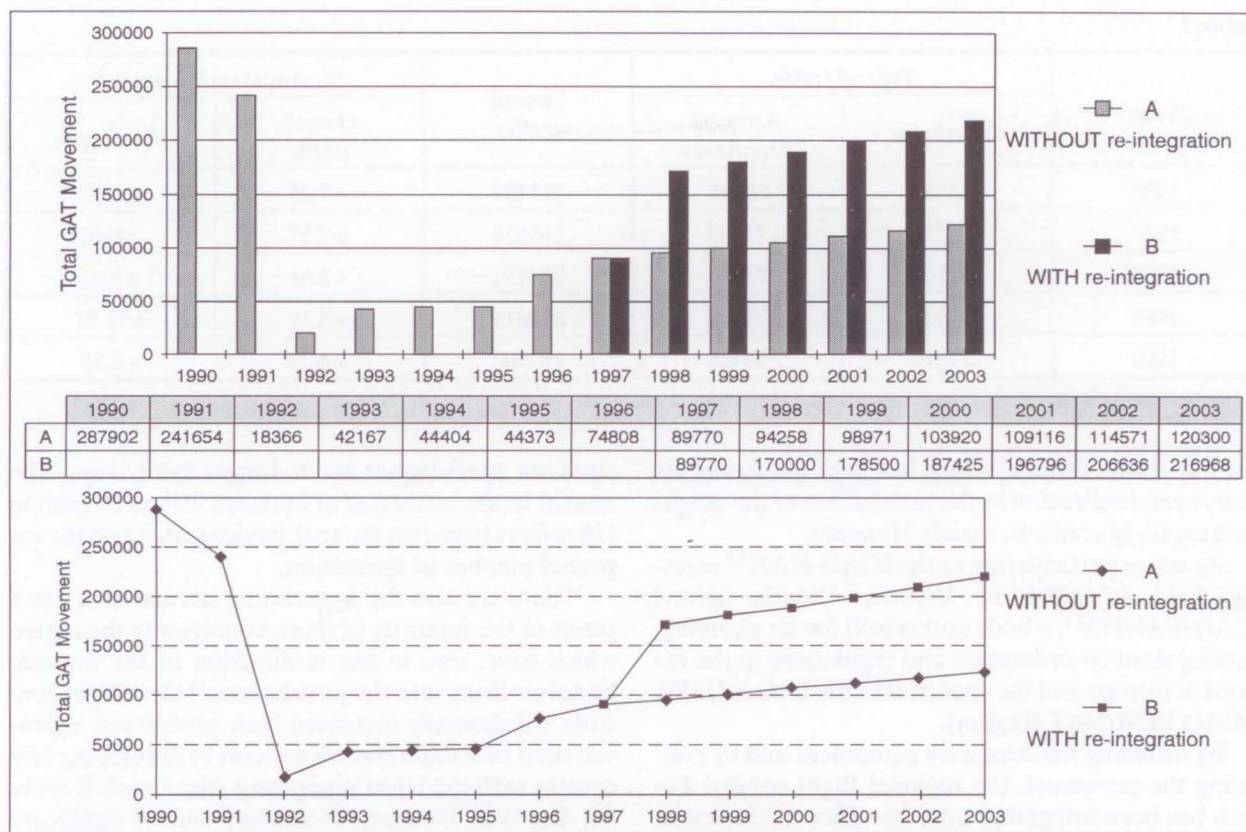


Figure 2 - Predicting the alternative options for air traffic development in Croatia

Source: EATCHIP - Convergence and Implementation Programme for Croatia, 1997.

tem, with the realisation planned according to the priorities of the so-called CAN- project.

The CAN-project includes three phases:

1. short-term (1995-96)
 - reconstruction of the infrastructure and equipment of airport flight controls
 - reconstruction and modernisation of the technical sub-systems: radar systems, Aeronautical Fixed Telecommunications Network (AFTN/CIDIN¹⁷ with AIS/MET¹⁸ bases), analogue-digital communication systems (VHF¹⁹ and INT/TEL connections), navigation equipment (VOR/DME²⁰, DME and ILS²¹), meteorological stations with satellite receivers, power supply systems etc.
 - intervention education and training of the flight control personnel
2. mid-term (1996-98)
 - completion of the started projects regarding facilities and equipment of airport flight controls, installation of radar and navigation equipment, improvement of the administrative and professional flight control personnel, and purchase of simulators for non-radar and radar control
3. long-term (after 1998)

- purchase of the new integral system for the radar and flight data processing - RD/FDP²²S

CAN project priority objectives have to the greatest extent already been realised in the first two phases, and the third phase represents the operative, technical support in the realisation of the object tasks of EATCHIP (technological adjustment to the systems of Western Europe).

4.2 EATCHIP (European Air Traffic Control Harmonisation and Integration Programme)

The European Air Traffic Control Harmonisation and Integration Programme was adopted in 1990 as a route air traffic development strategy by the end of the century at the ministerial meeting of the ECAC. In order to alleviate the negative influence of incompatible segments, first of all airport controls, which have not been included in the initial development "En-Route ATC" concept, EATCHIP was extended by the so-called APATSI-programme.²³

In the area of navigation, the flexible structure of air traffic routes has been planned, by the introduction of RNAV-routes²⁴, and a satellite navigation system GNSS.²⁵ By introducing the "Mode S"-radar, radar

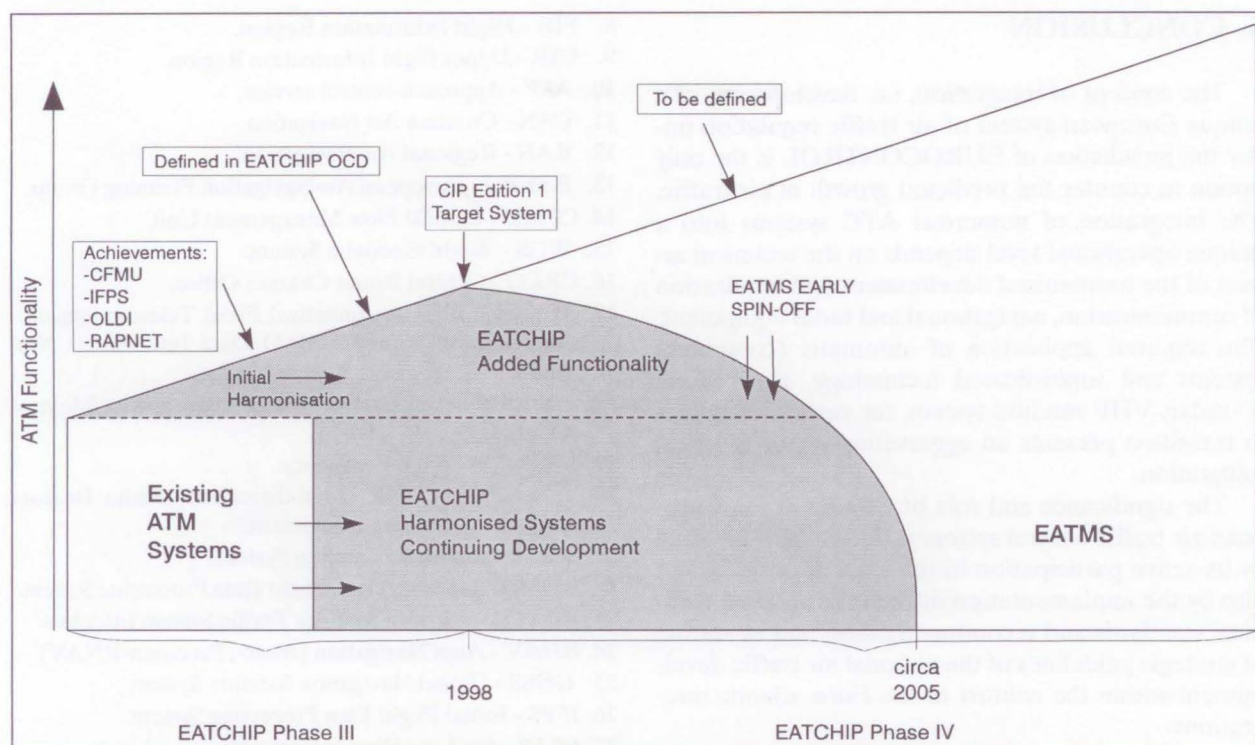


Figure 3 - EATCHIP-strategy of transition into EATMS

Source: EATCHIP - CIP Workshop, EUROCONTROL

flight control will be supported by IFPS-system²⁶ for automatic processing and flight plan data transfer based on the OLDI²⁷—standards.

The planned completion of the third phase of the programme, the so-called acquisition and implementation is the year 1998, followed by an integration phase, i.e. a phase of implementation of the future European air traffic flight control system - EATMS²⁸

Along with the adopted ECAC institutional strategy - INSTAR, which has already been incorporated in the new EUROCONTROL Convention, revision and elaboration of the whole development strategy of the European air traffic control system - ATM 2000+²⁹ - is being planned in 1998, which should be adopted at the next ministerial meeting of ECAC beginning of 1999. The operative concept of the ATM 2000+ strategy is based on extending the EATCHIP from the route development strategy to all air traffic subsystems, i.e. at the unique technological chain "Gate-to-Gate".

4.3 CEATS - project (Central European Air Traffic Services)

The project of establishing a traffic control centre in the upper air space - UACC³⁰ for Central Europe i.e. CEATS-joining members (Austria, Bosnia and

Herzegovina, the Czech Republic, Croatia, Italy, Hungary, Slovakia and Slovenia), should start in 1998 under the jurisdiction of EUROCONTROL, after agreeing on a location, and the service is expected to start in 2005.

Regarding the potential location of the control centre precisely in Croatia, active participation in this project is of extreme importance since it proves the traffic and strategic orientation of Croatia within the context of Euro-atlantic integrations, and on the other hand contributes to establishing permanent international air traffic flows in the Croatian air space.

4.4 EAD - project (European Aeronautical Information Service Database)

The project of co-ordinating the European air information system plans organisation of a completely new service within EUROCONTROL, with the latest technology of gathering, processing and distributing relevant air traffic data for the needs of the national air traffic control systems and all the air space users in Europe. Participation of Croatia in this project will be a significant contribution to the quality and level of the national flight control system services, i.e. the appropriate aeronautical information service.

5. CONCLUSION

The concept of integration, i.e. development of a unique European system of air traffic regulation under the jurisdiction of EUROCONTROL is the only option to counter the predicted growth in air traffic. The integration of numerous ATC systems into a unique operational level depends on the technical aspect of the harmonised development and application of communication, navigational and radar equipment. The required application of automatic (computer) systems and sophisticated technology, e.g. "Mode S"-radar, VHF satellite system, for certain countries in transition presents an aggravating factor of equal integration.

The significance and role of Croatia in the European air traffic control system is determined not only by its active participation in the current projects, but also by the implementation of the international technical standards and recommendations, and by setting of strategic guidelines of the national air traffic development within the context of the Euro-atlantic integrations.

SAŽETAK

KONCEPCIJSKE POSTAVKE INTEGRACIJE HRVATSKE U EUROPSKI SUSTAV KONTROLE ZRAČNOG PROMETA

Početak 21. stoljeća planira se puna implementacija završne faze EATCHIP-a koja će redefinirati europski sustav regulacije i kontrole zračnog prometa. Integracija velikog broja ATC-sustava u jedinstvenu operativu podržana je tehničkim osuvremenjivanjem i ujednačavanjem komunikacijskih, navigacijskih i radarskih sredstava. Uključivanje Hrvatske u europski sustav kontrole zračnog prometa pretpostavlja njeno aktivno sudjelovanje u tekućim projektima, implementaciju relevantnih tehničkih normi te strategiju razvoja nacionalnog zračnog prometa u kontekstu euroatlanskih integracija.

REFERENCES

- At the beginning of the 90s the regulation and flight control in the European air space was divided on 51 regional control centres with 31 various computer systems supplied by 18 different manufacturers.
- CIP - Convergence and Integration Programme.
- Horizontal separation of 5 NM (nautical miles), and vertical separation above flight level FL 290 of 1000 ft (instead of 2000 ft), which would provide six more flight levels in the upper air space.
- ICAO - International Civil Aviation Organisation.
- ECAC - European Civil Aviation Conference.
- EUROCONTROL - European Organisation for the Safety of Air Navigation.
- LoA - Letter of Agreement.
- FIR - Flight Information Region.
- UIR - Upper flight Information Region.
- APP - Approach control service.
- CAN - Croatian Air Navigation.
- RAN - Regional Air Navigation.
- EANPG - European Air Navigation Planning Group.
- CFMU - Central Flow Management Unit.
- WGS - World Geodetic System.
- CRCO - Central Route Charges Office.
- AFTN/CIDIN - Aeronautical Fixed Telecommunications Network/Common ICAO Data Interchange Network.
- AIS/MET - Aeronautical Information Service/Meteorological.
- VHF - Very High Frequency.
- VOR/DME - VHF Omni-directional Radio Beacon/Distance Measuring Equipment.
- ILS - Instrumental Landing System.
- RD/FDPS - Radar Data/Flight Data Processing System.
- APATSI - Airports and Air Traffic System Interface.
- RNAV - Area Navigation (Basic-, Precision-RNAV).
- GNSS - Global Navigation Satellite System.
- IFPS - Initial Flight Plan Processing System.
- OLDI - On-Line Data Interchange.
- EATMS - European Air Traffic Management System.
- ATM 2000+ - Air Traffic Management 2000+.
- UACC - Upper Airspace Control Centre.

LITERATURE

- Božičević J. et al.: *Prijedlog Strategije prometnog razvoja Republike Hrvatske (draft)*. Institut prometa i veza, Zagreb, 1997
- Radačić Ž., Steiner S.: *Promemorija uz prijavu znanstvenog projekta "Konceptija razvoja zračnog prometa Hrvatske"*. Faculty of Transport and Traffic Engineering, Department of Air Transport, Zagreb, 1998
- Steiner S., Pavlin S., Mavrin I.: *Geotrafic position of the Republic of Croatia and Bosnia and Herzegovina within the European and intercontinental airways system*. Faculty of traffic and communications University of Sarajevo & Scientific Council for Traffic of the Croatian Academy of Sciences and Arts, Symposium "Position and role of Bosnia and Herzegovina and Croatia in the European Transport and Communication Corridors", Sarajevo, June, 1997, Proceedings, pp. 35-38
- Steiner S.: *Sigurnost u zračnom prometu, Dio II*. Faculty of Transport and Traffic Engineering, Zagreb, 1998
- EATCHIP - Local Convergence and Implementation Programme Document for Croatia. Edition 3.0, 1997
- EATCHIP increasing Europe's ATC Capacity*. EUROCONTROL, External relations Bureau, Brussels, 1995
- EUROCONTROL in brief*. EUROCONTROL, External relations Bureau, Brussels, 1995
- The EATCHIP concept of the flexible use of airspace*. EUROCONTROL, External relations Bureau, Brussels, 1994