The Air Traffic Management System for 2050

Virtual - Global - Automated

Marc Brochard EUROCONTROL Experimental Center Long Term Investigation Programme Manager marc.brochard@eurocontrol.int

Abstract

As stressed by ACARE - SRA II), " world aeronautics is entering a new age of aviation – the age of sustainable growth - characterized by the need of more affordable, cleaner, quieter, safer and more secure air travel". ATM system of the future will have to respond to several challenges. especially a higher diversified air transport demand mixing commercial and scheduled flight with personal and non-scheduled one being manned and un-manned.

This paper provides a vision about how the ATM system might look like in 2050 responding to the challenges foreseen today by the experts. ATM will be highly automated. 4D trajectory, self separation application and subliminal control means will be developed releasing the Air Traffic Controllers (ATCo) from his/her current tasks. He/she will become more managing flow rather than flights. controlling Advanced air station and highly flexible airspace meeting both civil and military needs will be designed to support mixed traffic. Unmanned Air System (UAS) will operate for both local and intercontinental missions. Small aircraft or Very Light Jet (VLJ) will operate for personal air transport needs. Small aircraft, still manned, will nevertheless be highly automated to be operated by low-skilled pilot.

Challenges for the future

Recent traffic forecasts point out that traffic will be doubling if not tripling for 2020, and will probably remain growing the years after. Nevertheless, energy and environmental issues might have a great impact on this traffic growth. But, considering the mobility demand, we can trust the human being to find new technologies that will enable a sustainable and always growing air transport business. So, even if traffic growth could be impacted by energy challenge and thus be slowed down, it is more likely that the traffic will remain still growing.

Considering this assumption, let us imagine what could this ATM system in 2050. First of all, it will be fully embedded in a Global Transport chain. Passenger will travel without really considering the transport means they will use: everything will be managed in a global transport process where the air vehicle will be one integrated element of that transport chain. The ATM system will have to operate drastic changes in order to cope with a highly dense and diversified traffic mixing scheduled with non scheduled flight and many new kind of air vehicle (UAS and VLJ) highly automated and operated by lessskilled pilot. Airspace users will be given access to an **Open Sky system** in order to support both scheduled and non-scheduled flights and also to enable flying on request. High automation will lead to have a **Virtual ATM System.** Operators (both Pilot and ATCo) will play new roles in that system more oriented to system supervision and flow management.

Last but not least, this future air transport system shall be environmentally friendly: green energies, neither polluting nor noisy.

The ATM system part of a Global Transport chain

As stressed earlier, air transport will be integrated in a global transport process where all kinds of transport means will be linked together into a **global pan-European transport network** supporting full integrated services provision leading to maximise its efficiency. The Air Transport will be one element of this global transport chain with the inter-modality as corner stone.

Ground and air transport processes will be integrated for both passenger and luggage handling processes. Passenger will be transferred smoothly from his/her home to his/her final destination: a home-to-home service sustainable using the most transportation to respond to individual transport requirements.

For managing mass transport for both people and/or goods, being medium or long range, new airport will be developed, called air station as they will not be dedicated to air transport mean only but more considered as inter-modal node linking several transportation means together (see figure 1). We can assume that except for personal flight, short range mass transport will be transferred to the ground.



<u>fig 1 - The airport of the future: an</u> <u>inter-modal mode</u>

Specific transport vehicle will be able to run on the ground as well as flying in the air. Specific green and clean aircraft will be designed offering high inter-operability, able to integrate any kind of transport vehicle, configurable on request to optimise their use.



fig 2 – Future personal transport

Small and personal air transport will be highly developed in order to meet on request and private transport needs. These small aircraft will be operated as the car of today (see figure 2). These small aircraft will not request specific ground area as they will stand "at home", in the garage, able to take off and land any where on the ground. These small aircraft will be able to fly short, medium or even long range, at low or upper level.

Security processes and means will be common for all kind of transport, be it ground and air transport, personal or mass transport. Nevertheless, no more specific checking process will be needed as security check will be performed automatically in a non intrusive mode as soon as the passenger and/or luggage will enter in the transport chain. Passengers and goods will be scanned and tracked all along the journey. For efficiency and security purposes, passengers and luggage will not be using the same transport vehicles. Luggage will be transported by unmanned vehicle. Luggage will be separated and desynchronised from the passenger, but always keeping a virtual link between them. Resynchronisation of passenger with their luggage will be performed when arriving at destination.

Open sky system

As for the road access today where you all can drive your car when you want without having to ask the access right to any regulation body, the European sky will be highly flexible in order to accommodate with scheduled and non scheduled, manned or un-manned aircraft. **Flying on request** will be highly developed for all kind of aviation.

Each aircraft will have to indicate its intentions (mainly its final destination) in order to contract a 4D profile with the Air Transport System. No strategic regulations will be needed but real time flying restriction might be decided when needed to face to unexpected event which would reduce the availability of Air Transport resources. This will lead to have real time 4D profile re-negotiation. Integrated multi-national flow management and regulation body will ensure the free, flexible, and equitable access to the sky for both civil and military airspace users. This body will have the responsibility to initiate alternative scenario when some Air Transport resources will become not available.

Virtual ATM system

ATM system will be totally transparent for the airspace users: a kind of **Virtual ATM system**.



When starting, any aircraft will be automatically connected to the ATM system. Aircraft identification will be automatically aircraft done and intentions will be given to the system. ATM system will be voiceless, high majority of the communication will be computer to computer communication. Aircraft will operate in a single sky; there will be no more sectors, neither Air Traffic control centre. In dense areas and/or final areas where and when the air traffic will be complex, the virtual ATM system will operate the aircraft in order to fit with a predefined but still flexible air route network. In less dense areas, the aircraft will be fully autonomous.

Nevertheless, mainly for homeland security and military requirement, some airspace areas might be closed for non authorised aircrafts. Virtual and electronic protected area will be deployed which will automatically divert any non authorised flight from entering into the protected area.

The virtual ATM system will be composed of few Air Transport Services centres. A complete and redundant of technical set infrastructure will be deployed in order to ensure a smooth and transparent transition of the aircraft between Air Transport Services centres. The virtual ATM system will be configurable according to the traffic density and demand in order to optimise the services (grouping or de-grouping Air Transport Services centres).

Aircrafts will be autonomous, flying predefined 4D trajectory along contracted as soon as the aircraft will be connected to the virtual ATM system and after providing its intentions final destination). (its Aircrafts will insure self safe separation with other aircrafts. In case of emergency and/or security, the aircraft will be fully piloted remotely from dedicated ground station.

ATCo will not control the flight as such but rather become Air Transport System manager. Nevertheless, they will be able to intervene in case of very complex and/or degraded situation or in case of emergency and/or security where they will take the traffic control and, ultimately, to take the full control of given aircrafts back to the ground.

The virtual ATM system will offer different level of services according to the user's needs and equipments leading to several levels of Air Transport Services charging rules. For example, scheduled aircrafts will be managed in order to arrive on time at the final air station. This will require specific equipments, rule of priorities and in dense and terminal areas, dedicated route network or tube segregated from the other airspaces users. Aircrafts will be allowed to fly with several levels of embedded automation supporting equipments thus, having access to various levels of Air Transport Services and potential restrictions.

Conclusion

All this can be seen as a dream, some crazy ideas which will never become reality. Other may think it would be better to forget all of that; but, why not?

In December 1903, Orville Wright took off for few seconds over a distance of 36 meters with a flying



machine. He was crazy and nobody would have ever though at that time that, within a century, this new mean of transport would have been drastically developed. In 2002, 14 millions of IFR flights and 5.3 millions of VFR airport movements were counted over Europe.

So, world is changing. What was not possible yesterday has been realized the day after. There are many barriers to the change, often people are afraid changing their habits but, on the other hand the same people are claiming for changes.

Air Transport will change as the world is changing. Pace of change will speed up. Current system is based on ideas which were defined in 60/70s. At that time, nobody was ready to simply imagine the huge technical revolution which occurred since. Powerful laptop, wireless device, massive information management system all over the world such as the World Wide Web network, global positioning system, space based application and fully automated vehicle and also, last but not least, the huge and still growing mobility demand from the society. ATM can not stand out of these technical and societal changes.

There is a definitive need to think out of the box, to give room for dream and innovation, to question the current foundations of our current ATM system. Clearly such steps can only be considered if there are the means to ensure that each step in the transition is safe, but we do need to consider the end point in our planning for these transitional steps.

Vision without action is a daydream, but action without vision is a nightmare says a Japanese proverb.