# Will we ever automate the tasks of the ATCO?

**by Job Brüggen**

Let's face it, everyone believes that future automation will take over the role of the Air Traffic Controller sooner or later...

Elevators were the first means of transportation to lose the driver/operator. Nowadays, we send spacecraft around the universe, we step into metros and trains in Paris or Toulouse that do not have a driver in the front anymore. Aircraft are flying across the globe on autopilot 99% of the time. The world's best chess player is a computer program. Robots will take over home care duties and many more tasks. Ha ha! Surely we must be able to automate the tasks of the ATCO! The ATCO is talking half-duplex to aircraft over a VHF line. If someone is transmitting, everyone else has to shut up or a message is lost. How silly is that in the modern world? Have we all been fast asleep for the last 50 years?

Do you remember the research efforts at the EUROCONTROL Brétigny centre with a project called 'ARC2000' (sending automated clearances to aircraft without a controller)? The PHARE Demonstrations (automated 4D trajectory negotiation over datalink)? Free flight self-separation trials? It would be only a matter of time. The future was coming and it was coming rapidly (I am talking 90's stuff here). In March this year, I read about an A320 that had undertaken the second "initial 4D" (i4D) trajectory flight trial as part of a SESAR project. Come on, we did that twenty years ago. What has taken us so long?

At the lowest level, we automate things that need processing, transformation or other treatment. Flight plans, radar tracks, label assignment, presentation screens, input methods, weather updates, information status pages, and so on. Basically it is all information (pre-) processing and assists all the mental gymnastics the controller still has to perform. Tasks are performed faster, more reliable, cheaper. A big help.

At the intermediate level, we can see algorithms that begin to assist the controller in exactly that mental process. Predictions, arrival management tools, conflict alerts, flow management tools: also known as decision support tools. They provide advice to the controller, who then can decide what to do with them. Again a great help to humans who are notoriously bad monitors. A machine continuously checking the separation between aircraft (which is, after all, our core business) can provide tremendous value.

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Still, humans are the centrepiece of the intellectual part of the job. Sure enough, we have 'cornered' the controller with enough automation to take the final leap. How difficult can it be to take over that part as well? The rules and procedures are clear and relatively simple. The manoeuvring space is big. The number of instructions that can be issued to an aircraft is very limited. Phraseology is standardised. A machine separating the aircraft will not get tired – or bored – when working night shifts. There is no union of machines to ask for a pay rise. So at the final level of automation, could machines take over the task of the controller? Take the decisions as well as execute them?

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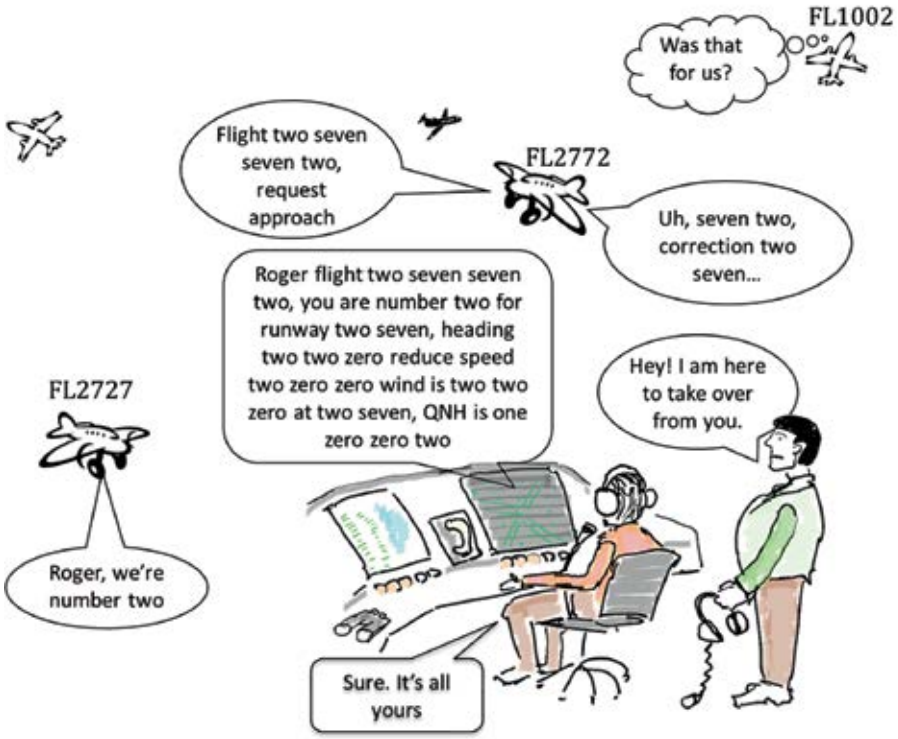


**Air - ground datalink could free us from elementary errors. How long have we been waiting?**

In 2001 there was an inspiring presentation by Heinz Erzberger from NASA called 'The Automated Airspace Concept'. He had developed the CTAS platform (Center Tracon Automation System) at NASA, and having thus proved that generating conflict free aircraft trajectories is quite achievable, he cleverly began with the question 'okay, but what if the automated system fails?' He defined a backup system (called TSAFE) that would independently monitor the automated clearances and the aircraft trajectories that would follow and would be able to send out alerts directly to the pilot. That backup system would also monitor the separation between manually-handled aircraft that would still not have the advanced systems on board – so yeah, still a controller around.

It would be an engineer's dream. Controllers would be system managers doing the really tough intellectual part, machines would ensure smooth flow and deal with the hassle of communicating clearances to aircraft. This is where a win-win situation would be created – significantly more capacity in the airspace and more safety! How's that for a paradigm shift? Nothing short of a revolution!

Alas, the matter proved to be more difficult. We can automate tasks that are highly deterministic; when you do this, then precisely that will happen. Flying an airplane for example. But controlling a bunch of aircraft, as simple as it may seem, is of much more dynamically unpredictable nature. The Paper accompanying the presentation I mentioned above cautioned against setting one's hopes too high by "…. the boundary between the set of solvable and unsolvable problems is unknowable. While the envelope of problems controllers can solve is also limited, it is much larger than the CTAS solvable set. Moreover, human controllers excel at adapting their control strategies to completely new situations, a capability that is beyond existing software design." It was 2001, so we could say this is a 'blast from the past', but I sense we have not really solved this puzzle yet.

So we are back at the human in the loop. The human excels in adapting control strategies to unexpected situations. Clearly that is their best asset in this game and it remains undisputed so far. The human sustains the all-important safety level by responding skilfully to changing circumstances by relying on good coping strategies. They provide the resilience that machines simply do not currently deliver. Is that, then, the main barrier to further automation? Please allow me to point out a conceptual flaw I see lying at the heart of the ATC industry. States are responsible for ensuring that air traffic service in their airspace is provided. And historically, states do not enjoy a great reputation for successful innovation. Sure, the European SESAR programme is burning money, but sovereignty of airspace remains a fundamental obstacle to further innovation. Moreover, the fact that many air navigation service providers currently enjoy a monopoly is a further disincentive to innovation.

We can, though, see signs of SESAR programme elements that are taking cautious steps to further automate the intellectual gymnastics of the controller. If you take the current 100-page European ATM Master plan, you will count 13 hits on the word 'automation', mostly associated with 'Conflict management and automation'. A shining star? Equally, the plan describes a significant change in the way the ATCO of the future will control traffic. Exactly what that role will be is not yet revealed and maybe this is for the better. - it will be part of an evolution rather than a revolution. It's amusing in a way how aerospace can be innovative on one side and so utterly conservative at the same time.

Quite recently, I read an article that claimed that office workers (so people like myself, ahem) were more likely to get automated out of the way than frontline personnel. That is of course ridiculous, unthinkable and will never happen…!