

## **Will we control the automation, or will it control us?**

**Tamsyn Edwards**

The purpose of air traffic control (ATC) is to provide a safe and efficient service for all air traffic. Since its inception, ATC has evolved in response to user needs, achieving exceptionally high standards of safety in a context of shifting complexity and density of air traffic operations. But predicted changes in societal demands, technological advancements and airspace-user needs create new challenges as we look to the mid and far term.

First, a growing number of industries are expanding into the aviation domain. Radical growth and diversification of non-traditional traffic is expected. One example of this is the increased utilization of high altitude airspace (above 60,000ft) for diverse operations such as long-distance weather balloons, supersonic aircraft, and high flying commercial aircraft. Traffic will need to fly through lower-altitude controlled airspace, however, creating an integration challenge for air traffic controllers (ATCOs) to manage traffic with widely varying performance profiles in the same airspace.

A second challenge is urban air mobility, in which small, passenger-carrying aircraft (e.g. sky taxis or personal aerial vehicles), will share airspace with traditional traffic, as well as drones. Current visions suggest that new entrant traffic will be managed independently of the traditional air traffic control system, by third party organizations as part of a wider distributed system. Initially human operators will assume traffic management responsibilities, though in the far term autonomous air traffic control is envisaged. Essentially, two different systems of traffic management may operate within the same airspace. All of this will occur against a predicted year-on-year growth of 'traditional' commercial traffic. To do this safely requires the identification and mitigation of workload drivers for ATCOs, clear function allocation between ATCOs and third-party organizations (especially concerning management of off-nominal events), and provision of new tool tools for ATCOs.

A majority of the predicted progressions focus on advanced automation to support service provision. One of the most fundamental changes proposed is the use of trajectory-based operations (TBO), predicted to be fully realized in the mid to far term

timeframe. TBO envisions that aircraft will fly pre-negotiated trajectories that are managed during flight via time constraints, generating a shift from manual, tactical air traffic control, to more automated, strategic traffic management. TBO aims to reduce ATCO workload, and enhance system efficiency by making use of narrower tolerances.

Human factors will have a significant role in a context of growing automation, as well as the introduction of Artificial Intelligence. Issues including automation transparency and reliability are key concerns, as are changes to the ATCO's role. There may be a need for a completely new role to supervise the automation or the AI, whether for security purposes in case of attacks, or for safety reasons. While other sectors of aviation are considering significantly reduced human involvement such as pilotless aircraft, completely autonomous ATC carries huge risk and responsibility. Until autonomous ATC becomes a real operational possibility – if ever – the human must be able to fathom what local, regional or network-wide ATC automation is doing, and why. The *why* that is the hard part. Proponents of AI do not guarantee their systems will be explainable.

Increased automation and reduced human involvement in ATC is appealing to some because it has the potential to support increased traffic throughput and growing demand. However, the depth of expertise of the human operator, and the extent of the ATCO's contribution to system safety, is easy to overlook (until it is too late). An additional concern is the potential for de-skilling of human operators as a result of increased dependence on automation. De-skilling would have serious consequences for the ability of a controller to intervene in safety critical situations, as well as for overall system resilience, effectively removing a safety barrier. Human Factors will be essential to ensure that there is not a loss of intangible skills and assets that currently keep the system safe.

ATC will continue to evolve to meet user demands. The application of Human Factors is critical to the successful advancement of the system, balancing forward progression with the maintenance of exceptional safety standards. At the moment, whether we control the automation or it will control us, is an open question. If we engage seriously with Human Factors in the evolution of system-wide air traffic management, it becomes a choice, one that is definitely under our control.