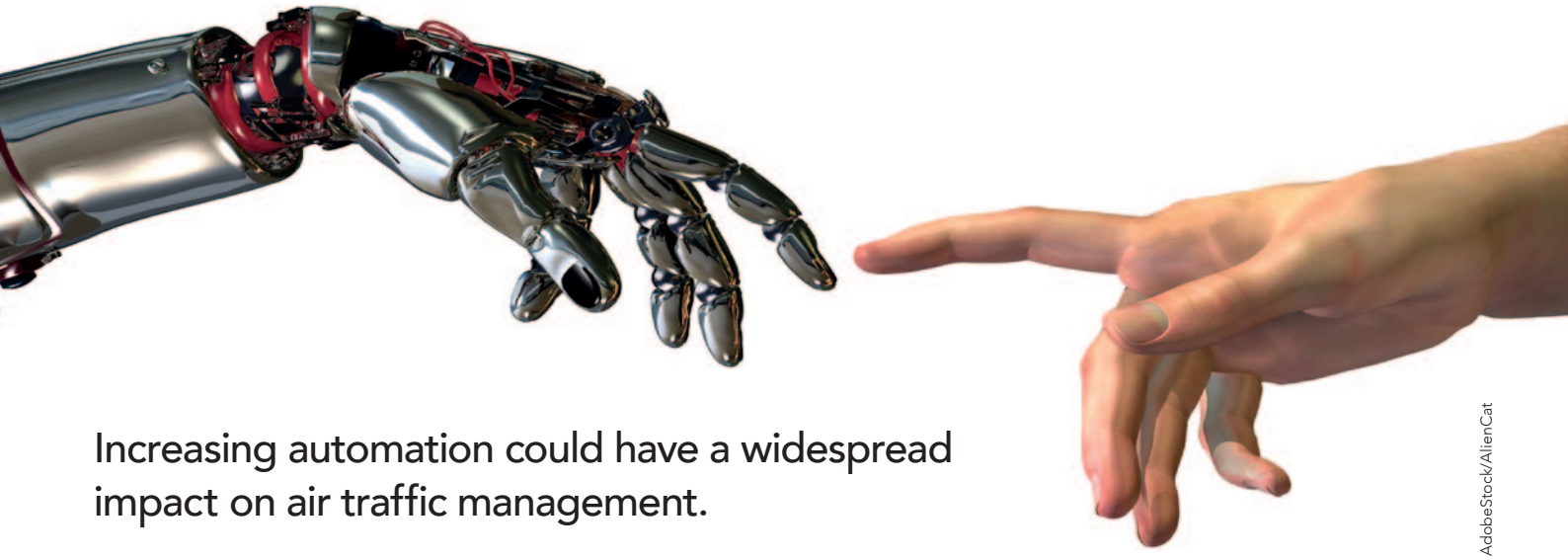
Rise of the machines



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Increasing automation could have a widespread impact on air traffic management.

Automation seems straightforward – get a machine to do the routine work of a human or at least support a human in his or her efforts.

From the industrial revolution onwards, the concept has been working well. In air traffic management terms, benefits range from safety to efficiency and capacity.

Already, automation is enabling planes to safely reduce separation minima and is taking responsibility for such core controller functions as conformance monitoring – ensuring aircraft are doing what they were authorised to do. It is driving efficiency through advanced flow management and optimising airport arrival and departure management.

Other positives include the facilitation of data sharing, thereby forging closer partnerships across the aviation value chain. That ultimately translates into safer skies and a better passenger experience.

Such benefits will proliferate as technology advances. In the foreseeable future, automation can be expected to contribute to predictive decision making, accounting for a wider range of safety and efficiency needs. And it will develop to fully utilise cockpit technologies and integrate them with increasingly advanced ground based systems. The refinement of the decision-making process will, in other words, continue.

Costs will reduce as a result. This is not necessarily through fewer controllers being needed – rare or unanticipated events will still require human intervention – but simply because resource usage will improve.

> Automation is often cited as improving productivity. But the elements that go into making a worker productive are numerous and includes experience in the job and an understanding of the bigger picture.

Data analysis

Kevin Shum, Director General of the Civil Aviation Authority of Singapore says automation has the potential to make ATM safer and increase capacity.

"Artificial intelligence and machine learning can make ATM safer, as systems can identify potential conflicts and surface them to controllers for immediate attention," says Shum. "Predictive analytics can help us to identify potential hot spots and safety risks. We can then design new procedures to avert such risks."

Shum believes the ATM environment must be fully digitised. Data needs to be collected, harmonised and a common format agreed to analyse the information. This would convert data into meaningful outputs, helping to prevent incidents or accidents, optimising airspace and developing performance benchmarking metrics.

"We are only in the early days of automation," says Shum. "In particular, I believe that there will be a quantum leap in ATM automation when unmanned aircraft systems traffic management (UTM) solutions are fully developed.

"By its nature, UTM will have to be highly automated, as it would not be practical for human controllers to manage UASs the same way we manage manned aircraft today. Separation distances and reaction times will have to be much shorter."

Counter-intuitive

But just as there are many benefits, so too are there many challenges. Automation in as complex an environment as civil airspace necessarily has an impact across all aspects of ATM.

Critical to this understanding is the definition of automation. Automation means technology performing a function – in part or in full – previously carried out by a human.

Electric windows on a car are an example although these are no longer viewed as automation as the word continues to evolve along with technology.

One plus point for technology's increasing influence is the fact that millennials will make up 50% of the workforce by 2020. This is a tech-savvy generation, far more in tune with the capabilities and limitations of technology.

Evolution is not so advanced, however, that automation should be confused with autonomy. Automated systems are not yet truly independent and therefore guidance on how human and machine can successfully integrate is essential. Because of the continued need for human involvement, automated systems, almost counter-intuitively, must be designed and deployed with the human in mind. Users need to be fully aware of the system state at all times and any decisions the system is making on the user's behalf.

This is a critical aspect of the transition to automation, noted Brendan Mulligan, Director of Human Resources at the Irish Aviation Authority and Chair of the CANSO Human Resources Workgroup, speaking at the CANSO Global ATM Operations Conference 2017 in March. Automation blindness can quickly set in, where a user over relies on the system information and forgets to continually question or contextualise the data.

Training must deal with this as well as user response to system failures or unusual events. It is critical to be able to spot what is known as "system drift" as early as possible. The training of controllers will need to reflect a deeper understanding of the technology so this knowledge can be applied whenever there is an error or system failure.

There are two aspects to this: the need to redefine contingency plans; and the gradual eroding of job demarcation lines.

Business continuity is now heavily reliant on technology. The end user is unlikely to have the skills to successfully repair a system and so must ensure more traditional skills are kept up-to-date. Meanwhile, engineers need to be included in emergency response planning.

Alongside this, old responsibilities are being blurred. Consider data-link technology connecting the ground and the cockpit in the first instance with voice acting as back-up only. How will this affect situational awareness and workload? Automation will inevitably redistribute the accountability of pilot, air traffic controller and engineer.

Workforce impact

Consequently, Mulligan noted, managers will need to work harder to build greater trust among the workforce as technology will be disempowering for some, dominating for others.

Indeed, how automation will affect the workforce is an intensely-debated topic. The foundation for this discussion has shifted from technology supporting humans to humans supporting technology.

Automation is often cited as improving productivity, for example. But the elements that go into making a worker productive are numerous and includes experience in the job and an understanding of the bigger picture. This could also be described as creative thinking, something a machine cannot replicate.

And there is one other thing a machine will never do; take responsibility. Accountability will always rest with the human. Admittedly, the industry is already heavily reliant on technology to arrive at the right decision and system wide information management (SWIM) is deepening this reliance. But all systems are human-designed and human-maintained.

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The challenge for an employer in ATM will be to keep them once they have been fully trained. As well as being technically capable, millennials are judged to be more transient and unlikely to be tied down to an single employer.

Disjointed system

Automation therefore needs to be seen in the wider ATM context, which has disparate levels of maturity and human involvement and wildly different airspace environments. Automating specific aspects at one ANSP may create a disjointed ATM system overall and introduce inefficiencies back into the ANSP.

It should be remembered, for example, that more data does not necessarily mean more control. Information from automated systems needs to be filtered appropriately so that the right information is presented at the right time. This is especially true as automation grows and integration – and therefore interdependencies – become the norm. This will call for careful management and far greater cooperation.

Any discussion on automation also needs to account for the regulator. New systems need to fully account for, and even exceed, existing safety requirements. It is likely that an automated system needs to be compatible with larger industry programmes such as the Single European Sky ATM Research (SESAR) project and ICAO's Global Air Navigation Plan.

Automated systems by their nature will be innovative and therefore the problems and challenges may be new too.

But crucial to their success is the need to understand the human element. Automation suggests that no operators are needed but in fact, the transition to a technology-dependent environment is centred on humans. The system must be designed with humans in mind, and humans must assess the quality of data and decisions and be ready to take control in an emergency.

The rise of the machines is a uniquely human phenomenon.

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