The FUTURE of FLYING in a Single European Sky

A CREW PERSPECTIVE

ECA Piloting Safety

European Cockpit Association

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Executive Summary

The Single European Sky initiative – set to modernise our airspace – outlines ambitious targets that will create a completely new operational environment, based on trajectory management, highly performing technologies and a much more strategic role for the flight crew. These changes are welcome and – at the same time – raise a number of challenges, such as the ability to increase both efficiency and safety. European pilots, as front end users affected by these changes, outline policy recommendations and prerequisites for successfully meeting the challenges of our future seamless skies.

The publication focuses on five overarching prerequisites that are key to the future of flying:

1. Safety
2. Pilot-centric solutions
3. Global interoperability
4. Attention to the human dimension
5. High-level resilience of the system

This 5-pillar strategy lies at the heart of a number of Position Statements outlined in this publication. Among those are pilots' views on improving weather information, datalink and communication specificities, cyber security provisions, integrating RPAS, developing proper regulation for Remote Tower Services, reducing environmental impact, etc.

Under the Single European Sky, the way of operating in the future is completely re-thought, including the pilot's role in operating their flights. Hence, beyond the many technical and policy aspects, this publication presents a unique "sneak peek" into the future of flying from a crew perspective!

Introduction

Fifteen years ago, the major undertaking of establishing a 'Single European Sky' was launched under the aegis of the then EU Commissioner for Transport, Loyola de Palacio. She understood that the fragmentation of Europe's airspace, the non-integrated organisation of air navigation services provision and the out-of-age air traffic management (ATM) technologies were the main issues at stake. The related inefficiencies resulted in non-optimal routes, longer flights, extra fuel burn and higher costs for airlines and consumers. And the forecast was that air traffic would double by 2020 leading to a major capacity crunch. This was the trigger for an ambitious action to modernise the European ATM system with the aim to have safer, much more efficient and sustainable operations in the future.

After a long and difficult decision-making process a first major step was achieved in 2004 with the adoption of the Single European Sky (SES) legislative framework. Enhancing cross-border co-ordination, ensuring greater interoperability, improving decision-making and increasing enforcement in ATM were the main pillars of this first legislative package. In 2009 the initial four SES regulations were revisited with the ultimate objective to increase the overall performance of the provision of air navigation services in Europe. A comprehensive performance-based regulatory pillar was introduced with the setting of targets for cost-efficiency, capacity, safety and environment. The SES regulatory framework was also supplemented by an integrated approach towards safety by extending the competencies of the European Aviation Safety Agency in the field of aerodromes, air traffic management and air navigation services.

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Yet despite these initiatives, the project was still not delivering as expected 10 years after it was launched. The European Commission therefore decided to renew its efforts to boost the SES project in 2012. The EU Transport Commissioner Siim Kallas (2009-2014) threatened Member States with sanctions as regards the lack of progress of Functional Airspace Blocks arranged around traffic flows rather than national boundaries and announced an interim update, the so-called Single European Sky 2+ initiative (SES2+). SES2+ aimed at accelerating implementation and built on the two previous legislative packages, SES and SES2. The two main objectives of this update are to go a step further in the application of a more hands-off performance oriented model of economic regulation, with enhanced independent oversight, and to overcome a number of overlaps in legislation left by SES2, so that the same provisions were found in several pieces of legislation.

The package has proved to be highly controversial as soon as it was put forward in June 2013. A core group of Member States expressed their opposition as it was felt the SES2 package was still being implemented and had not produced its full effect. In addition, a number of provisions related to opening some support services to competition have been heavily criticised, including by several stakeholder groups. The co-decision process is still on-going after the European Parliament voted the package through in Plenary in March 2014 and Member States finally reached a general approach in December 2014, with a final deal expected in 2015.

In addition, over the past year, there have been a number of important institutional developments specific to SESAR (Single European Sky ATM Research) programme, i.e. the technology pillar of the Single European Sky. The SESAR Joint Undertaking (SJU) was extended by the EU Council of Ministers beyond the organisation's original timeframe, thus securing the continuation of adequately funded European ATM R&D activities under a single umbrella. More recently, the signature of the partnership agreement between the EU Transport Commissioner Violeta Bulc and the SESAR Deployment Alliance consortium was a milestone to support the synchronised and coordinated deployment of breakthrough technologies across Europe. Another important step was the signature of a Memorandum of Understanding between the SJU and the SESAR Deployment Manager (SDM), providing a platform on which to build cooperation for the smooth delivery and timely deployment of SESAR Solutions to the ATM community.

The Single European Sky is a European Commission initiative by which the design, management and regulation of airspace will be coordinated throughout the European Union.

This is expected to benefit all airspace users by ensuring the safe and efficient utilisation of airspace and the air traffic management system within and beyond the EU. Airspace management is planned to move away from the previous domination by national boundaries to the use of 'functional airspace blocks' the boundaries of which will be designed to maximise the efficiency of the airspace. Within the airspace, air traffic management, while continuing to have safety as its primary objective, will also be driven by the requirements of the airspace user and the need to provide for increasing air traffic. The aim is to use air traffic management that is more closely based on desired flight patterns leading to greater safety, efficiency and capacity. Source: SESAR Joint Undertaking

A New Concept

From Airspace to Trajectory Management

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The Single European Sky project has not been limited to regulatory developments. In fact, the basic technology of today's ATM system was developed in the 1950s.

The only way of communicating between an aircraft and the control tower is still the radio with low quality connection and capacity overload. Comparable to what has been achieved in aircraft design in the past 40 years it was recognised that designing a new generation of ATM system and developing breakthrough technologies was required. This is the main purpose of SESAR. Not only a comprehensive roadmap for R&D activities was produced by the ATM community (ANSPs, airspace users, airports, manufacturing industry, professional staff organisations, etc.) – and is being implemented since 2009 – but also a complete new operational concept. The way of operating in the future was completely re-thought, moving from airspace to trajectory management.

Single European Sky ATM Research (SESAR)

SESAR is the technological pillar of the Single European Sky. It aims to improve Air Traffic Management performance by modernising and harmonising ATM systems through the definition, development, validation and deployment of innovative technological and operational solutions. Source: European Commission

The only way of communicating between an aircraft and the control tower is still the radio with low quality connection and capacity overload.

Under this new concept, tomorrow's operations will be based on 4D trajectories, which is the integration of time into the 3D aircraft trajectory. It will entail the systematic sharing of aircraft trajectories between the various participants in the ATM process to ensure that all participants – the 'partners' – have a common view of a flight and have access to the most up-to-date data available to perform their tasks. While accommodating all airspace users' needs (general aviation, helicopters, RPAS, commercial airlines, etc.), this new concept will enable the dynamic adjustment of airspace characteristics to meet predicted demand with minimum distortions to the aircraft trajectories. In exchange for an agreed business trajectory meeting the original user preference much closer than today, the aircraft will be obliged to adhere to this trajectory very accurately in all four dimensions

The human role in, and the human contribution to, the ATM-system will change according to this new operational concept and the overall system infrastructure. This is especially true for pilots and controllers. Their tasks and responsibilities will significantly change to make the evolving technology work. Let's travel into the future to figure out how air operations will concretely look like in 20 years' time and what flying as an airline pilot will mean across all phases of flight.

Flying to the Future

The Flight Deck Perspective

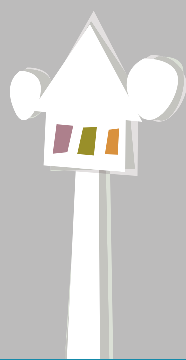
9 March 2035, 08:30 The air crew arrives at the dispatch office in Madrid Barajas airport to prepare their flight to Moscow and back. It is going to be a long day and strong airmanship skills will be needed. One of the most important and basic rules taught to pilots is that their mind should be always several minutes ahead of the airplane, constantly planning ahead, trying to manage their workload appropriately in order to maintain maximum situational awareness.

This has never been so true and relevant as today, with the new ATM concept of operations fully implemented across the network. A key requirement is that the trajectory intentions must be shared with a much higher level of accuracy, well in advance, for detection tools to be able to anticipate possible conflicts between flights. To do so, the flight crew must analyse very thoroughly – and from the first moment – all available parameters. Sharing 'intentions' with such a big anticipation represents a new important task for the crew but the big gain is that the conduct of the flight is no longer constrained by fixed airways and cumbersome procedures.

On the basis of a set of data and information the dispatcher has already created, the ad-hoc waypoints that will be transmitted into the FMS to fly the preferred route to Moscow today. It is not the shortest route, at least not in ground miles. But for sure it is in terms of air miles. Compared to 30 pages NOTAMs, mixing non-relevant information with very important one, the new digital and human-friendly tools show to the crew what they need to know. This enables them to take the best possible decision according to a set of criteria and to their preferences, with the assistance of the dispatcher. The crew then takes into account the latest updated weather information through the Weather Cube to decide in advance the desired flight level.

"The new digital and human-friendly tools enable pilots to take the best possible decision according to a set of criteria and to their preferences, with the assistance of the dispatcher."

Arriving at the aircraft and performing their pre-flight duties, the commander and first officer check that everything needed is available. Today everything is going as expected, but they are vigilant about anything which may disrupt the on-time start of the engines and take-off. Any problem must be communicated well in advance by the crew to the airport. It is a precondition in this new environment to share real-time information about the flight status through the System-Wide Information Management



(SWIM). This way all partners have an accurate situational awareness and know where the aircraft intends to be at a given point of time.

The crew inserts the trajectory (not the flight plan) into the FMS together with the updated meteorological information; the computer starts calculating all the estimates for the different points along the route. This is already shared, and as soon as the loading figures are available, the commitment to fly the requested level is confirmed.

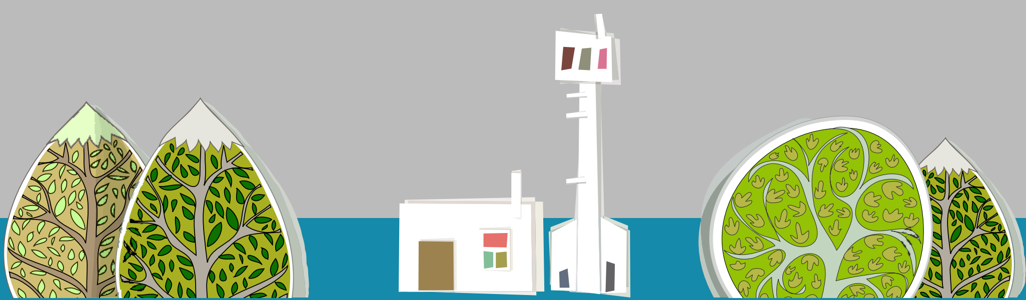
"All communication is performed through downlink and uplink capabilities, except in critical phases of flight"

09:20 Once ready for start-up of the engines, contact with the controllers is established via Controller-Pilot Data Link Communication (CPDLC). Clearance for start-up and a target time for moving from the stand are given in return. Information on how the taxi time is evolving at the airport is available on board – and most of the times it actually coincides with the course of action. Just after starting engines, taxi clearance is requested and the trajectory is uploaded and displayed on the cockpit screens, with clear indication of limits dependent on other evolving traffic.

Once airborne, the aircraft proceeds along the published standard instrument departure. It is not a long and complicated layout as it used to be. It is a much simpler one which leads directly to the departure point of the Terminal Manoeuvring Area, with a few restrictions to avoid noise on the ground and to segregate the flows of arriving traffic from those departing. From this point the flight proceeds to the first preferred waypoint created to make better use of the winds today. For today's flight the crew has decided to leave the Peninsula via the Basque Country, then to continue northwards up to Copenhagen, and from there, slowly falling to the east towards Moscow. Definitely not the shortest route, but due to a high-pressure system in central Europe flying north will imply tail winds during more of the flight, thereby saving time and fuel burn.

During the flight no voice communication with controllers takes place, except in critical phases of flight. Instead, all communication is performed through downlink and uplink capabilities. The crew is just acknowledged to proceed further with their preferred trajectory as long as there is no conflict with any other traffic.

11:00 When approaching the core area over Brussels, traffic increases significantly, the crew receives two instructions to modify slightly the flight trajectory. In both occasions it is considered acceptable



and directly uploaded into the FMS. In two other occasions the Air Traffic Control Centres (ACCs) indicate to the crew a time window to maintain the required separation with other traffic crossing the flight trajectory. At this stage, the crew's main task is to monitor that the action is properly performed by the aircraft.

13:30 When approaching the destination, Moscow ACC receives the intended trajectory and uses the extended arrival management tool to merge the flight into the arriving traffic. It is peak time in Domodedovo and a Required Time of Arrival at a metering point is therefore assigned to the crew to optimise airport capacity. This only implies adjusting slightly the speed as this information had been computed already well in advance.

Once in the middle of the descent, the approach sector gives the instruction to follow a given aircraft on the arrival by flying directly to the metering point and then following this aircraft with 80 seconds separation. To perform this "self-spacing " task the pilot-flying is assisted by the new ASAS (Airborne Separation Assurance Systems) application. As the exact amount of miles to be flown until touchdown is known the crew takes the opportunity to make a continuous descent approach to be as cost-efficient and environmentally-friendly as possible.

This is what flight operations should look like in the future, when all the operational and technical changes are mature. Added to other upcoming procedural initiatives and changes, the pilots' 'experience' of the European air transport system will be completely transformed compared to today. However, for the foreseeable future it will remain a human-centred system, depending on human performance and human interaction. Pilots will be assisted by dedicated tools and major technology improvements on board (sophisticated FMS, data-link and computational power). But this new way of flying, i.e. engaging much more in the strategic phase, to a higher level of detail and precision, and then ensuring that the trajectory is flown to an utmost level of precision will be quite demanding for the crews – and for sure not less challenging than today.

"Once in the middle of the descent, the approach sector gives the instruction to follow a given aircraft on the arrival by flying directly to the metering point and then following this aircraft with 80 seconds separation. To perform this "self-spacing " task the pilot-flying is assisted by the new ASAS (Airborne Separation Assurance Systems) application."

Prerequisites for a Successful & Safe Single European Sky

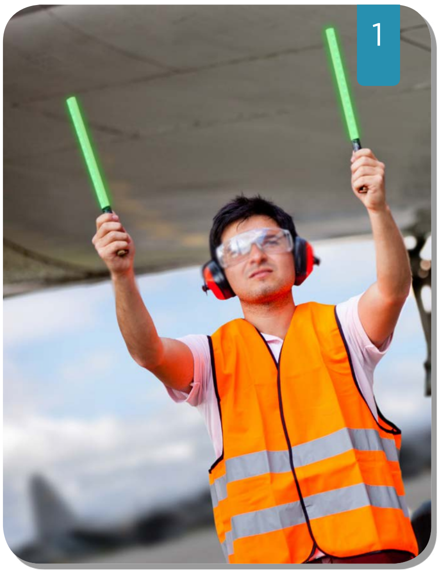
This new operational environment, based on trajectory management, highly performing technologies and many more interventions of the flight crews at a strategic level, raises a number of challenges, such as the ability to increase both efficiency and safety. It also changes the roles and responsibilities of front-end users. This transformation, and the related transition, cannot happen without the active involvement of pilots in the development of new systems, providing their "niche" of operational expertise vis-à-vis new technologies and equipment.

For the last 5 years, ECA, as the representative body of European pilots, has been actively involved in various work packages of the SESAR Programme, bringing operational experience and technical expertise. A team of a dozen of experts have contributed and provided inputs to a number of projects dealing with airborne and ground safety nets; remote and virtual tower; airport safety support tools; airborne collision avoidance systems, weather information (MET) or Remotely Piloted Aircraft Systems (RPAS) to name a few. Over the period ECA has also been involved in the important transverse activities of developing SESAR concepts of operations and revising when needed the European ATM Master Plan, the agreed European "roadmap" connecting research and development with deployment scenarios.

ECA pilot experts have also participated in many validation exercises organised by the SESAR Joint Undertaking through a yearly Release process to measure the maturity of key concepts and the robustness of the related breakthrough technologies.

Such an involvement of unbiased, yet experienced, active line pilots, together with other front-end users such as controllers or electronic engineers, provides the operational point of view, a key to success when addressing the possible solutions within the scope of a research programme like SESAR.

Based on the active involvement of its ATM expert pilots in the programme over the last few years and on the opportunity offered to assess the feasibility, usability and acceptability of advanced concepts and flight deck technologies ECA has identified a number of overarching prerequisites:



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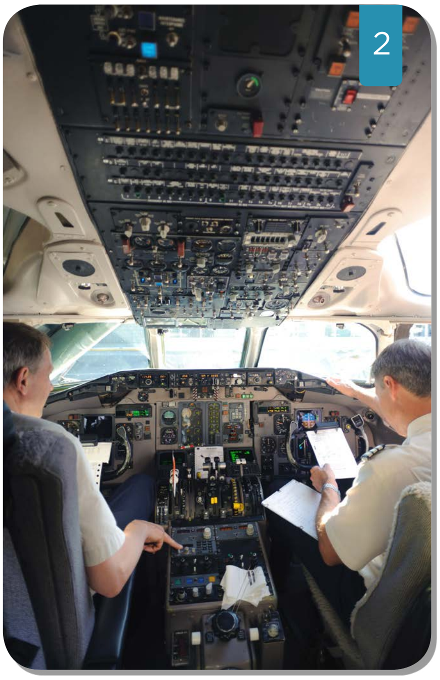
Safety is paramount

One of the key performance targets of the SESAR work programme is to improve the safety performance by a factor of ten, while air traffic is expected to grow significantly. From a pilot's point of view, as front-end users, maintaining and increasing safety in such a completely new operational environment is not only crucial but a precondition to move forward with this initiative:

» Under no circumstances shall an effort to increase efficiency be to the detriment of safety; only where several comparably safe solutions are available, the most efficient may be chosen;
» As safety is a key element and cornerstone of the on-going maturity assessment of SESAR technologies, a candidate technology shall not be deployed if it is not able to guarantee safe operations under the most demanding scenarios;
» Operational staff – and in particular flight crew – shall be involved in all 'reality check' activities performed in view of the upcoming deployment to provide their 'front-end' operational safety expertise.



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Pilot-centric technical solutions

As the pilot-in-command of an aircraft remains responsible for the operation of the aircraft in accordance with the Rules of the Air, solutions that consider "flying the aircraft" from the ground shall be avoided. Technical solutions shall be pilot-centric as far as possible to ensure that the pilot-in-command remains the final authority as to the disposition of the aircraft during all phases of the flight.

In an increasingly dense and highly complex traffic environment non-routine situations do arise, often beyond the scope of the automation, unanticipated in the automation design, and hard to effectively handle from the ground. In such cases, the pilot's ability to 'improvise' and flexibly manage threats and errors is key to a safe conduct of the flight and outperforms automated as well as ground-based solutions.

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The ‘human dimension’

The ‘human dimension’ in terms of change management, acquiring new skills, and training – both for flight crew and for air traffic controllers – shall remain at the forefront of the initiative, and shall be an integral part of the implementation process. Regular checks shall be performed to assess the match between the human skills and the technological applications and adequate training programmes shall be developed and implemented well in advance.

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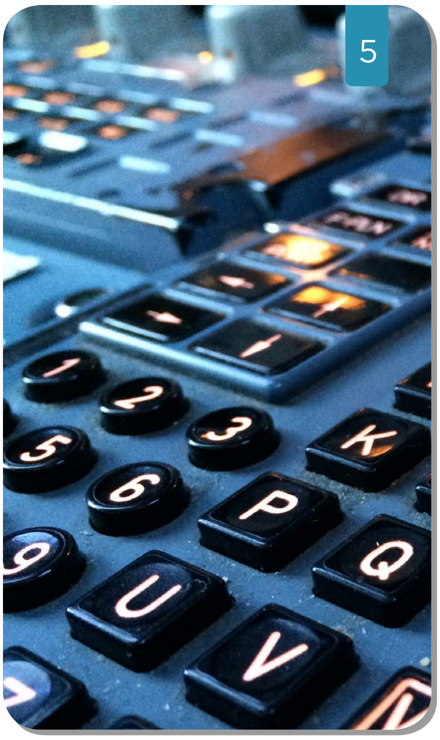
Harmonised and interoperable

The technologies and **systems shall be harmonised and interoperable** in order to support the transfer and sharing of correct, coherent and relevant information covering all phases of flight and the cooperation of technical sub-systems. Interoperability shall be achieved through the development and application of internationally approved and open standards. The interoperability requirement also addresses the harmonisation with implementation initiatives in other regions, in particular with the ongoing NextGen project in the USA.



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A complex and interwoven environment

The envisaged new ATM system encompasses a more complex and interwoven environment. As flight conduct is more directly influenced, the system shall demonstrate a very high level of resilience.

Resilience can be briefly defined as the robustness to withstand and cope with disruption. The new ATM system will have to cope with a greatly increased number of disruptions as every flight will have an influence on the entire system. These disruptions can be system-immanent (e.g. degradation), circumstantial (e.g. weather) or pilot induced (e.g. turbulence avoidance). The ATM system has to be able to absorb all of these factors within acceptable parameters and recover within an acceptable time and composite costs and risks. Therefore system design shall take into account all imaginable disruptions in order to create system solutions that accomplish the above-mentioned task reliably.

Position Statements

1. ECA supports the objective to design a system capable of handling safely and efficiently the expected increase in traffic maintaining the environmental impact as low as possible at an adequate cost.

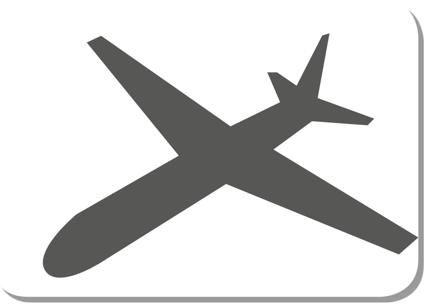
This implies modernising Europe's ATM system by addressing the current fragmentation, imposed burdens on an efficient provision of the service. ECA's position reflects the global considerations of the International Federation of Air Line Pilots' Associations (IFALPA) as outlined in their vision statement "The Future of Air Navigation" (2013).

2. The pilot-in-command shall retain full responsibility and capability for the navigation and piloting of the aircraft.

The pilot has a clear picture encompassing all different parameters that affect the flight. That not only includes the needs of a safe and expeditious handling of the traffic but also other considerations that may impose restrictions in the way to operate that flight (e.g. airline policies, performance restrictions due to technical limitations, passenger comfort, network preservation, etc.).

3. Any concept, procedure or solution that could result in a reduction of the crews' situational awareness shall be avoided.

The crews shall remain instrumental in any intended change of the flight trajectory and any interference/change from other actors shall be approved previously in a clear and distinctive way.

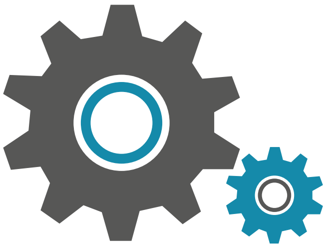


4. The ATM system shall be capable of dealing with revised user requirements (requests to amend the active business trajectory) in an appropriate way.

While the ATM system will be based primarily on an automated management of accurate 4D trajectories, the necessary flexibility for the flight crew needs to be catered for. A dynamic response capability of the ATM system shall provide flexibility regarding speed control, level changes, weather deviation, etc. to support the flight crew in order to execute a flight safely and economically.

5. Technical modernisation on the ground and in the air shall be synchronised.

To exploit the full capabilities of today's and future technological achievements it is critical to ensure that air and ground systems are upgraded with state-of-the-art technologies in a coordinated way.

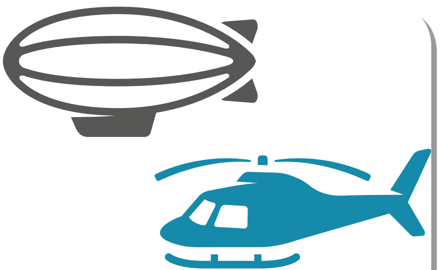


6. Interoperability of the SESAR deliverables with systems in other regions shall be guaranteed.

The global aviation industry cannot afford regional-specific solutions. Hence, common standards will have to ensure interoperable solutions with worldwide applicability permitting economies of scale for the ATM system and guaranteeing optimal resource allocation. Crucially, harmonised procedures are the best guarantee to enhance safety. They enable pilots to focus on the conduct of the flight and not to struggle with different procedures all around the world.

As interoperability is indispensable, cooperation with similar programmes, especially with NextGen in the US but also with CARATS in Japan or with other major modernisation initiatives in other parts of the world, should be assured to avoid divergent, non-harmonised solutions. In that respect the collaborative harmonisation work that is being performed under Annex 1 of the EU/US Memorandum of Cooperation (MoC) on Civil Aviation Research & Development is very welcome.

Complementary improvements developed through the EU Clean Sky programme should be mutually integrated for synergy



7. Airspace is a common resource that needs to be shared with different types of users. Airspace design shall address the need to protect public air transport by providing controlled airspace with appropriate separation service and of sufficient dimension – as small as possible and as large as necessary.

Airspace design needs to address the requirements of the other members of the aviation community, specifically general aviation users, to operate freely, through the allocation of appropriate airspace and / or corridors. In addition, airspace design should include considerations regarding proportionate avionics requirements to adequately balance the need for navigation and surveillance capabilities versus equipment cost.

8. Future ATM-related flight deck Human Machine Interfaces shall be regarded as the "System of Systems" that provide improved situational awareness.

A "system of systems" allows to adaptively allocate one or several agents (pilot, controller) to the respective task (e.g. trajectory re-negotiation) delivering all resources required (e.g. weather, performance, system state).

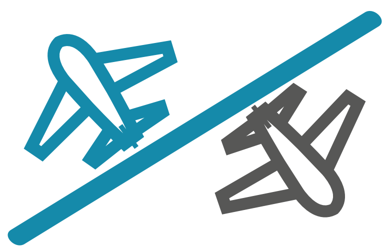
As such, it shall furthermore ensure the creation of a shared (global) situational awareness and maintain safety nets, i.e. by maintaining the two-way-communication principle in a multi-crew flight compartment.

Resilience should be granted by allowing reconfiguration and/or degradation of such a system in any phase and situation of a flight.

For such a system, significant changes in Human Machines Interfaces (HIMs), SOPs, and consequently new training scenarios and proper risk mitigation procedures are the next steps to take for both, manufacturers as well as operators.

9. While the carriage of Airborne Collision Avoidance System (ACAS) is required for all air transport aircraft, this condition shall not be used in the determination of the target level of safety of the ATM system.

An ACAS is not an air traffic control tool but constitutes a last resort safety back-up, complementing the ATC system, but does not substitute adequate separation services or determination of conflict-free 4D trajectories.

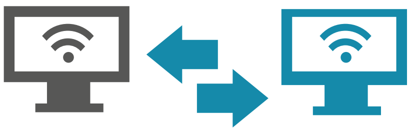


10. While Airborne Separation Assistance System/Self-separation (ASAS/SSEP) may be used in the determination of conflict-free 4D trajectories, such systems and / or operations shall not compromise the independence of ACAS.

Any de-confliction tools used in automated air traffic management should not be relied upon as an anti-collision device, as this would constitute an inappropriate use of the safety net.

11. Extended use of safety nets on the ground is welcome, provided that a clear, unambiguous and harmonised layout and common functioning is granted through a certification process.

Measures such as Runway Status Lights are welcome as long as the related concepts are harmonised and unambiguous, and proper training and clear roles are granted for each of the actors involved.



12. Extended use of data link procedures to communicate with Air Traffic Services (ATS) has the potential to increase overall ATM system performance, subject to conditions.

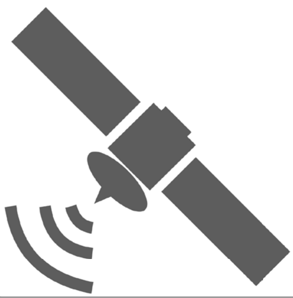
Workload in the cockpit should not be significantly increased and situational awareness should be enhanced so to not interfere with the safe operation of aircraft.

Flexibility in communication should be guaranteed in normal and abnormal situations, taking into account mode degradations and system malfunctions.

Current Controller Pilot Data Link Communication (CPDLC) systems and procedures are not suitable for operation during the departure and approach phase of a flight. Given the need for increased data link usage in future ATM operations, data link procedures will contribute to achieving SES goals provided that their performance and reliability is improved.

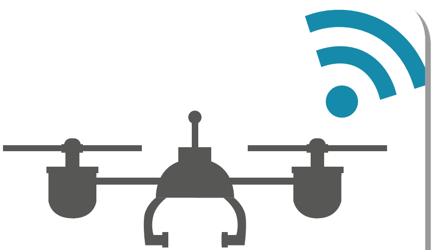
13. All ATS communications, be them Radio Telephony or digital, shall use standard phraseology.

This includes new phraseology that should be agreed for procedures like A-CDM (Airport Collaborative Decision Making), ASAS (Airborne Separation Assistance Systems), RADL (Resolution Advisories Down Link), Point Merge, etc.



14. The use of satellite based surveillance brings overall benefits, such as increased flexibility or a better quality of service, but over-reliance should be avoided.

A proper assessment should be carried out to counter the threat that a single event could lead to a major degradation of the whole system. As communications, surveillance and navigation could rely on a single source, the whole aviation system would be at stake in case this network fails.



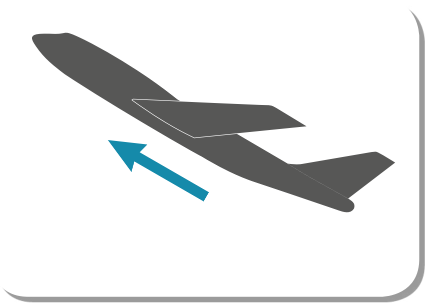
15. Remotely Piloted Aircraft Systems (RPAS) may only be accepted in non-segregated airspace provided they do not increase risk for other airspace users, after a proper risk assessment and following a clear designation of the roles and responsibilities of RPAS pilots. This type of operations shall fulfill the same requirements as manned aircraft.

The pilots of RPAS should have the same status than pilots of manned aircraft and be fully trained and licensed accordingly. As such they remain responsible for their flight and comply with all the legislation applicable to any other airspace user.

An equivalent level of safety similar to the one of manned aviation shall be guaranteed and a risk assessment should demonstrate that the risk to existing manned airspace users is managed, including any situation involving technical failures or non-normal situations of either user group or ATM infrastructure. Airspace use will only be permitted where there is a clear designation of the roles and responsibilities of the remote pilot, including their compliance with all legislation applying to other airspace users. The RPAS must remain under the command of a remote pilot trained and licensed to the same level as pilots in command of manned aircraft.

16. Flight crews have to safely operate the aircraft but shall also foster the reduction of the environmental impact, as far as possible.

This consideration implies that airport or environmental authorities may not impose any kind of procedure or constraint on the flights for the sake of the environment, without due consideration of its safety impact. It is crucial that environmental/capacity objectives are confronted to safety and operational considerations when assessing the feasibility of procedures, e.g. no tail wind operations above 5 knots component.



17. Continuous climb and/or descent procedures shall be designed taking into account their operational and safety implications.

The workload for the crews during these safety critical phases should be assessed and taken into consideration. Proper mitigation of the threat of being too "hot and high" and subsequent un-stabilised approach/risk of runway excursion should be considered – and pilot experts be involved – when designing such procedures.

18. Latest weather information, in full colour graphical form shall be provided to pilots during briefing and all flight phases in order to improve decision-making and situational awareness.

Real-time advanced radar and satellite pictures including the flight path are needed, as are forecasts updated every 3 hrs or less. Pilot-selectable and customised weather information for specific situations, e.g. strong winds, winter weather, fog, volcanic eruptions, space-weather, tropical systems, etc. is needed.

19. The possibility of a cyber-attack on airport, control tower and aircraft shall be envisaged and appropriate counter measures should be designed to minimise their impact. All aircraft systems and data transfers between aircraft and ground should be protected from hacking, data manipulation and viruses.

Separating in-flight entertainment systems from all other aircraft systems is highly desirable. All pilots should be trained to increase their awareness about cyber vulnerabilities and to help them recognize a cyber-attack. Precautionary measures and contingency procedures should be established to prevent an attack, and to minimize its consequences. Operators should establish a mandatory reporting system for cyber-related occurrences, and cyber security should become an essential part or their security management system.

Cockpit-based solutions that prevent the take-over of aircraft command by any person on board or by unlawfully interfered ground stations shall be developed. The significant multiplier-effect potentially arising from several aircraft being unlawfully controlled from the ground should be fully taken into account in the overall design of the system.

ADS-B spoofing is introducing false projections of aircraft on radar screens. Air traffic controllers could receive inaccurate or no information from a hacked aircraft ADS-B system which would consequently lead to a misinterpretation of the information displayed on their information screen. To address this threat and be able to cross-check information, primary radar should be available to confirm ADS-B signals.

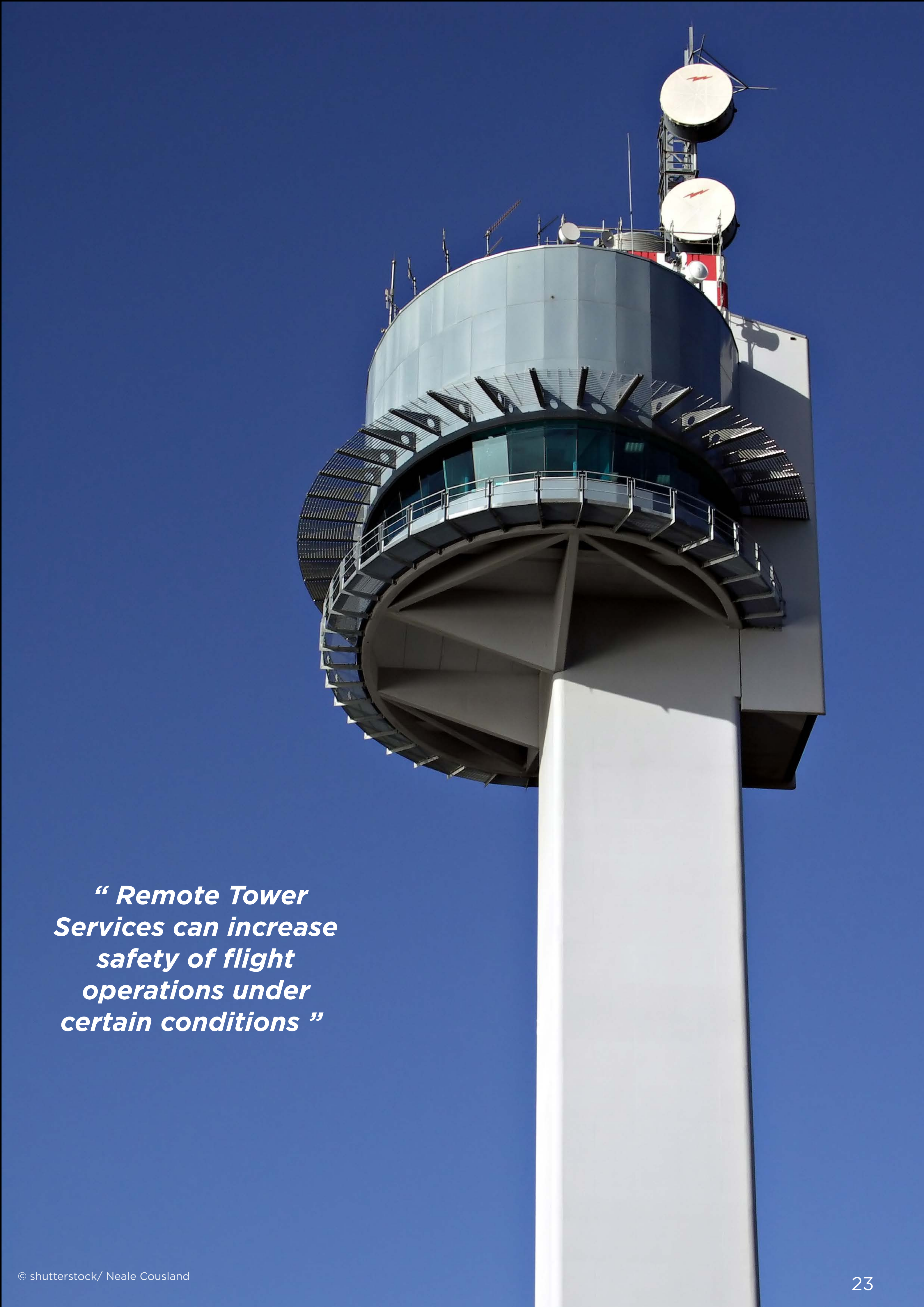
20. Remote Tower Services (RTS) can increase safety of flight operations under certain conditions.

RTS have the potential to increase safety, especially at smaller airports without ATC service. In the absence of any ICAO provisions on RTS, ECA calls for the establishment of common definitions, standards and recommended practices. These include radiotelephony procedures and airspace design, transmission of weather and surface data and contingency measures in case of system malfunctions among others.

The RTS service level provided should be the same or better as the previous one for each airport and airspace users should not be negatively affected. For example, holding patterns, diversions and other undesired situations due to staff shortages should be avoided.

RTS is not acceptable without proper regulation put in place, in advance of its expansion, to ensure that service providers do not abuse the concept as a means to pick a labour or tax environment with less stringent standards than those that would apply based on the physical location of the tower.

ECA does not consider that a proper Safety Risk Management is supporting the operation of Multiple Remote Tower Services at this moment.



“ Remote Tower Services can increase safety of flight operations under certain conditions ”

About ECA

The European Cockpit Association was created in 1991 and is the representative body of European pilots at the EU level. It represents over 38.000 European pilots from the national pilots' associations in 37 European states. Our motto is 'Piloting safety!'

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