



# The legal and organizational aspects of crisis management in the Single European Sky

**Marek Telesfor MARKIEWICZ**

✉ [m.t.markiewicz@akademia.mil.pl](mailto:m.t.markiewicz@akademia.mil.pl)

id <https://orcid.org/0000-0001-6085-5906>

War Studies University, Warsaw, Poland

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## Abstract

Crisis situations in civil aviation pose a serious threat to the safe operation of aviation stakeholders (airports, airlines, air navigation service providers) as well as to passengers using air transport. Therefore, there is a need for an aviation crisis management system that identifies threats, assesses the risk of their occurrence and takes preventive action. The purpose of this paper is to present the determinants of air traffic crisis management in the European Air Traffic Management Network (EATMN). This paper analyses the evolution of this process from the perspective of the EU Single European Sky (SES) legislation. The author also presents lessons learned from the crisis situation that have occurred in European airspace over the last two decades and emphasizes the role of the Network Manager (NM) in resolving them. This article has been developed using a combination of research on EU aviation legislation and background documents and the case study method.

**Keywords:** air navigation service providers, aviation crisis management, European air traffic management network, Network Manager, Single European Sky

## 1. Introduction

The air transport sector is highly sensitive to all destabilizing factors, whether arising from political tensions, armed conflicts, market fluctuations or individual events that disrupt the normal operations of aviation industry stakeholders. These events can include terrorist acts, volcanic eruptions, civil aviation technical infrastructure failures, cyber-attacks on databases and many others. Such a sudden, unexpected and undesirable event may result in a crisis, posing an immediate and serious threat to operational safety for various aviation companies (airports, air carriers, air navigation service providers), as well as for air travelers. The impact of a crisis can include significant financial, environmental, social or material damage. Due to the multiplicity and diversity of possible crisis situations, there is a need to establish an aviation crisis management system, the aim of which is not only to react when a crisis situation occurs, but also to take measures to prevent its occurrence and lead to the restoration of the pre-crisis state.

Crisis management requires the development and practical implementation of undertakings falling into four stages: prevention, preparation, response and recovery. In order to prevent a crisis situation in the European air traffic management network, it is necessary to assess the vulnerability of the various entities, prepare for anti-crisis measures, and forecast the further handling of a specific crisis. A rapid and coordinated response to crises and disruptions can significantly mitigate their effects. It is, therefore, important that stakeholders involved in air transport operations have crisis response procedures and contingency plans



in place to quickly restore the safety and continuity of the services they provide. Contingency plans aimed at mitigating the effects of disruptions in the capability of any component of the ATM system should be drawn up, published and periodically reviewed. These plans should include such elements as: a description of a potential failure of ATM resources; measures to be taken in response to the disruption; the process for applying measures to each emergency; recovery procedures; information on emergency contact points, roles and responsibilities; and post-crisis reporting procedures.

Crisis arrangements in the European ATM network are now closely linked to the Network Manager's (NM) air traffic flow management (ATFM) activities. With this process centralized at the European level, it is possible to mitigate disruptions and crises not only for ATM system assets but also for airports and air carriers. The purpose of this article is to outline how aviation crisis management in Europe has evolved over the past three decades, with a particular focus on crisis situation management in the European air traffic management network (EATMN),<sup>1</sup> and to identify future prospects. The predominant research method used to develop this article was a critical analysis of EU legislation, documents of the European Organization for the Safety of Air Navigation (Eurocontrol) and literature sources. Some of the information was obtained from interviews with air traffic management experts.

## 2. The origins and first experiences of crisis management in European airspace

The history of the emergence of crisis management in European civil aviation is linked to the decision to create the Central Flow Management Unit (CFMU), which was taken by the Eurocontrol Standing Committee in 1989. This body started its operation in 1995 and became the vehicle for coordinating action during any airspace disruption. Prior to the establishment of the CFMU, European countries used the ICAO European Office and the Eurocontrol Management Committee to coordinate national actions in times of crisis. However, in order to deal with crises, the CFMU required a structure that would bring together senior operational representatives from air navigation service providers (ANSPs) and airspace user associations. To this end, at its 178<sup>th</sup> session in 1995, the Eurocontrol Management Committee established the Crisis Management Group (CMG) as an *ad hoc* operational structure in cooperation with the CFMU, where national ANSPs and aircraft operators liaise to try to resolve crisis situations. Membership in the CMG was open to all European Civil Aviation Conference (ECAC) countries and air operators' associations. The main reason for creating the CMG was the need for air traffic flow management and air traffic control (ATC) authorities at all levels to cooperate effectively in crisis situations. It was the responsibility of the CMG to inform members, through the Chairman, of events that could lead to a crisis situation, so that preventive planning could be initiated in good time and to support the ATFM crisis planning carried out by the CFMU in conjunction with national experts. The actions taken by the CMG were to contribute to removing the cause of the crisis or, if this was not possible, to improve ATC capabilities to mitigate its effects. The CMG was also to ensure that the crisis response arrangements made and agreed upon were applied and implemented by the relevant national authorities. A crisis was defined as the occurrence or high probability of an unexpected event that seriously disrupts the flow of air traffic and/or severely limits the capacity of ATC. The interpretation of what constituted a crisis situation in each specific case was left to the responsible Director of Air Navigation, who could then, in close cooperation with the Director of the CFMU, ask the CMG to consider the issue (Sultana, 2011).

To deal with the crisis, the CFMU, together with experts from the Member states, would prepare a detailed air traffic flow management plan. The effectiveness of this plan could be enhanced if States were able to provide additional airspace capacity. Therefore, the members of the crisis management structure were given the authority to make decisions and implement measures that would help to bring the crisis under control quickly. In addition, members were to inform each other regularly of any developments that could lead to a crisis, particularly the possibility of strike action. This allowed for better preparation and the correct information to be passed on to senior management and aircraft operators. The operational structure that had been set up and fully functioning since 1989 seemed ready to manage any crisis that might affect European airspace. However, it turned out that the two major crises that occurred in Europe in the following three years verified the effectiveness of the CMG as a crisis management body, which did not play a significant role.

The first serious crisis for European aviation was the war in the Balkans in 1999. At that time, airspace and airports in Croatia, Bosnia, FRY (Federal Republic of Yugoslavia), FYROM (Former Yugoslav Republic of Macedonia) and Albania were completely closed to air traffic. The airspace of Hungary, Slovenia, Romania and Bulgaria was partially restricted. The airspace over the Adriatic Sea was also closed. The conduct of combat operations by military aviation had a negative impact on civilian aircraft traffic and air traffic management services. It was necessary to quickly develop and implement ATS routes avoiding the airspace affected by the hostilities. Despite CFMU's efforts, there was a 30% increase in delays due to capacity imbalances with high airline demand. The aftermath of the war and the increase in traffic across Europe in 2000 made the situation of network delays even worse.

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<sup>1</sup> The European ATM network includes EU Member States and non-EU countries that are members of Eurocontrol or have concluded an agreement with the EU on the implementation of the Single European Sky or participate in a Functional Airspace Block (FAB). SES area comprised the EU Member States plus Norway and Switzerland.



The CMG's role in the Balkan crisis was insignificant because its limited composition and appointed representatives were not appropriate to the political and military dimensions of the crisis.

Another unforeseen crisis that affected European aviation was the terrorist attacks of September 11, 2001, in the US. Following these tragic events, the FAA Air Traffic Control and Systems in Washington informed the CFMU that it was immediately closing all US airspace. This meant that much of the air traffic over the Atlantic heading to the US would have to turn around and head back to European airports. In these circumstances, the CFMU team leader took the decision to ground all European flights with destination airports in the US on that day. The CFMU system identified each flight that should be grounded and sent individual messages to all ATC towers and air carriers, informing them that the flight could not be operated due to the closure of US airspace following the terrorist attack. Coordination links were quickly established between the FAA's civilian and military representatives in Brussels and the CFMU Eurocontrol, which facilitated the rapid location of a number of flights that the US National Security Agency identified as potential threats. Subsequently, the CFMU, the FAA, civilian and military representatives and the aircraft operator liaison cell implemented an *ad hoc* operational crisis management cell, which disseminated all relevant information to aviation stakeholders (e.g., ATS authorities, airspace management cells, aircraft operators, airports, ground handling agents, etc.). In turn, the CFMU, after establishing contacts with the US Department of Defense in Washington and the US Air Force in Europe (USAFE) in Ramstein, Germany, established a procedure for obtaining military clearance for certain flights to the US. The crisis cell operated until September 14, 2001, providing information on how and when airspace would be reopened and who would be allowed to use it. Once US and Canadian airspace was reopened, the CFMU managed a gradual return to normal operations. The terrorist attacks of September 11, 2001, in the US have had a major impact on the aviation industry and led to a re-examination of the contribution that ATM can make to overall aviation security.

Following these very serious events affecting air traffic in Europe, Eurocontrol and the national air navigation service providers discussed the future role of the crisis management cell. It was recognized that, in addition to the activities of this cell focused on mitigating disruptions and finding solutions for airspace users, practical solutions were needed to enable coordination at a higher operational level when current operational procedures and practices are insufficient. It was also felt that these senior representatives (CFMU Director and Operational Directors) should meet regularly to assess any impending network disruptions (e.g., strikes) and jointly prepare an operational plan in case the situation escalates into a crisis. In the following years, until 2010, there were no comparable very serious crises affecting European aviation and the crisis management cell at Eurocontrol was not convened. The management of minor airspace disruptions took place at the operational level between the concerned air navigation service providers with the support of the CFMU.

The genesis of the current organizational shape of crisis air traffic management in the Single European Sky is linked to the eruption of the Eyjafjallajökull volcano in Iceland in April 2010. The eruption created a volcanic ash cloud over Europe, leading to the closure of airspace in most countries on the continent and initiating very serious disruptions to air transport operations. As part of its response to the situation, the CFMU began to organize teleconferences to present the forecasts published by the Volcanic Ash Advisory Centre (VACC) in London, as well as the decisions taken by various state authorities and explain their implications. On the basis of the information received about the spread of ash, Eurocontrol then established three types of flight zones in European airspace: a restricted no-fly zone (NFZ), a low contamination zone (LCA) and a non-contamination airspace (NCA). The national air navigation service providers, having again received information from the CFMU regarding the no-fly zone (NFZ) and the SIGMET message, were obliged to issue NOTAM messages. The highest number of Area Control Centers (ACCs) under total airspace closure was recorded on the weekend of April 17 and 18, 2010. As of April 16, the *ad hoc* crisis cell began operating, which was to work continuously until April 21. It comprised senior members of the European Commission, Association of European Airlines (AEA), Airports Council International (ACI) and Eurocontrol. This crisis management cell had the right level of membership, as well as a direct link to the Directors General of Civil Aviation and Ministers of Transport of the respective countries. Its task was to find a way to reopen European airspace without compromising flight safety. The role of the CFMU, on the other hand, was to manage the day-to-day operational situation. On April 21, air traffic in Europe returned to normal, and the crisis cell went on standby for monitoring.

On May 1, there was a second phase of volcanic ash eruption, and on May 3, volcanic procedures coordinated by the crisis cell (which now included the European Aviation Safety Agency, EASA) resumed. This resulted in the closure of airports in the UK and Ireland, followed by Portugal, Spain, Italy and Morocco. An extraordinary meeting of the Council of the European Union was held on May 4, 2010, during which conclusions were adopted on the European Union's response to the consequences for air transport in the event of a volcanic ash cloud, which discussed the need for the immediate establishment of a crisis coordination cell. On May 19, 2010, the European Aviation Crisis Coordination Cell (EACCC) was established to facilitate management of any future crises affecting aviation in Europe. The EACCC was co-chaired by the European Commission (EC) and Eurocontrol. It consisted of EASA and representatives of aircraft operators, regulators, air navigation service providers, airports, aircraft manufacturers, the military



and ICAO. Depending on the nature of the emergency, representatives from other organizations may have been invited to attend. The cell was responsible for, *inter alia*:

- coordinating the management of the network emergency response involving close cooperation with the relevant structures in the Member States (State Focal Points – SFPs);
- supporting the activation and coordination of contingency plans at the Member State level,
- preparing counter-measures at the network level to ensure a rapid response to such network crises in order to secure and ensure the continuity and safety of the network's operation;
- ensuring effective information management and communication by providing accurate, timely and consistent data to support the application of risk management principles and procedures in decision-making.

Through the interaction of the EACCC with the State Focal Points, the demand for effective crisis management was to be realized.

### 3. The evolution and existing legal framework on crisis management in the European aviation network

In 1989, the Transport Ministers of the European Civil Aviation Conference (ECAC) decided to develop an air traffic management strategy for the 1990s in response to the air traffic crisis of the late 1980s. With air traffic expected to double in the next fifteen years, the Ministers realized that European ATM systems would not be able to meet the growing needs of airspace users without very serious new initiatives. The ATM Strategy for the year 2000 and beyond was launched at the MATSE/6 meeting on January 28, 2000, in Brussels to cater for the projected growth of European air traffic. It proposed to plan and organize the European ATM on a pan-European basis in order to cope with the ever-increasing demand for its services while respecting the prerogatives of states to provide air traffic services over their own territories and the requirements of sovereignty and defense.

In December 1999, the European Commission initiated the legislative process for the creation of the Single European Sky (SES), the main objective of which was to improve the overall performance of the air traffic management system by reforming the air navigation services providers (ANSPs) in the EU Member States (European Commission, 1999). The result was the adoption by the European Parliament and the Council in March 2004 of the first package of four regulations that constituted the SES program (No. 549/2004, 550/2004, 551/2004 and 552/2004). After five years of implementing the legislative provisions and subsequent implementation of rules issued by the EC, unsatisfactory progress towards the SES objectives has been identified in several key areas (e.g., increase in airspace capacity, reduction of ANS provision costs). In an effort to improve the situation, and in particular, to ensure a high level of efficiency and cost-effectiveness in air transport, the European Parliament and the Council adopted two further regulations – No. 1070/2009 amending the existing Single European Sky legislation (hence called the SES II package) and another (No. 1108/2009) extending the tasks of the EASA to include airport safety and ATM/ANS (Goudou, 2011). The most important element of the SES II legislation was the establishment of the Performance Scheme and the associated Network Manager (NM) functions. The issue of crisis management in the Single European Sky legislation is part of the implementation of centralized network functions at the supra-national level, i.e., the European ATM network (Calleja Crespo & Fenoulhet, 2011).

The SES regulations adopted between 2004 and 2009 included only a few provisions related to air traffic flow management and ATM network management. Regulation (EC) No. 549/2004 (the framework), in addition to defining ATFM and the European ATM network, required the European Commission in Article 11 to carry out a performance review (based on Eurocontrol expertise) to assist, *inter alia*, air navigation service providers in providing the required services and to improve safety, efficiency and capacity. Regulation (EC) No. 551/2004 in its Article 6, entitled *Network management and design*, delegates the Commission to adopt implementing rules for the network functions of air traffic management. These implementing rules will address, in particular: the coordination and harmonization of processes and procedures; detailed arrangements for cooperative decision-making between the Member States, the air navigation service providers and the network management function; and arrangements for consultation of the relevant stakeholders in the decision-making process both at national and European levels. In turn, Article 9 of that Regulation requires the Commission to lay down implementing rules for air traffic flow management functions to support operational decisions by air navigation service providers, airport operators and airspace users. Provisions for optimizing available airspace capacity and enhancing the ATFM process should cover, *inter alia*, issues such as flight planning, the use of available airspace capacity during all phases of flight (including slot allocation), the use of the route system by general air traffic (GAT) and priority rules for access to airspace, especially during periods of congestion or crisis. It is worth noting that the Commission Regulation (EU) No. 255/2010 laying down common rules on ATFM rules was issued after six years – in 2010. In accordance with Article 6 of Regulation (EC) No. 551/2004, the detailed legal arrangements for the network functions as services for the European air traffic management network were adopted by implementing the rules of the European Commission. To date, the three regulations in question have come into force, published in 2011, 2014 and 2019, respectively.





The implementing rules for the network functions are contained in the Commission Regulation (EU) No. 677/2011, which established common procedures for the design, planning and management to ensure the efficient and safe management of air traffic at the European ATM network level. Article 3 of that Regulation establishes the Network Manager as an impartial and competent organization for the performance of the tasks necessary for the execution of the network functions. The appointment of the NM shall be by Commission Decision following consultation with the Single Sky Committee (SSC). The European Commission designated Eurocontrol as Network Manager because of its extensive operational experience and expertise in air traffic management. The creation of the network manager function was driven by the need to coordinate the activities of the various network functions and run them through a single body. Air traffic flow management is one of the main network functions that the Network Manager performs as part of his duties. In addition to the execution of the network functions, the NM will perform other tasks aimed at improving the operational performance of the network in the Single European Sky, which contributes to the achievement of the European Union-wide performance targets. In accordance with Article 4, these tasks are, in particular, to develop and implement the Network Strategic Plan (NSP) and the Network Operations Plan (NOP), to coordinate the management of the ATM network in crisis situations and to ensure coordination with other regions and third countries. The Regulation No. 677/2011 defines a “network crisis” as the “inability to provide air navigation services at the required level resulting in a major loss of network capacity or a major imbalance between network capacity and demand or a major failure in the information flow in one or several parts of the network following an unusual and unforeseen situation” (Article 2). The management of the European ATM network should also contribute to global interoperability and cooperation with neighboring countries. In order to ensure that the network functions entrusted to it are carried out in a safe, efficient, continuous and stable manner, the network manager was required, among other things, to create contingency plans for all network functions it carries out in the case of events that cause significant deterioration or interruption of ongoing operations. It should further be mentioned that it is the responsibility of the Network Manager to put in place arrangements to enable appropriate coordination of activities related to network functions with the military authorities of EU Member States (Article 11).

In order to adopt measures for the management of the network functions and to monitor their effectiveness, the NM, under Article 16 of Commission Regulation (EU) No. 677/2011 shall establish a Network Management Board (NMB). The tasks of this body include, but are not limited to, approving the internal rules of procedure of the European Aviation Crisis Coordination Cell, following a positive opinion of the SSC; and monitoring activities related to the management of network functions and the Network Manager’s activities related to network emergencies. The Single Sky Committee (SSC), as an advisory and consultative body of the European Commission, also plays an important role in the management of network functions. A detailed catalogue of the SSC’s responsibilities in this respect is set out in Article 17 of Regulation No. 677/2011. In particular, the SSC gives its opinion on the designation of the NM and also gives its opinion on the internal rules of procedure of the Network Management Board and the EACCC.

The European Aviation Crisis Coordination Cell was established under Article 18 of Commission Regulation (EU) No. 677/2011 to support the Network Manager in coordinating the management of the response to crisis situations affecting aviation, in close cooperation with the relevant structures in each country. This provision replaced the *ad hoc* EACCC established after the volcanic ash crisis. The EACCC brings together all relevant political and operational stakeholders to ensure that the situation is assessed on the basis of available information and that a coordinated response to the incident is formulated. It included individual representatives from: the EU Member State holding the Presidency of the Council of the EU, the Commission, EASA, Eurocontrol, military authorities, air navigation service providers, airports operators and airspace users. The EACCC is activated when circumstances beyond the normal scope of operations are apparent and operational procedures are not sufficient to normalize the situation. It organizes special monitoring meetings to coordinate efforts to address the threat as part of a harmonized response. Commission Implementing Regulation (EU) No. 970/2014 established new rules on the tasks of the network manager, governance and budget, NM relations with third countries, and the integration of several safety management activities. The expanded scope of the NM’s activities included, among others, identifying operational security risks at the network level and assessing the associated risks.

The current Commission implementing regulation for network functions is Regulation (EU) 2019/123. This Regulation combines the provisions of both the previous Network Functions Regulation (No. 677/2011) and the ATFM Regulation (No. 255/2010). It establishes two bodies: the Network Management Board to monitor and guide the implementation of air traffic management network functions and the European Aviation Crisis Coordination Cell to ensure crisis management effectiveness at the network level. Regulation (EU) 2019/123 changed the existing composition of the EACCC. The permanent members of this body now consist of one representative each from a Member State authorized for these purposes by all Member States; the European Commission, the European Union Aviation Safety Agency (EASA), Eurocontrol, the Network Manager, the military (upon proposals from the European Defence Agency, EDA), the air navigation service providers, the airport operators and the airspace users. The Commission will appoint the members of the EACCC and their alternates upon proposals from the relevant organizations or from the European representative bodies (European Commission, 2019).

Each Member State will designate a State Focal Point (SFP) and an alternate to the EACCC and facilitate their access to relevant information from national crisis management structures, which shall not be limited to the field of aviation. The State Focal Point



will perform its duties in accordance with the rules of procedure of the EACCC. The cell cooperates with the network of central state focal points and carries out exercises to prepare for the response in the event of an actual crisis situation in the network in order to limit its impact. Depending on the need and nature of the specific crisis situation, the EACCC may involve experts to assist it in developing a crisis management response. It is the responsibility of the NM to provide the resources necessary for the establishment and operation of the EACCC. The Network Manager may approach the chair of this cell after consultation with the Commission. The changes introduced by Commission Regulation (EU) 2019/123 concern the possibility for NMs to benefit from the support of the EACCC only, when necessary, to support crisis management at the Member State level through State focal points, to carry out continuous monitoring of the network in an independent manner to detect crises and to manage related information to support the decision-making processes of all parties involved. An important change is also the obligation for the Network Manager to report to the EACCC on the recovery of the network. In addition, the new rules require the NM to organize and implement crisis simulation exercises (in conjunction with Member States and operational parties) and to develop, implement and monitor a work program and risk register.

#### 4. The practical dimension of crisis management in the European ATM network

In 2011, the EACCC took the lead role for the first time in the ICAO VOLCEX 11/01 exercise as coordinator of the European ATM response. The purpose of the exercise was to test the updated national and European region procedures as described in the revised and agreed ICAO EUR/NAT Volcanic Ash Contingency Plan and, in addition, to simulate among airspace users a scenario involving the application of a risk assessment methodology not yet implemented by ICAO, EASA and national authorities. The exercise was an opportunity for the EACCC to apply its procedures and take initiatives to monitor the ongoing crisis and develop appropriate emergency responses. Airline representatives supported the management of network operations and, in twice-daily teleconferences with the entire EACCC membership (the Commission, EASA, Eurocontrol, Member States and air transport stakeholders), developed responses to ensure the best possible response to this potentially disruptive European aviation event. A new tool that supports decision making during crisis events that have an adverse impact on aviation in Europe, the European Crisis Visualisation Interactive Tool for ATFCM (EVITA), was used during the exercise. This tool provided a visual display of data on volcanic ash concentrations, planned routes and danger areas declared by national aviation authorities, allowing for improved decision-making and use of airspace. The exercise confirmed the EACCC's view that a safety risk-based approach is the most appropriate for the European ATM network and should be the basis for airspace users' decisions on operations.

The lessons from the 2010 volcanic ash crisis, as well as the VOLCEX 11/01 exercise, supported the view that crisis management must take place at two distinct levels: operational and strategic/political, both of which must be strongly coordinated (Council of the EU, 2010). The operational level encompasses the activities of Eurocontrol's management services, the senior operational management of air navigation service providers and the operational stakeholders directly affected, in particular airspace users and airport operators. At the strategic-political level, there must be a separate aviation crisis coordination body with quick access to decision-makers, including Ministers of Transport, European Commissioner for Transport, Directors General of Civil Aviation of all European States and top management of responsible military and national security entities. Its members must include the top management of the European Commission, EASA and Eurocontrol. Based on the lessons learned, a Network Manager function was established under the SES legislation in 2011 to manage the European ATM network at the operational level and the EACCC for crisis management at the strategic-political level.

In the following years, a number of events in the European aviation network caused air traffic management crises (see Table 1 and Table 2). Among the most serious were the shooting down of flight MH 17 in Ukrainian airspace on July 17, 2014, and the terrorist attack at Brussels airport on March 22, 2016. The EACCC was first activated in response to the terrorist attacks in Brussels. These events have confirmed the need for a central entity that can coordinate mitigation measures at the ATM network level and support managing aviation crises at regional and local levels.

**Table 1.** Crisis management situations and responses in the European ATM network

| Years | Crisis management exercises, NM/EACCC workshops  | Disruption and crisis situations  |
|-------|--|---|
| 2014  | ICAO VOLCEX 14/01, NUCLEAR 14, annual workshop with State Focal Points   | shooting down of the Malaysian MH 17 in Ukrainian airspace, outbreak of Ebola, activation of the Icelandic volcano Bárðarbunga, rocket attacks on Ben Gurion Airport in Tel Aviv  |
| 2015  | Three EACCC meetings, annual workshop with State Focal Points  | conflict in Ukraine, Germanwings plane crash, fire at Terminal 3 at Rome Fiumicino Airport, power failure at Belgocontrol, radar failure at ACC Stockholm   |
| 2016  | SECURITY INCIDENT 15, activation of the EACCC  | deployment of new technical ATM systems in the Prestwick and Langen ACC, closure of Brussels airport due to the terrorist attack, power supply (emergency) failure at the Polish Air Navigation Agency during the technical inspections |
| 2017  | POWER 17, three EACCC meetings, annual workshop with State Focal Points  |   |
| 2018  | EACCC18 Coordination ATM/Cyber, three EACCC meetings, annual workshop with State Focal Points  | technical failure of the Enhanced Tactical Flow Management System (ETFMS) at NMOC   |
| 2020  | Activation of the EACCC on January 31, 2020, 21 teleconferences with State Focal Points, two EACCC meetings                                  | COVID-19 pandemic   |
| 2021  | ICAO VOLCEX21, two EACCC meetings, 18 teleconferences and annual workshop with State Focal Points, deactivation of the EACCC on July 2, 2021 | COVID-19 pandemic   |

Source: The author's own elaboration based on Eurocontrol's Network Manager Annual Reports from 2012- 2021.

**Table 2.** Crisis management training and exercises in the European ATM network

| Years | Crisis management exercises, NM/EACCC workshops  | Disruption and crisis situations |
|-------|--|----------------------------------|
| 2012  | ICAO VOLCEX 12/01, annual workshop with State Focal Points                                     |                                  |
| 2013  | VOLCEX 13/01, CYBER 13, annual workshop with State Focal Points                                | air traffic controller protests  |
| 2019  | EACCC19 PANDEMICS, ICAO VOLCEX 19, two EACCC meetings, annual workshop with State Focal Points |                                  |

Source: The author's own elaboration based on Eurocontrol's Network Manager Annual Reports from 2012- 2021.

The NM coordinated the response to various disruptions within the network, organized and conducted crisis simulation exercises (together with Member States and operational stakeholders), and developed, implemented and monitored the work program and risk register. Between 2020 and 2021, network crisis management was dominated by the COVID-19 pandemic. The COVID-19 crisis had a catastrophic impact on aviation, but it was not a network crisis but a public health crisis. Therefore, decisions to implement measures were not made in the aviation field. This fact greatly limited the role of the EACCC and the SFPs. The European Aviation Crisis Coordination Cell was activated in January 2020 in response to the COVID-19 pandemic and remained active until July 2, 2021. During this period, the EACCC held a number of teleconferences with State Focal Points to collect and disseminate information on national restrictions.

The EACCC's activities also included the maintenance of a risk register listing threats to ATM in Europe that could lead to a crisis in the aviation network and an assessment of the risks and associated countermeasures. Identifying and mitigating risks in the European ATM network is one of NM's highest priorities. The NM risk management process covers risks to NM work program delivery and to the NM business continuity. For example, the top security threats in 2021 included: Risk 1 – IT obsolescence, Risk 2 – Cyberattack, Risk 3 – Talent management (this risk used to be called "Demographic challenge"), and Risk 4 – Full loss of flight plan service (Eurocontrol, 2021). Lessons from the COVID-19 pandemic impact assessment led to a number of improvements in crisis management, including the preparation of the Weekly Rolling NOP and the set-up of the ANSPs CEO Sounding Board, and the preparation of the European Network Operational Plan (NOP) – Rolling Seasonal Plan in collaboration with stakeholders, effective from October 2020. In addition, EVITA, the visualization tool used by the NM in the event of a volcanic ash crisis, has been significantly upgraded, showing the ash cloud on a map along with flights, airspace elements and observations reported by pilots during flight. In 2022, network operations were strongly affected by Russia's military aggression against Ukraine. The NM worked with airlines, ANSPs, ICAO and neighboring regions to find solutions to mitigate this crisis from both a planning and operational perspective and to ensure maximum resilience of the European ATM network.



## 5. Conclusions

The last three decades have been particularly challenging for European civil aviation, as it has experienced numerous crises and other unexpected events that have severely disrupted air traffic flows or reduced the capacity of air traffic control (ATC) systems. To date, the European air traffic management network has been most negatively affected by local armed conflicts and geopolitical instability, volcanic eruptions, air traffic controller strikes and very serious technical failures of ATM systems. These events have verified the effectiveness of the operational structure set up on an *ad hoc* basis for air traffic crisis management and demonstrated the need for a central entity that is capable of coordinating the response to and mitigating the impact of situations of crisis on the network. Based on the lessons learned from the crises that occurred in European airspace, numerous improvements have been made at operational, institutional, and political levels. A key factor in enabling such progress was the adoption by the European Commission of appropriate legal solutions within the framework of the Single European Sky legislation. The two-level structure established under this legislation centers around the Network Manager, who coordinates and supports the management of network crises and activates the European Aviation Crisis Coordination Cell (EACCC), in consultation with the Commission.

To ensure the effectiveness of crisis management at the network level and to support the Network Manager and the EACCC in their tasks, a network of State Focal Points has also been established. In the event of a crisis, these points facilitate the involvement of national authorities and ensure close cooperation with the relevant structures at Member State level. Effective cooperation between the various air traffic management entities in crisis situations makes it possible to minimize their adverse effects and accelerate the return to normal aviation operations in Europe. However, it should be noted that the current crisis management organization allows rapid and effective action, mainly in the case of short-term disruptions in the air transport sector. In major and long-lasting crises (caused by pandemics or armed conflicts), additional support should be sought from operators of other modes of transport who can identify and implement intermodal solutions. During events with such catastrophic consequences for aviation, decisions are taken at the highest political levels, which limits the influence of crisis management bodies in the European ATM network.

### Declaration of interest

The author declares that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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