Risk Governance and Risk Communication in Air Traffic Management (ATM)

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Abstract: The purpose of this article is the demonstration that risk governance and mitigation in aviation can only be comprehended as an abstract concept on a higher level where several mitigating actions have to be derived from. Due to the fact that the European airspace is tight, there is a new approach to effectiveness, on the one hand, and to safety issues, on the other one: the Single European Sky Project (SES). Thinking about airspaces and aviation safety means thinking about a closely cooperating Europe with various member states together with a variety of different stakeholders. Risk governance is a challenge to be met on every single level, be it local, national or throughout Europe. Risk assessment and mitigation is an ongoing process for all participants in aviation. It demands a close cooperation and a thoroughly done communication between all parts in aviation on every level in order to identify the weaknesses in the system and create sufficient safety barriers.

Keywords: Single European Sky, effectiveness and safety; risk classification methods; Bottom – Up and Top – Down processes; audits and inspections

1. Introduction

Assuming that all European states are participating in aviation, the European airspace has developed to be one of the highest covered airspaces concerning aircraft movements worldwide. According to the European Organization for the Safety of Air Navigation ((Eurocontrol) is an intergovernmental organization responsible for the central organization of Air Traffic Management in Europe), there are meanwhile 41 member states (Eurocontrol member states) participating in a close cooperation and an exchange of safety information. With the beginning of the Single European Sky project (SES) the intention is the effective use of airspace with the shortest track possible so that the airline companies would be able to save fuel and maintenance costs and take the passengers directly to places in time wherever they like to go.

Main purposes for the Single European Sky are:

1. To abbreviate the flying time due to shorter air tracks
2. Thus leading to reduction of fuel consumption
3. Optimized take-off and landing procedures
4. Reduction of delays
5. Reduction of environmental pollution
6. Reduction of the systemic risk

In order to achieve these goals mentioned above, several other aspects have to be taken into account. Meanwhile, modern aircraft are equipped with particular technical items for being able to be separate in shorter distances within the Upper Airspace (Reduced Vertical Separation Minima - RVSM) as it has been in the past. That means that it should be possible that in the same airspace more aircraft are present than some years ago. Thus, the effectiveness of aviation shall be increased and the transport of goods “just in time” to every part of the world shall be guaranteed.

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Aviation belongs to one of the "High Risk" technologies, characterized by complexity, non-linearity and social ambiguity. Where the airspace becomes tighter, it must be clear that this implies a higher risk for an unwelcome incident. In the last few decades, Europe has seen some fatal accidents which demanded immediate action in order to prevent the reoccurrence of such unwelcome events and to mitigate the imminent risk. The main idea was therefore the simplifying of a multitude of national airspaces into one single European sky in order to improve the effective use of airspaces. Even at this point it becomes evident, that there are different levels of actors playing a decisive role in risk governance. Every single participant in aviation has specific tasks to fulfil in order to keep the Single European sky project going.

During the last decades it became very clear that it is almost impossible for one single member state to find proper solutions in regard to aviation safety issues and to carry out particular programs in order to reduce the imminent risks in aviation. Due to the fact that single actions taken by one state alone are not very effective, it is absolutely necessary to be in close cooperation with other member states and the “industry” - the stakeholders. Coordinated actions proposed for all member states (i.e., State Safety Program) have therefore a greater impact on risk reduction rather than states acting alone without having contact to other concerned nations. Communication on European level with all participants in aviation is therefore crucial if the risk reduction in the European airspace is to be successful.

It is important to determine the key risk areas and to derive proper solutions to mitigate the risk. In close cooperation with the European Organization for the Safety of Air Navigation (Eurocontrol), several action plans have been developed and are to be implemented on national level by the air navigation service providers and by the airline companies, too. Particularly the term "Safety Oversight" on a national level conducted by the assigned competent authorities is therefore a main concern for all member states [1]. During audits on a regular basis the competent authority verifies the implementation of the published actions plans.

Additionally, there are two main regulations to be taken into account:
1. Commission Implementing Regulation (EU) No 1034/2011 pointing out the importance of a functioning safety oversight system set up by the respective national aviation authorities [1].
2. Commission Implementing Regulation (EU) No 1035/2011 dealing with the duties of the respective air navigation service providers (ANSP) in regard to safety issues [2].

2. The Challenge of the Risk Governance

Effectiveness in aviation means high pressure on cost reduction and in increasing the capacity, not only in regard to fuel consumption and abbreviation of the flight paths but much more in regard to cost reduction concerning crews and ATC personnel, particularly in reduction of educational costs. To these aspects refers the Commission Regulation (EU) No 805/2011 in the preamble, (17). The regulation draws a line between "high standards of competence", on one hand, and "unit training is very costly and decisive in terms of safety", on the other hand. Due to the fact that language issues and communication problems are known as contributing factors to most of the unwelcome incidents, the preamble of Commission Regulation (EU) No 805/2011, (16) points out, that all air traffic controllers are required to have detailed language knowledge and are obliged to improve them on a regular basis in order to prevent unwelcome incidents or fatal accidents. Nevertheless, the continued education in this respect is limited although otherwise recommended and the unwelcome incidents concerning language capabilities or communication issues still remain.
All these problems are well known. In order to meet this challenge, one important element of safety oversight is the incident reporting [2]. The collection of these data throughout Europe reveals the challenges in aviation safety to be met. Risk governance is therefore based on a “Bottom – Up”- and a “Top – Down” process. Some coordinating elements on a European level (i.e., European Agency for Safety in Aviation (EASA) and Eurocontrol) are necessary to stay in permanent contact with the different levels of stakeholders.

In the first place, air navigation service providers are obliged to set up a so called Mandatory Reporting System in order to get an overview over the own safety situation within the company. The LuftVO, Annex 6 and 7 to §5b defines some crucial events to be reported to the respective authority if having occurred in order to identify some systemic risks to be mitigated.

In most of the cases one main aspect could be identified as to be responsible for such unwelcome incidents: the Human Factor. Misjudgement, overload of work in combination with time pressure, misleading communications etc. lead to slips and mistakes. Basis of all risk governance is therefore the identification of the key risk areas which can only be done if there is a good reporting culture existing throughout Europe. The main issue is to identify the weaknesses of a system (in order to identify a risk), not to blame a single person. Only in an environment of trust and reliability, the air traffic controllers and technicians are willing to report their incidents. Thus, the companies are committed to protect their reporting employees from all kind of prosecution unless in cases of gross negligence and willfulness, not least because it is their main interest to identify the gaps in their system and to mitigate the risk.

3. Identifying the Safety Key Risk Areas: Two Examples

Effective occurrence reporting is based on confidence. That means: that all information shared with the respective competent authority will be protected from prosecution unless in cases of great negligence and deliberate actions [14]. Lessons learnt from an unwelcome incident are disseminated in a completely de-identified manner. There shall be no possibility to track down personal information neither of the reporting person nor of the reporting organization. The main focus is set on the amount of a particular incident type, not on the single incident itself. Most of the incidents may happen in times with not much traffic to be managed. It can also be observed that an unwelcome incident occurs after the air traffic controller has experienced a peak of high workload with difficult traffic situations. Having solved such situations, in the relaxing period, it can happen that the controller probably fails to recognize the approximation of two aircraft within his sector. Such an event is called a "Separation Minima Infringement" (SMI). ‘En route’**, an aircraft shall have at least a vertical distance to the next one of 1000 ft (by about 300 m) or shall have a horizontal distance to the next one not less than 5 NM (9.26 km).

The most frequent incidents on aerodromes are “Runway Incursions” (RI). According to the definition of International Civil Aviation Organization (ICAO) a runway incursion occurs due to the "incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft"[3]. In most of these events, the air navigation service provider has no contribution to the incident. Before being approved to enter the runway strip in order to begin the take-off run, the crews have to stop their aircraft at the respective holding point outside of the protected area of the runway. However, it may happen that the crew members are distracted due to own departure preparations and communication with the cabin crew. So, they do not realize that the aircraft has already crossed the holding point and is meanwhile about to enter the protected area of the runway.

**‘En route’ refers to the distance flown outside a circle of 40 NM around the airport [13].
The consequence might be then that an approaching aircraft has to carry out the "Missed approach procedure" or simply "to go around".

It might also happen that a controller has to estimate, if it is still possible, to give clearance to a waiting aircraft for take-off while another aircraft is already approaching and in a short distance to the threshold of the runway strip. Due to the fact that the traffic in the rush-hours is rather high at some aerodromes, the controllers have only limited time for a decision and for action. If they hesitate too long, the time frame might be too short to let an aircraft depart and another one land safely on the same runway strip. It is a matter of an "Efficiency-Thoroughness Trade-Off"[4]. Most of the time the controller's decision has a wanted outcome, but it may happen that the controller misjudges the situation due to psychological reasons and other contributing factors. One important contributing factor is the communicational issue. Not knowing what is actually going on in the cockpit and not sticking to the standard phraseology it might happen that the controller’s message to the crew is misleading. Due to some key words mentioned in the message, the crew is sure to have got the permission to enter the runway in order to begin the take-off run. In fact the controller has just chatted, not being aware that the crew only heard the awaited key words and afterwards unconsciously constructed in their minds the potential correct instruction and carried it out.

4. The Competent Authority – Its Role within the Risk Management

In Germany, eight different air navigation service providers offer their services in German territory and the cross border area. Due to the fact that every single organization reports the unwelcome events to the competent authority and every single report reaches the department for occurrence management, it is the national competent authority which sees the whole picture on a national basis and which is able to identify the local key risk areas. Thus, the occurrence management plays an important part within the risk governance. Within 72 h after having taken notice of what has happened, the air navigation service providers are obliged to send a notification message to the competent authority. In urgent cases, they inform the manager in charge via cell phone (i.e., in cases of incidents with medial relevance - fatal accidents, phenomena of nature etc.). According to the Regulation (EU) 376/2014 Art 4, the air navigation service providers are obliged to investigate the event and to send their radar plots and transcripts of the radio recordings attached to the final reports to the competent authority. Every piece of information completes the picture of what has happened. On a national basis, the collection and analysis of incidents have an additional function. Due to the fact that a national competent aviation authority is one part of a functioning national safety management system, the collected data and the location where the incident took place, are the fundament of announced audits and inspections on a regular basis [1]. The regulator verifies the compliance of the air navigation service provider with the proposed European action plans, with the respective EU-regulations and -directives and with the recommendations given by the respective safety manager in the incident report to his air navigation service organization. If the incident was difficult and it had a high severity classification, it might sometimes be necessary to discuss the mitigating actions offered by the air navigation service provider. In such cases it is useful to have a regular contact established in order to meet and to discuss the situation. If the safety situation presented by the air navigation service provider demands immediate action, the respective competent authority will conduct an adhoc-audit in order to make sure that the fundamental safety requirements are met and that aviation safety will not be compromised.
5. **Severity Classification - The RAT Methodology**

In order to assess the severity of an incident, it is necessary to collect immediately the following data which is:

1. To verify the minimum distances,
2. To document the radio communication between crew and controller,
3. In that file, it is also documented how experienced the respective controller was,
4. To show if there was probably a training situation at the particular position,
5. To show when the shift of the involved controllers had started,
6. To register how long they had worked at the respective position,
7. To collect how many days they had been on duty since the last vacation.

The investigation report concludes the incident investigation. A detailed description of the sequence of the events with the exact values of distances between the involved aircraft and the recorded radio telephony data are the main part and the main source for a correct risk assessment of the incident. Appropriate recommendations in regard to the risk mitigation, a short conclusion and the severity classification complete the investigation report done by the respective air navigation service provider. The last step is the assessment of the severity. In former days, every air navigation service provider has had his own safety assessment method, which was not compatible, not even comparable to those of the other air navigation service providers throughout Europe. Therefore, in 2008, Eurocontrol developed a risk assessment tool, particularly configured for the needs of air navigation service providers in order to be able to compare the events and the assessed results on a European level. Due to the fact that there are so many different states and languages it was absolutely necessary to unify the access to a common understanding about terms and events and the method of assessing and analyzing the incidents.

The assessment tool, called RAT, is similar to the well known Zurich methodology. It is an appropriate procedure to determine hazards and risks in order to derive appropriate mitigation actions. It is a rather simple method to assess the potential accident and incident risk in regard to the severity of the event and to the probability of the occurrence. The severity class is determined by two parameters:

1. Determining the particular severity class
2. Determining the repeatability (probability of reoccurrence)

In order to correctly assess the severity of an incident, there are two parts to be completed:

1. ATM Ground
2. ATM airborne.

If there is evidence that the air navigation service provider might probably have had a contribution to the event, the left side has to be completed (see Figure 1) [5]. In regard to the ATM airborne part on the right side of the tool, it is recommended, that the air navigation service provider assesses the crew’s reaction to the controller’s instructions and the behaviour of the aircraft based on the instruments and the data recordings available at the particular units such as radio communication and radar plots.

The assessed severity (ATM overall) has a range from class A (highest severity class possible) to class E (no safety effect). It represents the traffic light model whereas class A and B represent the red zone where immediate actions are necessary. Class C with a high probability of reoccurrence would also be counted to the red zone. If the severity was assessed with class C but with a lower probability of reoccurrence, the yellow zone is reached. Severity class E represents always the green zone. Severity class D means that the risk is "not determined". Severity class D is always given when there are too little data available to assess a definite severity class. Thus, severity class D does not mean that there was no risk, rather
than there could have probably been a high risk. But the data available in regard to this event are not sufficient to make a clear decision.

The latest development of the RAT tool was the introduction of the severity class "N" (see Figure 1). Due to the fact that the air navigation service providers have not always a contribution to the incident, it was their wish to make this evident by introducing the class "No contribution" ("N"). It is now possible for them to select this item in advance of the assessment, so that then there would permanently appear a green field in N5.

The advantages of the RAT methodology are:

1. An almost objective severity assessment based on the data given from the radar plots and the detailed description from the involved persons.
2. An easy application of the method without a need of detailed mathematical knowledge. Due to the fact that most of the safety managers were originally air traffic controllers and had never attended classes about risk assessment at a university before, it was necessary to give them an easy access and understanding to an incident assessment tool.
3. Online availability [6]. If registered, the assessed incidents can be stored in the Eurocontrol database or, if this is not wanted, within the own network available, either as an xml-file, as a pdf-file or as an excel-file.

However, progress goes on. In the shade of the Regulation (EU) No 376/2014 which will become applicable in November 2015, the European Commission assigned the European Agency for Safety in Aviation (EASA) with the development of a new risk assessment tool which shall be available in 2017 at the latest. The European Commission realized that all participants in aviation should assess their incidents on their own in order to get a clear overview over the systemic risks. This newly developed risk assessment tool will then also be applicable for the airline companies, rather than the "old" RAT tool which was exclusively...
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6. Risk Mitigation

Risk mitigation points in two directions:

1. The prospective view: air navigation service providers are obliged "to notify the relevant competent authority of all planned safety related changes. [...]" [7]. This includes safety related software changes as well as changes in the air traffic flow management system (ATFM). It implies an appropriate severity assessment, conducted by the respective air navigation service providers. The competent authorities are obliged to review and approve the documented procedures of assessing the imminent risk concerning the planned changes of the functional systems. In order to get a valuable estimation in terms of a potential risk or hazard resulting from a planned change of functional systems, several mathematical methods are applied. Intention is the identifying and mitigating of potential hazards and "the demonstration, that the safety objectives, safety requirements and other safety related conditions are continuously met" [8].

2. The retrospective view: air navigation service providers are obliged to report all unwelcome incidents which are collected under the Mandatory Reporting System. Regulation (EU) 376/2014 of the European Parliament and of the Council points out that "Experience has shown that accidents are often preceded by safety-related incidents and deficiencies revealing the existence of safety hazards" [9]. This is taken into account by establishing a Mandatory Reporting System in order to get an overview about key risk areas, complemented by a Voluntary Reporting System, collecting all incidents which could have led to an incident summarized under the Mandatory Reporting System. Investigating and analyzing unwelcome incidents can be summarized under "Reactive System" identifying the "Root Causes". They are to be complemented by a proactive system in order to identify and mitigate potential risks in advance (see above).

The analysis of the data and the derivation of actions to be taken in order to mitigate the risk can only be as good as the data set collected within the European Central Repository. Thus, special attention has to be put on the data quality. Since several years, the member states are obliged to report those unwelcome events regularly in a de-identified manner via the so called Annual Summary Template (AST) to Eurocontrol which was exclusively in charge of safety issues around Europe until 2008. With that kind of method it was possible to analyze whether the assessment of the incidents has been done with the RAT methodology as demanded in the "EASA Applicable Means of Compliance" 4 to 7 [10] and in the Commission Implementing Regulation (EU) No 390/2013, Annex I, Section I, 1.1.

The EASA now in charge for these issues appreciates this kind of de-identified incident reporting due to the markedly good data quality of the reported results. Every single incident is to be reported line by line via a particular template with particular parameters. The result of the AST reporting is biannually published via the SRC Safety Report [11], addressing all Eurocontrol member states in order to improve their safety management on national level. Meanwhile, 40 states in and out of Europe agreed in reporting via AST on a regular basis in order to improve aviation safety in a mutual effort.

Further on the European Commission needs the collective incident data set for developing Union-wide target values within a particular reference period in order to prepare safety performance plans for each airspace block and for evaluating the safety performance of each member state and the designated respective air navigation service provider. According to
Commission Implementing Regulation (EU) No 390/2013, those incident numbers have to be reported twice a year to the respective focal point collecting the data of the performance indicators Union wide. The compliance of the member states is monitored by the EASA on behalf of the European Commission. If the Commission observes a persistent drop of the performance "on local or airspace block level", it may request corrective actions, particularly then, if the whole European airspace is affected by the non-compliant member state. In order to prevent such situations, the EASA is obliged to conduct standardization inspections in regard to the state safety performance at national level [12].

7. Conclusion

SES with the high pressure of effectiveness and cost reduction brings safety issues into focus. A functioning proactive and reactive system is the basis of mitigating follow-up actions. Risk governance can only be successful if every participant in aviation on every level is included in the safety "chain". A common understanding of risk assessment and exchange of expertise are the fundamental elements of a functioning safety culture. Europe with its multitude of nations can only be effective in mitigating the risk in aviation when all member states are included on every level with all stake holders. “Bottom – Up” processes lead to the identification of important safety issues in European airspace, and “Top – Down” processes meet the challenge of mitigating the risk due to a close cooperation and a thorough communication between all participants in aviation and the development of actions plans and regulations which are applicable for all member states.

A successful risk governance is based on thousands of confidentially reported incidents. Thus, a good reporting culture is essential for getting information about the key risk areas to be known. With little data gathering the imminent risks cannot be revealed nor can mitigating actions at any level be derived from. Risk governance and risk mitigation is a mutual effort, taking place on every single level and is interacting in both directions. It is absolutely necessary that the knowledge about key risk areas lead to appropriate actions on each level, always interacting and informing the dependent co-actors. The collection and assessment of incident data on the lowest level leads to a deeper insight and thus to consequences on the highest level in the form of action plans and legislation actions. These decisions and regulations on a European level address a particular safety issue which cannot be solved on a national level alone.

References:


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