SECURITY FOR AVIATION

A RESEARCH PROGRAMME OF THE FUTURE SKY JOINT RESEACH INITIATIVE

VERSION – JULY 2020

SUMMARY

Future Sky Security for Aviation is the framework programme promoted by the Association of European Research Establishments in Aeronautics (EREA) to tackle the aviation security. It is part of Future Sky, an ambitious EREA initiative intending to address the main issues challenging the EU leading position on Aviation. This societal demand about aviation security requires the development of appropriate, efficient and consistent solutions against the present and future threats to boost aviation security.

Since 2001 the way to envisage aviation security has deeply evolved because of terrorist attacks and the increase of emerging threats and vulnerabilities. Although many projects were focusing on detection and prevention, studies need to be carried out to determine the best measures for protection and the most appropriate reactions and to develop a joint simulation environment to evaluate the efficiency of security concepts or security systems. The performance assessment of security solutions and the definition of appropriate Key Performance Indicators (KPI) are today essential needs to build an aviation security policy taking into account the issues of the development of autonomous systems, which increases dramatically the complexity of the threat management.

The main goals are to identify the best solutions in a standardised way regarding their efficiency and trust for the protection and to improve the resilience of the whole aviation system and the passenger survivability. Furthermore the aviation community has to anticipate unknown future threats instead of reacting continuously in hindsight with new strict regulations.

To cope this challenge and to give key concrete outcomes to Europe about the performance assessment of aviation security concepts, EREA members suggest to launch the development of a joint simulation environment which will be used to evaluate and rank the performance of security solutions in the case of an attack involving several drones in the threat team against an airport in which are taken into account the air activity and a set of countermeasures (including drones) dedicated to its protection.

In a nutshell, security for aviation is expected to be even more fruitful than at present by encompassing a larger scope through agile and dedicated cooperation. To cope with this aviation security challenge it is essential to develop efficient security solutions that meet the societal demand, the growth of the air traffic and the adaptations of the international regulations on one hand and that foster the European competitiveness and strengthen our position in the aerospace field on the other hand.

LEGACY

Following the terrorist attacks on 11 September 2001 in the United States of America, the European Union decided to modify the Aviation security management, which was previously under the responsibility of each EU member State. In 2002 common rules were established and then several supplementary regulations were adopted. Furthermore, in its 2011 Transport White Paper[1], the European Commission highlighted the ambitious objective of being a world leader in safety and security of transport in all modes of transport by 2050.

The 2017 Research Theme Analysis Report – Transport Security[2] set indications for future research to develop efficient solutions to cope of the wide types of security threats (and the emerging threats) in order to enhance survivability and the resilience of all the aviation system. Furthermore, the Strategic Research and Innovation Agenda – 2017 update[3] underlined the need that new security threats have to be better understood and mitigated.

Nowadays, the security is a crucial international and societal challenge which faces a growth of the diversity security threats and the development of autonomous systems which increases dramatically the complexity of the threat management. Furthermore it is becoming more and more urgent that the stakeholders have the means to adapt the security measures to the threat evolutions, and to anticipate unknown future threats instead of reacting continuously in hindsight with new strict regulations.

The civilian aviation security challenge may lead both to new topics for research and to a reassessment of existing tools in a renewed framework with appropriate KPI focused on the efficiency of security solutions.

CHALLENGES

SECURITY INTELLIGENCE

The Strategic Research and Innovation Agenda – 2017 update highlighted that "*security must be supported by intelligence that provides the information necessary to develop a comprehensive and detailed catalogue of threats and system vulnerabilities*". This intelligence approach must also detect the emerging threats and vulnerabilities by the analysis of technology and societal trends. The information concerning security intelligence must be shared with all the stakeholders involved in the aviation and transport security chain.

In a structured way, the identified new threats and new vulnerabilities are then implemented in processes and simulation platforms to rank the concepts or the solutions of protection in various scenarios and to assess the resilience of the aviation system.

At the end, the European community will develop its ability to anticipate the management of unknown future threats.

PERFORMANCE OF SECURITY CONCEPTS AND POTENTIAL PROTECTION SOLUTIONS

The assessments of security concepts and potential solutions of protection are crucial needs to identify the most efficient tools or processes that must be implemented in the aviation system. This formidable challenge requires

[1] Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system (COM(2011)144), European Commission, 2011.
[2] Research Theme Analysis Report – Transport Security, European Commission, 2017.
[3] Strategic Research and Innovation Agenda, 2017 Update, Volume 1, Advisory Council for Aviation Research and Innovation in Europe, 2017.

the development and standardisation of methodologies, processes and simulation platforms and the establishment of appropriate KPIs.

In particular the development of simulation platforms which can interoperate is essential to asses security concepts or potential solutions of protection dynamically and to cope with scenarios involving multiple and coordinated threats. This development of simulation platforms must take into account the knowledge of the defence field. Indeed wargames are being used for a long time to assess dynamically military programs.

At the end the use of such tools should increase the efficiency of security developments and the return on investments for Europe.

SECURITY IN THE DEVELOPMENT LIFE-CYCLE: A DESIGN-IN APPROACH

The Strategic Research and Innovation Agenda – 2017 update pointed out that "*security needs to be addressed from the beginning to the end of the development life-cycle, covering all phases from the initial concept, through design, deployment, operations and decommissioning*". Moreover a design-in approach which integrates security requirements during the development phase will avoid extra costs resulting of a late integration of security requirements or of fundamental re-design.

This design-in approach must comply with legal frameworks and agreed international standards to assure the global leadership of EU in security for aviation.

SECURITY AS A CHALLENGE FOR THE COMPETITIVENESS OF EUROPEAN AVIATION COMMUNITY

The EU repeatedly insists on the very strategic nature of the aircraft industry to uphold its global leadership in aviation while raising its ambition of defending the highest living condition for its citizens.

Though intensive research studies on threat detection or prevention, many aspects of security have to be addressed: identification, protection, reactions and recovery. The final goal is to avoid fatalities, to minimise societal and economic impact, to strengthen the resilience of the global aviation system and to increase the survivability.

Furthermore it is crucial to anticipate as soon as possible the developments and standardisation in the US and Asia in key concepts and technologies for efficient security solutions that meet the societal demand, the growth of the air traffic and the adaptations of the international regulations.

The establishment of a Civilian Aviation Security Research Network in which all research establishments together with universities and industry will, in a standardised way, provide complementary tools and skills in order to cover the whole "Security for Aviation" field is essential. This network has to foster the collaborative research and the cross-fertilization between aviation and transport security domains by the involvement of the relevant public and private stakeholders of different domains: aviation, transport, security and defence. Furthermore the management of the security and safety fields has to be harmonized during the design phase.

Taking into account the worldwide competition and the economic and societal challenges, it is essential that EU supports such a leading security network in order to strengthen the European Union's role in aviation security. This network team should lead the European communication at several levels (Non Member States, Third Parties, and International Organizations).

AVIATION SECURITY – ACTION LINES

DEVELOPMENT OF A JOINT SIMULATION ENVIRONMENT AND THE ASSOCIATED TOOLS

The assessment of security concepts is a key need for the society and a top priority of EREA. The development of a joint simulation environment and the associated tools and platforms is essential to assess the performance of security concepts and solutions against present and future threats. Indeed the simulation platforms must share the protocols with the "Security for Aviation" stakeholders to assess their performances through defined KPIs (security concepts, security paradigms, security systems, vulnerability of systems, tools, metrics, process, methods,…), and through both risk and threat analysis: the goal is to identify the best solutions regarding their efficiency and trust for the protection of the civilian aviation against a set of threats taking into account the dynamics of the attack and the response of the security system. It is essential that the assessment of security concepts is performed in a structured/standardised way to enable easy exchange of results and to define or enhanced existing international security standards. To ensure a high valuable development, the consideration of the following recommendations will be useful:

- This joint environment is the mean to develop a comprehensive aviation security knowledge and the appropriate management of the aviation security based on the performance of the entire security system. So it is essential to use verified and validated models and to ensure the global consistency of the simulation. The tasks concerning the consistency of the simulation and the maintenance (evolution) of the platform by public actors are of utmost importance for the stakeholder's confidence in the outcomes of the aviation security performance assessment and the guarantee of the IP rights of the owners of the systems studied models. As a consequence, the high quality of the (standardised) results allows us to improve the resilience of the whole aviation system and the passenger survivability.
- In order to obtain credible and valuable conclusions, this joint environment must be able to assess complex scenarios including attacks of multiple and coordinated threats against different and complementary security systems.
- For an efficient development of such key tools, synergies with the simulations activities in the defence field (e.g. wargames) have to be tackled.
- The results of studies dedicated to the evaluation of concept performances and the assessment of security solutions should be capitalized.

Though many studies have been performed in the past to identify potential solutions, they were not assessed dynamically or ranked by efficiency in different scenarios. But the performances or the efficiency of security concepts or security solutions are essential KPI to identify the best promises solutions.

The members of EREA, having skills and facilities in aviation and defence field and having a broad experience in collaborative research and supporting European aviation stakeholders for decades, can contribute efficiently to build such a joint simulation environment for the benefit of the European aviation security community.

In a practical way, EREA is ready to support the development of this simulation environment based on a shared platform and/or a network of connected platforms. Furthermore, the members of EREA suggest to use this environment for the analysis of a scenario involving several drones in the attack team against an airport in which are taken into account the air activity and a set of counter measures (including drones) dedicated to its protection.

SECURITY OF AVIATION: A CONSISTENT AND EFFICIENT METHODOLOGY

The key point is the good balance between the developments of the different strategic facilities: numerical tools, experimental tools and system tests. Models, simulations and several types of real tests are indispensable elements for the development of valuable solutions of protection and resilience. The development of specific testbeds and laboratory testing facilities for aviation security purposes are required in accordance with the evolution and the complexity of present and future threats. The high quality of security recommendations will be obtained by the dynamic analysis of the scenarios of the attack and by the analysis of all the phases of the attack:

- The development of dynamic risk assessment methodologies taking into account the threats, the vulnerabilities of the aviation system and the potential security solutions is required to reach valuable "Security for Aviation" conclusions. These new types of conclusions are one of the highest outcomes of a joint simulation environment.
- Although many projects were focusing on detection and prevention, new emerging threats require further investigation on threat detection (especially: malevolent drones; CBR&N agents; weapons; illicit traffic, abnormal behaviour…), identification and prevention (for example: surveillance; tracking; identification of situational recurrence…) in order to compare the efficiency and the performances of the potential system solutions (e.g. rate of success, false alarm rate…). Also studies need to be carried out to determine the best measures for protection (mainly against: aviation cyber-security attack; electromagnetic and laser weapon; laser dazzling of pilots…) and the most appropriate reactions (prepare, respond, recover) against the present and future threats.

Moreover EREA partners are able and also used to investigate and to analyse threats and security systems based on generic models and components in order to overcome limitations due to IPR and national classification issues. This approach will be very useful for international exchanges.

In a practical way, EREA members suggest to develop generic modules validated with real tests and to apply dynamic risk assessment methodologies for the analysis of a scenario involving several drones in the attack team against an airport in which are taken into account the air activity and a set of counter measures (including drones) dedicated to its protection.

The final goal of the associated tasks is to avoid fatalities, to strengthen the resilience of the global aviation system and to increase the survivability. To progress on this way the opinions of European experts involved in the fields of aviation, security and defence from different Member States are the first key step to converge on valuable and shared conclusions for Europe and Member States.

SECURITY COMMUNITY AND SOCIETY

It is crucial to promote the collaborative research and the cross-fertilization between aviation and transport security domains by means of specific Calls ensuring the involvement of private and public stakeholders under the leadership of a team of public research establishments to develop efficient standardised tools that will be shared with the aviation security community in order the appropriate solutions for the future.

Regarding the societal expectations, the performance of the surveillance within the aviation system and the monitoring of potential threats have to be evaluated taking into account ethical aspects in order to identify and suggest to the citizens a good balance between the security constraints and the travellers' privacy (general right of personality).

All the technical developments are dedicated to help all the "Security for Aviation" stakeholders to learn about the efficiency of security solutions, to adapt the security measures to the threat evolutions, and to anticipate unknown future threats instead of reacting continuously in hindsight with new strict regulations. Furthermore, these recommendations pave the way to take into account the issues of the development of autonomous systems, which increases dramatically the complexity of the threat management.

The establishment of Civilian Aviation Security Research Network in which all research establishments will provide complementary tools and skills in order to cover the whole Security for Aviation field is essential. EREA, having a broad experience in collaborative research (technology, safety, environmental…) and supporting European aviation stakeholders for decades and having substantial assets (facilities, research infrastructures, skills, systems…), can be a core actor with JRC, airports and EASA to fulfil the European needs in aviation security taking into account the synergies with safety trends.

DESIGN-IN: INTERDEPENDENCIES AND INTER-MODALITIES

It is essential to fulfil the requirements mentioned in the Strategic Research and Innovation Agenda – 2017 update: "*New methods must also be developed for testing, along with innovative means to evaluate, verify and validate security performance during design, and in other development life-cycle phases. New approaches may include the use of modelling and simulation tools to demonstrate compliance to security requirements at component, product, system and system-of-systems level, addressing human, social and technical aspects. In keeping with the international nature of the challenge, new systems must be studied, designed and manufactured to permit global harmonisation of security performance".*

A long-term vision with far goals and disruptive approaches has to be encouraged in the aviation security domain. Furthermore, specific Calls for cross-fertilization with other domains (transport, ICT…) will allow the dissemination of aviation security knowledge and pave the way for the intermodality security on one hand and will simultaneously foster disruptive approaches on the other hand (e.g. security by design).

ORGANISATIONAL REMARKS

Up to now, EREA as establishments involved in key aviation, civil, defence and security research addressed the security issue mostly by itself, i.e. by its members. Current collaborations have been set up mainly through European projects or GARTEUR[4] initiatives.

A FLEXIBILE ORGANIZATION

With regard to these challenges and with the complex landscape from which they stem, the range of partners to be involved by EREA in Security for Aviation is to be extended with the following ones:

- EU Policy-makers,
- The academic and university research centres,
- The Aviation industry,
- The Security industry,
- The security stakeholders (Police…),
- The European network Small and Medium Enterprises,
- The Airport network (ACI Europe),
- European organisations (EASA, JRC…),
- Public Private Partnerships or Joint Research Initiatives,
- Similar eligible entities from non-EU countries.

Through Security for Aviation, the EREA intends to articulate with relevant partners shared views endeavouring to pave the way for common projects. Further to the challenges introduced above, these projects may target the priorities detailed hereafter. The institutional framework in which these priorities should be addressed remains H2020 in the short term but will be soon Horizon Europe. It is therefore important to keep a great deal of flexibility in the way through which these priorities will be tackled, as the detailed organization of Horizon Europe is not set yet.

EREA is dealing with aviation security at different level in Europe. The first one is its involvement in the ACARE Working Group 4 dedicated to Safety and Security. Recently EREA was invited to join the SAGAS[5] whose role is to advise the Commission in the preparation of legislative proposals and policy initiatives.

[4] GARTEUR: Group for Aeronautical Research and Technology in EURope.
[5] SAGAS: Stakeholders' Advisory Group on Aviation Security

Furthermore, EREA members have the network to connect/reach out to non EREA expertise through participation to other groups: GARTEUR, NATO...

TRAINING & EDUCATIONAL ACTIONS

The European Aviation Science Network (EASN) composed of Universities is an official partner of EREA. It is therefore important to start engaging a common approach on this topic in the prospect of raising awareness of teachers and lecturers from Universities and Engineering schools and to be more attractive for young professionals. It is noteworthy that this kind of educational actions, once well-defined and duly introduced, may be also supported by the European Commission.