

# Measuring safety in aviation

*newsletter*

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**Publication date**

2017

**Document Version**

Final published version

**License**

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**Citation for published version (APA):**

Karanikas, N. (Ed.) (2017, Sept). Measuring safety in aviation: newsletter.

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# Measuring safety in aviation newsletter

AMSTERDAM UNIVERSITY OF APPLIED SCIENCES (AUAS) – AVIATION ACADEMY

OCT 2016 - SEPTEMBER 2017

## Status & next steps of the project

by Nektarios Karanikas

Dear partners,

It has been almost a year ago since our last newsletter. A lot of work has been done since then, so this newsletter is an opportunity for a summary of the accomplishments so far and our next steps and forthcoming challenges.

### What we did so far

Following the release of the reports about the review of existing aviation safety metrics and the results of the surveys across our company partners, we started designing new safety metrics. These metrics are based on concepts and approaches referred in the literature and industry practice but not yet fully operationalized and tested. The metrics under development were selected according to their potential to be quantified and be representative of various areas related to safety management. The overarching hypothesis to be tested through the application of those metrics is that the larger the gap between Work-as-Imagined (i.e. standardized, described) and Work-as-Done (i.e. actual activities), the lower the safety performance.

The steering committee approved the report about the concept for the design of new metrics, which cover the following: (1) SMS assessment and scoring based on results from the System Theoretic Process Analysis (STPA) technique, (2) assessment of safety culture development plans and their implementation, based on a theoretical framework published by the Aviation Academy in 2016, (3) measurement of complexity/coupling of a defined system, (4) metric for the effectiveness of risk controls, (5) measurement of the resource gaps across different organizational levels, and (6) the distance between Work-As-Imagined and

Work-as-Done at the operational/process level.

All reports and papers published so far are accessible through the project webpage ([www.amsterdamuas.com/asm](http://www.amsterdamuas.com/asm))

### Next steps/ milestones ahead

At this time point, we have drafted the new metrics and we are in the process of reviews/pilot-studies with the support from knowledge experts and companies. On one hand, the response to the metrics is positive, but on the other hand, more work needs to be done in order to meet the criteria referred in literature with regard to the quality of metrics in general. The plan is to finalize the design of metrics by the end of 2017, so we can start applying those and collecting data in the beginning of 2018.

The challenge discussed during the status report meeting in June 2017 is how to attract and maintain company partners in the project in order to have an adequate sample for the data collection and reach to valid results by the end of the project. A few attendees of the aforesaid meeting expressed their ideas and offered to function as gateways for getting more companies involved, but we definitely need the support from all current partners. From the side of the research team, we are going to present the project during industry conferences. We already sent out letters customized to European and overseas SMEs and large companies in order to communicate briefly the project scope and impact and ask for participation along with expected short- and long-term benefits for the company partners. Any further assistance to communicate the project broadly (e.g., through associations or groups you participate) will be highly appreciated. We

must keep in mind that if we don't obtain a sufficient sample size, our metrics might be valid only in terms of reasoning and not based on empirical evidence.

Lastly, taking opportunity from our communication here, I would like to bring your attention to the events the Aviation Academy organizes. Please see the respective section below and visit our website ([www.amsterdamuas.com/aviation](http://www.amsterdamuas.com/aviation)) for more information.

Best regards,

Nektarios Karanikas

### The RAAK PRO research team



From left to right: Robbert, Steffen, Nektarios, Alfred, Selma

### Agenda Aviation Academy 2017-2018

International Cross-industry Safety Conference (ICSC), 1-3 November 2017, Amsterdam ([www.amsterdamuas.com/icsc](http://www.amsterdamuas.com/icsc)).

Master Class Safety & Human Factors, 15-19 January 2018, Amsterdam ([www.amsterdamuas.com/hfs](http://www.amsterdamuas.com/hfs))

Master Class Risk Assessment, 12-16 March 2018, Amsterdam ([www.amsterdamuas.com/mcra](http://www.amsterdamuas.com/mcra))

Master Class Incident Investigations, 16-20 April 2018, Amsterdam ([www.amsterdamuas.com/mcii](http://www.amsterdamuas.com/mcii))

## Activities

### STAMP European Workshop (Zurich, 13-15/9/2016)

Dr. Karanikas co-authored a presented paper which articulated (1) the first results from a System-Theoretic Process Analysis (STPA) based approach to the identification of hazards and safety requirements in small drone operations, and (2) an adaptation of the Risk Situation Awareness Provision Capability (RiskSOAP) methodology in order to quantify the differences amongst 4 drone models regarding the extent to which they fulfill the safety requirements identified through STPA. The results showed that the drones studied satisfy the safety requirements at low and moderate levels and they present high dissimilarities between them regarding the extent to which they meet the same safety requirements.

### 32<sup>nd</sup> conference of the European Association for Aviation Psychology (Cascais, 26-30/9/2016)

Dr. Karanikas presented a paper which discussed the similarities and differences between the System Theoretic Accident Model and Processes (STAMP) and prevalent human factors techniques and models. The paper concluded that STAMP can serve in minimizing the gap between human factors and safety engineering sciences, which can collectively offer inclusive solutions to the industry.

### Human Factors in Automation (Soesterberg, 12/10/2016)

Steffen Kaspers attended this small conference where leading researchers from all over the world were present, such as Neville Stanton and Dave Woods. The focus was on operators and the interaction with their systems, although one of the speakers addressed the need to focus on the interactions of multiple systems and their emergent behavior which is more in line with the project.

### Conference of the Flight Safety Foundation Mediterranean (Larnaca, 21/10/2016)

The event's central theme was about drones and attracted more than 100 attendants from authorities, companies and academia. Dr. Karanikas presented the current challenges regarding the prevention and investigation of small drone events that have dramatically increased. He focused on the lack of reliable data to perform probabilistic analyses of drone accidents, the highly diversity of drones in the safety characteristics they embed, the non-homogeneous population of drone users, and the expected further increase of drone-related safety events. Dr. Karanikas recommended the application of new hazard analysis methods based on systemic approaches, an agreement between manufacturers and authorities on a minimum list of safety requirements for small drones,

the inclusion of human factors fundamentals and systems approaches in secondary education, and that responsibilities amongst stakeholders of small-drones flights must be fairly distributed and adequately monitored.

### Human Factors in Aviation (East Midlands, 7-8/11/2016)

This yearly two-day conference brings together representatives from airlines, air traffic control organisations, industry regulators and investigators, and university research groups, examining a range of human factors issues in aviation safety in both the military and commercial sectors. Presentations were held about Operations, Safety Culture, Operator Performance, and Innovations in HF. The AUAS was represented by Selma Piric and a poster presentation was given about our RAAK PRO Measuring Safety in Aviation project, which received considerable attention.

### International Cross-industry Safety Conference (Amsterdam, 3-4/11/2016)

The Aviation Academy was proud to organize the 1st International Cross-industry Safety Conference (ICSC) dedicated to both practical and theoretical aspects of safety. The conference functioned as a platform to disseminate and share knowledge and experience about safety within and between industry and academia. The conference featured keynote speeches by Neville Stanton (Professor of Human Factors in Transport at the University of Southampton, UK), Johan Svenningsson (CEO Sydkraft Nuclear Power AB & Country Chairman Uniper, Sweden), David Lindley (Aviation Engineering and Safety Consultant, UK), and Bart Poolman (Lead QASHE Advisor for Heerema Marine Contractors, NL).

The ICSC proved to be a unique opportunity to bring together various industry sectors and the academia. Besides the keynote speakers, 16 delegates from various industry, academia and (inter)governmental organizations delivered their presentations and discussed with the attendants a wide range of practical applications and research results. Those speeches covered a spectrum of topics around the areas of safety metrics design, performance-based safety assessment, measuring of distances between system states, safety and efficiency, safety data sharing, future safety challenges, safety and culture, and harmonization of safety regulations.

### International Air Safety Summit (Dubai, 14-16/11/2016)

The largest industry event dedicated to safety welcomed hundreds of participants mainly from companies and regulators/authorities. For the first time, special sessions for aviation maintenance and air traffic management were held and the quality of presentations was high. Best practices, ideas to deal with major problems, and future challenges were articulated and inspired the audience. The Aviation Academy was the only academic institution which presented at the event the

current situation regarding the safety embedded in the design of small drones along with the necessity for the harmonization of the regulatory framework worldwide.

### Safety in African Aviation Conference (Livingstone, 24-25/11/2016)

The Aviation Academy was invited by the Aviassist organization to attend and speak at the event which is held annually and aims at raising safety awareness of the African aviation industry and regulators. The attendants came from various African countries and demonstrated in high interest in the international developments in the area of safety. Dr. Karanikas presented the published work of the Aviation Academy regarding the prerequisites for the development of a mature and effective safety culture.

### Annual Safety Conference of the European Business Aviation Association (Vienna, 28-29/11/2016)

Steffen Kaspers was invited to talk about our project for many small companies. The problems regarding measuring the current level of safety were presented and it was widely recognized in the industry. There was also interest in the next steps of the project.

### Athens International Airport Safety Day (Athens, 7/12/2016)

With the opportunity of the international aviation safety day, Dr. Karanikas was invited to speak at the event organized by the International Airport of Athens. After presenting briefly the theoretical framework for developing a safety culture, Nektarios discussed with the participants about the barriers in fostering a safety culture within an company and the paradoxes in the implementation of respective organizational plans. The speech was inspired by a relevant project the Aviation Academy executed at a Swedish nuclear power plant in 2015.

### ANSI Z10 Meeting (US, 23-25/1/2017)

Dr. Karanikas delivered a presentation through Skype to the participants of the ANSI Z10 meeting, which has the aim to monitor and revise Health & Safety Management standards in USA. Nektarios talked about the on-going research about the assessment of aviation Safety Management Systems with the support of the STPA technique. The approach deemed highly appealing to the board members who will consider to follow a similar approach for the assessment of Occupational Health & Safety Management Systems.

### Master Class Risk Assessment (Amsterdam, 6-10/2/2017)

For the first time in Europe, the Aviation Academy delivered a master class in Risk Assessment based on the STPA technique. Dr. de Boer and Dr. Karanikas created a highly interactive, demanding and challenging environment. The participants were introduced to systems thinking and learned how to apply systems thinking to hazard identification and risk assessment in

various areas such as safety, quality and production. The attendants evaluated the course positively in terms of achievement of the learning objectives and organization. The next master class in Risk Assessment will be offered in 13-16 March 2018.

#### Imperial College London Seminar (London, 22/2/2017)

Following an invitation from the Centre for Transport Studies, Dr. Karanikas presented the results from a research which was performed with the participation of Jeffrey Nederend, who graduated from the Aviation Academy in 2016. The research regarded the amendment of the controllability classification of events, which was recently published in Safety Science, and the results from its application to a large number of aviation safety investigation reports. The whole study will be submitted to a journal for publication.

#### European Union Health, Safety & Environment Forum (Amsterdam, 21-22/3/2017)

ORCSHE Strategies is a global network of health, safety and environmental leaders, helping companies and other organizations achieve Health, Safety and Environmental (HSE) performance excellence for more than 42 years. Dr. Karanikas was invited to present the safety culture development tool which comprises part of the RAAK PRO project and has been coordinated by Selma Piric of our team. The meeting attendants found the tool inclusive and well targeted, and they volunteered to review the tool during its further development. Three of the safety managers who participated in the ORCSHE meeting provided already their feedback on the specific tool.

#### STAMP MIT Workshop (Cambridge, MA, 27-30/3/2017)

The annual STAMP workshop at the Massachusetts Institution of Technology (MIT) gathered more than 250 practitioners and academics who have applied the STAMP model and associated tools and recognized their analytical power. The presenters talked about the results of their studies and applications, which in overall confirmed that the specific model and techniques provide to the analyst a systematic/systems approach to deal with problems in modern socio-technical systems. Dr. Karanikas attended the event and met with Dr. Thomas, who works in the lab of Prof. Leveson and further develops the STPA technique. They discussed the positive results of our Risk Assessment master class in February 2017 and Nektarios received respective guidance to further increase its quality and effectiveness.

#### 7<sup>th</sup> PESARO Conference (Venice, 23-27/4/2017)

Selma Piric presented our paper Measuring Safety in Aviation: Empirical Results about the Relation between Safety Outcomes and Safety Management System Processes, Operational Activities and Demographic

Data at the Seventh International Conference on Performance, Safety and Robustness in Complex Systems and Applications.

#### SMICG Meeting (London Gatwick, 16/5/2017)

Alfred Roelen attended the Industry Day of the Safety Management International Collaboration Group. This year's topic was 'SMS Interfaces' on which various speakers from the industry presented their view. The main common message is that interfaces between different functional areas within a company and across companies are important for safety but notoriously difficult to manage. Exchange of best practices is therefore particularly necessary.

#### Conference of the European Association of Work and Organizational Psychology (Dublin, 17-20/5/2017)

Dr. Karanikas presented a research which was performed in collaboration with Steffen Kaspers, PhD student at the RAAK PRO project, and Glenn Diepstraten, a graduate of the Aviation Academy. The research regards a tool that includes the communication variables and characteristics referred in the academic literature. This tool can be applied to record such communication parameters that are present in safety occurrences or reports where communication problems were recognized. Frequency and statistical analyses of the recorded data can reveal communication weaknesses and drive improvement efforts respectively.

#### European Business Aviation Conference & Exhibition (Geneva, 21-24/5/2017)

The bonds made with an EBAA member during the ICSC event and the EBAA safety conference (read about the respective events above), led to an invitation to talk to this large event dedicated to business aviation. Dr. Karanikas presented the results of the 1<sup>st</sup> phase of the RAAK PRO project and communicated the approach to the design of new metrics during the 2<sup>nd</sup> phase of the research. A few companies expressed their interest to become partners in our project. We have already followed-up with those companies in order to engage them in the review and application of our metrics.

#### International Society of Air Safety Investigators Seminar (San Diego, 22-24/8/2017)

The Aviation Academy was for the first time represented in the annual ISASI seminar which gathers safety investigators from all around the globe and aims at sharing relevant experiences, advancements and techniques. Dr. Karanikas presented a technical paper which regarded five metrics that are based on data from safety investigation reports and process records and can reflect the maturity level of organizational safety management aspects. The Aviation Academy will consider participating in the ISASI 2019 seminar which will be organized by TU Delft and ALPA in The Hague and must be supported by the whole Dutch aviation community.

#### FURTHER ON-GOING/COMPLETED RESEARCH ACTIVITIES AT THE AVIATION ACADEMY

1. The extent to which new safety thinking is known and applied by safety investigators (Student: Luke van der Laan, Supervisor: Dr. Nektarios Karanikas).
2. Development of a safety investigation handbook for general aviation (Student: Jamie Ruiter, Supervisor: Dr. Alfred Roelen).
3. The extent to which the criteria for designing safety recommendations are known and applied by safety investigators and professionals (Student: Salih Ogretici, Supervisor: Dr. Nektarios Karanikas).

#### Aviation Academy (Co)publications

- Plioutsias, A., Karanikas, N. & Chatzimichailidou M. M. (2017) Hazard Analysis & Safety Requirements for Small Drone Operations: To What Extent Do Popular Drones Embed Safety?, Risk Analysis, pp. 1-23, DOI:10.1111/risa.12867
- Karanikas, N. & Chionis, D. (2017) Exploring the Line between the Preventive and Punitive Character of Measures in the Frame of a Just Culture. Policy and Practice in Health & Safety, pp.1-13, DOI: 10.1080/14773996.2017.1341596
- Karanikas, N. (2017). Evaluating the Horizontal Alignment of Safety Management Activities Through Cross-reference of Data from Safety Audits, Meetings and Investigations, Safety Science, 98, pp. 37-49, DOI: 10.1016/j.ssci.2017.05.008
- Kaspers, S., Karanikas, N., Roelen, A., Piric, S., van Aalst, R. & de Boer, R.J. (2017). Measuring Safety in Aviation: Empirical Results about the Relation between Safety Outcomes and Safety Management System Processes, Operational Activities and Demographic Data, PESARO 2017: The Seventh International Conference on Performance, Safety and Robustness in Complex Systems and Applications, IARIA, pp. 9-16
- Chatzimichailidou, M. M., Karanikas, N. & Plioutsias, A. (2017). Application of STPA on Small Drone Operations: A Benchmarking Approach. Proceedings of the 4th European STAMP Workshop 2016, Procedia Engineering, 179, pp. 13-22. DOI: 10.1016/j.proeng.2017.03.091.
- Karanikas, N. (2017). Human Factors Science and Safety Engineering. Can the STAMP Model Serve in Establishing a Common Language? In Schwarz, M. & Harfmann, J. (eds.), Proceedings of the 32nd EAAP Conference, 26-30 September 2016, Cascais, Portugal, European Association for Aviation Psychology, pp.132-149..
- Karanikas, N. (2016). Exploiting Data from Safety Investigations and Processes to Assess Performance of Safety Management Aspects, Policy and Practice in Health and Safety, pp. 1-13 DOI: 10.1080/14773996.2016.1255444
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- Karanikas, N. & Dokas, I. (2016). Measuring Safety Through the Distance Between System States with the RiskSOAP Indicator. Proceedings of the 1st International Cross-industry Safety Conference, Amsterdam, 3-4 November 2016, Journal of Safety Studies, 2(2), pp. 5-17. DOI: 10.5296/jss.v2i2.10436
- Kaspers, S., Karanikas, N., Roelen, A., Piric, S., van Aalst, R. & de Boer, R. J. (2016). Exploring the Diversity in Safety Measurement Practices: Empirical Results from Aviation. Proceedings of the 1st International Cross-industry Safety Conference, Amsterdam, 3-4 November 2016, Journal of Safety Studies, 2(2), pp. 18-29. DOI: 10.5296/jss.v2i2.10437
  - Plioutsias, A., Karanikas, N. & Chatzimihailidou, M. M. (2016). How Completely and Similarly Do Safety Authorities Address Hazards Posed by New Technology? A Paradigm from Small-drone Operations. Proceedings of the 1st International Cross-industry Safety Conference, Amsterdam, 3-4 November 2016, Journal of Safety Studies, 2(2), pp. 79-90. DOI: 10.5296/jss.v2i2.10442

RAAK PRO partners



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