Measuring safety in aviation

Newsletter

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AMSTERDAM UNIVERSITY OF APPLIED SCIENCES (AUAS) – AVIATION ACADEMY

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Welcome! Status & near future of the project

by Nektarios Karanikas

Dear partners,

On behalf of our research and project teams, I am glad to introduce this first newsletter, which is linked to the RAAK PRO project but will also serve as a platform for sharing safety and human factors news among all project partners.

Therefore, the scope of the newsletter is not only to inform you about the progress of our research and the next steps, but also communicate the safety related activities of all partners. For example, companies would share best practices and experience, universities and research institutes could share studies, papers and articles, authorities would inform us about new / changed rules etc.

We plan to publish our newsletter every 3-4 months, so Robbert van Aalst, our project assistent, will remind to you the opportunity to contribute.

What we did so far

Following the initiation of the core project activities after the kick-off meeting, the research team, with the support of the expert knowledge group, completed a review about the existing safety metrics in aviation. The results of the review were highly interesting and mostly valuable for the next phases of the project. We indicated a plethora of safety metrics proposed by literature or/and applied in the aviation industry, the validity of which has not been yet fully studied. We envisaged that systemic safety models have the potential to complement the existing ones in terms of developing new safety metrics.

In overall, the review confirmed the need for this research project and set the foundation for the next steps. So, we are glad that we are together on board of this important research for aviation! The report will be sent to all partners next month after its approval by the steering committee.

Next steps/ milestones ahead

Now it is time for more on-field action! The next big and important step is to visit our partner companies in order to:

- Explore what safety metrics they use, what do those mean for the organization, how are those used and monitored.
- Collect their views about other safety metrics referred in literature or applied in the industry.
- Collect representative samples of data related to those safety metrics.
- Offer to the companies our knowledge and expertise in safety culture development and new safety thinking. This is a great free-of-cost option that companies might choose in turn for their support to our project. We will enrich the topics in the future, but companies can also require specific advice on an area of concern.

I know it is part of the project plan, but I like to remind that confidentiality is secured! The final results will not allow identification of any partner. However, each company will receive a short customized report regarding the analysis results of their own data. Hence, benefits for the industry, but also benefits for each company!

The surveys will be mainly conducted by Steffen Kaspers (our PhD researcher) accompanied by one graduate student and another member of the team (Alfred Roelen, Selma Piric, Robbert van Aalst or me). Robbert van Aalst coordinates the arrangements for the surveys.

We will all be happy to meet you on site!

I look forward to our further cooperation and making this project a success!

Best regards,

Nektarios Karanikas

The RAAK PRO research team

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

Agenda AUAS 2016

20-24 June – Master Class Human Factors and Safety

03-04 November – International Cross-industry Safety Conference

10-11 November – INAIR Conference 2016

12-16 December – Master Class Lean MRO

Activities

EASA Working Group

The Aviation Academy is the only university participating in a group of representatives from EASA, European aviation authorities and the industry with the goal to develop a cross-domain tool for the evaluation of aviation Safety Management Systems. The group was formed at the end of 2014 and meets every about 2-3 months; the most recent meetings were held in September 2015, December 2015 and February 2016. The group initially evaluated the practicality of various existing SMS assessment instruments and concluded that the tool produced by the Safety Management International Collaboration Group (SMICG) would be the basis for the group's work. At this point, the group amends and populates the SMICG tool; the final product is expected to be delivered in middle 2016. We will keep you informed about the work progress.

Flight Safety Symposium

Dr. Nektarios Karanikas presented to the Flight Safety Symposium (London, 15 – 16 September, organised by Flightglobal) the safety culture development framework generated by the Aviation Academy in the frame of a contract research commissioned by a European Nuclear Power Plant. The presentation included also the findings of the respective research as means to raise awareness of the audience about possible challenges to be encountered during the implementation of a safety culture program. The audience seemed engaged in the topic and was interested in the operationalization of the aspects of the framework developed by the AA.

Safety at Nuclear Powerplant

In September 2015 Prof. Dr. Robert J. de Boer and Dr. Nektarios Karanikas delivered a workshop to the senior management team of a European Nuclear Power Plant in order to present the results of two research projects accomplished in the plan, discuss the implications for the organization, engage managers of various departments in the safety management initiatives and raise the profile of the human factors department. The first project explored the quality of the recommendations generated through safety investigation reports and revealed the strengths and weaknesses of the company in terms of their safety thinking, design of investigation procedures and management of safety recommendations. The second project addressed extent to which the company plans its safety culture development in comparison with literature references and wide industry guidance. The results showed that the organization has planned for about 60% of the safety culture initiatives referred in literature and needs improvements in the way it fosters and monitors safety culture. The reactions of the workshop participants were extremely positive and their commitment to consider safety as inextricable factor of their decision-making was expressed.

3rd STAMP EU Workshop

The AUAS presented the 3rd European STAMP Tutorials and Workshop from 4th to 6th October 2015. Traditional system safety approaches are being challenged by the introduction of new technology and the increasing complexity of the systems we are attempting to build. STAMP is a new systems thinking approach to engineering safer systems described in Nancy Leveson's book "Engineering a Safer World" (MIT Press, January 2012). While relatively new, it is already being used in space, aviation, medical, defense, nuclear, automotive, and other sectors. The workshop attracted about 90 attendants from Europe and overseas and included two keynote speakers (Prof. Sidney Dekker from Griffith University, and Dr. John Thomas from the MIT) and 22 presentations from various industry sectors and the academia. 11 of the papers submitted were published in Procedia Engineering (Elsevier) and the feedback received was in overall encouraging in terms of the content and the organization of the workshop.

ESReDA seminar

Dr. Alfred Roelen presented in the 49th ESReDA seminar the combined results of two graduation projects during which AA students analysed safety investigation reports published by the Dutch Safety Board (DSB) and the Australian Transport Safety Bureau (ATSB) as means to explore the extent to which new safety thinking and models have been embraced by those authorities. The results indicated differences between the DSB and the ATSB whereas it revealed that their safety thinking has not changed much over time. The framework which was used included 10 aspects of new views on human error and accident causation and is currently applied to reports released by the Transport Canada and the UK Civil Aviation Authority. We will keep you informed about further results.

Other conferences

Prof. Dr Robert J. de Boer presented at the European Chapter Conference of the HFES (Human Factors & Ergonomic Society) in Groningen (the Netherlands) in October. Work he presented was by student Pedram Soltani and others on the use of speech prosodies (ie. Sociometric signals) in assessing crew resource management performance. This work is currently being continued at the Dutch Air Force. Also Karel Hurts, an affiliated researcher of the Aviation Academy, presented a new model of automation surprise based on our survey amongst 200 commercial pilots.

Mrs. Selma Piric attended the conference "Human Factors in Aviation Safety", organised by the Chartered Institute of Ergonomics and Human Factors (UK) from 9th to 10th November 2015. p. 3

Dr. Nektarios Karanikas attended the conference "Can we do things differently in aviation safety?" organised by the Royal Aeronautical Society (UK, 26-27 November 2015).

Research recently launched at the AA

1. Development of Safety Management Systems assessment tool based on the STPA methodology
2. Development of a tool for evaluating quality of recommendations formulated in accident investigation reports. 3 students will apply the tool to investigation reports published by the Dutch, Australian, British, Canadian and USA authorities.
3. The extend to which new safety thinking is reflected in the safety investigation reports published by the UK Civil Aviation Authority and Transport Canada.
4. Application of a new accident classification to a large sample of safety investigation reports.

Publications

1. Karanikas, N. (2015). "Correlation of Changes in the Employment Costs and Average Task Load with Rates of Accidents Attributed to Human Error", Aviation Psychology and Applied Human Factors, 5(2), pp. 104-113.
2. Plioutsias, A. & Karanikas, N. (2015). "Using STPA in the Evaluation of Fighter Pilots Training Programs", Proceedings of the 3rd European STAMP Workshop, STAMP EU 2015, 5-6 October 2015, Amsterdam, The Netherlands, Procedia Engineering, 128(1), pp. 25-34.
3. Passenier, D. Sharpanskykh, A. & de Boer, R. J. (2015) "When to STAMP? A Case Study in Aircraft Ground Handling Services", Proceedings of the 3rd European STAMP Workshop, STAMP EU 2015, 5-6 October 2015, Amsterdam, The Netherlands, Procedia Engineering, 128(1), pp. 35-43.
4. Pappot, M. & de Boer R. J. (2015) "The Integration of Drones in Today's Society", Proceedings of the 3rd European STAMP Workshop, STAMP EU 2015, 5-6 October 2015, Amsterdam, The Netherlands, Procedia Engineering, 128(1), pp. 54-63.
5. Karanikas, N. (2015), "Human Error Views: A Framework for Benchmarking Organizations and Measuring the Distance between Academia and Industry", Proceedings of the 49th ESReDA Seminar, 29-30 October 2015, Brussels, Belgium.

Human Factors in Aviation Safety Conference

November 9, 10 East Midlands Airport

By Selma Piric

The Chartered Institute of Ergonomics & Human Factors (CIEHF) is a UK-based professional body with over 1700 members. The CIEHF raises awareness of the discipline, sets and maintains professional standards, supports its members, and promotes networking and communication.

In addition to organising the annual conference which takes place every April, the CIEHF has organised – for the first time ever – a conference specifically targeted at one industry: Aviation.

Among the delegates and presenters were professionals from (amongst others) easyJet, NATS, EUROCONTROL, BAE Systems, QinetiQ, the Air Accident Investigation Branch, and CAA. Academia was represented mostly by Cranfield University and Coventry University.

Because there were many speakers during both days (each speaker only being allowed to speak for 15 minutes) I will sum up a selection of the presentations by topic.

Just & Safety Culture

One of the major and hot topics (still) within the aviation industry is Safety Culture. One organisation that has recently launched a safety culture initiative is easyJet, by surveying their engineering community using a safety culture tool that was developed by EUROCONTROL. The results that were derived from the survey and workshops will be used to develop solutions, communicate these to the department, and re-assess the safety culture. Then, this strategy will be used in the same way for other departments as well. This is a massive undertaking considering the number of routes, fleet, crew, and other personnel at the company. This time consuming initiative has come across many practical difficulties including staff by in, staff availability, shift hours, engagement fatigue, and various work sites.

Another type of culture that recently has become even more relevant is just culture, which is *a culture in which frontline operators or other persons are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but in which gross negligence, willful violations and destructive acts are not tolerated*. EASA has established that an organisation must now ensure that a just culture is adopted. However, the regulatory article (EC Regulation 376/2014) does not clarify what the difference is between "willful violations" and practical workarounds due to procedures not working on the work floor that could be seen as willful violations. There is a big challenge here for authorities and regulators to define the difference and to be able to apply them within aviation operations.

Unmanned Aircraft Systems (UAS)

As UAS are taking over the world by a storm, so is the number of research initiatives into this topic. BAE Systems has conducted research into the human factors issues associated with UAS to better understand the performance of the remote human operator. Key considerations in the research include 1) command and control link delays between operator and UAS, which also defines the impact of the UAS operator interaction with ATC 2) Handover of control of the vehicle between operators and remotely located operators 3) Manual override of the system and 4) Detect & Avoid impact on the operators' performance. One major result from the study is that the operator not only would like to be the sender of information: the operator would like to receive feedback on whether or not the system has received their command. But there are many more human factors related issues that require attention, for example, the UAV type, the area flown, the design of the HMI, operator trust in the system, operator workload, the supervisory framework, the ground infrastructure, the team roles and responsibilities and the related CRM, and the operational context.

Human-Machine Interaction

Ever since the artificial horizon was first used in 1929 in the form of a gyroscope, not much has changed in the cockpit in terms of displaying information, and this includes also the advanced technologies of the glass cockpit. In fact, many of the instruments and their displays have hardly changed or have even caught up on the knowledge that we now have of how the human brain actually works and processes information. Dr. Wilson from Coventry University illustrates this by the following notion: the Attitude Indicator, the Horizontal Situation Indicator (HSI), and the Navigation Display all position the aircraft at a different perspective: the Attitude Indicator forces you to see the aircraft as if standing from behind the aircraft, the HSI looks at the aircraft from above, while the Navigation Display also looks at "the triangle" in relation to the surrounding area. Because these indicators and display all look at the aircraft from a different perspective (forcing the pilots brain to be able to position the aircraft using 3 different angles, which could extend cognitive activity, decrease cognitive capacity and potentially lead to confusion), he believes that the current cockpit design is inherently flawed and that this has contributed to CFIT and irrecoverable escalation into loss of control for a number of incidents and accidents. He says that these aviation paradigms have contributed to the loss of – for example - AF 447 in 2009 and the serious incident with China Airlines 006 in 1985, where the crew became convinced that all of the three attitude indicators in the 747 cockpit were faulty (they were not). Dr. Wilson would like to see these dormant and un-addressed issues eliminated through a complete redesign of how information is displayed in the cockpit.

Dr. David Thompson, who has presented about mode switching and mode confusion (cognitive mismatch between a crew members' mental model and the real world), illustrates in what way this redesign could be approached: organise information around goals (what does the operator need to know); support the formation and maintenance of situational awareness (how can the information be presented unambiguously ensure the best possible processing); present Comprehension level information directly; provide assistance for Projections level information; and, elimination of multiple similar systems delivering similar outputs.

Predicting the Fatal Flaws: Can we do things differently in aviation safety?

November 26-27, Virgin Atlantic training centre (Gatwick, UK)

Organiser: Royal Aeronautical Society (RAeS) / Human Factors group

By Nektarios Karanikas

The conference was attended by about 55 delegates mainly from the civil and military aviation industry and authorities, included 26 presentations about current challenges in the aviation industry, and 4 plenary sessions. This was the first time the Aviation Academy attended an event of the specific group; half of the presentations were just views and concepts, but the other half clearly addressed current and future problems in aviation; those might worth including as research topics in our portfolio. I met some members of the RAeS human factors group and they look forward to our cooperation; the group consists of about 20 active and 20 following members from many countries; the Netherlands are not represented so far. In general, RAeS is a globally recognised institute with thousands of members worldwide. Our close collaboration with the RAeS is expected to increase further our visibility; pending my membership application for becoming member of the RAeS, the chair of the human factors group invited me to join her team.

Actually, there was little reference to prediction of flaws; the speakers addressed many problematic areas that we still need to resolve as aviation industry. The subjects that were discussed and attracted much attention were:

1. The lag of regulations in a continuously changing world and the common hazards that might threaten security across the industry (i.e. attacks against internet protocols, VoIP applications and satellite communication channels). On the other side, a representative from the USA FAA explained the difficulties regulators meet when they must balance amongst competing goals and satisfy multiple stakeholders, the public, market, politicians etc.
2. The on-going developments in civil and general aviation and drones' operations regarding the avoidance of mid-air collisions, and the need for an intra-vocational cooperation (ATM, pilots, ground services etc.)
3. The high importance of the context in which studies are performed and metrics are developed; we must understand the real meaning the figures represent. Some research results regarding a first attempt to measure Safety II (i.e. emphasis on successes and not only failures) were presented; however, the researchers measured behaviours (e.g., how many times a check-list was used by the flight crew) and did not reveal the underlying mechanisms. Safety II encompasses the urge to indicate how and why people make decisions and enact and not just observing activity patterns.
4. The need for an organizational view of the adverse events and continuous improvement of resilient abilities (i.e. anticipation, monitoring, response and learning). Data, information and knowledge sharing across industry sectors and stakeholders is required in order to further improve safety. It is time to move from our simplistic approach of operations to the recognition of complexity; we must focus on controlling the present than just analysing the past.
5. The effects of conflicting zones on air traffic and the challenges when assessing risks without adequate information from intelligence agencies and national authorities. In this frame it was claimed that a security management system (SeMS) must be operated as we now run Safety Management Systems (SMS).
6. The transition from the old corrective ergonomics (i.e. fix the problem after the event), to interaction ergonomics (i.e. design the system so to minimize errors due to poor interactions between machines and operators), and, quite recently, to the integration ergonomics (start designing systems around the operator by including the end-user as part of the system).

RAAK PRO partners