“Flight Safety in Combat Training: A revised pilot’s error framework for EU Air Forces”

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Abstract – Denial or failure of an organisation to improve its processes can cause nonconformities and defects. The purpose of this paper is to present an ongoing research for military aviation organisations in order to further improve flight safety and safety culture. The requirement is a revised, more comprehensive military pilot’s error framework. The intent is to start to bridge and compare existent mostly reactive, Flight Safety programmes among NATO/EU Air Forces and show how a more proactive and predictive Safety Management System can be realised. The thesis outcome aims to produce and document meaningful recommendations for military operators to begin addressing the overall problem of flight safety, by equipping them with a standard template for managing all safety risks affecting military aviation organisations to remain at an acceptable level of safety (ALoS) or to a level as low as reasonably practicable (ALARP).

Overview

The aim of this paper is to present the concept methodology used for a scientific multi-national research in order to further improve flight safety and safety culture in NATO/EU Air Forces. (NATO/EUAF). The requirement is a revised, more comprehensive military pilot’s error framework. The intent is to compare existent, mostly reactive, Flight Safety programmes among NATO/EUAF and show how a more proactive and predictive Safety Management System (SMS) can be implemented neither with nonconformities nor potential defects. As a first step, in what will be a quality improvement process, this dissertation will defend that for such military organisations that train their own pilots, pilot performance must be mostly viewed in terms of the organisational context in which it takes place (Heinrich et al. 1980).

Besides, this paper argue that although the existing aviation safety agencies regulations, guidance’s and applications are mainly directed to civil aviation authorities, a plethora of those may be as well applicable and mandatory to military organisations. A core, international civil aviation organisation (i.e. ICAO) is beginning to require through productive cooperation, coordination and exchange of ideas and data, the implementation of effective Safety Management Systems (SMS) by providing to civil aviation authorities all the necessary tools for the related training courses. On the other hand, prestigious NATO/EUAF have proposed and established over the years numerous other Safety Programmes, Safety Cases and Operational Risk Management (ORM) models for developing flight safety in combat training, defining and aligning competitive advantage. As a result, this research will focus initially to provide an overview and comparison of selected “well-liked” models used in the development and appraisal of NATO/EU national’s defence flight safety models, as well as, a brief discussion of schools of aviation agencies thought and theory. Taking into consideration the available literature reviews and the provided access to several defence organisations, various selected flight safety models and tools will be compared systematically for the first time in one single dissertation.

With the aim to produce and document meaningful recommendations to enable military operators to begin addressing the overall problem of achieving an acceptable level
of Safety (ALoS) or to a level as low as reasonably practicable (ALARP), the potential thesis will examine to what extent significant NATO/EUAF take account of fundamental components of SMS, such as Safety Policy, Safety Risk Management (SRM), Safety Assurance (SA) and Safety Promotion. Finally, this dissertation aims to close with the proposal of a common “Flight Safety in Combat Training” pilot’s error framework for EU Air Forces, exemplified by “Deem the Métis” model.

Motivation

All humans make errors as an inevitable consequence of being human (Adams, 2006; Helmreich & Merritt, 1998). At the end of the twenty century, sophistication and reliability of fighter aircraft capabilities were improved considerably and increasingly challenged the abilities of pilots. Consequently, aircrew error began to play a progressively larger role in aviation accidents, as aircraft became more sophisticated and reliable (Shappell & Wiegmann 1996). The role of human error in aviation accidents is well established with previous studies reporting that between 70% and 80% of aviation accidents result from some type of human error (Lourens, 1989; Shappell et al, 2004). Moreover, most of these rates of accidents occurred not only in poorly or insignificant civil and military aviation organizations, but also in prestigious, war experienced and combat ready Air Forces, such as many of the remarkable NATO/EUAF.

Only during 2000-2010, the Hellenic Air Force (HAF), just one of the prominent Air Forces, counted fatal losses of 35 pilots and 60 aircrafts, so many as two of its fighter squadrons. In fact, most of these Category “A” aviation mishaps (>90%), safety occurrences and incidents have not occurred due to faulty control equipment or due to bird strikes, but rather to human error, rarely including mistakes made by air traffic controllers and aviation maintenance personnel. As a result, the greatest potential for reducing aviation accidents lies in understanding the human contribution to accidents (Wiegmann & Shappell, 2001). When the number and consequences of errors are reduced, safety is enhanced (Adams, 2006; Helmreich & Merritt, 1998). However, human performance doesn't take place in a vacuum; it always takes place in an environment engendered and maintained by management, government, and frontline personnel (Lauber, 1995), and flight operations occur within the context of three cultures – the national culture surrounding the organisation, the professional culture of aviators, and the company’s organisational culture (Helmreich, R.L. 1998).

Therefore, nowadays supervisors (at all levels) acknowledge that errors are often based on organisational failings (RAF Bulleting, 2009). Generally speaking, the most elusive of latent failures revolve around issues related to resource management, organisational climate, and operational processes (Shappell, S.A, and Wiegmann, D.A., 2000). Indeed, all professional pilots in both the military and commercial aviation industries operate within an organization or company that regulate their time and performance in the cockpit. These organisations are also responsible for instituting appropriate procedures that ensure safe operations of the aircraft (Shappell and Wiegmann 2000).

Furthermore, Reason (1990) traced the causal chain of events back to the supervisory chain of command. As such, he identified four categories of unsafe supervision: inadequate supervision, planning of inappropriate operations, failure to correct a known problem, and supervisory violations. Fallible decisions of upper-level management directly affect supervisory practices, as well as the conditions and actions of operators. Unfortunately, these organisational errors often go unnoticed by Aviation Safety professionals, due in large part to the lack of a clear framework from which to investigate them. Therefore, from the organisational perspective, aircrew errors and subsequent
accidents are believed to occur when high rank managers and supervisors fail to set up basic conditions within the organisation that promote flight safety (Reason 1990).

Last, but not least, many Air Forces are influenced by CSDP and NATO security policies, guidelines and directives, share common interests and contribute to the field missions and military capabilities concept of these organisations. Since interoperability is one of the main challenges which are unmoving in debate among several EU and NATO members’ countries, Flight Safety in Combat Training may be one of the key elements that should be addressed.

**Literature Review**

The need to address the psychological or ‘human’ side of aviation safety sparked the emergence of several human error frameworks, such as the Human Factors Analysis and Classification System (HFACS). HFACS originally developed and tested within the U.S. military as a tool for investigating and analyzing human causes of aviation accidents (Wiegmann & Shappell, 2001). Drawing upon Reason’s (1990) concept of latent and active failures, HFACS describes four levels of failure: 1) Unsafe Acts, 2) Preconditions for Unsafe Acts, 3) Unsafe Supervision, and 4) Organisational Influences (Shappell, S.A, and Wiegmann, D.A.,2000).

Although, recent investigations based on HFACS usually establish what and how injuries occur, it is often more problematic to identify why the injuries occurred, why the aircrews failed to escape and/or why they did not survive (M.E. Lewis, 2009). Furthermore, there is still a little empirical work that formally describes numerically the relationship between the levels and components in the model, such as the organisational structures, psychological pre-cursors of errors and actual errors (Wen-Chin Li & Don Harris, 2006).

In addition, a core civil aviation safety agency (i.e. ICAO) have launched through productive cooperation, coordination and exchange of ideas and data, the requirements for the implementation of effective Safety Management Systems (SMS), Fatigue Risk Management Systems (FRMS), State Safety Programmes (SSP) and Aviation Incident Reporting Systems (AIRS) by providing since 2008 to National Authorities all the necessary tools for the related training courses. On the other hand, prestigious NATO/EUAF have proposed and established over the years numerous other Safety Programmes, Safety Cases and Operational Risk Management (ORM) models for developing flight safety in combat training, defining and aligning competitive advantage.

**Safety Programme Vs SMS:** An Air Force Safety Programme is just different from a Safety Management System (SMS). An SMS is primary proactive and predictive. It is one method of requiring certificate holders to carry out their own safety risk and quality management. It considers hazards and risks that impact the whole organization, as well as risk controls (ICAO SMM, 2009). On the contrary, a flight Safety Programme is primary reactive and typically focuses on only one part of the system – the Air Operations (Safety Management International Collaboration Group – SM ICG, 2009).

**Safety Case:** UK MoD and Royal Air Force (RAF) officially published in 2002, the development of a Safety Case (i.e. JSP318B) that could provide a compelling, comprehensible and valid case that a system is safe for a given application in a given environment. However, on 28 October 2009, NIMROD accident report came to reveal organisational and safety culture shortfalls, leadership failures, an ineffective and wasteful Safety Case and a non “fit for purpose” Military Airworthiness System as the major causes for the loss of RAF Nimrod XV230 in Afghanistan on 2 September 2006 (Charles Haddon - Cave QC Report,2009).
ORM Vs SRM: Air Force’s flight operations perform in a rapidly changing environment. Any changes to the situation (i.e. operations environment, needs for the unit) require a model that could immediate re-evaluate all possible risk level changes per step one. To this sense, the adopted by NATO/EUAF Operational Risk Management (ORM) model is neither dynamic nor responsive to abrupt changes. On the other hand, Safety Risk Management (SRM) is an iterative system with an internal continual cyclic process (ICAO SMM, 2009) and easily adjustable to any changes. Moreover, Cost Benefit Analysis - a key parameter that ORM model simply ignores - is at the heart of SRM and encompasses both the direct (i.e. physical damage, injuries) and the in-direct costs (i.e. damage to the reputation of the organization, loss of staff productivity) of the system.

On the whole, it is difficult to get an overall idea of how to classify and value all these flight safety management systems, tools, models and programmes. Undoubtedly, NATO/EUAF formally gives the impression of pursuing a goal to maximize their military aviation safety. However, it seems so far that each Air Force in that field isolated and independently, follows a different path in order to achieve an apparently common goal (emphasis added).

Research - Methodology

The requirement is a core, more comprehensive military pilot’s error framework around which a new safety policy can be promoted, a new safety culture can be adopted, new lessons from civil aviation can be learned, new investigative methods can be designed and existing accident databases can be restructured. Nevertheless, the key research question is whether a common driven model or just a further quality improvement on existing national safety programmes will be more beneficial to EU Air Forces and adequate to promote flight safety in combat training among them. As a result, a number of steps will be developed to break down the task, as shown in fig.1.

To begin with, seven prestigious NATO/EU Air Forces, i.e. Royal Air Force (RAF), French Air Force (FAF), Hellenic Air Force (HAF), Royal Netherlands Air Force (RNLAf), Italian Air Force (IAF), Spanish Air Force (EdA) and German-Luftwaffe/ Air Force (GAF) will be initially compared. Based on the fundamentals prerequisites for the development of an SMS, a separate System Description for each Air Force (AF) will set off the project. The thesis initially plans to provide a better understanding of the environment and the existent safety culture in which each AF operates, rooted from personal working experience; extensive literature review; relevant and official statistical data; investigations of major accidents and Subject Matter Experts (SME’s) reports; Pilot’s Management and Safety survey’s; questionnaires such as Safety Attitudes Questionnaire (Sexton et al., 2000; Thomas et al., 2003); Flight Management Attitudes Questionnaire (Helmreich et al, 1993); research on Safety Departments; Aviation Safety Industries/Organisations (i.e ICAO, EASA, FAA) and pertinent institutions.

Besides, this study will identify for every of the abovementioned Air Forces which of the components and elements of an SMS are currently in place and which components and elements must be added or modified to meet the SMS requirements (Gap Analysis). In addition, the results will be compared with the national and international requirements for establishing an SMS. An SMS implementation plan will be projected by using qualitative and quantitative research methods and the model Gantt chart. This plan will also focus on findings based on errors at the operational level as well as organisational inadequacies at both the immediately adjacent level and higher levels in the organization. At the end, the projected SMS plans will illustrate how NATO/EUAF can implement their own SMS on the basis of lessons learned from civil aviation, national requirements, international
Standard and Recommended Practices (SARP’s), the findings of the System Description and the results of the Gap Analysis.

However, where really is the safety process level of a specific Air Force today? Which level of improvement is looking for and which level is possible? Therefore, a concurrent methodology, exemplified by “Deem the Métis” model in fig.2, comes to propose as well a quality improvement method for the reduction of safety process variability and other organisational issues that have an impact on human performance, during a hypothetic ICAO SMS implementation within Air Force organisations.

Figure 1: Research Methodology
Without a doubt, this project is subject to a number of constrains. In an effort to surpass potential complexities, it will be beneficial to consider the following suggestions, prior to promulgation of a common NATO/EUAF Safety Management System rule.

(a) Formation of an independent National or EU-driven Military Airworthiness Authority (MAWA).

(b) Coordination Plan that MAWA should develop and give to the people in key MoD’s positions the authority to set priorities for a revised pilot’s error framework for NATO/EUAF.

(c) Regulation for protecting SMS safety information and proprietary data against disclosure and inappropriate use.

(d) Assigned Accountable Executive who will be final responsible for the effective and efficient performance of the military organisation’s

(e) Reliable planning group within each NATO/EUAF organization responsible for implementing the SMS framework.
**Instead of Epilogue**

This thesis aims to defend a proposal in the critical domain of aviation safety, to fill gaps in existing research, to cross departmental boundaries and to extend understanding in a particular topic, such as Flight Safety in Combat Training. So far, NATO/EUAF through various Flight Safety Programmes isolated and independently, follow a different path in order to achieve an apparently common goal. Therefore, it is important to provide an in depth scientific multi-national research, in order to further improve flight safety and safety culture in military aviation organisations. The outcome will produce and document meaningful recommendations for military operators and contribute to a contemporary approach for addressing military pilot’s continual errors in the cockpit.

At the end, will NATO/EUAF achieve an acceptable quality sigma level of safety by adopting SMS? That’s really not the question. The question is: “How much are existent flight safety process variations and defects costing them?”

**Bibliography**


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