A SOCIO-TECHNICAL APPROACH TO SAFETY
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The requirement for commercial operations to implement safety management systems (SMS) coming into force, comes in a time where our approach and understanding of safety are changing. Even though traditional assumptions are much in common place, the regulator has adopted and mandated a seemingly straight-forward tool, which is, however, based on new, often not well explained or understood, and even conflicting philosophies and assumptions. Organisations and front-line workers find themselves in a dilemma, often faced with conflicting manifestations in a time where helicopter safety is already under much scrunity from a variety of stakeholders. In this paper we have a closer look at the implications of our history and the new requirements of safety management and its consequences in present times at operational level. Based on lessons learned, feedback, literature and observations, it is proposed to take into account and appreciate the valuable contribution of professional people in day-to-day operations, to maintain and improve our standard of operation with an increased focus on safety and (their) well-being.

Introduction

Developments in safety thinking and continuous improvement have built and maintained an excellent safety reputation for aviation. Nevertheless, innovation, new technologies and new ways of working are being introduced to improve safety and reduce risks of accidents and incidents.

The year 2013 has been a difficult year in terms of safety for the helicopter industry, especially in the UK. Another fatal crash on British soil this year has added even more strain. In addition to already existing economic, environmental –, operational – and safety challenges, the industry faces public opinion and negative publicity, more powerful now than ever before. In the U.S., the NTSB (National Transportation Safety Board) have put Helicopter Safety on their top 10 'most wanted' list) early 2014.

The use of helicopters is promoted as they can be widely, effectively and safely used in operations where no other machine would have the same capabilities, including commercial transport. The promotion goes hand-in-hand with investment, research, legislation, training and more. Flight data monitoring (FDM) and safety management systems (SMS) are examples of initiatives that support organisations for this improvement.

SMS is embraced by authorities, regulators and associations. SMS is, or otherwise soon will be, a requirement, leaving no option for organisations but to integrate SMS into their organisation. In this scenario, meeting resistance and observing signs of apprehension regarding SMS is a concern.

Delay, limited success or even counterproductive results in managing safety are booked when either technological or social aspects are not given sufficient attention. And, we find that improved technology, legislation, training and increased insight in what caused failure in our safety systems, does not suffice (anymore) in achieving (even) higher safety goals. We need to understand our successes in daily operations better and become more pro-active.[1]

A deep concern of the author is the increased tendency within the field of safety (management) to apportion blame at individuals operating at the sharp end of an operation, should something have gone wrong. This is a trend becoming increasingly visible in other industries and society as a whole also. This trend is counter effective for improvement in safety and leads to the alienation of our professionals. A cause of this development are deep-rooted beliefs and assumptions about technology, safety and (risk-taking) behaviour in our industry and bear a very strong link with both safety – and organisation culture. Together we explore such relations and discuss the appropriateness of blame.

A conclusion is that we should be able to improve safety without the costs of making our industry less attractive due to inappropriate blame, related stress and ultimately, alienation of our professionals. The suggestion is that we can improve and that they are key to success for achieving ambitious safety ànd operational goals.

The Development of Safety

The concept of safety has considerably changed over years. In aviation in the early days, safety as we know it today, hardly existed. Flying was based on science, underdeveloped technology and skill, mixed with a lot of passion, bravery, trial and error.[2] Accidents and incidents were common.

In the 'technological era' we mainly looked at technology, materials and structures and improved all these to a very high standard. Standards were documented and regulations on technology, quality and reliability of materials and techniques became very important, to the extent that aviation has become heavily regulated.

Later, we discovered, most through accident investigation, that technology and materials were not the main safety concern anymore, the 'human factor' component was introduced in the seventies and still is a safety concern these days.[3] In this 'Human Factors era' the focus was to identify, prevent and reduce effects of human error.[4]

Managing safety in a structural way, was first introduced late last century but did not find widespread acceptance until relatively recent. Many organisations stil struggle with the concept and the daily operation, but positive feedback and results are heard. SMS fits the philosophy of an 'organisation accident' where 'latent conditions', 'hazards' and other 'hidden defects' may cause harm to our operation. Identifying, assessing and mitigating these, are at the heart of Safety Management.

The 'systemic era' is an even more recent way to look at safety and could be seen as a reaction to the technoligical, human and organisation era. It includes the complexity of our organisations and operations these days and integrates these into this safety philosophy.[5]

It is important to look at the history of safety philosophy, as we need to understand what our management tools, regulations and decisions are based on. Even though the changes in 'safety eras' are described in literature used by most operators (ICAO, Sintef and more) the implications are often overlooked. We need to understand what is expected from our organisations and people, before we put all the tools in place.

Even though very briefly described above, it makes a significant difference in safety management if safety is defined by technological and regulatory aspects only. Including 'the human factor' and later 'organisational factors', have major implications on how your SMS is organised, used, managed and accepted.

Our (safety) philosophies are based on contemporary insights, assumptions and beliefs shared by our customers, the public, regulator, staff and stakeholders: a different era means different beliefs, possibly value contestations and

can prove challenging when integrating 'new' safety systems in organisations.

(Risk-taking) behaviour
Including human behaviour into safety analyses, training and regulation has been accepted widely. Successful training has been developed along the lines of Human Factors and Crew Resource Management, for example. Unfortunately and much less positive, simultaneously and related, a 'blame culture' has developed with implications for safety and safety management today.

For decades, a common and widely accepted assumption is, that for humans, risk-aversive behaviour is natural and rational and risk-seeking behaviour abnormal, even though there is hardly much evidence to support this assumption. [6] This assumption, however, is still very strong today, also in aviation. Possibly because risk has a negative connotation that it did not always use to have.[7] Some argue this is true: 'if a person can choose between A and B, they will choose the least 'risky' option. Yet, choices in life are hardly between 'A' and 'B', do not enable us to oversee the consequences and always contain an element of hope and fear [8] so are not necessarily rational. In contrast and more plausible, it depends on the (organizational) culture and its dynamics to what level indeed risk-aversive behaviour is 'normal' and risk-seeking behaviour not-favourable.[9]

Research has been done about attitudes and behaviours and especially informally, we talk about 'bad attitudes and behaviours' in relation to accidents and incidents. Even though attitude can be described as an intention to behave in a certain way,[10] it is not an accurate predictor for behaviour. An attitude can be defined as a positive or negative evaluation of people, objects, event, activities, ideas, or just about anything in your environment,[11] therefore, an attitude is learned through direct or indirect experience. People do not 'just' develop bad attitudes in isolation: influencing attitudes means changing those experiences.

In general, people come to work to do a good job.[12] This also is an assumption on attitude, but most pilots, technicians and others perform well and they are trusted with great responsibilities. An unfortunate outcome does not justify a total reverse in that given trust or judgment of capabilities.

Error and Violations
'Errors' and 'Violations' are often used to describe human behaviour as a root cause for any unwanted or undesired outcome. 'Intent', (with

intention or purpose [13]) separates error from violation. Three types of error are laps, slips (caused by lack of attention) and mistakes (insufficient information or time to make proper judgement).[14]

Errors are natural and every human errs [15] and human error is a natural part of any socio-technical system [16]. Violations, however, are seen as a different category: violations occur when people knowingly or wilfully bent rules.[17] At the same time, they are seen as ... '*a natural response of motivated and competent individuals, often selected for their ability to show initiative, in the face of poor planning and the existence of alternative ways to get the job done.*[18]

Violations, or non-compliances, have been identified as the most frequent type of dangerous activities in terms of accident outcomes.[19] Therefore, managing non-compliance can be seen as a very important strategy to improve safety and models have been developed to assist organisations to manage non-compliance based on rewards and punishment.

Unfortunately, behaviour is hard to manage, especially based on unrealistic behaviourist assumptions on reward and punishment. Also, and interestingly, 'violations' are categorised in different types, of which *at least* two would be unintentional, which makes the earlier divide between error and violation a lot less clear.

In our reality today, both error and 'violations' are hardly accepted in many organisations in relation to an unwanted event: people are mostly blamed based on bad outcomes, rather than their actions[20]… '*our response to error and mistakes that end badly is to spew out more policies, disciplinary measures, warnings, naming and blaming. Mistakes that don't cause repercussions somehow tend to escape moral and ethical labels*'.[21] In other words, error and violations can be seen as 'ok', as long as there is no negative outcome, but are seen as 'moral wrong-doing' when brought in relation with a negative outcome.

This relation itself has been questioned and criticised in more recent safety literature.[22] For decades we have relied on an assumed linear relation between a root-cause and an accident or incident, in which the root-cause is often expressed as an 'unsafe act' or an error. Based on principles of causality and decomposition we 'trace' back events to one or multiple causes.[23] Yet, our organisations and operations have increased so much in complexity, that these principles do not apply anymore.

Furthermore, linear causation thinking and models have contributed to a deep and widely shared belief in the reverse relation: 'if something goes wrong, someone has done something wrong'. [24] So, with the linear thinking coming from more traditional safety thinking, we have reached a point where these prove insufficient for learning and contribute to a blame culture, basically reaching the opposite effect aimed for in safety management. At least, in the way we see safety and safety management today.

Just Culture
Blaming can be defined as attributing wrong or fault and is actually an intelligible concept to protect a society from harmful behaviour.[25] Danger is defined to protect public good and by 'flagging' behaviour harmful or dangerous to the whole group, blame is automatically assigned to individuals engaging in such behaviour. More solidarity and a (fragile) temporary balance are reached as protection of a group.[26]

Loosely organized often means that blame goes everywhere. A loosely organised environment becomes unpredictable, especially in times of crises, making people insecure, as they cannot rely on their organisation. Being strongly organised, which means having for example, institutionalised and accepted ways of solving conflict, ways of working, (hierarchic) relations and finding explanation for unexpected events, means that processes of apportioning blame and applying justice are more predictable.[27]

Just Culture is a term often used to describe such organisation processes and a variety of models have been proposed over the years. Most of these models, however, are based on linear thinking where we relate outcome to error or 'unsafe acts'. Just Culture can also be described as 'balancing learning and accountability.'[28] Learning and accountability are compatible and form the essence of how we view safety today. However, in order to achieve this, we need to accept alternatives to our linear thinking and …'*reduce our dependency on 'human- error' as a near-universal cause of incidents…*'.[29]

Organisation Culture

The 'organisational culture' model, suggest there are three 'levels' of organisational culture. Organisational culture manifests itself through artefacts, symbols, myths, heroes, rituals, structural layout.... observable, often tangible.
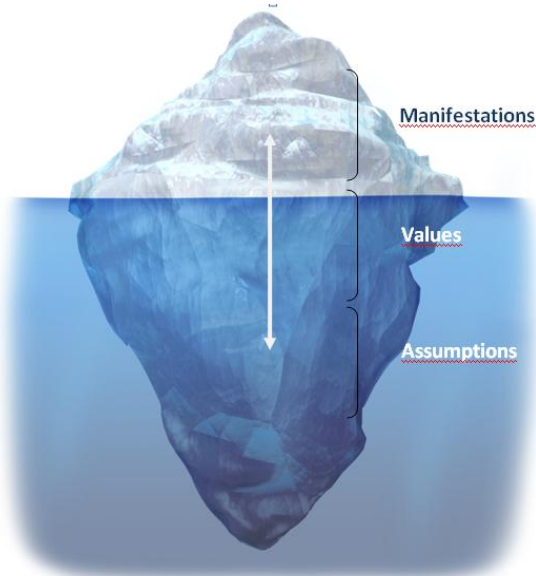

Figure 1. Adapted from Schein's three levels of culture, Schein, Edgar H, Organisational Culture and Leadership in Huczynski & Buchanan (2001)

Through 'surface manifestations', an organisation presents itself to visitors, customers and employees.

'Values' outline tendencies of (power) relations and attitudes towards hardware, software, people and actions; they provide a common direction and guidelines for all employees. Values are operationalised through practices and procedures, as detailed in the surface manifestations. Values distinguish one organisation from another as they affect basic assumptions at the heart of culture.

'Assumptions' in this model, refer to the invisible and 'taken-for-granted' understandings held by individuals with regard to human behaviour, nature of reality and relationships with the environment. [30] Assumptions are 'unseen' and therefore more difficult to access. Assumptions are of great importance in any process of change, as conflicting underlying assumptions may hinder any policy, decision or change to be carried out properly (manifestations).

Culture is referred to in its simplest form as a 'collective mapping of the mind'. It influences the values, beliefs and behaviour that we share with other members of our various social groups. It binds us together as members of groups and provide clues and cues as how to perform in both normal and unusual situations. [31] Such notion of culture, similar to many other definitions, imply culture is a 'set' and is static.

However, culture is dynamic and it changes, as culture is learned and negotiated. More accurately, culture can be described as a 'pattern of shared basic assumptions that a group has learned as it solved its problem of external adaptation and internal integration, that has worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems' [32]

In simpler terms, culture is the learned outcome of our choices and actions in relation to our environment. Solutions for problems proven *successful*, are repeated and develop into shared assumptions. Continuously, while dealing with new problems, new solutions are found and their validity judged. Culture is learned, negotiated and, important, an outcome![33]
Interestingly, assumptions are referred to as 'valid' as they were once proven successful and at the same time as 'taken-for-granted' (see above). In other words, assumptions are deep-rooted beliefs that we do not, or rarely question anymore. But they do inform our beliefs and behaviours.

Safety Culture

Safety Culture is commonly defined as the set of enduring values and attitudes regarding safety, shared by every member of every level of an organisation.[34] Many safety professionals argue, that a safety culture should be implemented or developed, either before or during the SMS integration process. Sometimes, it is referred to as a pre-requisite. Yet, as culture is the *outcome* of people interacting with each other and their environment, it only makes sense, and is far more pragmatic, to develop technical and social aspects simultaneously towards successful *solutions.* An outcome would then be a stronger, safety-oriented organisation culture.

Such socio-technical approach recognizes the interaction between people and technology in the workplace: the social aspects of people and society as well as the technical aspects of organizational structure and processes. In other words, for a successful integration of SMS (and other systems) understanding the requirements (SMS) ànd its implications as well as your organisation in terms of technology and people is a prerequisite.

Socio-technical theory explains that when introducing a new system, i.e. SMS, to an organisation while overlooking either the technological or the social aspects, the result, in terms of performance and well-being, is actually going to be worse than before. It is argued here, that overlooking the *implications* of safety and safety management and what it actually means to people and their work-relations, are often the cause for the reservation and even the resistance in organisations for making changes with regards to safety.

Assumptions and Beliefs
Such reservation of resistance can be manifested for example by 'on the shelf-SMS systems, giving the responsibility of safety managers to a less popular team mfember, the newest team member, low levels of reports, unrest and lack of trust in safety officers and management, etc.

Such signs are common and actually logic and understandable, given that the implications of safety management are rarely understood.

The core of safety and safety management these days is about learning. We can learn from past experiences, incidents, accidents and near misses and we can learn from knowing why things go well.[35] We expect our crew, technicians and other professionals to provide important information, including mistakes, errors, organisational mishaps, etc. This is based on the assumption that when we know our operation well and we know how we do things well, we can pro-actively see where things can go wrong.

A pre-requisite for people to actively participate in this type of organisation learning, is the trust for not being punished for either error or 'violation', must be in place. Yet, establishing this trust can be harder as the *assumption* that 'if something goes wrong, someone must have done something wrong' is still widespread and hardly challenged. In other words, the same people seeking ànd needing such trust, hold assumptions based on our shared dependence on 'human error' as near-universal explanation if something goes wrong.

Ultimately, our assumptions on linear causality of accidents are in conflict with our (mandatory) request to report, own up, admit error and mistake. Efforts to instil such trust that are based on the same linear assumptions are counter-effective, as in reality they impose restrictions in terms of rules, procedures and consequences for the individual.

This process hampers learning and causes conflict at individual and organisational level and ultimately alienates professionals from what they do best: flying, maintaining aircraft, … . This is a serious concern, especially because we need the experience, skill and talent in a time these are increasingly hard to find.

Conclusion
SMS has been introduced and will become mandatory for many operators within the next month, or two years. Even though the technical aspects of SMS are explained, their implication has been poorly understood and described by the same institutions that promote them. Our concept of safety is changing and with another 'push' to make operating helicopters even safer, we need to take these changes and their consequences explicit to the people that need to work with them.

For decades we managed to increase safety with the use of linear causation models. An unfortunate by-product is that this had lead to a too strong focus on human error, making humans the biggest problem with regard to safety. Alternatively, in today's complexity, we can look at systems that perform reliably *thanks to* people's ability to adapt.[36]

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