

# CRITICAL INCIDENT STRESS MANAGEMENT (CISM) AND THE INTERACTION WITH SAFETY CULTURE

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Safety

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# CRITICAL INCIDENT STRESS MANAGEMENT (CISM) AND THE INTERACTION WITH SAFETY CULTURE

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## ABSTRACT

This thesis consists of three articles written by Jörg Leonhardt in cooperation with Joachim Vogt and his team. The underlying hypothesis is that Human Factors (HF) Programs do have a positive influence on organizational and safety culture and vice versa. A prerequisite for that is a valid, approved and embedded HF program.

Our HF example program is the Critical Incident Stress Management (CISM) of the German Air Navigation Service Provider DFS and 10 years of history and research to proof the hypothesis. The program was implemented, conducted, and quality assured according to the standards of the International Critical Incident Stress Foundation (ICISF). The thesis starts with an introduction and brief history of CISM in Air Traffic Control (ATC). The implementation process of CISM in air navigation services is described and the special requirements for ATC in this field. The advantage of a Peer based program is underlined: The Peer model is based on operational colleagues, for example air traffic controllers, who are selected or elected to become CISM Peers.

Article 1 introduces the concepts of culture, high reliability organisations, and safety culture. It approaches the cultural differences in dealing with critical incidents and uses among other experiences the disaster of Überlingen as an example.

Article 2 is the main part of the thesis. In the theoretical part it outlines the neurobiological similarities and the cultural modifications of handling critical incidents. The interaction of HF programs like CISM and their interactions with safety culture are described. Two studies empirically underline the theory: Study 1 was a qualitative survey among CISM experts about the cultural peculiarities of crises and CISM in their countries. Study 2 refers to a quantitative, formal evaluation study of the CISM program at the German Air Navigation Service Provider (ANSP) DFS. It showed significant interactions of the implementation of CISM and the development of the safety culture at DFS.

Article 3 presents an innovative concept of facilitating the synergy of HF programs and safety culture. A management tool is suggested to professionally and proactively develop safety culture in high reliability organisations.

An author note at the end of the of each article and before the next level two heading summarises the function of the article within the thesis. Moreover, information is given as to where the work was published or submitted for publication, respectively.

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# THESIS MAIN BODY

## **Introduction**

This chapter provides a brief History of CISM in ATC and an overview about the implementation process of CISM in Air navigation Services. It describes the special requirements for ATC in this field and explains the advantages of a Peer based program. The Peer model is based on operational colleagues, for example air traffic controllers, who are selected or elected to become CISM Peers. After they are selected/elected, informed about their potential future task, and accepted it they are educated in at least four ICISF certified courses over a period of three years and with relevant practice in between.

### *Critical Incident Stress Management in ATC*

Within Air Traffic Management (ATM) and Air Traffic Control (ATC) CISM has gained importance since the accident of Sioux City in July 1989. After the crash, the Air Navigation Service Provider of Canada (NAV Canada) started to establish a CISM program for their Air Traffic Controllers (ATCOs). Several Air Navigation Service Providers (ANSP's) followed the Canadian example and began to implement their own CISM programs. Some ANSP's realized the necessity of established CISM programs for their organization and safety, others started with the implementation after the organisation had faced a major accident.

The German ANSP (DFS – Deutsche Flugsicherung GmbH) took the chance to learn from the experience NAV Canada had to face and therefore decided to implement a CISM program without a serious or disastrous accident.

DFS started to plan and implement a CISM program for the operative personnel in 1997, first of all for the Air Traffic Controllers (ATCOs), but just as well for the Air Traffic Service Assistants (Flight Data Personnel), technicians and administrative staff.

Based on the publications and recommendations from Dr. George Everly and Dr. Jeffrey Mitchell – the co-founders of the CISM model - DFS established CISM according to the standards of the International Critical Incident Stress Foundation (ICISF).

Since 2000, DFS can rely on more than 80 trained and ICISF certified peers, who offer their colleagues CISM support in all units 24 hours every day.

### *Special requirements for ATC*

Air Traffic Controllers (ATCOs) are working in a high reliability business. They have to maintain constant vigilance, high concentration, stress resistance and also team performance. Besides the mental and team related requirements for ATCOs that demand enormous energy, Critical Incidents always depict extraordinary situations that go beyond the every-day stress and the resulting strain.

Due to their education, their training and stress management ATCOs are able to deal with the special demands. An ergonomic work organisation with, for example, forward rotating shift systems, and breaks matching their position's workload can help coping with the daily work stress. These issues are continuously communicated to and discussed with the ATCOs already in the beginning of the training and therefore they are very familiar with them.

The ATCO will actively manage his/her stress in terms of an individual maintenance of performance and well-being.

Nevertheless, some incidents and the related critical incident stress reactions (CIS) might exceed the individual stress tolerance and coping capacity. They cannot be dealt with by the controller himself and require a comprehensive CISM program for ATCOs.

The debate on stress and stress reactions especially in this particular field of work has led to an awareness of the Critical Incident Stress Reactions. Therefore, the possibility of reactions

after a critical incident is known to ATCOs. They are informed about the different types of critical incident stress reactions and the consequences, personally and professional.

During the information campaign as the first stage of the CISM implementation plan, all ATCOs got this information in briefings, within documents and during presentations on the local operational units.

Meanwhile, dealing with Critical Incident Stress Reactions is part of the professional self-concept of ATCOs in Germany and it will be in every country where CISM is a solid program.

The solid implementation, the support from Managers and the broad information campaign is the basis for the positive effects of CISM on the organizations safety culture. This is described in various viewpoints in the later articles.

The requirements on a CISM program in air traffic control (ATC) differ in three major aspects compared to other occupational groups like, for example, police officers or fire fighters:

1. Critical Incidents in ATC do not necessarily mean an accident has actually happened.
2. Basically, the ATCO working in the Area Control Center (ACC) and Upper Area Control (UAC) is separated from the incident itself and has no direct sensory impressions. Only the tower controller may witness with the own eyes an accident on the runway.
3. Due to his job the ATCO is directly involved in the development and progress of a Critical Incident and usually feels responsible.

The three aspects will be further explored in the following sections.

#### *Critical Incidents in ATC are not necessarily an actual accident*

In the view of an ATCO, a Critical Incident is, for example, a separation loss between two aircraft. The safety margin is as a rule big enough that falling short of the separation minimum does not lead to an accident. Normally, it is not even noticed by the passengers or the public. However, an unintended separation loss, even if it is marginally, can be a major threat to the professional self-conception of an ATCO and thus it can lead to Critical Incident Stress Reactions.

The ATCO's "inner eye" is viewing a catastrophe of what could have happened and the fantasy completes the inner picture. This is a mental construction and does not necessarily correspond to reality. But it is the nature of our brain trying to complete a picture. In training and professional experience the ATCO develops pattern recognition for potentially critical situations. Due to this early warning system, the ATCO is aware of the potential danger an unintended separation loss may have, if there are other aircraft around and the situation becomes increasingly critical. Even if there has been no direct danger of a crash, the ATCO's mental early warning system has already raised alarm. The anticipation of what could have happened can trigger the inner pictures, which are truly experienced and can therefore lead to Stress Reactions. The old brain structure responsible for emotions, the limbic system, triggers physiological reactions of the body. Originally, they were conceived to facilitate fight or flight behaviour and include, for example, adrenaline efflux, heart rate and blood pressure increase. Modern work environments like in ATC, however, do not require fight or flight so that today critical incident stress reactions are maladaptive and need professional treatment like CISM. The imaginations activate physiological reactions of the brain and cause Critical Incident Stress Reactions. Although the situation caused no accident and harm to others the stress reactions are real and potentially harmful to the ATCO.

The incident is barely (e.g. pilots) or not at all (passengers, public) perceived as such.

The ATCO's subjective experience of the incident and the adherent stress reactions do not correspond to the reality as perceived by others.

Thus, an ATCO talking to people outside ATC about an incident she/he experienced as critical may be confronted with lack of judgement, misunderstanding, and ignorance.

In such a situation potential helpers, who are not familiar with the special requirements of psychological first aid to ATCOs – even if they are professional physicians, psychologists or spiritual advisers – may try to downplay the incident by relating it to real accidents like “nothing really happened”. Thus they inevitably would trigger the process of inner pictures and imaginations of what could have happened described above.

Often people face their own inability to help and try to comfort the affected person in trying to convince him or her that nothing happened and there is no reason for such reactions.

The ATCO will feel even more misunderstood during such a discussion and try to avoid talking about his/her actual reactions and symptoms. The ATCO probably will be highly irritated and get the impression that something is wrong with him and his perception of reality.

This might lead to enormous health consequences if a constructive debate and coping are missing. The ATCO might withdraw and hide his/her true feelings and reactions. The irrational belief and connected feeling of “I am not normal”, “Something is wrong with me” gets overwhelming and intensifies the crisis. If nobody else regards the incident as problematic and if it seems there is no reason to worry or get crazy, the own reactions are more and more perceived as abnormal.

Self-medication (e.g. with alcohol, sleeping pills, and sedatives) often is the next step in the vicious circle: The symptoms stay or get even worse; medication is increased and so forth.

Some ATCOs try not to show the symptoms to the public and the self-treatment continues. The longer this vicious circle persists, the harder it is to ask for help and exit the circle.

The belief not to be normal and self-doubts get out of control and it becomes increasingly difficult to put the symptoms into perspective with the incident.

The symptoms might get chronic, in the worst case a Posttraumatic Stress Disorder (PTSD) develops – and the original relation of symptom and incident is blurred.

In such a worst case, it is common that only the physical symptoms are treated with medication or surgery. In this state it is difficult to relate disorders to an incident which is maybe years ago.

In case of an accident noticed by the public – as tragic as it might be – the vicious circle of the reality-disrupted self is less likely to develop as the individual reactions and the perceived reality correspond. The reactions of the people affected are assessed as “normal”.

Beyond the reactions perceived as unusual and causing self-doubts, the blow to the professional self-concept of ATCOs has to be considered. This is especially true because ATCOs have experienced similar situations before without strong stress reactions. ATCOs are traditionally socialized in a way that critical incidents are part of the job and can be coped with alone. Modern ATC needs a shift from this “lonely rider” or “cowboy mentality” to a team-based culture, in which learning also includes learning from failure, which is organized and not sanctioned. A healthy safety culture allows and accepts the normality of stress reactions after a critical incident. An active support and a promotion from operational managers to ask for CISM support foster the relief and the recovery of the ATCO.

Self-doubts have an intensifying effect: “I have dealt with such situations before”, “I am not sure anymore if I am capable of doing this job”, “I have experienced worse than this and managed just fine”.

Self-doubts intensify the feeling of “not being normal”, as others deal better with the situation or the person affected used to deal better before. Self-doubts depict an obstacle for professional help.



*The ATCO working in ACC and UAC is physically separated from the incident itself*

Critical situations usually do not lead to an accident. If the unlikely actually does happen, ATCOs working on the radar are excluded from all direct sensations. Smell, sound, taste and visual sensations are not perceived. Following the accident happen on the radar screen the ATCO imagines pictures and sensations of the events happening on the site.

Therefore, it is not possible to talk about direct sensations during a CISM intervention.

However, the pictures the ATCO has imagined and the involved (imagined) sensations and perceptions have to be addressed.

The visualisations do not necessarily correspond to the actual happenings and might lead to a deferral of perception in the long run. The media partly contribute to an adjustment of the inner pictures and visualisations; nevertheless the media show a subjective reality as well and do not always aim at objective reports. However, in terms of a CISM measure it is crucial to support the ACTO in the adjustment of the subjective reality.

For example, in January 2004, there has been an emergency landing of a passenger aircraft approaching Munich Airport. The forced landing took place on a free, snowy field, controlled by the approach control and the tower controllers at Munich Control Tower, however, outside the view of the controllers. After the information that landing was conducted according to the emergency procedure and that nobody has been injured or died, managers of DFS Munich called for CISM measures.

Besides the applied Peer support ATCOs could visit the place of the happening, to have a look at the respective aircraft, speak to the pilots etc. The benefits of this procedure will be described in the following section.

*The ATCO is involved in Critical Incidents automatically due to his/her work*

Having a look at the aircraft, getting a picture of the real extent of the incident, and being able to adjust the own imaginations thereupon (e.g. condition of the passengers) and to speak to the pilots, contributed to a high degree to stabilise the ATCOs. The comparison of the own imaginations and the reality, the adherent reflection of the incident and the stabilisation depict the first step of coping and of reducing the effects of the stress reactions.

The pilots have given the ATCOs positive feedback on their professional support and work. For this reason, the ATCOs were able to experience their work as an important contribution instead of a failure. Thus, the ATCOs obtained a holistic view of the situation and what their own contribution was. The fact that the professional work of the ATCOs contributed that everybody getting out lightly helped the ATCOs to recover faster from the critical incident stress reactions.

Also in cases of tragic accidents with death and/or injury it is important to compare the inner pictures and to realise the own contributions. Feelings of guilt play an important role in this context. It has to be assumed that ATCOs always make heavy demands on air traffic safety and act accordingly. Feelings of guilt are understandable as they highlight the ATCOs' responsibility for their work. However, guilt in a legal sense is another topic than feelings of guilt and it is not part of a CISM intervention to inquire or to investigate in this.

When and to which extent reality is closely analysed is dependent on the situation, the reaction of the ATCO, the expected consequences, and the peers' ability to cope with stress. Comparing the own perceptions with reality does not mean to confront oneself directly with the worst. It is rather a stepwise approach to the incident, the accident, and the negative consequences. This approach may take several weeks or months and should happen with professional support (psychologist, clergyman, physician, or therapist) and does not belong to the tasks of the peers. However, the peers should make sure that the ATCO receives professional support if necessary – this is called referral in the CISM terminology. Facing the

reality is an important part of a lifelong recovery from critical incident stress and an important contribution to the prevention of PTSD.

The professional involvement of the ATCO in the incident causes usually self doubts:

“Have I done everything correctly?” “Shouldn’t I have tried this or that?”

In the retrospective it is much easier to rethink the decisions, because the results and how they were generated are known. In the acute situation, however, decisions must be made, although time and information are restricted. Everyone in this field creates safety through practise and doing the best to do a good job. This is especially true for air traffic control and aviation which is highly dynamic and also complex, i.e. many different and interacting factors have to be considered. The ATCO is part of this system and contributes significantly to the safety of the system. However, she/he is also subject to the contextual factors and can influence them only partly.

Nevertheless, feelings of guilt play an important role for the ATCOs. Dealing with the feelings of guilt, overcoming them and adjusting to reality are fundamental elements of CISM intervention. Peers are able to understand the feelings of guilt, the reactions after a critical situation and the impact of the professional self concept such an incident has. Peers can therefore normalize such reactions and getting the necessary trust from their colleagues in this abilities.

These elements have to been one of the main focuses in the training of the peers as well. After the three requirements on a CISM program in ATC were explored, we now turn to how CISM ideally is implemented. This includes the identification of suitable peers, their training, the structure of the program and the experience made.

### *Implementation*

Before the implementation of a CISM program an initial and conception phase takes place. During the initial phase, the CISM manager or the CISM team name people, who will be responsible for the implementation and the establishment of the program.

In the DFS it is well-established that the management initialises the first phase in order to add importance and support for the program.

The nominated person in charge will get acquainted with the methodology and strive for support from experienced colleagues.

During the conceptual phase, relevant steps and their implementation are defined. The concept should comprise the following aspects:

- embedding of CISM into the culture of the ANSP
- methodology and processes of CISM
- definitions and basic understanding of CISM, CI, CIS
- model of the peers and election/selection of the peers
- training and education of the peers
- certification of the peers
- training of the supervisors and managers
- standards and procedures
- Crisis Intervention Team
- information campaign within the organization
- quality management

### *S/Election of the peers*

The choice of the peers can take two paths: selection or election. For the selection, candidates apply for the job. They go through different selection procedures and become trained afterwards.

For the election, colleagues and/or managers nominate their candidates, or the interested people nominate themselves and are elected secretly by the staff. After their election, they start the CISM training.

Both procedures have been applied in different ANSPs and both proved successful. However, each procedure has certain advantages over the other.

The focus of the election lies upon the trust in the candidates. Is the candidate the one who is believed capable of fulfilling the role as a peer, is it the one to turn to in case of an incident? Is the elected person to be trusted in terms of treating the personal feelings and statements confidentially?

The election procedure should be applied, if CISM is to be established within an organisation, in which less culture of dealing with failures can be found. In an organisation having difficulties in dealing with feelings of the employees the election procedure is the appropriate way.

During the training, the skills of the peers and the CISM methods are focused. There is no later assessment or selection of the people who has finished and completed the Peer training. When selecting peers, the choice of the “appropriate” peers is focused: People emotionally stable, capable of dealing with others’ emotions and people meeting the ability requirements of a peer.

For the selection procedure it is very important to have experienced CISM Mental Health Professionals, who know the context of ATC, as members of the selection team.

A solely psychological selection with the common procedures does not cover the whole range of selection criteria for the peers.

After the selection procedure, the training should focus on information and the self-promotion. It is essential to built up trust in the peers and their role.

The selection of the peers has to be well considered and should focus on the culture of communication and management of failure within the ANSPs.

#### *Training and education of the peers*

The peers have to be well trained. The peers are employees filling an additional role they have to be trained for.

The training should be carried out according to the established and proven standards of the International Critical Incident Stress Foundation (ICISF) and be conducted by an ICISF certified trainer.

The training and education are accomplished over 3 to 4 years based on following courses:

1. Individual Crisis Intervention and Peer Support
2. Basic Group Crisis Intervention
3. Advanced Group Crisis Intervention
4. Strategic Response to Crisis
5. The Changing Face of Crisis Intervention

In between the courses 12 to 15 month should pass by in order to apply the methods learned. Refresher courses and Peer supervision meetings are optional, but highly recommended.

The courses are completed with an internationally recognized certificate of the ICISF.

The certification of the ICISF is important for the organisation as it ensures an established, evaluated, adjusted and world-wide proven training of the peers. The certification is important for the peers as it gives the peers confidence and trust in their work.

An established and high-quality training represents the quality of the organisation and its CISM program. This aspect is not to be neglected.

### *The Peer Model*

The following section describes the peer model in CISM. Critical Incident Stress Management is based on the involvement of peers from the same professional environment. The peer model offers several key advantages:

- Colleagues are often accepted more quickly than individuals from outside the profession such as psychologists, physicians, members of the clergy and pastoral workers.
- Peers from the same occupational group appreciate the individual's CIS reactions better, because they may understand them better – the peer may even have experienced similar reactions.
- Peers have a better understanding of the facts and circumstances of the event, because they have the same professional qualification and socialization. This is especially true with respect to the above mentioned discrepancy of public opinion and ATCO view on critical incidents.
- The understanding of feelings of guilt is easier for Peers.
- Peers can normalize the stress reactions and reduce the unwanted feelings better, because they have the same background and similar experiences
- Peers are speaking the same professional “language”
- An action to address the situation is often more credible and more easily accepted if proposed by a peer.
- The involvement of health professionals (e.g. physicians, psychologists) may cause the impression that the individual is ‘ill’, which is not the case with peers.
- Peers can often be called in more quickly and without complicated or bureaucratic procedures.

Peers are not professional mental health people, therefore their abilities are limited

- The identification with the colleague and the critical incident may trigger critical incident stress reactions amongst peers. In the worst case, the peer's professional aptitude may be impaired.
- The fact-finding phase might become overly comprehensive, with both parties becoming too involved in discussions of detail and procedure.
- Emotional phases in CISM, namely the reaction phase, may be too brief or even skipped entirely, since both parties may consider them as ‘threatening’.
- People or procedures may be left unduly exposed to criticism.
- Too little consideration is given to self-motivation as a peer.
- The limits of the discussion are not respected – often it may be difficult to avoid straying into personal matters.

However, the advantages clearly outmatch the disadvantages and these can often be limited or even eliminated through good peer management. To help Peers in overcoming their identification with the reactions the colleagues has as well as giving them the opportunity to have a break and to recover, Peer Supervision and Peer Debriefings are necessary.

### *Structure of the CISM program*

Parallel to s/election and training of peers, a clear structure for the application of CISM interventions and the respective rules and procedures needs to be established.

It can be assumed – and this will be described in chapter # – that the critical incident stress reactions of an ATCO alter his ATC skills. This must not necessarily mean that the ATCO is

unable to work, but it implies that any incident can become critical in the sense that it impairs the ATCOs well-being and performance potential. Therefore, a realistic self-assessment of the ATCO with respect to work ability as well as the leadership skill of the watch-supervisors and the professional behavior of the peer is paramount.

If these aspects are not granted – how can watch-supervisors and peers assess the actual stress coping capacity of the ATCO under consideration of the social and family circumstances?

How can the self-assessment of the ATCO be corrected if needed?

This can be achieved by clear procedures and distinctive rules within the CISM program. The rules and procedures are designed to ensure that the assessment of the own ability to perform, the consultation of a peer or manager and the decision to get a CISM measure are understood as normal procedures.

If everybody sees the necessity of CISM, if everybody experiences that people affected as well as their colleagues and the organisation as a whole profit from CISM, it will be easier to acknowledge CISM interventions as a standard procedure.

Not every exceptional situation is a critical incident, but every situation can turn into such, even it is not an exceptional one.

As the consequences of critical incident stress reactions can be serious, it has to be assured that the ATCO possesses an unrestricted ability to perform – anything else would be a danger to safety within air traffic control. This requires an integrated approach throughout the whole organisation. Manager need to be trained to recognize and handle performance losses, employees need to be informed and convinced that CISM is part of their professionalism, best practise examples should be published in internal papers and professional journals.

Surveys conducted so far revealed an improved culture of safety for ANSPs with an optimal interaction of ATCOs, peers, and managers. This is also true for an international comparison despite the cultural differences.

All issues dealing with human aspects within air traffic the so-called human factors are established. Moreover, if crises are dealt with professionally, this promotes human factor improvement also in other areas. A well-established and solid CISM program positively affects the culture of failure, the culture of safety, the team resource management program, the motivation, and the preservation of work force.

A CISM program has positive economic effects as well and the investment in the establishment and the running of the program pays off quickly.

### *The DFS experience*

The experiences of DFS with respect to CISM are very rich. CISM evolved to be a normal procedure, which as a standard is offered by every watch-supervisor in charge during a critical incident. This ensures contact between peer and ATCO, which then may be extended to a full CISM intervention, if both parties agree. The initial contact can also refrain to a bilateral assessment of the situation and the ATCO's responses.

Over 90 certified peers are working at DFS. The number of peers at each DFS location matches the size of the unit. Therefore, a peer is either on site or can be called in immediately. The peers are actively supported by the watch-supervisors and managers and vice versa. Thus they can fulfil their task in a professional manner and with the necessary organisational support.

Due to the quick availability and the high acceptance of the peers over 90 percent of DFS CISM interventions are applied as SAFER-R i.e. immediately and directly after an incident.

As a consequence the yearly evaluation shows that more than 90 percent of CI affected and CISM treated ATCOs are able to work the first day of their scheduled shift again.

DFS has registered no delayed symptoms or consequential losses ever since the introduction of the CISM program.

Besides the experience of everyday critical incidents, the DFS crisis intervention team has also made experiences with major accidents (Mid Air Collision over Überlingen) and natural catastrophes (Tsunami).

The international cooperation with other ANSPs and the intensified networking within aviation is well-established and ensures the mutual support in case of an accident.

CISM is a standard of care in DFS.

Becoming a Peer, having a good education and training and developing a Peer personality is a benefit for the organisation, the employees and also to the Peer himself. There are a lot of changes in the behaviour, in the understanding of others and in the ability of having a social or emotional intelligence for the trained and experienced Peer. Becoming a Peer and being a Peer is an important and upright role to take and to perform. It is much more than applying a method it is a personal outlook and a responsibility.

Being a Peer is a lifetime commitment – as my friend and colleague Preben Lauridsen from the Danish Air Navigation Service Provider NAVIAIR used to highlight: “it is like Hotel California, the song from the EAGLES, you can check out every time you want, but you can never leave.”

#### *Author Note*

This chapter was written as an introduction to the following articles. CISM and the Peer-Model were described as well as the peculiarities in the application to ATCOs. The following chapter, article 1, will outline cultural differences in dealing with critical incidents generally. Article 2 will approach the interaction of CISM as one HF program with safety culture in an expert survey and a quantitative formal evaluation study. On the basis of the promising results, article 3 will suggest the development and testing of management tools to integrate HF into business.

### **Article 1: Cultural differences in dealing with critical incidents**

#### *Abstract*

This article discusses the cultural aspects of High Reliability Organisations (HROs), such as air navigation services organisations. HROs must maintain a highly professional safety culture and must always be prepared to handle crises. The article begins with a general discussion of the concept of organisational culture. This is followed by a discussion of the special characteristics of HROs and their safety culture. Critical Incident Stress Management (CISM) is a prevention program which can successfully guard against the negative effects of critical incidents. The CISM programme of DFS (Deutsche Flugsicherung) was evaluated by the University of Copenhagen. This evaluation not only confirmed the successful prevention of negative effects at employee level (especially air traffic controllers), but also showed a sustained improvement of its safety culture and its overall organisational performance. The special aspects of cross-cultural crisis intervention and the challenges it faces as well as the importance of prevention programmes such as CISM are illustrated using the examples of two aircraft accidents: the crash landing of a calibration aircraft and the Überlingen disaster.

#### *The concept of "culture"*

As there are as many definitions of the word as there are authors writing on the subject, it is difficult to say what exactly "culture" is. Attempts at a definition range from "the human made part of the environment" (Triandis, 1989) to "a collective programming of the mind" (Hofstede, 1980). Kastner (2006) draws the following distinction between ethics and culture: That what we strive for, the values and goals to which we aspire, these are our ethics (what we do, why we're here). The way we realise this is our culture.

The definition depends on the author's perspective. Thomas (2003a) suggests the following definition as helpful for improving cooperation among people of different nationalities: "Culture is always presented as an orientation system that is typical for a nation, society, organisation or group". In summary, culture may be defined as the sum of all conventional actions, mindsets, mentalities and beliefs shared by a group of people or a nation. They are expressed through language, body language (gestures, facial expressions), clothing, status symbols and rituals. Common values and norms are the essence of culture and influence attitudes and behaviour (Trompenaars, 1993). Culture reduces complexity; thanks to culture, we are not constantly forced to consider how to interpret situations and how to behave in them.

### *Culture in High Reliability Organisations (HROs)*

Organisations which operate in safety-related areas are called High Reliability Organisations (HROs). An HRO is characterised by the high complexity and interactivity of its processes and actors responsible for protecting life, limb and the environment. Typical HROs are, for example, air navigation service providers, airlines, hospitals and nuclear power plants. The potential risk of an "organisational accident" (Reason, 1986) which could lead to a disaster is present at all organisational levels. But its immediacy becomes more and more acute from management to the actual operators. The operators at the "sharp end" directly control processes and thus avoid accidents. For this reason, operators in HROs have a keen awareness of risks and of the responsibilities borne by each operator. Disasters are often too hastily attributed to human failure if technical failure has to be ruled out. However, the operators at the "sharp end" do not bear the sole responsibility for the safety of processes in HROs. Safety depends on the cooperation of all involved, and such cooperation is based on the interactive dynamics of all actors belonging to such organisations. In his article "Safety as a Social Construct", Gene Rochlin describes this interaction and division of responsibilities as a constructed network of safety held together not only by the interaction of those involved, but also by certain attitudes, opinions and assumptions. In accordance with the idea of a social construct, culture in these organisations is based on the way operational safety is perceived both within and from outside the organisation. Passengers boarding an aircraft assume that all involved will do their utmost to guarantee that the aircraft is technically sound, that the pilots are well-trained and experienced and that the aircraft will reach its destination safely. But passengers and markets also form parts of this social construct, which, for example, is also based on the assumption that low-cost flights are safe. HROs specially hire experts on safety culture.

### *Safety culture*

Safety culture, which is based on the social construct of interactivity and on the way an organisation sees itself and is seen by outsiders, is of central importance to an HRO. What is safety in this sense? With respect to HROs, safety seems to be nearly as difficult to define as health. According to Fritz Simon, the current definition of health is the "absence of illness". While we can easily describe illness in much detail, health is reduced to the mere absence of illness or feelings of being unwell and thus remains undefined. The same applies to safety, which exists when no accidents occur. A description of safety is usually limited to the absence of accidents. Defining a concept by means of a negative event which is to be avoided always influences the way safety culture is seen. In the worst case, safety culture is eliminated when short-sighted managers think that they can save money in this field simply because nothing bad has happened for a long time.

For this reason, safety and safety culture need positive definitions which clearly describe what "safe" means and what makes an organisation safe. Safety culture is not a linear process that

can be defined on the basis of incident or accident statistics. It has to be present in the interactions of actors and in operational processes. Safety culture is a systemic construct. When an accident is assessed in a safety culture where systemic aspects are taken into account, it is evaluated as part of the overall system and not only attributed to the actor at the end of the chain. The overall safety culture system thus comprises aspects such as:

- the significance of safety for an organisation,
- how this significance is expressed both in daily work routines and in management decisions,
- how effective regulations and procedures are,
- how criticism, problems, and errors are dealt with,
- how much is invested in training measures for operators and how effective these are,
- how the required competence of operators is maintained,
- whether management adapts its goals and decisions to new findings,
- how an organisation communicates,
- how transparently decisions or changes are communicated within an organisation,
- whether the way an organisation perceives itself and the way it is seen by outsiders (i.e. customer expectations) are regularly analysed and evaluated.

It is generally assumed that technology is now so advanced that efforts to increase safety through technological innovations will only lead to marginal improvements. The greatest potential for maintaining and enhancing the present safety level lies in safety culture and the human factor – which includes managers. From a systemic point of view, even the customer will contribute to the progress – or regress – of safety, as he will have to question the demand for ever-cheaper flights and recognise the potential risk inherent in the bargain-hunter mentality.

According to Hollnagel (2006), safety culture is what an organisation does, not something it has. It is an active element and not a matter of course which has already been achieved. Safety culture must be actively maintained through the interaction of operators and managers; it draws its strength from how the managerial staff of HROs see themselves as managers.

### *Dealing with crises*

Based on the culture of an HRO, its safety culture and the importance of its management, the way an HRO handles crisis situations may reflect how it perceives its own safety culture. There may be different types of crises affecting different people in different organisations. Since the focus of this article is on HROs' management of crises and critical incidents, we shall discuss three crisis scenarios:

- individual operator-related crises
- organisation-related crises
- crises affecting persons outside the organisation

### Individual operator-related crises

Irrespective of the organisation, individual crises related to operators are always to be expected in safety-relevant areas. This applies to pilots in the same way as to surgeons, nurses, air traffic controllers and other professional groups. The operator at the "sharp end" of the process chain has a direct and immediate influence on actions and their outcomes. An air traffic controller's instruction to a pilot to climb, for example, can both improve and worsen the safety situation. Because of the considerable amount of responsibility involved in these professions, those who practice them have a keen sense of personal responsibility, reliability, flexibility, resistance to stress and ability to work under pressure. In the case of air traffic



controllers, an elaborate selection procedure is used to determine whether candidates are allowed to enter training. Thanks to a combination of personal disposition and daily experience, an air traffic controller is able to deal with unusual, complex and dynamic situations. The same applies to a surgeon, who is confronted with unexpected situations during an operation, or to a nurse, who must handle emergency situations during the night shift. What these competent professionals have in common is the ability to cope with such situations. They "create safety through practice" (Dekker, 2004).

Emergencies and critical situations are an integral part of these professions and thus represent an occupational "normality". However, they can also lead to reactions on the part of the actors which are either unusual, unusually prolonged or which cannot be handled without assistance. Irrespective of the incident, the reaction of the operator remains the decisive factor when it comes to crises, although major disasters always pose a potential emotional threat. A crisis can trigger reactions in a person that he does not expect, does not expect to be as strong or which he expects to wear off quickly.

If a crisis is caused by an event in an every-day situation, it causes so-called critical incident stress reactions. These reactions are either physical (high pulse, trembling), cognitive (uncertainty, limited decision-making ability), emotional (anger, aggression) or behavioural (reclusiveness, isolation, insecurity). And they are difficult to understand for the persons affected by them, as they do not match the image he has of himself as a person and a professional. As explained above, those affected are not accustomed to such reactions and cannot reconcile them with their professional self-image.

If a person experiences these reactions in a corporate culture in which this understanding of the profession is taken for granted, in which trust is not cultivated and in which the operator carries the ultimate responsibility, the feeling of being "different" is aggravated and coping strategies are suppressed. For this reason, a company's corporate culture plays a key role in the management of personal crises at the operator level. The systemic self-concept of an HRO, its management concept, the behaviour of both management and team members vis-à-vis those in crisis situations are decisive for dealing with crises in an adequate and sustainable manner. An evaluation of the CISM programme at DFS confirmed that air traffic controllers who were replaced by their managers immediately after a critical incident (e.g. aircraft proximity), assigned peer counsellors whom they could talk to and released from work for the rest of the day recovered from the incident the most quickly and effectively. Although the absence of the affected controller and the peer counsellor as well as the overall programme are a significant cost factor, CISM has proved to be profitable for the organisation in the long run, since the affected controllers were able to return to work much sooner than in cases where no CISM programme was in place and/or where the controller concerned was not given leave from work for the remainder of the day (Vogt & Pennig, 2006).

#### Organisation-related crises

By definition, HROs always face the risk of a disaster. Nevertheless, the rate of incidents and accidents in such organisations is markedly low. Because of this, they are considered to be very safe by the general public and are sometimes even referred to as "ultra safe systems/organisations" (Amalberti, 2001) by the scientific community.

Besides the small number of accidents, this perception is based on the notion that these organisations put safety first and do all they can to conduct their business safely. However, when a disaster does occur, the affected HRO can be faced by such a serious crisis that the economic survival of the organisation is put in jeopardy. For HROs, such a crisis is usually a disaster or an occurrence which causes devastating damage rather than a financial crisis. Such disasters always affect a large number of persons, often leading to casualties. Be it a railway disaster as in Eschede, an aircraft accident as in Überlingen, a nuclear accident like in

Chernobyl or an accident at a chemical plant like in Bophal, those affected the most are passengers, workers, or residents.

For the company, the impact of the disaster for which it is accountable is the main crisis and not the direct economic results (e.g. the loss of an aircraft). And the way an organisation handles such a crisis shows whether it has a state-of-the-art corporate culture and safety culture or not. Crisis management can only be effective if there is open communication, if the persons affected are treated with respect and understanding, if the accident is assessed from a systemic point of view as described above, if all relevant background information is disclosed, those in charge are held accountable and if, above all, quick and efficient assistance and psychological support is provided to those affected.

An organisation can financially survive a disaster if it does everything it can to put safety first before the accident. After the accident, it must then do everything it can to investigate the accident and to cope with its effects. Even managerial decisions which later prove to have contributed to a disaster (e.g. changes to maintenance schedules) are made in a specific context and based on rational considerations which seemed correct at that time and in that context. The negative consequences of an accident can only be dealt with in an open manner, if neither the operator at the "sharp end" nor the manager at the "blunt end" is blamed for the accident due to the prevailing culture.

In an international or global market, it has to be expected that people of other cultures are among those affected by an accident. For this reason, an organisation must always take account of the different needs of individual cultures in its crisis management and take an active interest in these cultures. In an international airport, there are passengers and staff from all over the world. The organisation must therefore be prepared for different national and corporate cultures, e.g. different ways of expressing grief in the case of a major disaster. In addition to the cultures, the political situation within and between the countries concerned must also be taken into account (Gaber & Drozd, 2006).

#### Crises affecting persons outside the organisation

One of the negative effects faced by an HRO after a disaster is the confrontation with those affected who do not belong to the organisation. This includes persons who are affected directly (e.g. casualties) but also those affected indirectly (e.g. relatives). Such people face an emotional crisis and often partly or fully blame the HRO. And they usually have to bear two emotional crises at once: the loss of a family member and the fact that this loss was caused by an organisation. In such cases, grief and anger tend to dominate and, combined, inhibit the emotional coming to terms with the crisis. Grief can lead to depression and a sense of helplessness and weakness and as a result interfere with anger as an extroverted behavioural regulator (e.g. activity, drive); anger, in turn, can inhibit the grieving process. Those affected feel like they are in a passive role both with respect to the cause of the disaster and to coping with it; they are victims in two ways.

The situation may escalate if cultural differences enter into play. If those affected by a disaster belong to a different culture than those who caused it (as in Bophal, for example) and if the ways of dealing with crises differ among these cultures, crisis management can become highly challenging for both the organisation and the individual.

Support in managing the crisis may come from within the organisation or from an outside source (e.g. politics). The emotional involvement of all actors must always be considered. The following section will introduce a programme developed to provide support within the organisation.

#### *CISM as a crisis intervention programme*

Critical Incident Stress Management (CISM) is a method for crisis intervention after critical incidents. CISM was developed in the 1980s by Mitchell and Everly. When CISM was first developed, its emphasis was on Critical Incident Stress Debriefing. Since then, it has developed into a programme comprising correlated and consecutive crisis intervention measures after critical incidents. It includes not only preventive measures and interventions for individuals, groups and large groups, but also support for families, communities, schools and organisations.

The methods of CISM are:

- Information and training
- Pre-incident preparation and education
- On-site support
- Individual crisis intervention (SAFER-R: Stabilise, Acknowledge, Facilitate, Encourage, Resolution, Referral to other services)
- Demobilisation
- Crisis Management Briefing (CMB)
- Defusing
- Critical Incident Stress Debriefing (CISD)
- Support for family and relatives
- Support for organisations and communities
- Referral and other medical and psychosocial care services

The International Critical Incident Stress Foundation (ICISF, [www.icisf.org](http://www.icisf.org)) continuously develops and evaluates the programme. ICISF develops training programmes, certifies training participants and provides instruction for future trainers. Since 2005, ICISF has maintained a European Office in order to take account of the linguistic and cultural diversity of Europe (c/o DFS in Langen near Frankfurt).

CISM methods are based on peer-supported crisis intervention. The colleagues of those who could potentially be affected by critical incidents, i.e. air traffic controllers, pilots, police officers and nurses, are trained as CISM "peers", or peer counsellors. Continuation training lasting several years (quality management by ICISF) enables the peers to offer crisis intervention as a form of psychological first aid to their colleagues. While peers continue with their normal occupations, they are also available to organisations or crisis intervention teams to support their colleagues. The particular strength of the peer concept lies not only in the peers' spatial proximity to those who need help, but also in their professional proximity to them, which in the case of a crisis facilitates the communication process, since both parties are in the same profession. Peers can better understand what their colleagues have gone through and thus better relate to and sympathise with their reactions. Talking with a peer helps to guard against the problems discussed above relating to the professional self-perception of those affected by critical incidents. The "normalisation" of stress reactions, i.e. their perception as normal and their integration into an individual's set of coping strategies, is achieved more quickly and effectively through peer intervention.

The CISM programme in accordance with ICISF standards has been established in many fields of work. In Germany, CISM has become an established and proved method of crisis intervention in air navigation services organisations, airlines and airports. Some organisations have firmly established crisis intervention teams to better prepare and perform the missions on site, e.g. at airports. DFS Deutsche Flugsicherung and the operator of Frankfurt Airport, FRAPORT, for example, have maintained a joint crisis intervention team, ATC-AP (Air Traffic Control - Airport), since 2003. The team is registered with ICISF and had its first large-scale mission after the tsunami in 2004 when it supported passengers returning from Southeast Asia.

### *CISM at DFS*

In 1998, DFS began developing a CISM programme for air traffic controllers working at 18 towers and 5 radar control centres in Germany. The safe and effective surveillance and handling of air traffic in and over Germany is the core task of DFS and is performed by approximately 1800 operational staff members. DFS controls over 2.5 million flight movements in German airspace per year.

The CISM programme of DFS is based on the support of peers as described above and provides qualified personnel (peers) to offer support throughout the company. All in all, there are more than 80 peers at DFS, all of whom have been trained and certified in the following ICISF courses:

- Individual Crisis Intervention and Peer Support
- Group Crisis Intervention
- Advanced Group Crisis Intervention

At all DFS locations, the counselling by peers after critical situations has become a standard procedure and now forms an integral part of the professional image of air traffic controllers. Peers generally do their work within the first six hours following an incident. This is only possible because there are enough peers at all DFS locations to ensure that someone is always quickly available. Air traffic controllers affected by critical incidents who subsequently receive peer counselling normally return to work the following day. Since the introduction of CISM, there have not been any reports of long-term problems resulting from critical incidents. The goals of the programme are to reduce stress reactions after critical incidents and to quickly restore the ability to work. These goals are met in all cases.

Peers are supported in their tasks by the Board of Managing Directors, the heads of the individual branches and the managers in operations. Thanks to the CISM programme at DFS, "safety leadership" is now practiced and experienced on a daily basis. As mentioned above, the importance of managers in operations in the implementation of CISM has been proved in an evaluation (Vogt & Pennig, 2006). The success of CISM, however, largely depends on top management's continual support of the programme (Riedle, 2006).

DFS has advised other air navigations service providers in Europe in their efforts to develop CISM programmes and has trained peers for them<sup>1</sup>. Every year, DFS organises a peer conference to which other air navigation services organisations are also invited. A sound network has developed as a result. This network is an important prerequisite for supporting each other in the case of a disaster, especially when different cultures and languages are at play.

### CISM and corporate culture

The evaluation of the DFS CISM programme by the University of Copenhagen also included an investigation into improvements related to corporate culture. The starting point was the result of a preliminary study which preceded the evaluation (Vogt et al., 2004). At the time, it had been determined that even air traffic controllers who had never taken advantage of CISM nevertheless attributed 3% of their recovery after critical incidents to the programme. The reason for this was that the introduction of the CISM programme had generally improved the corporate culture of DFS and particularly its safety and communication culture. The introduction of the CISM programme alone showed that critical incidents were no longer seen as the result of "human failure", but rather as an inherent part of the job for which the organisation must make provisions, about which the team must talk and from which all involved must learn. The entire staff – even those who never experienced a critical incident or

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<sup>1</sup> More information can be requested from the DFS Air Navigation Services Academy, Am DFS-Campus, D-60225 Langen, Germany.

never used CISM after such an incident – benefit from this improvement of the corporate culture and from the back-up offered by the programme in case they need it some day. As a result, the organisation as a whole benefits from CISM.

In order to corroborate the hypothesis that a cultural change has occurred at DFS, all 352 air traffic controllers and peers who took part in the evaluation of the DFS CISM programme were asked to describe the changes to DFS culture following the introduction of CISM. A list of adjectives describing culture was provided: sensible, helpful, supportive, safety-conscious, egoistic, resistant to change, clique-oriented, competitive, disciplined, uptight, polite, team-oriented, staff-oriented, open. On a scale from -2 (much worse), -1 (worse), 0 (unchanged), +1 (better) to +2 (much better), the participants were asked to indicate how their interaction with their colleagues had changed after the introduction of CISM. On average, the change was rated between +0.1 and +1.1. This means that the introduction of CISM improved the culture with regard to all adjectives (more sensible, more polite, less uptight, etc.). Although the changes were rather small, the sample group was large enough to ensure that these changes are, with few exceptions, statistically significant. The adjective "safety-conscious" must be stressed, because it is crucial to the core business of air navigation services and improved by +0.7.

In summary, these empirical findings confirm the importance of a corporate culture for an HRO which was explained in theory above. And it must also be noted that this culture can be positively influenced by the introduction of a programme like CISM, bringing advantages for both the organisation and the staff.

The next section will show how a positive corporate culture is also important outside the organisation when it comes to coping with major disasters.

#### *Crisis intervention missions after major disasters / crashes*

In addition to the frequently occurring individual crisis situations attended to by the peers on site, there may also be aircraft accidents. Although they are rare, they unfortunately can never be ruled out. In the following text, we will look at two examples. The accounts are not focused on the accidents themselves, but rather on the work of the DFS crisis intervention team and on the lessons learned in dealing with cultural differences.

##### *The crash landing of a calibration aircraft*

In the year 2000, a calibration aircraft commissioned to calibrate the arrival and departure navigational facilities of a smaller aerodrome in Germany crashed into a mountain. The aircraft was destroyed and caught fire; the crew – pilot, co-pilot and two calibration engineers – were killed on the spot.

The organisation responsible for the calibration aircraft offered the relatives of the victims the opportunity to travel to the crash site to see the site themselves. DFS promised additional support in the form of its crisis intervention team. Among the relatives of the deceased crew members were parents, brothers, sisters and wives. The DFS crisis intervention team was composed of five peers and two psychologists. The team met one evening prior to the actual mission and discussed the accident and the planned course of action for the mission on the basis of the facts available at the time.

As planned, they met with the relatives, who came from different towns in Germany, at a central location. A representative of the company gave the relatives a description of the accident and informed them of the facts available at the time. Then the head of the crisis intervention team introduced the individual team members and the support they offered. After this meeting, which lasted approximately one hour, everyone – i.e. relatives, company representatives and the crisis intervention team – was taken by tour bus to the crash site. The bus ride lasted approximately two hours.

In the preparation phase, the crisis intervention team discussed the following:

- Since the relatives do not know the members of the crisis intervention team, contact must first be established while, at the same time, they must be made aware of the support it offers and its limitations.
- These limitations are due to the amount of time given to the mission; furthermore, the members of the crisis intervention team are not peers of the relatives, they are only there for them for a short time.
- To prevent feelings of a lack of interest or helplessness caused by the limitations of the mission, the peers who were chosen for this mission lived in the same town or at least near the places of residence of the relatives. This created a certain sense of solidarity.
- The bus ride was used as an opportunity for initial personal contact.
- The peers collected information about the support systems available in the cities where the relatives reside so that they would be in a position to refer them to other aid organisations upon their return home (e.g. priests, psychological services, information centres).
- The support was limited to one day and focused on coping with the confrontation with the crash site.
- In addition to psychological support, the peers' expert knowledge as air traffic controllers was helpful when relatives had questions about the facts presented.

One of the deceased was an ethnic German from Russia. His wife and son were also present during the trip. This was a particular challenge for the preparation because the wife could hardly speak German and most of the communication had to be mediated by the son.

When the bus reached the town where the crash had occurred, the relatives had to walk about 30 minutes through a forest to reach the crash site. The crash site had already been cleared at this point, so there was no visible wreckage. The traces of fire on the ground and on the trees, the smell of kerosene and the broken branches of the trees sufficed to describe the situation. The relatives asked to be shown the spot where the dead were found so they could say their last goodbyes. While the German family members were rather quiet and contemplative, the Russian wife began to weep very loudly, as is customary in her culture. The crying grew into a loud screaming and pleading; the woman threw herself to the ground and made gestures to express her grief.

The way the woman dealt with the situation, the way she coped with her emotions and her grief was in stark contrast to the reactions of the other mourners. Because of the silence of the others, the behaviour of the Russian woman felt even louder and more foreign. On the bus ride back, the Russian woman seemed considerably more detached and clear-headed than the other relatives.

From the point of view of crisis intervention, we can make the following observations about cultural differences:

- We knew early on that a woman with Russian background would be present. However, our preparation was limited to the question of religion, and since the woman was Christian, we saw no reason to consider special treatment. In view of the mixed group, its size and the limited time for preparation, this seemed to be an appropriate procedure.
- Still, a discussion of cultural differences in dealing with grief would have been helpful.
- It was not clear whether we should have done something, and if yes, what. Because of the common cultural background shared by the helpers and the other relatives, it was easier to treat those quietly mourning with respectful distance and to intervene only upon receiving certain signs. A certain amount of cultural identification could be taken as a given and a reliable appraisal of the mourners' actions was possible.

- The behaviour of the woman, however, created a sense of insecurity, as the loud pleading and crying did not correspond to the culture of the German helpers. Furthermore, this behaviour was interpreted as an emotional collapse and a loss of self-control, and thus for those from our cultural background it signalled a need for intervention all the more.
- Since a message is interpreted by those who receive it and the interpretation is based on past experience and cultural consensus, the helpers also experienced the emotional insecurity caused by the situation and the sense of being "threatened" by it.
- In this situation, helplessness turned out to have a positive effect: We did not react. It could very well have aggravated the situation if, for example, a helper had tried to offer consolation with the intention of lending support. Consolation in the usual sense would probably have interfered with the grieving process, with coming to terms and coping with the loss, which, from her point of view, were not threatening at all.
- Interfering with a person's coping mechanism is detrimental to a lasting, effective emotional process of coming to terms with the situation. It interrupts the process of coping and weakens those affected because it causes them to go from an emotional to a cognitive/rational state.

The mission was an overall success, as the feedback from the relatives also confirmed. This example also shows, however, that an intensive preparation of the crisis intervention team must include information about the cultural backgrounds of all affected. Dealing with cultural particularities not only refers to different religions but also to the way in which members of different cultures react to crises and cope with grief and loss.

#### The disaster of Überlingen

Another experience of the DFS crisis intervention team was supporting the air traffic controllers of the Swiss air navigation services organisation skyguide. In summer 2002, around midnight, a Russian passenger aircraft from Bashkiria collided with an American cargo aircraft over the city of Überlingen on Lake Constance. The collision took place on German territory; the aircraft was controlled by the Swiss air navigation service provider. On board the aircraft from Bashkirian Airlines were children and adolescents who had won a school competition, the prize being a trip to Barcelona. On board the cargo aircraft were pilot and co-pilot.

All 71 passengers and crew members of the two aircraft were killed in the crash. As if by a miracle, there were no additional deaths on the ground.

The DFS crisis intervention team arrived in Zurich five days after the accident to offer support to the Swiss air traffic controllers from skyguide. A total of six CISM debriefings were performed as group measures. Approximately 120 skyguide staff took part, the majority of whom were air traffic controllers.

The DFS team consisted of two mental health professionals, i.e. a psychologist and a family therapist, and 5 peers (DFS air traffic controllers). The peers were selected according to the following criteria:

- Level of training and experience as peer
- Sex (both male and female peers were to be present)
- Emotional involvement and emotional stability
- Ability to work in a team

The crisis intervention team discussed the situation in detail and worked out a course of action prior to their departure to Switzerland. The roles they would each take in the process, the responsibilities and the sequence of events were discussed and agreed upon (Leonhardt et al., 2006).

In the debriefings, the participants identified themselves very strongly with the Danish air traffic controller on duty at skyguide the night of the disaster, with skyguide and with the air traffic controller profession in general. This identification connected them emotionally to the disaster – "it could have happened to me". Such reactions were even more marked on the part of other Danish air traffic controllers working at the Swiss air navigation service provider, since identification due to shared nationality and expatriate status also came into play. This aspect was further intensified by the differences in the way Danes and Swiss deal with their emotions. We had the impression that showing and expressing emotions is seen as normal in Danish culture and is thus acceptable; in comparison, it seemed that the Swiss were more determined to rationalise their emotions.

In debriefings in which Danes participated, the emotions expressed were more distinct and more strongly emphasised than in debriefings with only Swiss air traffic controllers. In retrospect, it might have been a good idea to form a purely Danish group in order to have a more homogeneous group. Emotions could then have been discussed in a culturally consistent way, which would presumably have also simplified matters for the debriefings in the Swiss groups. On the other hand, such a procedure could have reinforced the impression of the "foreignness" of the Danish air traffic controllers and therefore have had a negative impact. This review of the events is to show that there is always a large number of factors to consider. A discussion of the cultural aspects of crisis intervention should form an essential part of team preparation.

In addition to the more obvious aspects of culture, such as religion and nationality, crisis intervention measures are influenced by other cultural factors, such as:

- the way operational staff in HROs see their profession, as described above
- the culture particular to an organisation (e.g. safety culture)
- the way managers view communication, crises and crisis management

The Swiss air navigation services organisation is to be credited for the fact that they were able to request help when in a state of organisational crisis and to benefit from that help. Their willingness to accept help from another state and from an organisation in the same line of business deserves respect.

One and a half years after the accident, the Danish air traffic controller who was on duty that night was stabbed to death by a man who had lost his wife and both children in the crash. The murder took place in front of the air traffic controller's house in Switzerland in the presence of his wife and two children. This is not the place to attempt a description of the factors which contributed to this tragedy. Nevertheless, the following points should be borne in mind to guarantee that no stone is left unturned to prevent such tragedies in future:

- After the air traffic controller was murdered, reports indicated time and time again that it is part of Bashkirian culture to ask forgiveness when someone is killed. This request for forgiveness can initiate the grieving process, which also leads to forgiving those guilty for the loss and accepting the situation.
- The air traffic controller was not allowed to ask forgiveness, since in legal terms it could have been interpreted as an admission of guilt and could have had legal ramifications for all involved.
- The accident was frequently represented as the result of "human failure". For this reason, the air traffic controller was taken to be the only responsible party and thus the only person to blame for the accident. In the case of this accident, however, an entire chain of situations, circumstances, actions and decisions led to the collision. It is therefore not permissible to solely blame one individual.
- The name, nationality and finally the place of residence of the air traffic controller became publicly known relatively quickly.



- In that light, the following questions must be discussed in a HRO in order to be equipped to handle an intercultural crisis:
- How are employees' personal data handled after accidents and critical incidents?
- How can data protection and the anonymity of those involved be assured?
- How can an organisation, when giving its account of an accident, avoid giving the impression that it is the result of an error of one individual?
- How can it be guaranteed that the term "human failure" is not used?
- When other nations are affected, what should an organisation do to understand their cultures and the special aspects of these cultures?
- Which measures should be taken to do justice both to cultural demands and to legal limitations?

When we ask such questions, we are not trying to tell the organisation concerned, i.e. skyguide, how to run their business, and we certainly do not intend to imply a failure on their part. That would be an allocation of blame to an individual organisation, which would be as inappropriate as attributing the cause of an accident to "human failure".

What is done is done; instead, the situation and the decisions made by responsible parties must always be seen in context and in relation to their reasoning at the time. Not learning from tragic events in order to be better prepared for the future would, however, constitute an unforgivable mistake. These questions will need to be pursued and more questions need to be raised. Three years after the murder of the controller, however, they should also be a basis for reconsidering intercultural crisis management and the responsibilities it entails.

### *Conclusions*

National and organisational cultures play an important part in dealing with critical and potentially traumatic events. Professional helpers who offer their services in such situations must prepare themselves for the culture of the people they are to help. High Reliability Organisations have the obligation to create and maintain an organisational culture and especially a safety culture, which help them to prevent critical situations as much as possible and, when they do occur, to handle them professionally and effectively. Critical Incident Stress Management has proved to be helpful in dealing adequately with crises on all three levels: personal, within and outside the organisation.

### *Author Note*

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## Article 2: CISM and the interaction with Safety Culture

### *Abstract*

This paper documents the interaction of a human factors (HF) program with the safety culture of high reliability organizations (HROs), for example, air navigation service providers. The results are based on two surveys on Critical Incident Stress Management (CISM) of European air navigation service providers: 1. A survey of CISM experts from nine countries about the cultural differences in dealing with critical incidents and the resulting stress. 2. A study conducted by the University of Copenhagen about the costs and benefits of the CISM program within the German air navigation service provider DFS (Deutsche Flugsicherung). Both studies confirm the authors' hypothesis that the HF program CISM interacts in synergy with the safety culture of the organization: A good safety culture will support the implementation of a CISM program and a sound implementation of a CISM program will improve safety culture. Synergy or failure is not only based on the quality of program implementation, it also depends on the support of managers at all levels. Therefore, safety leadership, safety culture, and human factors are interconnected systemic actors.

### *Introduction*

#### Culture

Even in a European context with largely shared religion and related cultural background there are big differences between neighboring countries. Also within one country, culture can vary between regions or organizations. From a business perspective an enhanced cultural collaboration throughout Europe is of utmost importance if we want to compete with the new, growing market economies in the East (Sørensen, 2005). The requirements for the collaboration are: We need to create a culture of trust and understanding to efficiently handle problems and be competitive.

It is hard to narrow the concept of culture down as there probably are as many definitions as there are researchers (Maziul et al., 2006). The definitions range widely from culture as the human made part of the environment (Triandis, 1989) to a collective programming of the mind (Hofstede, 1980). From a perspective of improving the co-operation between people of different backgrounds, the following definition of culture is helpful: Culture manifests itself in an orientation system typical for a specific nation, society or organization (Thomas, 2003). Culture can be broadly defined as the sum of a group's or nation's way of thinking, believing, feeling, and – most important for an HRO – acting. A system of shared values and norms is the essence of culture and again influences attitudes and behavior (Trompenaars, 1993). The system offers a framework for people's behavior and at the same time influences their perception, way of thinking, and assessment of social situations. The crucial aspect is the consensual function of culture: it sets the frame for appropriate and inappropriate action and thinking within a society, may it be a nation or an organization. Nevertheless, there is a specific margin, in which the behavior can vary without breaking cultural standards. Breaking cultural standards and going beyond the specific margins can lead to rejection and sanctions (Thomas, 2003).

Within organizations the standards of the organizational culture must be clear and accepted to avoid misunderstandings and unfavorable behavior. This is especially true for HROs like aviation services. As a specific but the most important part of their organizational culture they need safety culture.

#### Safety culture

The term safety culture is used to describe a culture that supports high reliability organizations (HROs). HROs must have a professional safety culture that enables them to cope with, for example, accidents or critical incidents as precursors of accidents. The term safety culture has been in use some time, but it is not always clear how safety culture is defined and how it relates to the aviation industry (Gordon et al., 2005). Safety culture is not just there and nothing an organization owns; it is a product of among others safety leadership, safety through practice, communication, and common understanding. Safety culture is thus rather what a system does than has (Hollnagel et al., 2006). It requires promoters, drivers, and door openers within and outside the organization, as well as methods that give evidence about its importance.

Dekker (2006) put it in these words:

“Finally when it comes to safety, every organisation has room to improve. What separates a strong safety culture from a weak one is not how large this room is. Rather, what matters is whether the organisation is willing to explore this space, to find leverage points to learn and improve”.

Safety culture is important even if sophisticated safety management systems are in place. Gordon et al. (2005) elaborated on the role of safety culture as an enabler for safety and the consequences of prevalent or missing safety culture, for example, on the number and handling of accidents. With respect to aviation, the risk of an accident cannot be excluded completely, their number, however, is very low relative to the large amount of air traffic. Therefore, some authors speak of “ultra safe systems/organizations“ (Amalberti, 2001).

Safety culture was reported to have a major role in several large accidents as the following quotation from Leveson et al. (2006) underlines:

“The CAIB noted that culture was a large component of the Columbia accident. The same point was made in the Rogers Commission Report on the Challenger Accident, although the cultural aspects of the accident was emphasised less in the report.”

It is an important aspect of safety culture that managers of high reliability organizations always decide in favour of safety:

“An effective Safety Culture produces a belief that when safety and production goals conflict, managers will ensure that safety will predominate” Flin (2006).

In summary, it can be stated that the core business of an air navigation service provider like DFS is safety. A prerequisite and condition sine qua non for the product safety is safety culture. There are similarities and differences in the handling of accidents or critical incidents. They must be considered when dealing with culture in general or safety culture in particular.

### Similarities and differences

National and corporate culture influence the way in which crises are handled and, in turn, which crisis intervention measures should be applied. Each culture qualifies crises in a different way. The intensity of its concrete experience with national crises determines the structure of the individual crisis intervention programs. This applies to nations as well as to companies. At national level, the need for structured crisis intervention measures is often demonstrated by national disasters (earthquakes, avalanches, floods) and more recently terrorist attacks (Madrid, London). At company level, it is often only recognized after or because of major disasters (high-speed train accident in Eschede, mid-air collision above Überlingen).

Without defined and structured crisis intervention measures, a reaction to an acute crisis often has negative effects on the persons involved and the company. The symptoms of those affected last longer and in some cases, they suffer from late effects or even post-traumatic stress disorder. Also, companies which do not have any – or any suitable – CISM programs sometimes even aggravate the damage to their reputation caused by the accident.

There is a connection between national culture and the handling of stress reactions. Frequently, inhabitants of Mediterranean countries are said to manage their critical incident stress reactions differently than inhabitants of Northern countries. Culture in general and organizational culture in particular can influence the way an employee or manager or the company in total deals with crises and critical situations. It can, for example, play a role whether an organization is willing to acknowledge that there are negative effects of critical incident stress on well-being and performance and therefore to offer professional support. In contrast a poor safety culture might lead to ignorance or even denial of critical incidents stress.

However, despite these cultural differences in organizations, the physiological-neurological stress reactions after critical incidents, i.e. critical incident stress reactions, are very similar in all cultures. Selye (1950) described a critical incident stress response pattern as a General Adaptation Syndrome because it occurred in all kinds of crises. Crises are always events triggering personal stress reactions and activating personal coping strategies. Even if a larger group of people is affected by an incident, it is the individual's reaction which turns a crisis into a trauma and a trauma into a post-traumatic stress disorder. This article does not deal with aspects of personal coping strategies, the enhancement of each individual's ability to cope by means of experience or the different types of crisis situations. Nevertheless, it is important to shed some light on the neurophysiological stress reactions to show that they are similar across cultures.

#### Neurophysiologic communalities

So what happens after a critical incident in all humans? Leonhardt and Vogt (2006) described the main human neurophysiologic and humeral stress reactions in the context of critical incidents. They are centered on the limbic system, one of the oldest regions of the brain, which can control and trigger autonomous processes. Autonomous means that the reaction is not under our conscious control. The limbic system can make use of two systems, which Huber (2003, page 44) calls the "cool system" and the "hot system". In a "cool system" state, the sensory system picks up a stimulus and forwards it to the brain region thalamus, then to amygdala and hippocampus. Via the thalamus the information reaches the two hemispheres, the language centres and the prosencephalon, starting the internal and conscious processing of the received stimuli (Huber, 2003, p. 44). In the case of a stimulus perceived as stressful, the "hot system" state is activated. In this case, there is a direct "link" between thalamus and amygdala. If the stimulus is identified as "hot", the "bypass" to the amygdala is used to alert the entire organism, which causes the stress reaction (Huber, 2003).

As early as in 1914, the US researcher Walter Cannon described these stress reactions as "fight or flight" reactions. *Fight* stands for the readiness to fight, whereas *flight* stands for readiness to run. When the inner balance is jeopardised (Hüther, 2004), the body is provided with the required functions to activate the emergency actions *fight* or *flight* within fractions of a second. Typical reactions are, for example: increased pulse, breathing and heart rates, constricted capillary blood vessels as well as other reactions. These bodily responses are facilitated by the sympathetic nervous system which stimulates the adrenal gland (located on the kidneys) to excrete adrenaline (epinephrine) into the blood. They are normal stress reactions that have evolved to ensure survival in critical situations. Such reactions are triggered as reflexes, in the same way as, for example, a bike rider ducks down when a branch is in his way. He ducks before he even consciously realizes the risk posed by the branch. In addition to the pattern of "fight and flight", there is also the reaction pattern of "freeze and fragment". *Freeze* is like a paralysis, whereas the *fragmentation* is a pattern of dissociation. Dissociation, "being separated from the body", is known from reports of accident victims who have seen themselves from outside the body, separated from their bodies and their pain

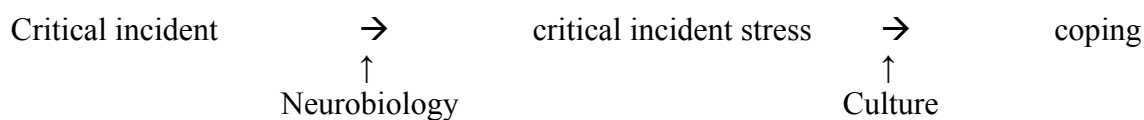
(Bauer, 2002). However, since our environment changed "fight and flight" as well as "freeze and fragment" are not the ideal response patterns any more.

Stress reactions to critical incidents can be understood from a cerebral-physiological point of view. They are crucial to "surviving" the situation. These stress reactions are understood in CISM as the "normal reaction of normal people to abnormal situations" (Everly & Mitchell, 1999), because they are general neurobiological adaptation processes. Stress reactions only become pathologic when they do not subside by themselves or due to the CISM intervention and instead become chronic.

This is phylogenetically determined in the processes taking place in the brain region of the limbic system – irrespective of culture (Marsella et al., 1994). There are numerous indications suggesting that the symptoms of the post-traumatic stress disorder are very similar in all cultures, even if some symptoms may be more or less pronounced in some cultures than in others (Joannidis, 2006).

### Intervention impact

The neurobiological communalities in critical incident stress mean that crisis intervention measures can be used across cultures. They should, however, be adapted to the relevant culture taking certain cultural, e.g. religious, aspects into account. While the critical incident stress responses themselves are similar across cultures, the coping process depends heavily on the prevailing culture.



**Figure 1: A critical incident causes critical incident stress responses via nervous and humeral pathways; the coping process is influenced by culture.**

Crisis intervention measures should always be process-oriented, because a process-oriented approach is most successful in all cultures (Leonhardt & Boege, 2008; Leonhardt & Vogt, 2008). In the case of defusing, for example, it consists of the following steps: stabilizing the situation, recognizing the crisis, promoting understanding, encouraging appropriate coping tools, restoring normal functioning or referring the person to a professional for help. This process-oriented approach in crisis intervention can be applied in different countries, if it is adapted to the prevailing cultural standards. The efficiency of critical incident stress management programs (CISM), for example, depends on culture: A sound safety culture will foster an efficient use of CISM (Vogt et al., 2007).

### Critical Incident Stress Management (CISM)

Crisis intervention measures are a necessary precaution for many businesses, especially for professional organizations delivering high reliability services in safety critical areas. Dekker (2007) sees some progress here:

„ Some professions have come quite far with the development of so called crisis intervention, peer support, or stress management programs that are intended to help practitioners in the aftermath of an incident. The importance of such programs cannot be overestimated: they help incidents become less of a stigma, that they can happen to everybody, and that they can help the organization get better if the aftermath is managed well.”

Critical Incident Stress Management (CISM) is a comprehensive, integrative, systemic, multi-component approach to handle crisis. Originally, CISM was conceived to help, for example; fire fighters, police officers and paramedics to cope with critical incidents like the sight of the

injured and the dead, in order to keep them going during their rescue work and to prevent post-traumatic stress disorders (PTSD) (Mitchell, 2006). PTSDs can be considered a super strength version of an acute critical incident stress response that became stuck in the 'on' position (Mitchell, 2006). They can occur after exposure to a horrible event, including, for example, a threat of death or serious injury to oneself or others, intense fear, and helplessness. In aviation, such events can be crashes, threatening and violent passengers or severe injury-generating turbulence for passengers and flight attendants. PTSD is connected to intense arousal symptoms like restlessness, sleeplessness, hyper-alertness, inability to relax and difficulties concentrating (Mitchell, 2006). Moreover, intrusive symptoms usually appear (mental replay of parts of the traumatic experience, i.e. mentally see, hear, feel, smell, taste aspects of the event and have repeated nightmares and flashbacks). People with PTSD show avoidance symptoms, they shut off, for example, their emotions, avoid places, equipment, people, conversations and other stimuli that remind them of the event. PTSD symptoms last beyond 30 days after the traumatic event. Anything short of a month is considered the normal, but distressing, response of normal people to an abnormal event (Mitchell, 2006). The PTSD condition causes significant disruption to, and impairment of, social, work and home life. CISM is a multi component and comprehensive model to support people in crisis and to prevent PTSD. The model is adoptable to many different contexts, in which a specific CISM program is to be implemented for crisis intervention. Crisis in this sense means being in an unstable emotional and cognitive status after a critical incident wherein normal coping strategies are failing. A critical incident (CI) in this understanding is defined by: Any situation causing reactions perceived as unusual by the affected person, but which in fact are normal reactions to an abnormal event.

Important in this definition is that any situation can be a CI; it depends more on the psychophysical status of the involved person than on the incident itself (Leonhardt and Vogt, 2006). A person in a good psychophysical and mental status, for example after the annual holiday, will have more self-coping capacity in the case of a CI compared to the same CI faced in a weak mental status, for example, after divorce. The mental status is influenced by a lot of external factors which are not directly related to the CI.

The CISM model includes several intervention methods to be applied after various situations; in general they are differentiated by group or individual intervention models as well as by time relations to the incident (Leonhardt, 2006; Mitchell, 2006).

The different methods are:

- Education and Training
- Pre-Incident preparation
- Individual Crisis Intervention SAFER-R

*Stabilize*: Stabilizing the situation and stopping the influence of the immediate sensations (smell, sight, taste, hearing).

*Acknowledge*: Acknowledging the crisis by inquiring about the facts, the reactions to the event and the possibility to talk about the situation and the reactions.

*Facilitate*: Facilitate the normal recovery process. Central in this step is the normalization of the critical incident stress reactions, because they are perceived as abnormal by the affected person. This "something is wrong with me" kind of perception is an obstacle in the recovery. Critical incident stress responses are normal in the unusual situation of a CI and this understanding is important for the coping process.

*Encourage*: Encouraging the adaptive coping functions.

*Recovery*: It is evident that the person in crisis is on his/her way to recover and restore her/his normal functions and abilities.

*Referral*: If needed, referral to other professional help is initiated (Spectrum of Care).

- Group Crisis Intervention: Defusing
- Group Crisis Intervention: Debriefing
- Demobilization
- Crisis Management Briefing CMB
- Strategic Planning
- Family and Organizational support

A CISM program should include all the different methods to be used in various situations. This enables an organization to react flexibly and handle critical events efficiently and professionally. CISM interventions are usually conducted by so-called peers or peer counselors. Peers are colleagues from the same profession who have completed CISM training. They are appointed in different ways, either by means of a selection process, e.g. an assessment centre, or through election by their colleagues. The decision for selection or election should be based on the communication culture in the organization (Leonhardt and Vogt, 2006). In organizations with a solid and open communication culture of trust which supports learning from errors (Angenendt, 2003), people likely discuss errors, mishaps and “feelings” after a CI; here, the selection process can be employed and the focus set on the skills of the future peers. In organizations with a blame culture, errors and mishaps are more often seen as individual shortcomings. Here, the election process will be the appropriate way to facilitate peers into their new job role. It is important to realize that after the election a later selection may not be possible; therefore, a special emphasis has to be placed on the training of the elected peers.

The selection process is usually conducted by psychologists, who aim to find suitable persons based on a range of criteria concerning personal and job-related abilities. The election process also focuses on the selection of suitable persons, but here the emphasis is on the individual's personality and the trust his colleagues have in him (Leonhardt & Vogt, 2006). Which procedure is chosen usually depends on the corporate culture. If the corporate culture takes crises seriously and provides psychological support, the selection procedure can be applied. If, however, the corporate culture is based on the concept of infallibility and the psychological effects of crises are not dealt with, peers should be elected.

The CISM peers, who are offering CISM to air traffic controllers, are air traffic controllers themselves and most of them are operational. Apart from this special and professional proximity, which facilitates understanding in the time of crisis, they are educated and trained in CISM through a period of three years and the following CISM courses:

1. Individual Crisis Intervention and Peer Support
2. Group Crisis Intervention
3. Advanced Group Crisis Intervention
4. Strategic Response to Crisis

The courses were developed by the International Critical Incident Stress Foundation (ICISF) and are carried out by qualified and certified trainers. All successful participants receive an internationally recognized certificate. This certification is very important as it boosts the confidence of the peers and the company can rest assured that their peers have received thorough training (Welzant & Kolos, 2006). Peers are laymen who are first on the scene to provide psychological support after a critical incident. Crisis intervention by peers is not and does not claim to be psychotherapy, which is often still needed later on.

CISM peers in air traffic control are activated by the operations room supervisors after a CI and they offer CISM to every colleague who feels affected by the CI. CISM as a method of crisis intervention is clearly distinguished from psychotherapy. Peers are crisis interventionists and are offering CISM to colleagues, who experience normal reactions in abnormal situations of distress. If CISM does not work or is not indicated, i.e. if critical

incident stress reactions persist, peers refer the affected colleagues to other psychosocial or medical services, for example psychotherapy.

#### CISM in Air Navigation Service Providers (ANSPs)

Several Air Navigation Service Providers (ANSPs) in Europe have CISM programs in place. The German ANSP DFS has conducted an extensive evaluation of the DFS CISM program also involving cultural effects which will be presented in section 2. The main employees and CISM target group are air traffic controllers (ATCOs), who work at the sharp-end of this high-reliability business. This means maintaining constant vigilance, high concentration, stress resistance and also team performance. Besides the mental and team-related requirements for ATCOs that demand enormous energy, CIs always depict extraordinary situations that go beyond the everyday stress and the resulting strain. A CI in this context is, for example, that two aircraft fall short of the required safety separation (separation infringement or loss). In contrast to police and rescue services, such a CI does not involve single or multiple victims of violence, crime, or accidents and the direct handling of casualties or dead people. ATCOs very rarely are involved in real accidents; they mainly have to cope with the imagination what could have happened due to the separation loss of aircraft.

Due to their selection and training, which includes a healthy stress management, ATCOs are able to deal with the special demands and the resulting strain. An ergonomic work place with, for example, forward-rotating shift systems, and breaks in line with their position's workload can help to cope with the daily work stress (Vogt, Hagemann and Kastner, 2006). These issues are addressed in ATCO training, medical check-ups (EUROCONTROL, 2000), and briefings; therefore, ATCOs are familiar with them. ATCOs actively manage their own stress in terms of an individual maintenance of performance and well-being.

Nevertheless, some CIs and the related reactions might exceed the individual stress tolerance and coping capacity. A comprehensive CISM program helps ATCOs to deal with these CIs, which cannot or can only be poorly dealt with by ATCOs on their own.

The requirements on a CISM program in ATC differ in at least three major aspects compared to other occupational groups:

- CIs in ATC do not necessarily have to experience an accident; the most frequent CIs are unforeseen separation infringements of aircraft
- Generally, the ATCO working in the radar centers of Approach (APP), Area Control (ACC) and Upper Area Control (UAC) is separated from the incident and has no direct sensory impressions. Only the tower controller may witness an accident on the runway with his or her own eyes
- Contrary to other CISM users like fire fighters or police officers, ATCOs are directly involved in the development and progress of a CI and usually feel responsible

The three aspects will be further explored in the following sections.

#### Critical Incidents in ATC are not necessarily an actual accident

For an ATCO, a CI is, for example, an unforeseen separation loss between two aircraft. As a rule, the safety margin is big enough to ensure that falling short of the separation minimum does not lead to an accident. Normally, it is not even noticed by the passengers or the public. However, an unintended separation loss, even if it is only marginal, can have a major impact on the ATCO's self-image and induce CI stress reactions.

Pennig (2007) reported that without CISM, ATCOs may isolate themselves or search for help from people in their social network or mental health professionals outside ATC. Isolation obviously does not support recovery. Helpers outside ATC frequently cannot understand why an unforeseen separation loss is so dramatic in the eyes of the ATCO; they would attempt to comfort in trying to argue that nothing happened and there is no reason for such reactions. As



a consequence, they would make the situation even worse by stimulating the ATCOs' mind to imagine what could have happened. The ATCOs could then feel even more misunderstood during such a discussion and try to avoid talking about their actual reactions and symptoms. Many ATCOs will be confused and believe that something is wrong with them and their perception of reality.

This can have consequences if a constructive debate and coping mechanisms are missing. The ATCOs might withdraw and hide their true feelings and reactions. The feeling of "I am not normal" or "Something is wrong with me" becomes overwhelming and intensifies the crisis. If nobody else regards the incident as problematic and if it seems there is no reason to worry or get excited in a negative sense, the ATCOs' own reactions are more and more perceived as abnormal. Self-medication (for example with alcohol, sleeping pills, and sedatives) aggravates the situation and a vicious circle begins. The ATCOs' belief of being abnormal and the self-doubts grow out of control and it becomes increasingly difficult to put the symptoms into perspective with the CI.

The symptoms might become chronic. In the worst case a PTSD can develop. The original relation between symptom and CI becomes blurred. In this case, it is unfortunately common to only treat the physical symptoms with medication or surgery. It becomes more and more difficult to relate these disorders to a CI which may have happened years ago.

Attention has to be paid to the reactions that the ATCO perceives as unusual and which cause self-doubts in general. In particular, the professional self-image of the ATCO must be considered, because ATCOs as described above are used to work stress and may have experienced critical situations before without strong stress reactions. Traditionally, it has been the culture in ATC to view CIs as part of the job which has to be coped with individually. The lonely riding cowboy has been used in the past as a metaphor for the ATCO, who alone bears the responsibility for air traffic safety. In aviation psychology, the term machoism was also used to describe this mentality (Jensen, 1997). Modern ATC needs a shift from this lonely rider or cowboy mentality to a team-based culture, including learning from failure, which is organized and not sanctioned.

The ATCO working in ACC and UAC is physically separated from the incident. CIs usually do not lead to an accident. If the unlikely actually does happen, ATCOs working in radar centers do not have direct sensations from the accident site. Smell, sound, taste and visual sensations are not perceived. After an accident has happened on the radar screen, the ATCO imagines pictures and sensations of the events happening on the site. Therefore, it is not possible to talk about direct sensations during a CISM intervention. However, the pictures the ATCO has imagined and the involved (imagined) sensations and perceptions have to be addressed.

The visualizations do not necessarily correspond to the actual events and might lead to a deferral of perception in the long run. The media partly contribute to an adjustment of the inner pictures and visualizations; nevertheless, the media show a subjective reality as well and do not always provide objective reports. However, in terms of a CISM measure, it is crucial to support the ATCO in the adjustment of the subjective reality.

How the adjustment of the subjective reality can be supported in practice is demonstrated by the following example: In January 2004, a passenger aircraft approaching Munich Airport made an emergency landing. The forced landing took place on an open, snowy field, controlled by approach and tower ATCOs in Munich Control Center and Tower, but outside eye view of the Tower ATCOs. After it was announced that the aircraft had landed according to emergency procedures and that nobody had been injured or died, managers of Munich tower called for CISM measures. Besides the applied measures (for example SAFER-R; see above), the ATCOs could visit the landing site to take a look at the respective aircraft, speak

to the pilots and so on. Taking a look at the aircraft, getting a picture of the real extent of the damage, and being able to adjust their own mental representation of the site (so far based primarily on ATC information) by actually seeing the condition of the passengers and speaking to the pilots greatly contributed to stabilizing the ATCOs. Comparing one's own imagination with reality, with the inherent reflection with the incident and the stabilization, is the first step towards coping and reducing the effects of the stress reactions.

The pilots gave the ATCOs positive feedback on their professional support and work. For this reason, the ATCOs were able to experience their work as an important contribution instead of a failure. Thus, the ATCOs obtained a holistic view of the situation and their own contribution. Realizing that their professional work prevented more serious damage helped the ATCOs to recover from the CI stress reactions.

The ATCOs are involved in Critical Incidents automatically due to their work

The professional involvement of the ATCO in the CI usually causes self-doubts: "Have I done everything correctly?" "Shouldn't I have tried this or that?"

With the benefit of hindsight, it is much easier to rethink the decisions because the results and how they came about are known. At the time, however, decisions must be made with little time and information. Everyone in this field creates safety through practice and striving to do a good job. This is especially true for air traffic control and aviation which is highly dynamic and also complex as many different and interacting factors have to be considered. The ATCOs are part of this system and significantly contribute to the safety of the system. However, they are also subject to the contextual factors and can only partly influence them.

Nevertheless, feelings of guilt play an important role for the ATCOs. Dealing with the feelings of guilt, overcoming them and adjusting to reality are fundamental elements of CISM intervention. Peers are able to understand the feelings of guilt, the reactions after a critical situation and the impact on the professional self-image of such an incident. Peers can therefore normalize such reactions. Thus, they gain the necessary trust from their colleagues to re-establish the professional confidence which can be lost after CIs. These elements are the main points of focus in the training of the Peers.

Peers, however, are very well suited to assess the stress reactions caused by the incident and have a better understanding of such situations. Their intervention makes it easier for the affected person to return to a normal situation and to recreate the stability that is necessary to cope with the incident. As the peers have the same profession as the person concerned, they are aware of the job-related standards, rules and procedures, i.e. the professional culture. With regard to crisis intervention, cultural aspects do not only refer to the culture of the nation but also to the corporate culture of the company in question.

The cultural competence of the peers ensures that the intervention takes account of the limits of the relevant culture, which, in turn, guarantees that the persons concerned and the company's management are willing to accept this crisis intervention. The CISM Main Study, conducted by the University of Copenhagen at DFS, shows the positive effects of CISM on the corporate culture of an air navigation services organization (Vogt & Pennig, 2006).

### *Method and Results*

In the following, the parts with cultural relevance of two studies will be presented. The expert survey is an explorative and qualitative survey among CISM peers of nine European countries. They report their experience of the interactions between CISM and culture. The DFS CISM evaluation is a quantitative study with the aim to test hypothesis on the cultural and fiscal effects of CISM. In combination, the two studies produced consistent results of high concurrent validity.

## Expert Survey

As part of the CISM program, CISM peers gather for conferences on a regular basis to refresh their knowledge, to exchange experiences, and to discuss best practice. Apart from refresher courses with certified ICISF trainers, CISM peers meet annually at the CISM Forum at DFS in February. The number of participants has risen from five in the beginning to 11 countries in the year 2007: Denmark, Switzerland, Austria, Czech Republic, Croatia, Turkey, Ireland, Portugal, Italy, France, and Germany. The CISM Forum serves as a networking platform and as a common learning and experience area. In addition to joint training sessions, this also comprises the exchange of lessons learned and discussions about special cultural aspects. The member states of this CISM network have agreed to comply with the standards of the ICISF and to be trained and certified by qualified ICISF trainers. This common basis enforces the cross-cultural networks and makes them more efficient and productive in times of crises. The expert survey was based on the DFS CISM Forum of the year 2007, which took place for the 7<sup>th</sup> time in February 2007. The focus of this annual CISM peer conference was on "Culture and Crisis". About 90 peers from 11 different nations participated in the CISM Forum. In line with its key topic "Culture and Crisis", the congress focused on cultural similarities and differences in the definition, experience, and coping mechanisms of crises. CISM peers from Austria, Croatia, Denmark, Germany, Ireland, Portugal, Switzerland, the Czech Republic, and Turkey presented how they deal with crises and their experience with CISM. They followed a presentation structure which was given to them prior to the conference. The following tables give the raw data.

It became clear that what constitutes a national crisis in a country is based on historical, political and geographical aspects and experiences (*Table 1*). To the Swiss, for example, a stock market crash or natural disaster such as a flood is the worst possible national crisis. Due to their latest experience with civil war in former Yugoslavia, no conventional crisis can be as bad as a war for the Croatians. In Denmark, the political crisis concerning the Muhammad caricatures and the avian flu were current topics. In Turkey the most important national crises were earthquakes and terrorist attacks.

**Table 1: What constitutes a "national crisis" in your country? Summary of the presentation results of peers from nine countries.**

What constitutes a "national crisis" in your country?	Countries	What exactly
War	Croatia Ireland	Civil war Civil war
Terrorist attacks	Denmark Germany Portugal Turkey	Fear of terrorist attacks Fear of terrorist attacks Fear of terrorist attacks Terrorist attacks
Accidents	Portugal Turkey	Traffic accidents, train accidents Traffic accidents: 136,000 fatalities in 26 years
Natural disasters	Germany Ireland Portugal Czech Republic Turkey	Flood Famine (historic) Forest fires Flood (1997, 2002) Earthquake
Technical failure	Ireland Portugal	Aircraft crashes Collapsing bridges

Epidemics	Denmark	Avian flu
Economic crises	Germany Austria Switzerland Turkey	Economic crisis Mass unemployment Economic crisis Stock market crash recession, unemployment (10%)
Political crises	Denmark Ireland	Muhammad caricatures Conflict between Northern Ireland/Republic of Ireland

It can be said that the notion of what constitutes a crisis is similar in all countries. However, the emphasis was put on recent events in the respective countries or significant historic experiences, such as war. Also possible future crises such as terrorist attacks or economic crashes were mentioned.

A country's inhabitants deal with their emotions after critical incidents is, however, a different story: When asked about how acceptable it is to show emotions in a professional context, the representatives from Denmark and Croatia emphasized that "we are all just humans" and that showing emotions in a work environment was acceptable. The peers from the Czech Republic and Ireland, on the other hand, stressed that in their cultures it is common to behave "like a man" after experiencing a crisis. This means that it is important to pretend strength, to deal with the situation by one self or to "go have a drink". The peers from Germany, Austria and Switzerland said that their national cultures were somewhere between these two extremes. Emotions are not shown in public but rationalized or even suppressed; if they are shown, this is done in private rather than in a work environment.

The following *Table 2* shows the results of the discussion "Dealing with emotions in a work environment":

**Table 2: Is showing emotions after a critical incident accepted in the work environment?**

Country	Is it acceptable to show emotions after a critical incident?	What is considered appropriate?
Croatia	Yes	Emotions can also be shown in a professional context.
Denmark	Yes	Change has happened: Young people today show their emotions more than the older generation.
Switzerland	To a certain degree	It is acceptable to show emotions as long as they are authentic.
Germany	To a lesser degree	Individual emotions should be suppressed in the work environment; everyone should deal with the incident themselves. In the case of large-scale disasters, however, there is considerable solidarity (flood).
Austria	To a lesser degree	A rather cognitive way of dealing with emotions; mourning, for example, is silent and done in

		private rather than at work.
Portugal	To a lesser degree	Showing emotions is not acceptable in a professional context. You must wait until you are at home to show your feelings.
Ireland	No	Notion of a "real man" who does not show his feelings, particularly in the case of men.
Czech Republic	No	Emotions should not be shown.
Turkey	No	Among managers, showing emotions would be interpreted as a weakness and lead to a loss of authority.

In Denmark, the acceptance of a display of emotions in a professional context has shifted from one generation to the next: older Danes are more reserved than younger ones who are more familiar with showing emotions even in a work environment. This is in line with other reports (Maziul et al., 2006). In Turkey, showing emotions is also a question of hierarchy: it is more acceptable for staff members to show their feelings than for managers, as they may experience a loss of authority if they do so. In Portugal, a differentiation is made between the work that has to be completed and the display of emotions afterwards.

These results show that the stress reactions themselves are universal. However, with respect to the display of emotions there are similarities but also significant cultural differences (Ekman & Friesen, 1969). If the peer and the person concerned belong to the same national, corporate and professional culture, these cultural differences are not important because both are familiar with the cultural circumstances. Understanding the cultural differences, however, becomes very important in an international context, when peers from one country are to provide counseling to people from another country.

The following *Table 3* shows the assessment of CISM and the changes that have come about in the organization since the implementation of the program:

**Table 3: Changes that have been noted in the company since the implementation of the program.**

Country	CISM assessment	Greatest changes since CISM
Croatia	Very successful	Ever since the implementation, it has been acceptable to request peer support and to publicly show stress reactions
Denmark	The display of emotions has become more acceptable with CISM	Managers and staff members show their feelings more openly, there have been more requests for peer and other support and it is more acceptable
Switzerland		Showing emotions after critical incidents has become more acceptable. Reasons for this could be CISM, a new generation of controllers as well as changes at the Swiss ANSP.
Germany	There is a high level of	After a critical incident, nobody is

	acceptance of CISM in the company	blamed; instead the emphasis is on the individual reactions of each person.
Austria	Benefits of CISM are recognized, displaying emotions is no longer taboo. Some managers, however, are critical of CISM (cost factor)	Before, emotions after a critical incident were considered to be "unprofessional" and seen as a weakness. Now, managers and staff members use a different approach to assess crises and the associated individual reactions.
Portugal	Acceptance of CISM increases in the company, among staff members and managers	Company-wide psycho-social help; managers see that it works and that their staff return to work more quickly.
Ireland	Program is supported by the company	More teamwork, higher acceptance of emotions, "blame culture" is no longer pursued in the company
Czech Republic	Program is too new to comment	
Turkey	Program is currently being implemented	

Generally it can be hypothesized that the implementation of CISM and the establishment of a peer support system in most of the air navigation service organizations supported the acceptance of a public display of emotions after critical incidents and made the request for psycho-social support by peers more common. Furthermore, the CISM peers felt that their support has had a positive effect on the corporate culture of their companies. In some countries, the fact that controllers are able to return to work more quickly has heightened acceptance of the program by managers. Unfortunately, Turkey and the Czech Republic, whose cultures least accept the display of emotions in a professional context after critical incidents, do not yet have any information concerning the efficiency of the program. It is very interesting to note that the implementation of CISM in Ireland, Portugal, Austria, Switzerland and Germany has made it possible for those involved in critical incidents to show their emotions and request peer support. The time where it was perceived as a weakness for controllers to experience stress is slowly coming to an end. Moreover, CISM is seen as a professional aspect of ANSPs. This belief has probably evolved from a cultural change which went along with CISM implementation. This is strongly supported by the DFS CISM program evaluation study.

#### DFS CISM Program Evaluation Study

The German air navigation service provider DFS let the University of Copenhagen investigate their CISM program with respect to costs and benefits. The results were overwhelmingly positive in that CISM supported a quick and sustainable recovery after critical incidents. Not only sickness leaves (Absenteeism) were shortened but also negative after effects of critical incidents at work (Presentism) were reduced, for example, performance losses due to bad sleep, work uncertainty, or déjà-vus. On this basis the fiscal benefits of the DFS CISM program were calculated and they exceeded the total costs in two separate studies by factor

2.6 (Vogt et al., 2004) and 3.6 (Vogt et al., 2007), respectively. Moreover, the study showed as an intangible benefit an improvement of culture. In the following this result is elaborated. In order to investigate the hypothesis that a positive interaction of CISM and culture had taken place, 1,030 questionnaires were delivered in the period June to October 2005 to the five largest radar centers and the six largest air traffic control towers in Germany (with the exception of Frankfurt Tower; Frankfurt Approach was included instead). The questionnaires covered the following issues:

1. Basic self assessment regardless of critical incident (baseline); abilities, for example selective attention, stress resistance; on-the-job-behavior, for example monitoring and planning of traffic; performance, for example average number of aircraft under control.
2. Description of the most serious critical incident during the last two years and its effects relative to baseline abilities, on-the-job-behavior, and performance; emotional and psychosomatic effects; potential effects on safety, errors, work flow, capacity, cooperation with assistant, adjacent sectors, staff planning.
3. Assessment of cultural changes due to CISM implementation and practice.
4. Long-term health effects of untreated critical incident.
5. The data on issues 1 and 2 were already published (Vogt et al., 2007) and the results here focus on issue 3, the cultural changes.

Thirty percent of the questionnaires were returned, i.e. 309. The participating employees rated on a five point change scale whether organizational culture described by an adjective list impaired or improved due to CISM (-2 major impairment, -1 minor impairment, 0 no change, +1 minor improvement, +2 major improvement). The average rating was tested in a two-tailed t-test against the counter-hypothesis (no culture change due to CISM). The admitted maximum error probability in testing the hypothesis was set to 5 percent ( $p < 0.05$ ). It was adjusted for the multiple testing of thirteen adjectives, i.e.  $0.05/13 = 0.0038$ .

With an error probability  $p$  below 0.0038, ten out of thirteen adjective ratings supported the hypothesis that organizational culture was significantly improved by CISM (Table 4). The strategy relevant attitudes “safety oriented” and “supporting” gained the highest average rating of about +1. They particularly confirmed that the strategic goal of safety is supported by improvements in organizational culture especially with respect to communication and error handling due to the introduction of CISM.

**Table 4: Mean experienced culture changes tested against 0 (0=no change; 0<improvement)**

Adjective	M	SE	n	t <sup>1</sup>	df	p <sup>1</sup>
Open	0.64	0.037	281	17.117	280	0.000*
Employee oriented	0.79	0.042	280	18.891	279	0.000*
Team oriented	0.41	0.034	279	12.077	278	0.000*
Pinched	0.06	0.030	277	2.135	276	0.034
Disciplined	0.21	0.028	280	7.660	279	0.000*
Competitive	0.06	0.028	278	2.191	277	0.029
Clique oriented	0.03	0.025	278	1.287	277	0.199
Change resistant	0.25	0.035	277	7.111	276	0.000*
Egoistic	0.13	0.027	279	4.728	278	0.000*
Safety oriented	0.83	0.043	278	19.424	277	0.000*
Supporting	1.06	0.044	279	24.301	278	0.000*
Promoting	0.59	0.041	280	14.252	279	0.000*

Sensible	0.78	0.045	280	17.408	279	0.000*
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<sup>1</sup> two-tailed

\* significant at the 0.05 level after alpha error correction (Krauth, 1988)

Apart from the contribution of CISM to organizational culture in general, the participants also rated the contribution of CISM to safety culture in particular. This rating was given relative to other elements of the safety management system. *Table 5* shows the average contribution in percent that the air traffic controllers assigned to each element and their statistical significance.

They reported CISM to be the most important safety culture driver with a contribution of 31 percent. The other elements of the safety management system contributed significantly between 21 (Safety Letter) and 11 (Voluntary Reporting System) percent. The Electronic Briefing System appears to be the only exception with no significant (and in tendency negative) contribution as the staff would prefer personal briefings.

**Table 5: Mean (M) Experienced Safety Culture Contributions of Elements in the Safety Management System (SE standard error, n number of cases, t t-value, df degrees of freedom, p error probability in statistical testing)**

Element	M <sup>1</sup>	SE	n	t <sup>2</sup>	df	p <sup>2</sup>
CISM	31	22	272	22.701	271	0.000*
Safety Letter	21	18	276	18.683	275	0.000*
Safety Panel	18	20	256	13.980	255	0.000*
Computer Based Training	17	19	276	14.284	275	0.000*
Safety Days	16	20	188	10.897	187	0.000*
Licensing Workgroup	16	19	235	12.516	234	0.000*
Team Resource Management	15	19	230	11.368	229	0.000*
Voluntary Reporting System	11	17	219	9.878	218	0.000*
Electronic Briefing	-3	24	254	-2.082	253	0.038

<sup>1</sup> positive M indicate improvement, negative M impairment; tested against 0

<sup>2</sup> two-tailed

\* significant at the 0.05 level after alpha error correction (Krauth, 1988)

Finally, the hypothesis was tested that an organizational unit with a traditionally good culture were more successful in the implementation of CISM and profited more from the implementation. Moreover, it was assumed that operational leaders have a key role in this synergy. From a DFS survey before CISM implementation (Kastner et al., 1998) two West-German units were selected in which employees significantly differed in their view on organizational climate: In unit 1, the culture was in general described significantly better than in unit 2. This was particularly the case for leadership, union representation, information and participation (Kastner et al., 1998, p. 279). CISM was introduced in DFS two years later in 2000 and the CISM evaluation took place in 2005. In 2005, 55 air traffic controllers of unit 1 and 21 air traffic controllers of unit 2 gave answers with respect to CISM implementation, culture interaction and the role of operational leaders. The units were of the same size. The fact that unit 1 returned more than twice the questionnaires than unit 2 was one more manifestation of the better safety culture and commitment to CISM. The ATCOs rated the



implementation of CISM in their unit on a percent scale with the following anchors: 0 percent means that the program is not implemented, 25 percent that it is poorly implemented, 50 percent that it is moderately implemented and worked-to-rule, 75 percent that it is fully implemented, and 100 percent that the unit is benchmark for European best practice in CISM. Table 6 shows that the implementation of CISM was rated significantly better in unit 1 (74 percent, i.e. applied in every safety issue) compared to unit 2 (59 percent, i.e. little more than work-to-rule implementation). It can be assumed that this difference in implementation success lead to a more appropriate handling of CIs in unit 1. Since both units were comparable in all aspects except corporate safety culture and corporate culture is mainly driven by unit leaders, the hypothesis was tested that CISM was better supported by the leaders in unit 1. The data verified this hypothesis on the usual 5 percent error basis (Table 6): While in unit 1 with the traditionally good safety culture the support was rated 67 percent, the employees in unit 2 experienced significantly less support of the CISM program by the operational managers (55 percent). Overall, Table 6 documents a statistically significant interaction of safety culture and CISM implementation.

**Table 6: Mean (M) experienced implementation of CISM in unit 1 (best DFS safety culture) and unit 2; SE standard error, n number of cases, t t-value, df degrees of freedom, p error probability in statistical testing**

CISM	M	SE	n	t <sup>1</sup>	df	p <sup>1</sup>
Implementation overall						
Unit 1	74	2.13	55	3.814	74	0.000*
Unit 2	59	3.16	21			
Support by operational managers						
Unit 1	67	3.34	55	1.928	73	0.029*
Unit 2	55	5.26	20			
Appropriate handling of CI						
Unit 1	51	7.18	47	2.273	61	0.014*
Unit 2	68	3.37	16			

<sup>1</sup> one-tailed

\* significant at the 0.05 level after alpha error correction (Krauth, 1988)

### Conclusions

Critical Incident Stress Management can be used across all cultures because the physiological processes of stress reactions are the same all over the world. The cultures differ with regard to what constitutes a crisis, which reactions to crises or critical incidents are considered culturally acceptable and how the persons affected are to be dealt with.

As discussed above, peers hardly notice the cultural differences during a crisis intervention. Normally, they have the same nationality and come from the same professional and corporate culture as the person affected. The CISM program, which was developed mainly in the USA, can be used in different cultures and contexts as long as the standardized procedures are complied with. Cultural adjustments can be made without affecting these standards. If, for example, it is not suitable in a certain culture for a woman to counsel a man (or vice versa), the interventions for women are conducted by women and those for men by men. Or to refer

to the Danish example of *Table 2* that the peer and the affected person should not significantly differ in age.

But what will happen if cross-border cooperation becomes more important and peers from different countries work together? Intercultural cooperation is already common practice in the aviation industry; however, cross-cultural support in crisis is still underdeveloped and not organized. It can work on an ad hoc basis, for example, between the Swiss and the German ANSP after the mid-air collision above Überlingen: DFS peers supported their Swiss colleagues (Leonhardt et al., 2006). This is a positive example of international crisis intervention work and should be organized formally and professionally on a regular basis to be prepared when disaster strikes. This is especially urgent as we soon will face major challenges in air traffic re-organization, for example, functional air space blocks on the short term and single European sky on the 2020 horizon. The merger of air traffic management organizations demands a merger of safety management systems and crisis intervention plans. Cross-cultural cooperation will be of significant importance because we will have much more interfaces between ANSPs on the one hand and a higher risk of critical incidents in the transition phases of new technologies, new procedures, and new organization on the other hand.

What should intercultural crisis intervention look like? One significant prerequisite is the communication and networking with possible cooperation partners before and after acute crises. For the air navigation service organizations in Europe, such an exchange takes place since a decade during the annual CISM Forum at DFS. Recently in 2008, the European Office of the International Critical Incident Stress Foundation has started organizing conferences on CISM in Europe. This meeting of about 140 CISM experts and practitioners is held in English and in the even years, 2008 the first time. It offers presentations about recent developments in CISM and facilitates practical work in workshops the second day. In the odd years, national CISM meetings with focus on branches (e.g. rescue services) and held in the national language will be organized by the European Office members.

While the crisis intervention measures remain the same, some cultural aspects have to be taken into account when different countries cooperate. These aspects can lead to a changed approach if, for example, a hierarchy has to be taken into account or attention has to be paid to the question of whether interventions with the opposite sex are permitted or not. Experience in intercultural cooperation and mutual support after critical incidents has shown that the supporting organization/culture has to adapt to the special aspects of the culture that receives the support. These processes should be promoted by means of an exchange of information in the network, trained CISM representatives in the individual countries and organizations, consultations and crisis intervention plans agreed upon in advance.

Why is human factors consideration like in CISM important? Traditionally the rationale for human factors consideration is the prevention of accidents. The DFS CISM evaluation has shown that this human factors program also has fiscal benefits and is literally worth the effort. The interaction of CISM with culture documents that the implementation of human factors programs can improve culture and vice versa. These are invaluable synergetic effects important for aviation safety and strategic success.

Working together in networks is to help people from different cultures to get to know one another. The aim is to find the best corporate culture by meeting in between the extremes of the individual cultures or get consensus about the common denominator. In most cases, this refers to religious differences, different forms of conduct and behavior, gender-specific aspects, the need for rules of convention (e.g. punctuality) or general issues, such as dinner time, which can deviate by more than five hours between northern and southern countries. Even satire and humor can lead to serious problems, if they violate basic principles or a person's honor. The caricature conflict in Denmark, for example, offended the religious

feelings of the Arab culture, on the one hand, and caused consternation with regard to the freedom of expression, on the other hand. In such a case, discussions, understanding and cultural adjustment have to take place in advance. They promote mutual enrichment, respect and understanding of the foreign culture. Positive examples of successful intercultural partnerships can be found in aviation. These include the MAYDAY foundation, the crisis intervention team ATC-AP (Air Traffic Control und Airport; joint crisis intervention team of Frankfurt Airport and DFS), the European CISM network, and the International Federation of Air Traffic Controller Associations (IFATCA).

The fact that people involved in aviation usually know and speak English facilitates intercultural cooperation. But the language barrier will play an important role when the groups involved do not share a language. For this reason, it is essential to establish crisis intervention programs and train qualified peers, who speak the language, in all countries. The foundation of the European Office of the International Critical Incident Stress Foundation is a first step in this direction. The European Office aims at training trainers and peers in the European countries and translating the written documentation of ICISF into all European languages.

#### *Author Note*

This chapter summarised the neurobiological communalities of dealing with crises and the cultural adaptation in mainly Western European countries. The interaction of the example HF program CISM with culture was approached by an expert survey in which CISM experts from nine different countries described what is considered a crisis in their country and how it is dealt with. A quantitative, formal evaluation study of the CISM program at DFS gave statistical information about the significance of cultural change due to CISM implementation in Germany. The work is currently under peer review for publication in *The International Journal of Emergency Mental Health*.

The next chapter suggests the professional and systematic use of the synergetic effects HF programs and safety culture have on each other.

### **Article3: How to integrate Human Factors Safety into Management**

#### *Abstract*

Management systems like balanced scorecards (BSC) are wide-spread tools in production and service providers. They are also well known in aviation organisations. Only few organisations utilise management tools for the so-called soft factors like, for example, employee health and organisational culture or – as a specifically important area in aviation – human factors. On the one hand, human factors play a significant role in almost 80 percent of all aviation accidents. On the other hand humans are the responsible warrantors and main enablers for safety. Hence, human factors in the Safety Management Systems of aviation organisations are most important conditions; however, human factors are difficult to measure and therefore also difficult to manage. Studies in other domains e.g. workplace health promotion, indicate that BSC-based tools are useful for soft factor management. Their mission is to develop a set of indicators which are sensitive to organisational performance and help identifying driving forces as well as bottle-necks. Another tool presented in this paper is the Human Resources Performance Model (HPM). HPM facilitates the integrative assessment of human factors programmes on the basis of a systematic performance analysis of the whole system. Cause-effect-relationships between system elements are defined in process models in a first step and validated empirically in a second step. Thus a specific representation of the performance processes is developed which ranges from individual behaviour to system performance. HPM is more analytic than BSC-based tools because HPM also asks why something is a driving

force or a bottle neck. Guidelines for the conception and implementation of such management tools were developed which need specification for aviation organisations. A significant research and development need is seen here, because soft factors are of increasing importance for organisational success. This paper suggests integrating human factors in safety management of aviation businesses – top-ranking even before technology and finance – and managing it with professional tools. The tools HPM and BSC were identified as potentially useful for this purpose. They were successfully applied in case studies briefly presented in this paper. In terms of specific safety-steering tools in the aviation industry further elaboration and empirical study is crucial.

### *Introduction*

In 2003 a special issue of Applied Ergonomics addressed the necessity that human factors (HF) experts talk business language to convince managers that ergonomics is good value for money (Stanton and Baber, 2003). The Stanton and Baber (2003) special issue provided a series of cost-benefit analyses (CBA) and business cases to help arguing why organisations must pay for ergonomics and HF initiatives. Chang (2008) also referred in the preface of a special issue of Ergonomics to the substantial losses ergonomic problems, in this example slips and falls, may cause. Bell et al. (2008) in the same issue impressively demonstrated that the implementation of a broad-scale prevention programme can significantly reduce injury claims. Although the number of CBAs in ergonomics has increased from less than 20 (Beevis and Slade, 1970) to more than 1300 (Beevis, 2003), ergonomics and HF still do not receive the due management attention. We need more evidence from CBAs and we must go beyond the financial justification of HF initiatives. The aims of this paper are to shift the representation of HF as a mere error management to an existential part of core business and to provide according measurement and management tools. This is especially important because we are facing existential challenges in all branches and in aviation in particular.

### Future challenges in aviation

In aviation we are facing major changes and challenges in technology, air space and air traffic organisation as described in the US (NextGen) and European future operational concepts (Single European Sky Air Traffic Management Research; SESAR, 2006). These concepts aim at allowing a two- or threefold increase of today's traffic. Since the relation between traffic and accident rate is assumed quadratic (e.g. Debels, 2007), the required safety improvement is by factor 10 in the long-term to avoid an increase in the absolute number of accidents. The SESAR safety performance objective builds on the EUROCONTROL (2003) Air Traffic Management (ATM) 2000+ Strategy:

“To improve safety levels by ensuring that the numbers of ATM induced accidents and serious or risk bearing incidents (includes those with direct and indirect ATM contribution) do not increase and, where possible, decrease.”

The expected increase in traffic volumes requires that safety levels gradually improve by factor 3 in order to meet the safety objective in 2020 and in the longer term by factor 10 to be prepared for a possible threefold increase in traffic. The 3-fold improvement in safety by 2020 accommodates a 73 percent increase in traffic in that period (SESAR, 2006).

These are per se ambitious challenges, even more so as aviation organisations will increasingly compete with each other. They primary compete as providers of air navigation services and thus come increasingly under cost pressure. They also compete as employers of highly qualified operational, management and research staff. Hence, organisational performance, cost effectiveness, HF and human resources (HR) management became key performance areas in the developing air traffic management concepts.

In the past, staff has been considered mainly under cost issues. In aviation, the perceived cost has been financial (staff costs) but also operational (human error). With the changes and challenges described above people increasingly realise that it is the human contribution that makes the system work safely and efficiently and that the negative view on the human in the loop has to be changed to more positive perspectives. This positive side of the coin may be called human factors in safety management, and its pro-active, innovative, and systemic approach is a necessary precaution to meet the above mentioned challenges of future air traffic management. In this view, the development of human factors safety deserves equal attention just like technological aspects of the system (e.g. state of system engineering) and finance (e.g. business turnover figures). This is especially true since current studies show that organisations with systematic and continuous human factor management tools perform better than those without (German Federal Institute of Occupational Safety and Health BAuA, 2008; Glaser et. al., 2007). The systemic view in human factors will change the focus from human error as a cause to performance variability as a resource and from linear causation into interaction and complexity. Overall concepts like resilience engineering will be the necessary theoretical basis to change the HF perspectives.

#### *Aims of this chapter*

The aims of this chapter are:

1. To promote the positive view on human factors in safety
2. To present the Human Resources Performance Model (HPM) as evaluation and management tool for human factors interventions; the HPM application to Critical Incident Stress Management (CISM) in air traffic control is briefly described
3. To learn from a similar domain, health management in general and in the automobile production, and from the experience they have with applying the balanced scorecard (BSC) to soft factors like health, which are complex, difficult to measure and difficult to manage
4. To transfer the experiences to 2. and 3. to human factors in safety and to suggest a BSC-like tool to human factors in safety

#### *Human factors safety as competition advantage*

Human factors are traditionally seen as significant contributors to critical incidents and accidents in aviation. To quote from the Transport Canada Aviation Safety Letter (2002):

“Approximately 80% of aviation accidents are primarily caused by a human error, while the remaining 20% almost always involve a human factors component.”

In the past this one-sided view has led to the conclusion that the human part should be substituted by reliable technical solutions. The positive view on the human in the system would see human error in a critical incident as the symptom of underlying technical or organisational issues, for example, a poor human-machine interface or understaffing. Moreover, relative to the millions of safe movements every year, the number of critical incidents or even accidents is very low. Some authors see the humans in the system as the guarantor for safe operations in times of trouble (e.g. Vogt & Kastner, 2002). Highly-selected, well-trained and motivated staff is the central resource for safety and performance. This is, for example, the case in air navigation service provider organisations, in which the air traffic controllers and their assistants always were the central resource (Köper, 2001). Certainly, they today have a lot of technical support but the central elements in the production of air traffic safety are humans. They create air traffic safety, the value or product of the branch. If need be they do so without any technical support, for example, in case of the Düsseldorf airport fire in 1996 (Vogt & Kastner, 2002).

The aviation branch has a long tradition in human factors research and reliability assessment (e.g. Kirwan, 1990). However, most of this work is organised rather bottom-up (task related) than top-down (strategy deduced). Callan et al. (2004) evaluated, for example, different task analysis approaches (see also Kirwan & Ainsworth, 1992) considering human error assessment. In the top management strategic point of view, soft factors like human performance issues are often seen less important than the hard facts in technology and finance. The reasons for this are manifold. They range from the long-standing tradition in technology focus on the one hand to the performance related payment (based on hard indicators) of managers on the other. As long as managers and decision makers focus on hard short-term financial indicators because their own success and performance related payment is based on this information, soft factors remain down prioritised. A recent publication (Rost & Osterloh, 2008) has shown that this current practice of priority setting does nearly not correlate with organisational performance. However, detached from tradition and current priority setting, there is another predominant issue inhibiting the systematic and active soft factor management, namely the lack of broadly accepted management tools for soft facts. The following sections will present different models and tools to integrate soft factors into the management instruments which currently mainly rely on hard factors. Data from several case studies will be presented, conducted in the human factors management of air traffic control and in health management of other domains, respectively. With the Human Resources Performance Model (HPM) a framework will be presented that facilitates the integrative assessment of human factors programmes on the basis of a systematic performance analysis of the whole system. Cause-effect-relationships between system elements are defined in process models in a first step and validated empirically in a second step. Thus a specific representation of the performance processes is developed which ranges from individual behaviour to system performance. In the case study, the individual behaviour concerns the performance loss after critical air traffic control incidents; as system performance the resulting air traffic control safety and capacity are considered. In analogy, HPM applied to safety in general would connect the individual safety behaviour with overall safety indicators on the organisational level with process models.

The other presented approaches (workplace health management and balanced scorecard) are so called indicator-based models. Their mission is to develop a set of indicators which are sensitive to organisational performance and help identifying driving forces as well as bottlenecks. The indicator-based models are less analytic than HPM as they do not ask why something is a driving force or a bottle neck. Their mission is fulfilled after statistical correlations are proved between influence and result variables. While HPM supports the assessment of single interventions or multiple intervention programmes, the scorecard-based models focus on the capture of the overall system status and subsequent management of the organisation.

Firstly, we present the Human Resources Performance Model (HPM) as an evaluation and management tool and how it was applied to a human factors programme in air traffic control. After this, similar approaches from other domains, namely integrative workplace health promotion management tools and a balanced scorecard for the health activities of an automobile manufacturer in particular, will be described. The applicability of these management tools to aviation safety and the human factors in particular will be discussed at the end of the paper.

#### *Methods in aviation and similar domains*

According tools – like any management tools – require four premises:

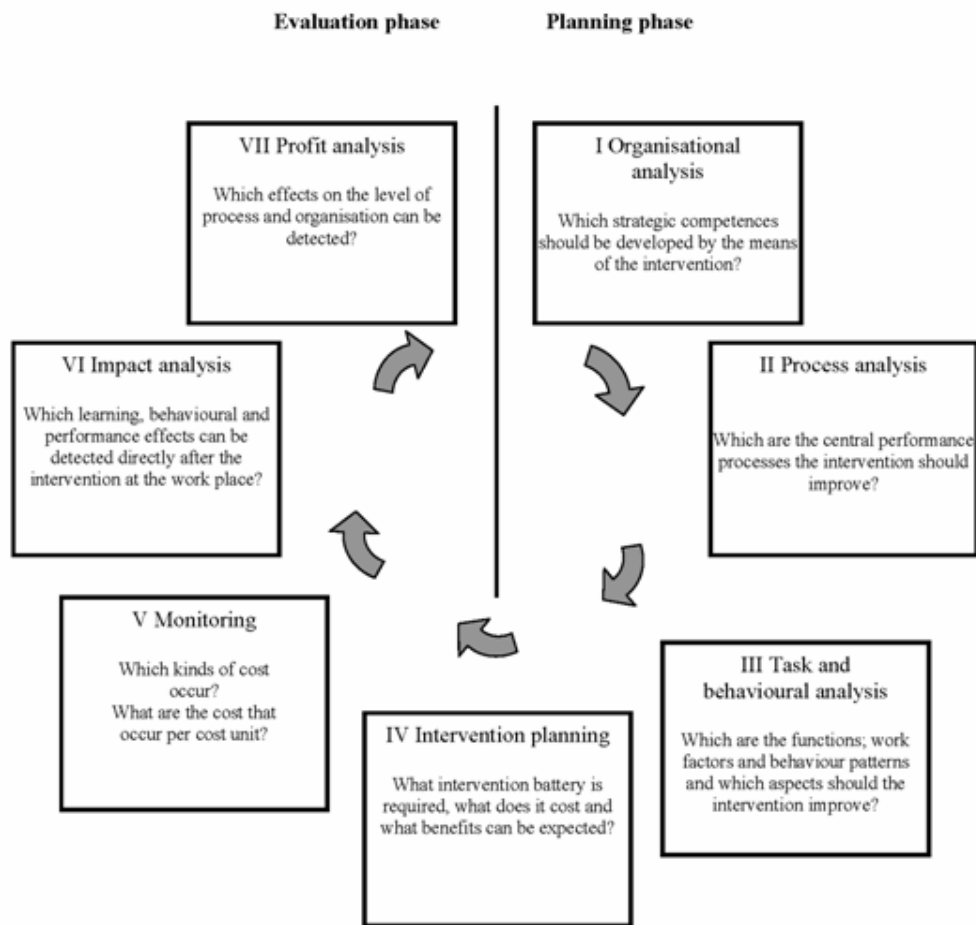
1. Continuous strategy alignment facilitated, for example, in strategy workshops.

2. Continuous networking between units facilitated, for example, by a steering group with representatives of all organisational units, unions, and top management.
3. Absolute management commitment on the operational and strategic levels.

Recently, many evaluation and management tools for single interventions or holistic intervention programmes and also literature reviews describing and assessing these tools were made available (Pennig et al, 2006; Pennig & Vogt, 2008). Moreover, the interrelations of human related factors and economic success, for example, earnings before interests and taxes (EBIT), cash-flow, quality, productivity, and absenteeism, were analysed in different studies (Glaser et al, 2007). Two of the more holistic steering approaches were applied and intensely assessed within different studies by the authors and their colleagues. These two concepts and some application results are presented below. At the end of the paper it is suggested to adapt the general concepts to the specific needs of aviation safety.

#### Human Resources Performance Model HPM and its application in air traffic control

The Human Resources Performance Model HPM (Pennig, 2006; later also called Behavioural Impact on Organisational Success BIOS; Pennig & Vogt, 2007) provides a structural and a process model for the evaluation and profitability assessment of human factors/resources programmes. The evaluation of human factors/resources programmes is seen as part of the human resources (HR) controlling. The aim is to provide information about cost, efficiency and effectiveness of HR management. Evaluation in this sense serves not only for assessing but also for steering these HR initiatives. In analogy to the conception of financial controlling the HR evaluation coordinates decisions and rationalises HR management. An economic evaluation links behavioural changes (due to the HR activities) with financial information in an interdisciplinary approach (i.e. social/behavioural sciences and economics). The links will be provided to managers and leaders in the organisation. HPM provides a structure for this kind of HR evaluation. It was developed, tested and validated in several studies within and outside the aviation branch. Core piece of the HPM is a seven-step process model:



**Figure 2: The 7 major areas of the HPM frame guideline**

HPM relies on the following assumptions:

1. Criteria for the evaluation of human performance management activities are derived from the strategy and the success indicators of the company in general and the company's human resources management in particular. A clear strategy is the precondition for the planning of the evaluation.
2. The strategic aims are to be defined on the following three levels: The organisational level (success of the company), the process level (the single production/service process contributes to company success) and the functional level (the single employee contributes to process performance).
3. The three levels are linked in an effect model so that effectiveness can be evaluated on each level and across all levels.
4. The evaluation serves different interest groups or stakeholders at the three levels, for example team leaders who are active mainly at the functional level, department heads who will use mainly the process information, and strategic leaders who are responsible for the overall organisational strategy and success. They have target perspectives with different scopes. To make the evaluation valuable for management, the generated information must be aligned to the targets of the stakeholders at the different levels.

With the application of HPM the importance of employee behaviour for the company's success will become transparent. The effects of performance variability within and between



employees on the work process and the company strategy will be visible. With this information, human resources activities can be tailored to the company's strategic goals. Interdependencies between HR and technical investments will become obvious so that synergies can be utilised and bottle-necks can be prevented. An example is the introduction of a new air traffic management (technical investment) which must be accompanied at the earliest stage by a re-analysis of training requirements and according HR investments to utilise the technical advantages of the new system.

The following process needs to be followed:

1. Analysis of the performance system on the three levels organisation, process and function/task.
2. The resulting understanding of bottle-neck and success factors will be the basis of investment decisions. The detailed planning of the investment and the implementation follows.
3. During and after the implementation an assessment of costs and benefits will be conducted. The benefit analysis needs to distinguish between the effectiveness of the investment (impact analysis), for example, with respect to employee behaviour, and the significance of these effects (profit analysis), for example, with respect to the strategic goal of customer orientation.

The method of global performance estimation was used to carry out a profitability assessment of a crisis intervention programme for air traffic controllers. This Critical Incident Stress Management (CISM) programme according to Mitchell and Everly (2001) supports air traffic controllers in coping with stress reactions after so-called critical incidents in the workplace. These include, for example, all types of incidents involving a less-than-safe distance between aircraft. As a rule, such an incident is not immediately dangerous for air traffic as the safety distances are set generously. However, it often represents a personally stressful situation for an air traffic controller since he may see his professionalism jeopardised. In the crisis intervention programme, selected controllers became qualified CISM peers to professionally support their colleagues after an incident of this type. The programme is viewed extremely positively by air traffic controllers (ATCOs) and is used in most cases. Within the framework of HPM, several steps were conducted to investigate whether the various measures in the programme were also worthwhile for the organisation.

The evaluation began according to HPM with an analysis of targets, interactions, and bottle-necks on the three levels organisation, process, and function/task. Especially the impact of performance variability after critical incidents was considered. The analysis included interviews of 11 chief executive officers of major air traffic control units. Moreover, 38 operational managers and 352 ATCOs (including all CISM peers of the 11 units) participated in the interview and questionnaire survey. On the basis of interviews and questionnaires, causal models connecting ATCO behaviour and performance on the individual, process and organisational level were derived (Vogt & Pennig, 2006; Vogt et al., 2007).

Among the 352 participating ATCOs were 87 who described critical incidents during the last two years. In 21 cases the incidents were related to private life (e.g. loss of close relative) and therefore excluded from the cost-benefit-analysis which focussed on the 66 clearly work related incidents of aircraft separation infringements. In 48 cases the critical incident was treated with CISM, in 22 cases the ATCO did not consult a CISM peer.

All critical incidents were described as emotionally stressful. On a percent scale the average rating of emotional upset was 80 percent. The stressful period lasted on average 10.8 days. During this period, the ATCOs reported feelings of guilt and uncertainty connected with an over-cautious separation of aircraft.

In the week with the critical incident the self-reported average performance loss was 20 to 25 percent. No ATCO took a sickness leave so that absenteeism indicators were unaffected. The

self-reported performance loss is considered a presenteeism effect: The ATCOs were present at work but they did not perform as before the critical incident. The performance loss cumulated to 5.4 days per ATCO on average (weekly performance losses summed up over the recovery period). Finally, the ATCOs were asked to what percentage their performance recovery was due to CISM and this figure was on average 36 percent.

During the recovery period, the ATCOs reported significant impacts of their critical incidents: The ATCOs who participated in the CISM programme reported reduced emotional stability while those without CISM reported reduced work abilities and rigid work execution (e.g. airspace user preferences were rejected). Among the impaired abilities of untreated ATCOs were mental flexibility, selective attention, and vigilance. The impaired mental abilities of untreated ATCOs correlated higher with work performance than the reduced stress resistance of CISM treated ATCOs. Hence only the untreated ATCO group reported impaired work like deficiencies in planning traffic flow, in checking data, in gathering traffic picture information, and in interacting with technical systems.

The ATCOs with and those without CISM consultation coped in a different way. In most cases of the CISM group, the CISM peers immediately after the incident started to facilitate the CISM one-on-one intervention structure SAFER-R:

- Stabilising the situation
- Acknowledging the crisis by inquiring about the facts, the reactions to the event and the possibility to talk about them
- Facilitating the normalisation of the responses as normal in the unusual situation
- Encouraging the adaptive coping functions
- Recovering, and
- Referring, if need be, to other professional help like psychotherapy

Especially acknowledging the crisis is connected with significant emotions. These are necessary for a long-sighted and sustainable coping process but on the short term they have the power to unbalance emotional stability as could be seen in the reduced stress resistance of treated ATCOs described above. This process is accompanied by the CISM peers who are well-trained in observing stress reactions and supporting the coping. They also can assess the recovery process in general and - since they are ATCOs themselves - with respect to work ability in particular. The ops room supervisor usually consults the CISM peer in the decision when and at what position the affected ATCO will work again.

The ATCOs who chose not to consult a CISM peer were not guided through the SAFER-R coping process. Instead they mused more or less alone over the critical incident which cost mental capacity for work tasks. They reduced their workload by separating aircraft with much more space than required and they rejected airspace user preferences, for example, higher flight levels or direct routings to the destination.

No ATCO reported a safety problem due to impaired performance after critical incidents. However, the moving air traffic, the airspace capacity and cooperation between airspace sectors was affected. Performed capacity and cooperation were significantly more reduced in the group of untreated ATCOs. No presenteeism effects and performance losses were observed in a sub-group of treated ATCOs who received immediate CISM and spent the rest of the work day outside operations (CISM no ops group; Pennig, 2008; Vogt & Pennig, 2007).

With regard to the strategic goals on the organisational level, CISM thus contributes verifiably to productivity. Half of the ATCOs who did not receive CISM reported impairments of traffic flow in the two weeks after the critical incident. Delays of flights were explicitly mentioned. The productivity loss in the untreated group was on average 10 percent over a period of 7.7 days. The CISM no ops group reported no productivity loss. The prevented productivity loss in the CISM no ops group was calculated on the basis of

controlled flight minutes and according air traffic control fees: For 100 critical incidents it cumulates to 4.68 million euros. On the cost side, only 33500 euros are due for giving the ATCOs time off operations after a critical incident for the rest of the workday.

In conclusion, the application of HPM in the study generated cause-effect process models validating the mode of functioning of CISM, proving its effectiveness and profitability as a human factors programme. The HPM structure and process model as well as the results of the study (and several further studies published in Pennig & Vogt, 2007, 2008) are a solid basis for an integrative management of safety, i.e. combining behavioural and microeconomic approaches. In the following, the development of an integrative management tool for a domain of similar complexity – workplace health promotion – will be described.

A Balanced-Scorecard approach (BSC) for integrative workplace health management and its application in other domains

In cooperation with the local health insurance AOK, Thul and Zink (2003) developed and evaluated workplace health management systems. The authors followed the EFQM model of business excellence. They developed a business indicator set (BSC like) linking employee health changes to organisational health promotion activities. Three stakeholder groups were considered: The society, the company, and the individual worker. The indicator set was as follows (in brackets are mentioned the stakeholders; example indicators; weights in percent):

1. Expenditures for performance (society; e.g. hospital expenditures, sickness pay; 15 percent)
2. Absenteeism rate (company; e.g. sickness leaves due to muscle-skeleton or respiratory tract disease; 25 percent)
3. Accident rate (company and employee; accidents per 1000 employees, insurance pay; 25 percent)
4. Employee health state (employee; general health, pain and strain related disease; 15 percent)
5. Employee satisfaction (company and employee; satisfaction in general, with colleagues and leaders; 20 percent).

In the evaluation, the following prerequisites of a good corporate health management system were studied on the basis of employee reports (weights in percent):

1. Leadership (10 percent)
2. Strategy and planning (8 percent)
3. Human resources management (9 percent)
4. Other resources management (9 percent)
5. Corporate health management system and processes (14 percent)

The following result criteria were used (weights in percent):

1. Corporate health promotion situation (24 percent)
2. Employee satisfaction (4 percent)
3. Customers and suppliers health (6 percent)
4. Impact on society (6 percent)

The results show that companies investing in health management were significantly more successful in reducing absenteeism and accident rate. Moreover, employee reported health problems decreased and satisfaction increased.

The authors conclude that an indicator based management tool combining employee reports with objective success criteria (absenteeism, accident rate) is appropriate to validate that it is effective (doing the right things) and efficient (doing them well and with optimum use of resources). Moreover, as the next section will show, soft factor management in general and health promotion as an example can also be linked to business success. Transferred to safety

and human factors, a combination of soft (e.g. employee reported safety culture) and hard indicators (e.g. number of separation infringements) will be a promising approach and discussed in the next section of this paper.

In the following the experiences of a BSC based approach in order to steer continuously an enterprises workplace health promotion are described. The findings might well be transferable to safety and human factors management. However, the BSC is a mere framework, which – in case of human factors management - has to be “fed” by other (behaviour related) models. Therefore, a combined model integrating the BSC-frame and a bottom-up approach of personal, situational and organisational premises is the best solution. HPM as described above was combined with the BSC-frame and a bottom-up behavioural evaluation model (Kastner, 2006) in a workplace health promotion study of the automobile industry (Möller et al., 2008) which is briefly described below.

The Balanced Scorecard (BSC) (Kaplan & Norton, 1996) is a well known and broadly applied management system to promote the enterprise’s strategy throughout the entire organisation and therefore align all organisational units and their target systems to the overall strategy. This alignment, as a top-down-process, is crucial in terms of the achievement of strategic objectives in due course. Strategic targets refer not only to financial issues, but also to other important perspectives as customers, processes, and potentials.

As mentioned above, human related factors contribute significantly to the enterprise’s performance, especially in aviation. However, the amount of this contribution and the interrelations between specific issues of health, motivation, leadership etc. and performance indicators are difficultly to measure and thus difficult to manage.

In order to fill this gap, the BSC-concept defines the four perspectives (finances, customers, processes, and potentials) and enables to map the heuristic relations of factors within and across these perspectives.

The BSC has to be “fed” in a bottom-up-process with human related indicators and “soft” factors of health, organisational or safety and human factors development. Valid and reliable data of other sources than business-management systems are needed. For this purpose a study by Möller et al. (2008) combined steering tools of business management on the one hand and organisational psychology on the other hand.

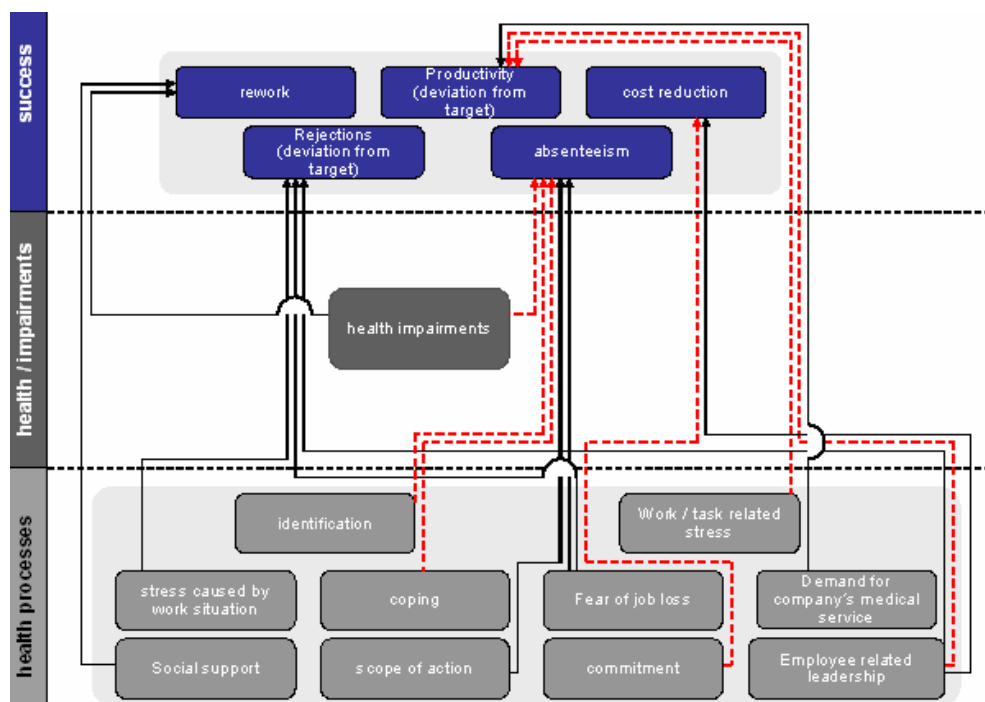
Within the Möller et al. (2008) study a continuous and systematic management concept for workplace-health promotion of a German automobile manufacturer was developed and implemented. For this purpose the strategic targets of the manufacturer’s health system was defined within workshops for the different perspectives

1. health performance (absenteeism, productivity, quality),
2. health customers (staff members and their state of health),
3. health processes (health impact factors due to curative and preventive processes including organisational and personal development) and
4. health potentials (knowledge and abilities of “health staff”).

In order to analyse the interrelations between these target issues (across and within the four perspectives) the staff members were asked health-relevant questions by means of a comprehensive questionnaire. This questionnaire consisted of 145 Items of perspectives 2 – 4 (stakeholders, processes, potentials). The accessible data for perspective 1 (success) were gathered by means of the enterprises financial controlling system.

The statistical interrelations were analysed by means of regression analysis. *Figure 3* displays some of the central findings of basic linear regressions. Most of these regressions were in line with the literature-based expectations, though some of them deviated. The statistical findings are in detail discussed elsewhere (Gamm et al., 2007; Möller et al., 2008). For the purpose of this paper, the study and the derived BSC has proven that the study concept, including the

statistical analysis, is a reliable and valid instrument to develop an indicator-based tool for soft factors and to re-check, whether expedient and success-related indicators are represented on the different BSC layers.



**Figure 3: Empirically found relations of health and success factors in regression analysis (red dashed lines represent positive relations, solid black lines represent negative relations; example for a negative relation: the more social support is reported, the less rework is needed; example for a positive relation: the more health impairments are reported, the more absenteeism is registered)**

The workplace-health-promotion BSC proved to be a feasible and reasonable approach to the consistent advancement of health-related targets and to steer the workplace-health promotion in a systematic, continuous and cost effective way.

#### A Balanced-Scorecard approach (BSC) to manage safety and human factors

In the aviation branch, safety was and still is the core of business. Although other key performance indicators like capacity, productivity, and cost-effectiveness gain importance too, safety will remain the back bone of aviation. The question arises, whether the safety management processes can be supported by the effective, systematic and continuous use of management models described above. The results of the health promotion BSC and the HPM application to CISM suggest the safety BSC to be a promising approach. Safety issues and their implications are – like health – complex and especially human factors are difficult to manage. On the other hand they are of fundamental meaning to the aviation branch. To manage safety both, the hard technical and the soft human factors need to be measured. Hard factors are, for example, reporting and assessment of safety occurrences as described in the EUROCONTROL Safety Regulation Requirements ESARR 2:

“... as a priority, the successful implementation of harmonised occurrence reporting and assessment schemes. Such schemes will lead to more systematic visibility of safety occurrences and their causes, and will allow identification of appropriate corrective actions as well as areas where flight safety could be improved by changes to the ATM system”.

Many aviation organisations systematically monitor these kinds of hard data on a regular basis. More difficult and an explicit weakness of BSC-like approaches (Horvath et al., 2003)

is the monitoring and managing of soft factors like, for example safety culture. Safety culture is defined as “the product of individual and group values, attitudes, competencies and patterns of behaviour that determine commitment to, and the style and proficiency of, an organisation’s health and safety management” (EUROCONTROL/FAA, 2008). Lacking safety culture was identified as one contributing factor in many accidents: The Chernobyl Nuclear Power Plant Disaster (International Atomic Energy Agency IAEA, 1986), the King’s Cross Underground Station Fire (Fennell, 1998), the loss of the Herald of Free Enterprise (Sheen, 1987), the Clapham Junction Train Accident (Hidden, 1989), the loss of the Space Shuttle Challenger (Rogers, 1986) and Columbia (Gehman, 2003) and the mid-air collision of Überlingen (Leonhardt et al., 2006). Safety culture interacts with human factors initiatives. Hollnagel et al. (2006) define safety culture as „what a system does rather than has“ and it becomes clear that only having human factors and safety initiatives is not sufficient. They need sustainably to be converted, i.e. integrated, networked, and managed actively. The safety BSC itself is an important contribution to doing, because it will help to find the drivers of safety and to systematically allocate resources to them.

The safety and human factors BSC must be tailor-made in accordance with the strategic safety targets of the organisation it is developed for. This is the basic finding of both, the HPM and the BSC study described above. Ideally, the safety and human factors BSC is top-down derived from the organisation’s overall BSC. In analogy to the classic balanced scorecard structure, the following perspectives focussing on safety can be defined:

1. „Success and finance“ contain key performance indicators for safety results, for example, the number of level busts or separation infringements. Also customer ratings, i.e. safety levels and safety efficiency perceived by airline pilots and airline managers could be considered in this perspective.
2. „Customers and stakeholders“ include all safety relevant cultures, attitudes and behaviours of operational staff like, for example, ATCOs and how they perceive the support offered by the safety processes.
3. The „processes“ belong to the third perspective and contain all safety programmes, for example, Human Error Analysis HERA, Critical Incident Stress Management CISM, and the like. The resources spent and the efficiency of these processes could be potential indicators here. HERA and CISM results can fertilise further initiatives like human machine interface improvement if they reveal, for example, perception and vigilance; as frequent error categories; or training initiatives if, to give another example, planning errors are made.
4. The fourth perspective „employees and potentials“ incorporates, for example, indicators for the qualifications and power of safety managers as well as financial budgets for human factor safety developments.

It is currently planned to develop the four perspectives of a balanced scorecard for safety and human factors in one participating aviation organisation. The definition of the strategic targets and suitable indicators to measure them need to be developed in a top-down-process with all relevant stakeholders (e.g. employees, unions, managers, departments, customers) of this organisation.

### *Conclusions*

The safety and human factors BSC – based on the experience of the health BSC and the HPM application described above - will facilitate an integrated human factors and safety management. A multitude of human factors and safety initiatives was developed and is used in today’s operation of aviation organisations. These initiatives are, however, not well networked. A management instrument, combining frame models of business administration and behaviour related concepts (as suggested in this paper), will support the coordinated and

synergetic use of soft factors. At the same time, it will draw top management's attention to the importance of soft factors because they are made measurable and manageable. A safety-strategy map will help managers to identify the drivers of safety and human factors and to allocate resources to them (Sveiby, 1997). It will, so to speak, help identifying the long- and short-term "ingredients" which – well-dosed and interacting – enable safe operations and help avoiding the incidents/accidents. To identify, analyse, and act on the right non-financial and non-technical factors driving organisational performance will be the main future challenge (Ittner & Larcker, 2003). Thus, managers will be able to steer effectively their organisation by a few selected key performance indicators measuring performance-drivers (e.g. Kaplan & Norton 1996, Ittner & Larcker, 2003). The identification of these leverage points in a validated, interconnected cause and effect framework (the safety and human factors BSC) is thus one of the most important challenges of future air traffic management.

#### *Author Note*

This chapter suggested professional management tools to develop an integrative human factors management. Several approaches were discussed like, for example, cost-benefit-analyses, balanced scorecard and Human Resources Performance Model. It is concluded that professional management tools should be developed and tested for human factors integration into management. Thus, cultural differences can be considered (article 1) and synergies of HF programs with safety culture (article 2) can be used. The work of article 3 is currently under peer review for publication in the Special Issue Human Factors in Aviation of Ergonomics.

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