

Hans-Joachim Ebermann and Gerhard Fahnenbruck

5.1 Introduction

It is virtually a natural part of the airline pilot's self-image to be able to adequately handle stress.

His work conditions and tasks exhibit the classic attributes of extreme stress. A high degree of responsibility, multiple burdens, time constraints, a continuously and intensively changing environment are intimately tied to this profession, just to name a few.

When stress continues over an extended period of time, it depresses performance capabilities and threatens health. According to physicians, over half of the illnesses we experience may be triggered by too much stress.

Extreme stress can lead to panic and possibly even to a loss of control over the motor functions. When individual stress limits have been exceeded, decisions can no longer be made (Koechlin 2011).

Just as with all people, pilots, too, bring stress from their private lives into the workplace, which ultimately adds to their job stress. For this reason, the following discussion is not limited to merely the occupational issues related to handling stress.

Flight-related stress plays a central role in Crew Resource Management (CRM). Among other things, decision making, information processing, human error and communication in the aircraft are directly influenced by too much, but also by too little stress.

H.-J. Ebermann (✉) · G. Fahnenbruck
Main Airport Center, Vereinigung Cockpit e. V, Unterschweinstiege 10,
60549 Frankfurt, Deutschland
e-mail: vc.ebermann@onlinehome.de

G. Fahnenbruck
e-mail: gerhard.fahnenbruck@human-factor.biz

Table 5.1 Error rates

Factor	Error rate increase
Novelty of the task	17 times
Time constraints	11 times
Too much information	6 times
Misjudgement of risk	4 times

In the course of **processing information and making decisions**, too much stress can lead to a limited capacity for receptiveness. Under some circumstances, we won't even recognize the information right in front of our eyes and have problems selecting between alternatives.

There again, decision making (or a lack thereof) is the greatest source of stress in the cockpit. The pressure associated with always needing to make adequate decisions under difficult and rarely occurring circumstances is one of the main drivers of mental stress.

The willingness to engage in risky decision making increases when time pressures become too great. When these risky decisions then lead to failures, the tendency develops to try to master the situation at any cost, even to the extent of potentially disregarding prescribed standards. The crew then very quickly finds itself entangled in the so-called **poor judgement chain**.

One indication of a crew being subjected to a high stress burden is the reduction of verbal **communication**. The breakdown of communication is one of the most commonly occurring factors in the causal chain leading to accidents.

While the frequency of **human error** *is increasing in general*, the probability of error increases significantly under stress. Williams (1988) ascertained increases in the following error rates (see Table 5.1):

Astonishingly, a systematic approach to coping with stress is usually not being taught in pilot training programs to this day. The Vereinigung Cockpit calls for the inclusion of stress training in the CRM seminars conducted during recurrent training.

The following discussion provides an introduction to the subject area of stress as well as an overview of the related content needed for airline pilot training.

5.2 What is Stress?

Stress has a cumulative effect (Jensen 1995).

Stress is the sum of all the stimuli influencing us. Eustress is positive stress, which is required for maintaining the health of the overall organism. Distress is damaging stress, which permanently disrupts our physical and mental equilibrium and, in so doing, can damage the organism.

Stress is experienced by each person **individually**. One person may encounter eustress while the other encounters dystress in the same burdensome situation. Aerobic flight or a CAT-III approach may be perceived as a positive challenge or as pleasure, but also as stress, depending on the individual's constitution, personality and experience. The borderline between eustress and dystress is blurred and oftentimes difficult to define.

5.2.1 Tension and Relaxation

The body is in a continuous state of alternation between activation and rest, or between tension and relaxation. The activation and tension phase is the stress phase.

When the stress phases clearly take prevalence over the relaxation phases, then physical equilibrium is no longer warranted. Dystress develops cumulatively.

Performance and rest, or tension and relaxation, are polarities, both of which belonging to a harmonious life. It is essential to establish a good balance between the two and to find "the right rhythm". If a rest period is not provided for, then tension can accumulate so extremely that it can't return back to a normal state of rest, even after work has ended. The person is then no longer able to unwind and relax. A portion of the tension is still present even at night, working to prevent him from falling asleep or sleeping soundly.

In the same manner, the balance is disturbed when the tension phases are deficient and the rest phases predominate. Here, too, negative developments can result, such as the rapid aging of older persons after completing their professional lives.

In highly automated aircraft, lapses caused by daydreaming or "spacing out" can occur during cruise flight that compromises "situational awareness" (NASA 1996).

Thus, every person goes through their own particular periods of performance-related highs and lows. This brings about very specific individual working rhythms, to the extent that external circumstances permit it. If the individual working rhythm stands in contradiction to work flow demands, then the natural process can be influenced to such an extent that signs of stress will result.

5.2.2 Stress: An Elementary Reaction

The typical stress reaction leads to changes in the body that prepare the organism for a near-term emergency reaction, also referred to as an **alarm reaction**.

In evolutionary terms, this alarm reaction serves to activate all bodily reserves for the flee or fight situations experienced by our ancestors. Even though we live much differently today, situations still arise that require our whole strength and/or attention. Imagine flying along an airway in cruise flight when an aircraft approaching from the opposite direction is recognized at the last minute as being on a collision course. A near-miss can no longer be avoided.

A typical alarm reaction would be experienced:

- All of a sudden, the person is wide awake.
- The heartbeat accelerates rapidly.
- The muscles tense up.
- The hands become moist.
- The heart feels like it's in the throat.

Unconscious changes also occur:

- The blood sugar and fatty acid levels rise.
- The blood's viscosity increases.
- The blood pressure rises.
- The metabolism changes.

All these processes are caused by the release of stress hormones.

Such a short-term stress reaction is normally completely harmless, especially when it is followed by physical activity. This is not possible, however, for a pilot sitting in the cockpit.

A bodily alarm reaction follows a stress situation. This alarm reaction activates all bodily reserves to subsequently flee or fight (with physical activity as a result). An exhaustion phase subsequent to the flight or the fight then ensues, followed by a rest period, after which the body returns back to its normal state.

This stress reaction is the organism's stereotype answer to the very diverse potential responses one can have to stress. Every stimulus to the senses, interpreted as a threat to the body or a disruption of the equilibrium, sets this in motion.

The hypothalamus, a part of the brain, triggers the release of adrenalin, nor-adrenalin and cortisone hormones into the bloodstream from the adrenal glands. These hormones produce the reactions just described in a fraction of a second. Any stimulus that can trigger this reaction is referred to as a stressor. Such a stressor can be acoustically stimulated, such as through an "aural warning", or even just a simple thought, such as thinking about one's own knowledge gaps just prior a check.

5.2.3 Stressors

The list of stressors is endlessly long. Just about every facet of life has triggered stress at least once in every person at some point in time.

Stressors can be subdivided into three groups:

- **Physical stressors:** noise, vibration, extreme temperatures and humidity, oxygen deficiency
- **Physiological stressors:** fatigue, poor physical fitness, illness, missed meals, low blood sugar levels
- **Psychological stressors:** mental workload, social challenges, difficult decisions, fear

Here are a few pilot-specific stressors:

Noise, low air humidity, abnormal, new airports, rushed approaches, weather, bird strikes, irregular and long working schedules, difficulties in planning free-time

and social activities, as well as with maintaining friendships, responsibility for the passengers, aircraft and crew.

Stressors can also be generated through the respective airline's corporate structure.

For example, it becomes burdensome when a flight operation puts its pilots under enormous cost pressures or fails to offer stable labour conditions. At the same time, insufficient recognition and anonymity are common within organisational departments that have become too large. According to the Human Error model from Reason, these create stressors that become the *latent conditions* in later accidents.

Extraordinary personal events in life can also represent particular stressors. Pilots should carefully consider when they should return to flight duty following a divorce or the death of a close family member. The burden accompanying such thoughts lowers a person's tolerance to stress. Even simpler life situations such as home construction or financial problems can quickly impair the receptive capacity of the brain's working memory.

5.2.4 Reactions to Stress

The vulnerability to stress can be extremely diverse due to conditioning from youth (e.g. "good boy") and disposition (phlegmatic or irritable).

Anyone who was raised by his parents to be a "good boy" learned from a very early age to conform. Good performance and unobtrusive behaviour were rewarded. Poor performance and loud, aggressive behaviour were punished. The questionable result of this form of upbringing is that this child will possess an exaggerated performance consciousness even into adulthood and may have difficulty "letting go" of feelings such as anger and resentment. Such an adult can encounter problems handling stress.

In his striving for achievement, this person may be subjected to too many stressors while repressing all stress dispelling emotions.

A precise scientific analysis of this type of individual and his psychological background would go well beyond the scope of this chapter, yet, it can generally be argued that an analysis of the individual's management of stress would be necessary in order to effectively combat stress.

5.2.5 Stress and Performance

Insights into the relationship between stress and performance have been known since the beginning of the twentieth century. They are summarized in the Yerkes-Dodson Diagram.

Every task requires a specific level of stimulated arousal in order to optimally accomplish it. Too many or too few stressors degrade the ultimate work result (Beehr 1995) (see Fig. 5.1).

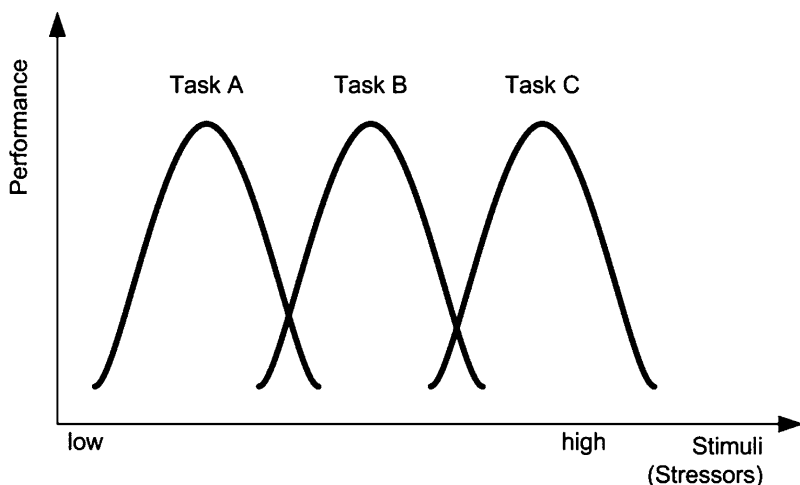


Fig. 5.1 Relationship between stimuli (or stressors) and performance

- Too few stressors:
Boredom, fatigue, frustration and dissatisfaction
- Too many stressors:
Inadequate problem solving, exhaustion, illness, low self-esteem
- Optimal stressors:
Creativity, continued development, satisfaction, progress, rational problem solving

The depiction in Fig. 5.2 (Jensen 1995) has also been widely propagated:

The flight crew's resilience slowly subsides over the course of a duty shift due to fatigue. The various flights or flight phases place differing performance demands on the crew. At the same time, the crew's capacity for stress should never become exhausted.

5.2.6 Stress and Pilots

Pilots that don't cope well with stress are more likely to be involved in aircraft accidents (Alkov et al. 1995).

Different professions, differing **stress levels**. Reference is made in this section to the English study done by Sloan and Cooper in 1986. The table below (see Table 5.2) shows the occupation-related stress ratings on a scale between zero and ten according to the estimations of stress experts (Sloan and Cooper 1986):

The airline pilot profession occupies a very high position on this list. To be a pilot means to be subjected to stress. The study also ascertained a significant

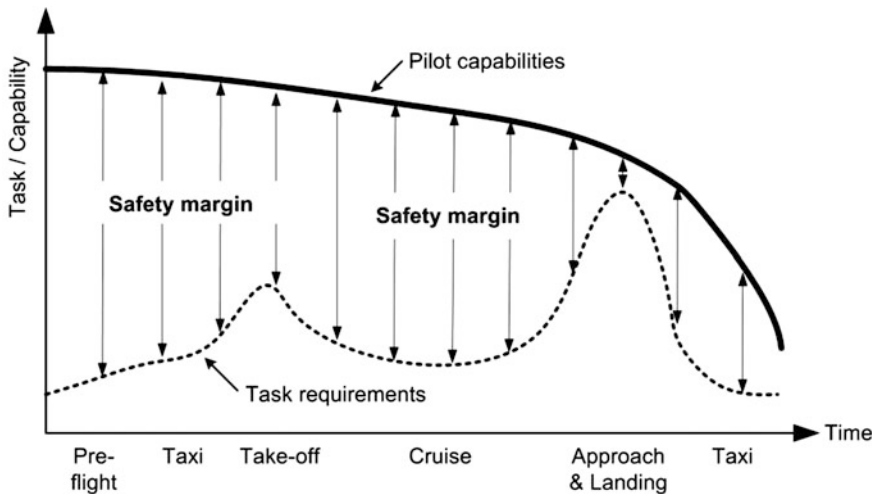


Fig. 5.2 Conceptual diagram of the margin of safety throughout a typical flight

difference between the pilot groups at 21–30 years and 41–50 years of age. Older pilots tend to be more prone to depression and psychosomatic disorders.

The pilots most susceptible to stress are those who are older, tired and weary. The same goes for pilots who do not have sufficient opportunities for rest and relaxation, and ultimately for those who cannot count on adequate support from family and friends.

Captains make up the group most particularly affected by stress. This is not due to their age, however, but because of the decisions they must make and the on board responsibilities they assume.

5.2.7 Pilot-Related Stress Model

From what has been shared to this point, a model can be built to depict the management of stress using several exemplary factors (see Fig. 5.3):

If the management of stress is inadequate, the following symptoms may develop:

- Depression
- Mental resignation
- High blood pressure
- Periods of absence
- Alcohol abuse

The symptoms arising from poor stress management function to some extent, themselves, as stressors and work to raise the already existing pressure. It's not long before one finds himself in the vicious cycle depicted below (see Fig. 5.4):

Table 5.2 Stress level related to particular professions

Profession	Stress level
Police officer	7.7
Journalist	7.5
Airline pilot	7.5
Dentist	7.3
Advertising professional	7.3
Performer	7.2
Other physicians	6.8
Med. nursing staff	6.5
Fire-fighter	6.3
Teacher	6.2
Social worker	6.0
Professional athlete	5.8
Manager	5.8
Stockbroker	5.5
Psychologist	5.2
Diplomat	4.8
Physiotherapist	3.5
Priest	3.5
Physicist	3.4
Biologist	3.0
Librarian	2.0

From what has been shared to this point, it is evident that the following points are of **considerable importance** for the cockpit working environment:

- Each crew member must actively strive to maintain a high degree of resiliency or a high threshold for distress.
- Each crew member must be capable of recognizing the imminent approach of his distress threshold and of responding accordingly.
- Each crew member must also be capable of recognizing the imminent approach of his own or his colleague's stress limits and be able to intervene accordingly. The working capacity of the cockpit team shall not be jeopardized.

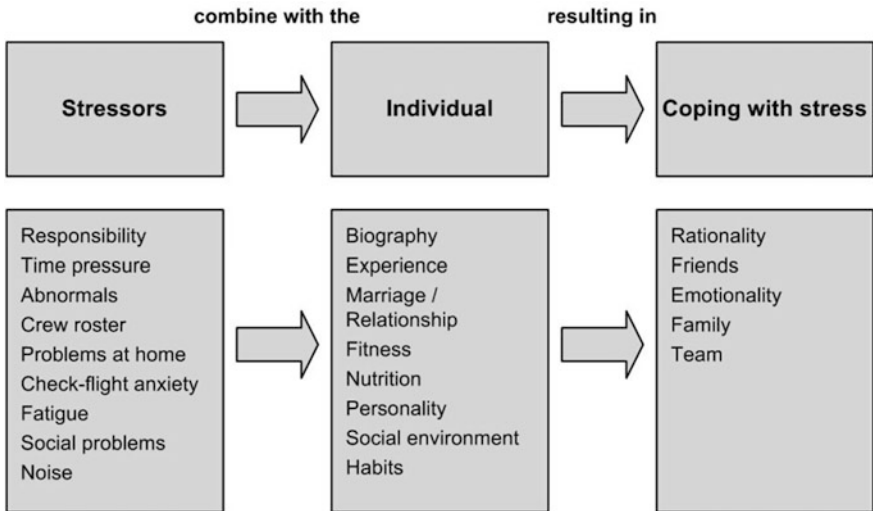
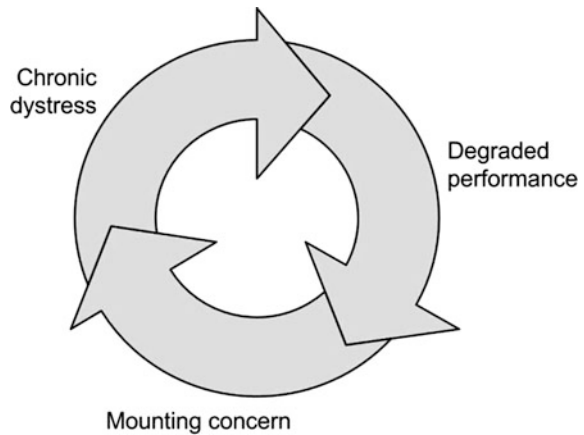


Fig. 5.3 Pilot-related stress model

Fig. 5.4 The vicious cycle of stress



5.3 Signs of Stress

The following discussion differentiates between two types of stress: chronic stress and acute stress.

Chronic stress builds over time due to persistent stressors, oftentimes external to the profession. For the most part, acute stress results from occupationally-related stress peaks that can extend up to the limits of one's productive capabilities. Both types of stress are cumulative, adding to the total stress burden. This means that

those persons already encumbered with chronic stress from home may not be able to handle that much more acute, sporadic stress before exceeding their personal stress limits.

When exposed to stress, the body sends out signals that are distinctly different and should be recognizable to anyone. The symptoms of chronic stress are subtler and more difficult to recognize than those of acute stress.

5.3.1 Indications of Chronic Stress

- Under a great deal of stress and in extreme situations, a person may feel trapped, desperate, helpless and miserable, yet without attributing this to the stress itself.
- He speaks more rapidly.
- He interrupts others in the middle of a conversation.
- He eats conspicuously fast.
- He takes on more commitments than he can successfully handle.
- He hates to squander time.
- He frequently drives too fast on the road.
- He attempts to accomplish several things simultaneously.
- He quickly becomes impatient when confronted with slower colleagues.
- He spends too little time resting or together with friends.
- He becomes increasingly more aggressive in response to criticism.
- He doesn't accept criticism.
- He tends towards arrogance.
- His problems with colleagues, supervisors or in the family become more frequent.
- He increasingly draws back from participating in social activities.
- He drinks, smokes or eats in conspicuously large amounts.
- He no longer achieves the same quality of work.
- He enters into high risk situations conspicuously often.
- He is potentially inclined towards uncontrolled fits of rage.
- He treats other persons unjustly.
- Over the long-term:
 - His personality changes and he is no longer the same person he once was.
 - He is increasingly inclined towards illness.
 - His appearance becomes grey and pale.

5.3.2 Acute Stress

Oftentimes, several things must be taken care of simultaneously when commanding an aircraft. Demands sometimes may appear to be too great for the time available, which can lead to oversteering. A state of tension and irritation follows,

along with a limited power of judgement. Headaches and digestive disorders can arise.

Time constraints and overloads manifest themselves through:

- A strained voice—rapid, high-pitched, hasty
- A tensed seating posture, oftentimes not in the centre of the seat
- Too rapid breathing rate or the holding of breath
- Perspiration
- Heavy and/or too rapid heartbeat
- Dry mouth
- Reddened skin colour
- So-called “white knuckles”
- The clenching or gritting of teeth
- Too rapid or no eye movement
- Tunnel vision
- Difficulty gathering thoughts
- Conversations will be merely technical in nature, if at all.
- No one jests or makes a joke.
- Attention is consistently drawn to incidental matters.
- Deviations from Standard Operating Procedures are undertaken.
- Decisions are no longer made.

When these symptoms appear, an increased risk for the flight, itself, exists. It is then increasingly likely that the crew will become entangled in the so-called poor judgement chain.

5.4 Poor Stress Management

A person is responsible for himself—and only he can do something for his own inner well-being (Crisand, Lyon 1981).

Most people do not handle chronic stress very well. We have developed various and very different options for automatically dealing with stressful situations.

We can:

- Suppress the problem.
- Look to others to blame for the problem, but not to ourselves.
- Take the blame exclusively upon ourselves (Gunn and Ruthrock 1994).

Each of these options can be helpful, as long as it is not used excessively. Exaggerated usage destroys the sense of reality and therewith the objective perspective of the problem lying beneath the chronic stress. Signs of an exaggerated suppression of the problem or a too one-sided view of the problem are anxiety, irritability or depressive tendencies.

- **Anxiety:** nervousness, indisposition, sleep disorders
- **Irritability:** loss of one’s own rhythm, alienation from friends and colleagues, lack of acceptance in one’s surroundings

- **Depressive tendencies:** hopelessness, disappointment, inadequacy, chronic fatigue, loss of appetite, sexual disorders, loss of interest

These phenomena are oftentimes combated with alcohol. An increased rate of alcohol consumption often points to a serious crisis. Further indications that the stress management process has been disrupted can be a noticeable aggressivity, as well as any form of addictive behaviour (miscellaneous drugs, anorexia, compulsive gambling and workaholism), shopping frenzies and noticeable cynicism.

The high demands placed by pilots on their own productive capabilities and emotional stability make it particularly difficult for them to seek psychological help. For this reason, severe but treatable disorders are often needlessly protracted. Self-help groups for addiction problems have now been formed among pilots and some pilots' associations such as the German ALPA offer burnout prevention seminars. These signify the overcoming of an old fashioned pilots' self-image.

Learning to live with distress is the worst approach to stress management. It may be unavoidable for short, manageable periods of time, but over the long-term it will create fundamental problems. An airline pilot who cannot adequately deal with stress on his own should not shy away from seeking help and advice.

5.5 Properly Coping with Chronic Stress

As a rule, the root of the chronic stresses pilots must deal with will not be found in factors directly related to flying (Crisand and Lyon 1991).

What can a person specifically do to better handle the personal stress he is subjected to?

To begin with, the management of chronic stress is an activity that must be initiated and carried out by the person, himself. In principle, there are two options to this end: The person should reduce the number and extent of his individual stressors, which is possible only to a limited degree within the scope of his profession. The other option is to change the manner in which the unavoidable stressors are dealt with.

One can obtain assistance for this by seeking the advice of a specialized psychologist, by attending a stress management seminar or by reading a book on this topic.

The methods used are approximately the same in each of these three options. A person's personal burden due to chronic stress is determined through testing. The individual's personal background and, with it, his disposition towards coping with stress are thoroughly illuminated. The main stressors for each individual are searched out and assessed. Finally, a management strategy is established together with the counsellor and progressively adapted to the current situation as necessary. In addition to these initiatives for dealing with chronic stress, there are a great many possible options for opposing the very draining professional demands through spiritual, mental and physical stability. A counterbalance to growing professional

challenges, including those related to flying, can be established through leading a responsible lifestyle. The following advice can be helpful therein:

Rest and slowness are essential. One merely has to consider the natural rhythm of tension and relaxation. Those who suffer from chronic stress almost certainly enjoy periods of rest all too seldom. The novel “The Discovery of Slowness” by Sten Nadolny offers an entertaining approach to checking one’s own attitude.

Friends: Especially flying personnel have frequent job-related problems cultivating and maintaining friendships. Friendships are an important counterbalance to stress.

The role of a **life partner** is particularly important: 40 % of all marriages will end in divorce if one of the partners is at the height of their professional agility but has less and less time to attend to private matters. Two thirds of all senior managers admit to having stress-related difficulties with their partners.

A pilot’s life partner has an especially difficult role to fulfil. Like a single parent, they are confronted with an unshared portion of the child-rearing and household burdens due to the pilot’s frequent absences. This is often a source of overburden and frustration. Moreover, pilots expect constructive support from their spouses when they return home from a flight. This same support is anticipated by the ones remaining at home, but they oftentimes don’t receive it.

The partner is subjected to a further burden in that the family often finds itself in a form of isolation due to the pilot’s work schedule, which doesn’t always allow for regular contact with the rest of the family or friends. Persons not actively working seem to struggle with these challenges to a greater extent than their employed partners (Sloan and Cooper 1986).

What can help?

- Regular conversations with the partner are important. Problems that can’t be solved alone must be openly discussed.
- Wives shouldn’t altogether abandon their career plans in favour of the family. Children must be nurtured for several years; the career shapes an entire life.
- Spouses have experienced favourable results by allowing their partners to be alone for some time after they return home. The conversation can be first sought out with the question: “You look exhausted, how are you doing?” Many will grab at the chance to vent their day’s affairs and talk about their experiences. Afterwards, they will be more interested in their partner’s daily routine. Both will benefit once the pathway to a dialogue has been found.
- Regular opportunities should be taken to discuss those aspects of the relationship that are going well or that are not going so well.

The best and most enduring partnerships are those, in which the partners coexist as equals with one another, and not just from the other or for the other (Handelsblatt 1995).

Adequate, uninterrupted **sleep** is one of the most decisive regenerative mechanisms of the human organism. Whenever possible, sleep disorders should not be just accepted. They can be alleviated by different means. This can range from doing relaxation exercises just before going to bed to taking a short walk in the fresh air. One should avoid switching on the television and it is better to read prior

to going to bed. Sporting activity shortly before going to bed is not good either, as the physical exertion temporarily acts as a stimulant (Garrett 1995).

Sleep induced by tablets or alcohol is merely a daze, but its relaxation effect is relatively low.

There has been some hope placed in melatonin, a substance produced by the brain during emerging darkness that provides the body with a “signal to fall asleep”. The body is then “tricked” into believing it is nighttime. Melatonin is used to combat the negative effects of a disrupted day/night rhythm, which is typical for the airline industry. But it is not free from side effects. Among others, the feel for mental resiliency is disturbed. In addition, the body’s own melatonin production rhythm can be disrupted.

Self-medication should be avoided by all means in order to prevent administering an incorrect dosage of melatonin (VC/DLR Alertness Management). Medical advice should be sought if sleeping problems remain stubborn. Perpetual sleep deficit has destabilizing effects and is a hazard to both the person’s health and the conduct of a flight.

The stress burden can be reduced through **exercise**. Those who regularly take part in endurance sports are generally more emotionally balanced and physically resilient. An endurance-trained person releases fewer stress hormones when subjected to the same stress burden. The resistance to stress increases thereby. Regular endurance sporting activity is an important instrument for sensibly and successfully managing and preventing stress.

Beneficial endurance sports can be jogging, hiking, swimming, cross-country skiing, rowing and cycling.

At the same time, it is important to avoid overestimating one’s own capabilities and to not carry over the performance-oriented mentality from the profession into the sport. The time invested in sporting activities should be consciously perceived as a period of relaxation following the tension built up on the job. Relaxation doesn’t have anything to do with competition, confrontation or a battle against time.

Sport, as an anti-stress device, means: *long and slow*. Physicians recommend 30–60 min of training at least three times a week with a continuous pulse rate based on the empirical formula of 180 minus your age (Skolamed 1993). An exposure of 80 % of the maximum individual pulse rate would be even better.

Sensible **nutrition** is another key to both inner and outer stability. Yet, despite all the efforts to explain its significance, it is largely still disregarded. The stamina and regenerative capacity of both the body and the spirit are decisively determined by nutrition.

A balanced and regular diet is often difficult to maintain and even sometimes impossible, especially for pilots underway in an aircraft or on a layover stop. The bywords here would be a well contemplated consumption of coffee, tea and alcohol, moderation with fats, meat and sweets, foodstuffs that are as natural as possible with lots of fruits and vegetables. Aviators in particular should give conscious heed to a regular diet without hectic or distraction. A more detailed introduction to proper nutrition would go beyond the scope of this discussion, but a wealth of literature is available in any bookstore. Moreover, within the context of a

CRM seminar, an aviation physician, for instance, could be invited to lecture on the subject.

In addition, regular **relaxation exercises** are recommended to round out the program. These include:

- Progressive muscle relaxation according to Jacobsen.
- Yoga, meditation, autogenous training, as well as massages and use of the sauna.
- Long walks and other extensive outdoor activities in a natural setting are also quite simple and effective.

The success that comes with relaxation exercises will be first realized after some time. The results from autogenous training, for example, may be expected after a good six months. Therefore, some patience will be required until noticeable effects set in.

A person is very essentially the product of his own **thoughts**. In addition to physical fitness, our productive capabilities also demand mental fitness. There exists a direct correlation between thought activity in the brain and the immune system. Simply put, this means: People can either think themselves sick or think themselves healthy. Someone who is easily excitable, who can't remain at a "composed distance", who is continuously brooding and sometimes speaks to himself in negative soliloquies, undermines his long-term joy for life, productive capabilities and health. Inner stability requires more than just purpose-specific technical expertise. The mental aspects are all too often neglected by aviators. The conscious and critical search for something new when engaging art, philosophy and even religion can be helpful.

According to one study, the best way to remain healthy while overcoming burdens is to actively comprehend them as being challenges, tests and opportunities to learn something new. One should therefore confront his burdens with optimism and a sense of responsibility (Volk 1996).

Good interpersonal relationships in the everyday work routine should not be taken for granted. The thoughts invested in categories such as speed, rivalry and competition not only burden interpersonal relationships on the job, but in private life, as well. The willingness to perform and the enjoyment of work are heavily influenced by the relationship to the colleagues. It is much more pleasurable to work together with a congenial and humorous colleague. Inappropriate behaviour, on the other hand, often returns like a boomerang.

Here are a few more flyer-specific tips:

- Avoid gaps in the theoretical knowledge needed for flying. Gaps cause insecurity.
- Consciously plan the use of time. It is better to arrive ten minutes earlier at the dispatch office during poor weather in order to avoid time pressures from the outset due to possible alternate planning difficulties.
- Make deliberate use of every training opportunity, including simulator events and line checks. Checks serve as a further training opportunity just as do performance-level tests. Good training creates self-confidence.
- Avoid the regular consumption of alcohol, such as might be common upon completion of a fight. Alcohol is of no benefit whatsoever when it comes to

combating stress over the long-term. The threshold to addiction is closer than most people think.

- It may be better not to report for flight duty when under a high degree of mental strain, perhaps due to a severe personal experience.
- Cockpit colleagues should be openly and earnestly informed about burdensome factors such as a sleep deficit, household problems, illness, etc. The colleagues' reservations about addressing unclear work processes will be reduced thereby.
- A colleague under stress will commit more work-related errors than normal. The error chain can be broken at the first sign of error through explicit and immediate enquiry on the part of the colleagues in the cockpit (Lufthansa 1994).

5.6 Properly Coping with Acute Stress

Never be in a hurry. If you are in a hurry, you are in danger (Aero Safe 1991).

Acute stress is the sum of all sporadically acting stimuli.

Examples might be an approach that is progressing too high and too fast, a hasty prepared flight due to a delay, marginal weather conditions, an abnormal procedure or a base check.

The probability of error increases significantly when time pressures exist. An analysis done in America regarding incidents where time pressures were indicated as being the triggering factor led to some interesting conclusions (McElhatton and Drew 1994):

- In 65 % of all incidents, the causal errors were committed by crew members who had a mental or emotional disposition towards being in a rush.
- Most time constraint-related errors were made during the flight preparation phase, followed by the taxi-out and take-off phases.
- The study offers the following advice for avoiding error when time constraints exist:
- Beware of a **rushed and hectic pace**, especially during flight preparation and taxi-out. Pilots must work to counter any external distractions (ramp agent, station, passengers) or pressures for punctuality when they arise during these phases.
- Be sensitive to the pressures as they start to build up. More time should be explicitly and purposely taken at these times in order to work through the pending tasks according to the urgency assigned them.
- Any non-essential tasks should be put off until a later point in time.
- Checklists should be read through completely and correctly at all times.
- When a procedure or a checklist is interrupted, it should be read through again from the beginning.

Here are a few more tips:

Naturally, acute stress can also be associated with all other work phases. In stress situations, one should be fully cognizant of his physical rhythm: demand, performance, fatigue and subsequent rest. He should take advantage of short periods of rest as soon as possible in order to be prepared for the next demand as it

arises. Beware of the poor judgement chain. When subjected to stress, the probability of error increases, so that when an error is made, the level of stress rises even further and the next error will occur that much sooner.

Accept one's own flaws. Respond to every error, even those you may have just made, yourself.

When subjected to stress, one tends to deviate from the SOPs. It is precisely in such situations that they should be complied with as faithfully as possible with no allowance be made for one's own, or a colleague's deviations. Stress situations should be deliberately and actively rectified whenever possible. This could mean initiating a go-around, entering a holding pattern, rejecting a "line-up and wait" authorisation or simply waiting a few moments.

Rectification should also be sought when it is noticed that one of the crew members is "not in the loop". Flying represents teamwork in practice and is not a stage for a "one-man show".

When a burdensome situation cannot be avoided despite these options, at least they can be better controlled through the appropriate and timely application of the following "emergency measures":

Relaxation Through Tension

The body's entire muscular system should be tensed and then subsequently relaxed. In so doing, a pleasant heaviness in the muscles will be noticeable. The relaxation of these muscles results in an inner calmness.

Conscious Breathing

The breath becomes quicker and flatter when subjected to acute stress. As a countermeasure, one should breathe in deeply and slowly through the nose while counting to five. The breath should then be held for three to five seconds and subsequently let out slowly while counting to five. The tension will noticeably dissipate from the body when this is repeated several times (Skolamed 1993).

Good experience has been made with autogenous feedback training. A group of pilots undergoing this training subsequently exhibited better results in the simulator (Kellar et al. 1993).

Endurance sports immediately following the flight will be beneficial for acute stress in the same manner as with chronic stress. As already mentioned when discussing the "elementary reaction", all bodily reserves should be mobilized to flee or to fight. The physical activity that follows then helps return the body to a normal hormonal balance. Endurance sports following a flight thus become our contemporary replacement for appropriately dealing with stressors.

5.7 Stress Following Particularly Burdensome Events

Events can occur while flying that go far beyond the extent of what a person in the given situation can cope with. In this case, it is not so much the event itself that matters, but the perception of the person affected. A good example would be the crew member who, upon assessing the inability to retract the landing gear due to a technical defect as a well-manageable task, is ultimately capable of

landing the aircraft safely. Another crew member, in contrast, may potentially recall scenes of collapsed landing gears and fear for his life right up to the landing.

Although seemingly astonishing at first glance, it makes absolutely no difference whether the person is male or female, has a lot of experience or just a little, or sits on the right side or the left side of the cockpit. Just how the event is ultimately handled is clearly not dependent upon these factors.

It almost seems as if it is simply a matter of who gets caught when, and by which situation. Literally everyone can be affected.

Nevertheless, if it is assumed that the event, itself, is the trigger and not how it is dealt with, then the experiences gained through the event become critical, especially if the life or soundness of one's self or a person in the immediate vicinity was threatened or appeared to be so.

Classic examples are:

- The death or near death of a passenger on board
- Even more critical is the death of a colleague on board or during a layover
- The threat to one's own life and limb, such as might be caused by:
 - system failure (in particular an engine or a landing gear)
- events based on external conditions, such as wind shear, turbulence or thunderstorm

The event, in this context, is not the problem, but rather the threat to life and limb that is perceived as arising from it. The risk of inappropriately coping with the situation is particularly great when the event occurs suddenly and unexpectedly.

Even though the resistance to stress and its management are enhanced through the techniques already mentioned, such as endurance sports, autogenous training, yoga, etc., everyone can still get caught off guard just the same.

Of course, not every event will leave a long-term impact on those involved. On the contrary, critical events in approximately 80 % of all cases will be handled by the effected persons alone and without any difficulties. 20 % of those affected will react more intensely. These reactions can be mental, physical or emotional in nature and be expressed through conspicuous behaviour. As a general rule, these are normal symptoms in healthy persons subjected to abnormal situations. The symptoms may be unpleasant for the effected persons at first, but they will prove to be of no real significance or not even bad. Only in extremely rare cases or when they persist longer than four weeks will they need to be treated. If crews do not receive support following these so-called "critical incidents", however, approximately 4 % will begin to suffer from depression, substance abuse or posttraumatic stress disorder (PTSD).

A list of the normal reactions and options for coping with them can be found at the homepage of "Stiftung Mayday" (www.Stiftung-Mayday.de) under Downloads, "CISM-Informationsbroschüre" and "Belastungshinweise" (the "CISM-Critical incident stress management information brochure" and the "Instructions regarding burdensome events" are both available in the German language only at the present time).

Stiftung Mayday has made it its goal to support license holders and their dependants in the German-speaking regions during and following critical situations. This support has resulted in a reduction in the number of long-term crew member illnesses from 4 % down to 0.8 %. At the same time, the progression of the illnesses that still arose proved to be much milder in scope and shorter in duration because of the support. The number of near-term illnesses has thus been reduced by 80 %. The work carried out by Stiftung Mayday is absolutely confidential and is not conducted inside the airlines intentionally, even though an airline may support the initiative both organisationally and financially. Crews should be provided an opportunity to talk about their situations within a framework that has nothing to do with the disciplinary structure. In the first instance, this is good for the effected crew members, but it is also of benefit to the employers because the rate of illness is lowered and the duration of those illnesses is shortened.

An “operational debriefing” should be carried out following any event that a crew member deems to have been a critical incident. The compilation of all views will contribute to a much more coherent overall picture as well as to considerable relief.

Operational Debriefing

When an abnormal incident leads to differing perceptions within the effected crew, the commander should then conduct an “operational debriefing” with all crew members.

Such an abnormal incident is defined according to three criteria:

- It takes place outside the scope of the daily routine.
- It leads to a deviation from the normal work routine.
- Differences are likely in how the incident may have been perceived and assessed.

The operational debriefing is confined to the pure facts. It should be carried out as soon as possible following the incident. Non-effected persons are not permitted to participate or to listen in. Examples could be: a go-around, a diversion to another airport, etc.

The following questions should be addressed and clarified during the operational debriefing:

- What are the facts and what course of action was followed throughout the incident?
- Are there differing perceptions among the crew members?
- Is there a need for continuing CISM measures?
- How should we proceed from here?

CISM measures are necessary when an operational debriefing lasts longer than 15 min and strong physical or emotional reactions are recognizable (see Fig. 5.5).

When an operational debriefing is not sufficient and the crew members still require further support or simply have open questions, they can contact the Stiftung Mayday hotline at any time: +49 (700) 7700 7703. Initial contact at this telephone number will be with a call centre employee who will record the call back number and a short description of the incident. Call centre employees are trained merely to gather information about and to record an incident. They are trained to

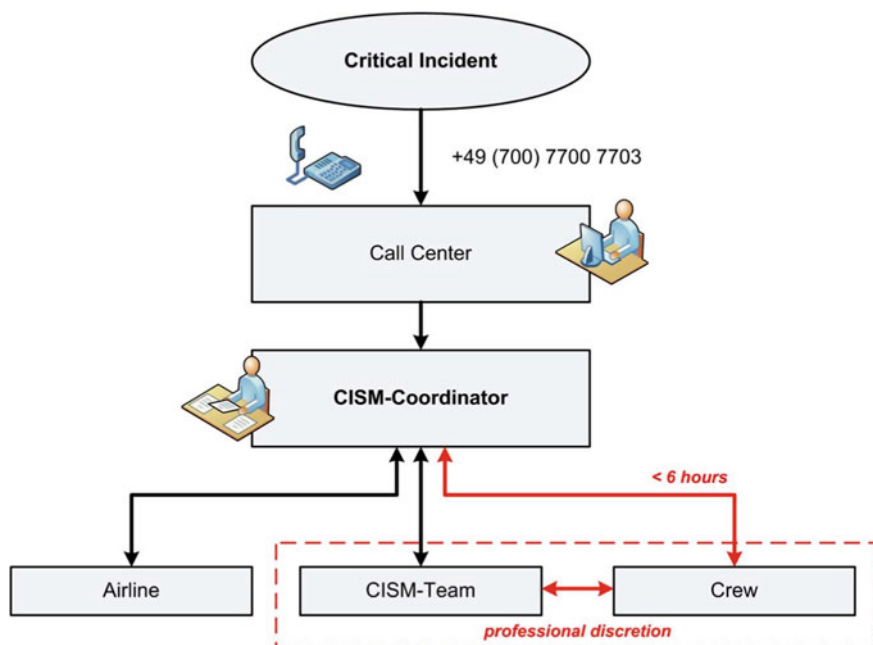


Fig. 5.5 Intervention following a critical incident (according to Stiftung Mayday)

provide a straightforward telephone support service, then to forward the telephone number with a description of the incident to a coordinator who will return the call to the initiator within 6 h. The caller can be an effected crew member, himself, or another person altogether. This service is also provided in English.

Coordinators are key figures in the concept of crew member support following critical incidents. They are very well trained colleagues out of the flying profession (cockpit and cabin) and have a great deal of experience. They will discuss the event and initiate measures as necessary—always in agreement with the caller. Such measures can be the conversation, itself, a conversation with a specialist, a pickup at the aircraft once it arrives at its base airport, a briefing with the crew immediately following its return or a few days afterwards. In some cases, information is initially sent via e-mail or fax in order to arrange a further conversation. No matter how the ultimate measure is carried out, the conversation with the coordinator as well as any subsequent conversations with other trained colleagues from the CISM team are bound by a commitment to professional confidentiality through Stiftung Mayday.

Stiftung Mayday is able to arrange for further measures at the request of the individual, but only if this process is not sufficiently helpful and he takes ill following the incident. The goal in every case is to ensure the full recovery of the effected colleague as quickly as possible.

5.8 Trainability

Stress is a popular subject; one that has encouraged a wealth of general literature. The ability to successfully cope with stress is obviously of significant importance for airline pilots.

Yet, one would think just the opposite is the case, as there is surprisingly little scientific material available addressing the effectivity of stress management training (Beehr 1995). The effects of the individual measures, such as relaxation training and biofeedback among others, are minimal or simply not verifiable by themselves. Furthermore, stress training sessions are aimed for the most part at the individual, while studies related to anti-dystress measures in teams or at the company level are virtually non-existent.

Thus, the knowledge available demands a holistic approach to addressing the stress potential of the individual. Only through comprehensive knowledge about stress and the recognition of how it manifests itself, along with the acquisition and the application of good stress management techniques, can its negative consequences be prevented.

With this in mind, we consider the following training content/learning objectives to be essential for attainment of the airline transport pilot license:

- Definition of the terms Stress and Stressors
- An understanding of the individual reactions to stress
- An understanding of the correlation between stress and performance
- An understanding of pilot-specific issues related to the subject of stress
- Recognition of chronic and acute stress
- An understanding of unreflective and poor stress management
- An understanding of, and training about how to properly cope with chronic and acute stress, with a focus on clear communication regarding stress limiting factors relevant to the cockpit crew, with a deliberate and concerted effort to avoid haste and hectic in the preparation and conduct of a flight. Moreover, the targeted intervention into the development of error chains and the active rectification of stress with a sensibility for crew workload can all be trained.

The knowledge referenced above with a focus on the practical aspects are also essential components of CRM seminars that should be repeated on a regular basis.

These practical training points should be continuously taught and refreshed throughout the professional career as part of the practical training that accompanies it in the simulator and aircraft.

We consider the conception of a pilot-specific seminar that comprehensively deals with chronic and acute stress to be highly desirable.

All newly initiated instructional and training measures should be accompanied scientifically and be examined for their effectivity on all accounts.

5.9 Relaxation Techniques and Addresses

Respiratory Therapy

Respiratory therapy with simple exercises leads to a resumption of the natural breathing process and to the dissipation of tension. Ilse Middendorf provides instruction in her book “The Perceptible Breath: A Breathing Science”, Junfermann Publishing House, with further addresses and links at the German language website for the “Arbeits—und Forschungsgemeinschaft für Atempflege e. V.” (Research foundation for respiratory care).

Autogenous Training

This method of relaxation instils a feeling of heaviness and warmth through concentration focused on the body. Health insurance companies should be able to provide information about competent trainers.

Meditation

Meditation focuses on a form of mental release or “switching off” rather than on physical relaxation. It functions through concentration on the respiratory rhythm, on music or through complete silence. An introduction into Zen is offered by the Shido Centre in Worpswede, Germany.

Yoga

Yoga functions through a tensioning and relaxing of the limbs in alternating body positions.

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