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WORKING CONDITIONS IN THE COCKPIT CABIN

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Abstract

Carrying 100-200 passengers on the board is a high responsibility. Inspite of technological and technical development human factors in the cockpit cabin are still very important. Work conditions are changing fluently. Pilots have to be trained by simulation to make right decisions in every situation.

Keywords: flying safety, human factors in flying.

1. Introduction

On the surface, the pilot is not different from most professional men and women, or from his fellow pilots [1, 4]. The variability of their control of any standard aircraft performance is slight. Giant differences among pilots are revealed as tension and confusion mount under operational stress.

Each airline pilot wants a quiet life. His ideal day is one in which he departs on time, arrives on time, and has a thoroughly routine and boring flight.

After all, disruption can alter his work pattern.

Accident records show all too often that under the pressure of the need to clear runway, the need to get the aeroplane positioned somewhere else, the need to get away before the weather further closes or flight limitations ground him, the pilot takes off.

Most of all, his psychological hang-ups and how they all relate to his biological inheritance as he travels across time zones with a group of people he may not have met before. But the airline pilot leaves his wife at home and travels across the world. After flying it is difficult to unwind and sleep. Much adrenalin is circulating. The brain and body don't just quietly switch off. His other worries: family illness, private problems add to his stress on the aeroplane.

Because of higher than average physical requirements for entry and regular medical checks throughout his career, the pilot should enjoy a higher than average life expectancy.

Not this is very much the case. They often get heart disease between the ages 55 and 64.

The psychological stress is very high as well.

Environment in which civilized a man lives has changed a lot. He follows the changes in technology and technique, but sometimes he knows very little about himself.

2. Environment of Work

2.1. In the Cockpit During Flying

The young pilots in their explorations were finding that the sky was even more dangerous than anybody had supposed [1, 4]. The early pilots had more difficulties.

Altitude causes lowering of the atmospheric pressure and of oxygen levels, lack of which would eventually cause disorientation and death. The slipstream blinds pilots' eyes, and they are poisoned by carbon monoxide from exhausting. Ice is an appalling danger, stopping engines, overloading fuselages, spoiling the aerodynamic qualities of wings. Certain clouds could break up aircraft.

If turned or pulled up too quickly at too high speed, the normal pull of gravity (G-force) is increasing many times, resulting injury or unconsciousness. Air sickness could be crippling.

2.2. Weather Conditions

As the years went by, more and more unexpected hazards were to appear – among them the microburst [1, 4].

This is a very strong downdraught approaching the ground and producing an outflow of tremendous winds and downflow. Usually small in area, it lasts only a few minutes but is highly dangerous, particularly for an aircraft on take-off or landing. A large downburst is called a macroburst. Pilots are trained in the simulator on how to deal with a microburst.

Other contributing human factors: expectancy, such as suddenly being presented with weather worse than forecast, change of plan, such as a diversion or a change of runway or let-down procedure, and interruptions in the act-wait-act task sequences.

2.3. Terrorism

Human error surfaces not just among its operating crew, but in operational and commercial management, in political wheeling and dealing, in aircraft design and maintenance and in the protection of passengers from terrorist attack [6].

Aircraft are larger and in many ways more vulnerable to be attacked than used to be. Explosives are more sophisticated and harder to detect. And where there is a prey in the shape of what terrorist would regard as a propaganda coup, there

will be predators. Nevertheless, airlines and airport security staff are aware of the danger, the question should be asked: Are they sufficiently trained, equipped and alert? And what of all the hidden international security services? Those faceless people being subjects of no democratic process – how are human failings monitored in them? Think of the 11 September 2001.

3. Selection

3.1. Requirements to Pilots

Aviation is still very much male-dominated [1, 4]. If a pilot had any illusions about the glamour of flying these would probably be discarded within the first weeks of the flying training.

The granting of a licence is merely the first check upon his ability. Throughout his career he will be called upon to demonstrate to hard-bitten examiners his awareness of the latest regulations and his continuing ability to do his job on the highest standard. His performance during the twice-per-year simulator checks will be analysed no less critically.

If he survives, he prays that the doctors would pass him fit on his regular check. In return he will get a smart uniform, a great fillip to his self-esteem, an image in society, a good salary.

From the candidates, there are few proven criteria of how to choose men and women who will remain cool and capable of making balanced judgements under trying circumstances, knowing that an instant decision taken at one hundred feet above a dark runway may well analysed later at four-hour meeting of desk-bound critics. Special personnel selection techniques emphasize skills and basic intelligence. Such measures do fairly well at predicting early success in flying training, but most do no more than predict 25 per cent of variance in pilot performance at advanced stages of civil aviation training.

3.2. Selecting Pilots

There were many different principals to select pilot-candidates [1, 4].

Testing the candidates not only medically but psychologically, giving them a test on attentiveness, memory, quickness and sureness of movement, capacity to withstand fatigue, timidity, orientation and discrimination. Another examination method was to measure the maximum time, how long he could ascend without oxygen. Then was a nervous shock-test, firing a revolver close to a candidate's ear and examining his reactions.

Other doctors concentrated on the function of the vestibular apparatus in the ear, under the belief that it orientated the flyer in the air as on the ground.

Many of human errors arise from our biological inheritance, from the very valuable mechanisms which helped us to survive in a primitive environment, and which have now become something of a liability, and though the pilot is no more prone than anyone else, he is more at risk of making errors, because ha has been catapulted ahead of the field into a more frustrating and unforgiving environment.

4. Actual Physical and Mental Ability of a Pilot

A pilot may not fly even if he has just a little sickness or inconvenience. This way he may deny starting if he had an excuse. He may not risk the safety. If any kind of unability occurs, the pilot will not fly [4].

But during the flight may arise similar phenomena. In this case the co-pilot has to take the role of the captain. He has to manage the process as emergency. To avoid stomach problems pilots in the same cockpit may not eat the same kinds of food.

Doctors recommend the list of medicines causing no side effects.

The following phenomena may cause unability:
diarrhea, flu, high temperature, retch, stomach cramp, food toxicosis, rapid start of any kind of pain, belly-ache, headache, ears-pain, toothache, weakness, leg cramp, nose bleeding, long sneezing, long caughing, chest pain.

Not all kinds of unability are clear. They trained how to check each others during flight in the cockpit cabin. If a pilot does not give right answer two times, he is unfitted for flying.

In this case the other pilot has to keep controlled the aircraft, to take care of the unable pilot, to do all the necessary jobs, to land as soon as possible as emergency process describes.

Pilots are checked psychologically also first when they are selected, and regularly after that.

There was only 1-2 events in the history of aviation when accident happened because of psychological condition or suicide.

Pilots have two times a year medical and ability check. It is said they have to be retired at the age of 60 because of the following statistics by NASA.

Age of pilots	No of accidents/100000 hours
20-29	5.0
30-39	4.0
40-49	2.6
50-59	2.4
60-69	4.9

The table shows, that experience and good decision making can balance the ageing until 60 years, pilots after 40 years are more reliable than before.

5. Seeing and Perception (to see and not to see)

A considerable amount of perception is learned [1, 5].

Once a perceptual experience has been named, then, we appear to be satisfied with that interpretation. We think we have identified the object adequately, even if in fact there are many aspects of it which we have missed.

We all look and do not see. It is a phenomenon of daily living. We do not see the bunch of keys or the pen or the book that is right in front of us. Especially we do not see if we are concentrating on something else. Furthermore we tend to see what we want to see, like a familiar face in a crowd. At the other extreme, we do not see what we do not want to see. Especially under stress. Aircraft are changing skies and changing background terrain provide excellent camouflage. There are not two but three dimensions. And aircraft speeds, always fast, are now approaching the velocity of bullets.

The idea that airmen should be able to see something that may possibly have been presented in front of their eyes for a few seconds is derived from the old structuralist idea of perception. A rough generalization may be made that the total amount which may be attended to at any one moment is constant. If attention is concentrated on a small part of the field, little will be perceived in other parts. If attention is diffused over a larger area, no part will be very clearly and accurately perceived.

Perception consists of two processes: to see something and to interprete it. First, the image on the retina is passed up the sensory chain to the visual cortex. And there the second process takes place, it is adjusted and interpreted by what we know, by our experience, and our interpretation of the world.

Our perception can also be impaired by another fact, what we expect to see.

One may have perceptual difficulties, but may develop a set of not seeing something. The vision may become tunnelled. This is particularly easy with three or four people encapsulated in close proximity on a flight deck. The vision is often so totally focused that it ignores the rest of the environment. The pattern of selectivity programmed into humans by the accident world is totally obsolete in the present day, where a flexible scanning throughout the visual environment is required. The human beings in the cockpit have to steer a difficult course between too many and too few visual stimuli. We should think of different instruments, they can be digital and analog.

Conscious awareness is a small flawed barred window on the great tide of information which flows unceasingly into, and under stress – the stress of landing, the stress of take-off – awareness narrows and the window becomes a tunnel.

One is an optimist who rejects the bad news, and shoots the messenger. And when the outside world is hostile, his defence mechanisms help him to rewrite the scenario.

6. Laterality

As a cause of accidents hidden lies the laterality, the pattern of hand preferences, the mixing of left and right [1]. The reversal of numbers called by psychologists transportation error. Numerical accuracy is so important in flying, reversals can have disastrous effects.

We may mix left and right and reverse numbers. Although the subject of laterality confusion in aviation has hardly been studied, there are far too many accidents in the air, on the roads and at sea to ignore it.. Without actually naming it, aircraft manufacturers and instrument-makers acknowledge the existence of laterality in the automatic feathering device previously referred to, which is designed to stop pilots feathering the wrong engine after a failure.Mixing of left and right and transporting numbers usually occurs when people are tired, in a hurry, under pressure or in a state of alarm.

7. Fatigue

7.1. Effects of Fatigue

We all know we perform less well when fatigued or stressed [1, 9]. Fatigue means a drive towards rest. This definition is a little bit strange and short but true.

Pilots' flying deteriorates under fatigue – courses and heights are less accurately maintained, fuel checking is liable to be forgotten, there is a tendency to become 'set' on a particular instrument, and subjects thought they are doing well when in fact they are doing badly.

The term of jet-lag became well known in the fifties. Pilots wanted to earn more, they took overtime, until psychologists and doctors began to understand the problem of long hours on duty and the consequent effect on health and behaviour.

Flight-time limitations were brought in.

After a long sleep, we can still feel tired. Yet at three o'clock in the morning we can be wide-awake. Fatigue protects us from overwork, and is a defence mechanism intended to prevent us from exerting ourselves too far and causing ourselves damage.

But a feeling of tiredness can be produced in any ways beside work overload – by monotony, high temperature, alcohol and other drugs, anoxia, low arousal, habit alterations, disturbance in bodily rhythms, pressurisation changes, knowledge of bad results and a host of personal factors. It can be dispersed by alarm, excitement, interest, change of work, some drugs, high arousal and by good morale. As aircraft flies across time zones, it begins Circadian dysrhythmia (jet-lag) contributed to fatigue. These rhythms exist throughout human physiology. They have a period of about twenty-four hours and measurable and stable fluctuations in blood pressure, body temperature, heart rate, sensory acuity, adrenal gland output and brain neurotransmitter levels.

This biological clock we inherited from our ancestors who needed to be able to tell the natural time and recognize and allow for regular environmental events in order to survive.

Because they themselves have suffered the effects of so-called jet-lag – the effect of crossing time zones – people are slowly becoming aware of the danger of such decrement of performance in aircrew, often during the most critical time at the end of the flight when they most need to be alert and fresh.

The pilot's sleeping and eating patterns will have been disturbed and his Circadian rhythms desynchronized. Furthermore, flying skills show rhythmic variation according to time of day, with the worst decrement of performance between 3 and 6 a.m.

Specific chemicals in the blood thought to be responsible for jet-lag are being identified and, most importantly, the very real danger of fatigue recognized.

7.2. Testing Alertness

There are different test-methods [1]. E.g. the Stroop-test consists of a hundred colour names – red, blue, yellow, green, twenty-five of each - printed on a card in the four different colours. The test is to read at speed the colour, not the name. Continually, the printed word gets in the way of naming the colour of the print. The more tired is the pilot, the greater the confusion. There is not always a direct relationship between frequency of errors and length of work-time. Many pilots make better landings at the end of long trips. Sometimes helps the long and good co-operation with their crew. General confusion persists about the whole problem of fatigue. Arguments arise regarding how to calculate hours on duty, day and night flights, sectors flown, time zones transited.

Pilots cannot subjectively gauge their own fatigue. During the early morning hours crew men display various brain-wave patterns characteristic of sleep or extreme drowsiness. Pilots described how fatigue could contribute to major operational errors, such as track deviations, landings on the wrong runway etc. .

Because of fatigue and the crossing of time zones, the safety record for long-haul operators is poorer than for short-range.

Older pilots tend to have less restful, more shallow sleep after an eastbound than younger crew, and most crew members are unable to assess their own sleepiness and alertness. It is found that pilots do nap on long night flights, though rarely (and it is to be hoped) not more than one asleep at a time on the flight deck. A nap on the flight deck, it was suggested, may act as a safety valve, and have a beneficial effect on the overall vigilance of the crew. Another beneficial effect would be some form of exercise, for sitting for hours making minute movements does nothing for the circulation. A few trips up and down the cabin, walking out of the cabin.

The crew members' fatigue seem to depend on the amount of interesting stimuli present. I.e. people become much more dependent on the environment to maintain their alertness.

8. Stress

Included in the stress envelope – and perhaps the most important – are the marital status [1, 8], private life, wife, family, home, money and job worries that the pilot always carries hidden in his luggage.The pressure to keep schedule is intensified because otherwise the rhythm of the flight is disorganised. A captain, consciously and unconsciously, plans his flight. If he can keep schedule, he may well remain most of the time in automatic thinking mode, doing the correct things by routine. If he gets off schedule, he may have some real hard problem-solving to do.

Pilots, especially of smaller airlines, may be pressurised to keep the schedule and not to tie up an aircraft. When an airport is busy and/or the weather is bad and liable to close the airport, there is a sub-conscious pressure on pilots to become airborne.

The pilot at the end of his flight has another stress factor to exacerbate his fatigue – the drive towards landing. This is partly the Zeigarnik effect (the psychological term for the need to complete a task once it is initiated), but it also seems to be a particularly strong sub-conscious desire, a need to get back into his own element, with his wheels and his feet on the ground. This not only increases his fatigue but is itself reinforced by that fatigue. Accidents show pilots repeatedly trying to land under adverse conditions.

9. Co-operation

9.1. Importance of Co-operation

The two or three people meeting together within the small confines of the cockpit may never have flown with each other before [5, 8]. In all walks of life we need time to get used to our workmates, a warming-up period to familiarize ourselves with people we do not know.

When the pilots do get to know each other, their personalities might well be antipathetic. There might be a generation gap, and if there is not there is the fact of implicit hierarchy. It takes time that crew can anticipate each other's reactions, weigh their strengths and weaknesses, and assess how far they can go with them, and whether it is safe or not to criticize, disagree or offer an opinion.

The group who had flown together previously, performs much better even if the pilots are tired.

Increased familiarity may go some way to curing the hesitancy in first officers to question the captains. Familiarity, in fact, may breed safety. There are more task-related conversation amongst crews who had not flown together, as if they were trying to get to know one another.

It would obviously be very difficult, if not impossible, to have such a crew concept in civil aviation today, and flying with the same crew for the rest of a pilot's working life might well bring about worse performance. But some issues

of familiarization should be addressed. A collection of highly individuals does not necessarily constitute an effective team.

The captain is always right, because he is elder, he has more experience, he has to be respected in every case ('the male ego').

Flying is considered 'macho'. There is a psychological evidence, that pilots exhibit active masculine personalities. But they should be careful with taking greater risks.

Women pilots are said to be more careful.

In both men and women, a responsible job reinforces their concept of themselves as valuable persons. However, the need to preserve that concept can combine other human factors like time pressure, conformity and the desire to please to produce a lethal situation. For all human factors are more deadly in combination.

In military flying the disciplined macho man is the chap they want. Military pilots have to risk their aircraft and their lives by putting them into potentially dangerous situations, and be quick-witted enough to get themselves out of those situations. It is also necessary to preserve in them the continual desire and ability to do so. Very important characteristic of successful flyers is their absolute faith in themselves. Anything that shakes or destroys this belief or casts doubt on their self-control leads to a disproportionate anxiety about flying. In free airspace, pilots must accept full responsibility for their aircrafts' deconfliction with others.

9.2. How do Crew Members Describe the Other Ones

Captains describing co-pilots [1]:
competitive, over-confident, strong personality, obstructive, obnoxious, bolshie, difficult, unco-operative, bored, lazy, number-chaser, no sense of humour, minimizer, complainer, lethargic, resentful, bullying, talkative.

Co-pilots describing captains [1]:
over-confident, arrogant, abrasive, bad tempered, unpleasant, sarcastic, over-critical, not easy to get on with, intransigent, pig-headed, unpredictable, aggressive, disagreeable, martinet, tyrannical, autocratic, authoritarian, incompetent, overbearing.

9.3. Team Spirit, Groupthink

Groupthink (a form of conformity) is identified rightly as the negative aspect of team cohesiveness, something to be avoided at all costs [3].

The pressures that bring about groupthink:

Peer pressure – We are all in this together.

People experiencing groupthink apply direct pressure to any one individual who momentarily expresses doubts about any of the group's shared illusions or who questions the validity of the arguments supporting a strategy favoured by the majority.

Time pressure – Let's get on with it.

Victims of groupthink are often more conscious of the time element than of how well the decision is processed when time pressure is critical. Time is more important than the task.

Self-censorship – What would I know?

A desire to avoid deviating from what appears to be group concensus, keep silent about their misgivings, and minimize to themselves the importance of their doubts.

Unanimity – We all agree …we are right.

The sharing of an illusion of unanimity within the group concerning almost all judgements expressed by members who speak in favour of the majority view. This is the partly result of self-censorship. The effects are augmented by the false assumption that any individual who remains silent during the discussion is in full accord with what the others are saying.

10. Cockpit Crew and Cabin Crew

Most passengers would surely prefer to know if their crews are adequately rested, and that the cabin crew has the same concept, trained enough, to haul the passengers with long experiences safely, not girls with very little experience[8, 9].

The uniform should have higher flame resistance even if not as nice as it is useful.

Uniforms are particularly dangerous when they are long-skirted national costumes. In one accident during an emergency evacuation, all the flight attendants sustained extensive friction burns on their buttocks where their loose-fitting skirts slipped over their hips, exposing their skin as they escaped down the slide.

An airline prescribes sensible shoes and the stewardesses can wear slacks.

11. Communication

Sometimes the common English language is not understandable for foreigners, because there are more spoken English [1, 5]. Every English-speaking nation has the own slang and accent. Pilots sometimes just repeated , what they heard, but they did not understand it. Reading back a clearance means that you have understood. This happens mostly between the air traffic controller and the captain or between the captain and the first officer.

The imprecision of natural language is coupled with expectancy that dangerous misinterpretation can come about.

It was noticed, that there was a tendency for crews who communicated less well not to perform well either. But more important than the amount of communication was the quality of the communication. Crews performed better when they were better informed, were part of the operation and, a popular term was in a slightly

different context. It has to be emphasised that precision and communication style are absolutely important.

Today the standard English phraseology is a minimum requirement (phonia).

Oral instructions are only 61 per cent understood, while less than half of written instructions are comprehended. The aircraft has been faster and more complicated and human tongue seemingly slower and more reluctant.

Communication difficulties combined with perceptual ones may cause a lot of trouble.

A new aircraft weighs its fuel in kilograms while other aircraft still weighed the fuel in pounds. This change has to be emphasized to the pilot.

12. Decision Making

An airline captain often has to take a decision quickly, but it has to be the right decision for a particular circumstance – and he must try to keep his mind flexible so that he can change that decision [9]. Effective decision-making is a biological, sociological and economic need for our survival.

There are skills which a pilot learns that becomes almost a conditioned reflex. By overlearning and practice, the pilot achieves a skill sequence and skill rhythm that is so well organized that it is highly resistant to wrong moves, though this skill sequence (with multiple variations built into it to cope with emergencies) may be disorganized by stress or fatigue.

There are, however, many decisions that an airline captain has to make which are not automatic. No flight is exactly like another flight and a lot of things must consciously thought over, as how to deal with different and unexpected circumstances. With a fire on board at take-off, should he try to return to the airfield or crash-land immediately? With unforeseen heavy headwinds, should he go on, go back or divert?

Decision making is a process. First, the pilot must weigh the input from a number of information sources to help him understand the situation. Additional information will be available to him from his memory store, but, there are many limitations on what we see and hear, and what we want to see and hear. From all this input the pilot has to make an assessment of the alternatives open to him. He then has to choose an appropriate action, balancing the pros and cons of the probable outcome. As in everyday life, the decision maker never has complete information. Unlike instruments, human brain is never switched off. In a reaction to menace or surprise, adrenalin pours into the blood to give it the strength and energy to fight, accelerating the heart-beat, raising the blood pressure. Under high arousal, thinking becomes more rigid. For every task, there is an optimum level of arousal. Extremes of arousal (very high or low) reduce any possibility of rational decision-making.

13. Human Factor Education

13.1. Strenghten Avareness of Pilots

Training in relevant aspects of human performance, human limitations, aviation psychology and crew co-ordination should be given to all flight crew members and trainee pilots [1, 4]. The main thing is to get pilots to look at themselves and the environment in which they function. They should learn to recognize that a danger as great as clear-air turbulence, thunderstorms, icing or microbursts may be within the cockpit in the crew situation. The aviation world has to learn to cope with these meteorological hazards and with the hazard of human factors.

The right aim and the right answer are self-knowledge and self-recognition. One should be careful with psychological investigations, because it can damage the pilot's ego.

Human factor study is no black and white exercise. In its own way it should be a vast research project. Everyone has some valuable experience, it is just the interpretation that can be guided. Real accidents can be re-enacted, real mistakes on video studied in real situations, those mistakes can then be interpreted and the common of them recognized. Personal awareness is the theme.

13.2. Human Factor Courses

One of them includes videos of accidents very similar to real ones, where actors play the parts of the flight-deck crews [4, 10]. As the drama proceeds, various errors are recognized by the viewer. As errors start swelling up to the climax of the accident, the audience feels a growing tension that can be almost unbearable. Slips are not corrected. False assumptions are allowed as a rather withdrawn co-pilot try to bring a dangerous situation to his overbearing captain's attention – and fails. Conformity, perception, decision-making, machoism, time pressure, risk-taking, regression and the concepts of psychology, etc. can be dramatically illuminated in this way. LOFT (Line Oriented Flight Training) and FORM (Flight Operations Resource Management) both focus on the human factors of the flying environment. FORM is the same as CRM (Cockpit Resource Management). The concept applies to all aspects of flight operations, including the cabin crew. It recognizes the contribution of each crew member to the safe operation of a flight. In the frame of LOFT an actual flight scenario is designed to test the skils of the whole crew. The instructor does not intervene or mark the performance.

The crew prepare and fly a 2-hour simulator trip, complete with flight plans, radio communications, navigation and all cockpit procedures. During the flight, the crew encounter a problem that requires a solution. A decision has to be made on whether to shut down an engine and proceed, or make an emergency landing. Or a decision has to be made on whether to land at a fog-bound airport or fly on to an alternate. There is no right or wrong solution.

Afterwards there is a video critique – since the whole exercise is video-taped. The whole crew discuss among themselves what went wrong and what went right. The tape is completely confidential and after debriefing it is erased by the crew members themselves.

Proficiency training on an en route flight for the pilots follows: this is graded by the instructor, but mistakes are allowed, the pilot is not identified and all data are confidential. Then in remaining the simulator time , the pilots are given the opportunity to experience unusual situations –high altitude stall, an unusual attitude recovery, take-off or landing on an ice-covered runway with maximum drift, or the use of asymmetrical thrust in a critical landing situation.

Another method's core concept is the use of a grid scale which defines behaviour as low or high concern for performance and low or high concern for people. In Aircrew Behavioural Compass six types of crew member are named. They apply psychologist who conducts a programme called Aircrew Resource Management (ARM) which will convert SAD TRIPS (Stress, Automation, Decorum, Tedium, Responsibility, Interface, Paradox, Survival) to GLAD TRIPS (Good Landings Are Developed Through Responsible Individuals Practicing the S-I-A – Skills + Interaction = Achievement) – strategy for aircrew effectiveness. The purpose of this programme is to create a sense of awareness of the three C's – concern, co-operation and communication amongst the crew. Synergy is the process that can make the team to seem greater than the sum of individual parts.

The ARM programme covers three major topics – personal behaviour styles and their impact on crew effectiveness, the importance of communication and the need for team work.

There are cultural limitations. American human factor programmes stress self-criticism, which goes against some Asian cultures and would be resisted by local crews, for eastern ethic obedience and hierarchy. Despite cultural differences, human factors have by their very nature common features that can be applied not only to aviation and other forms of transport, but to almost every human activity.

Learning about ourselves and how others relate to our style is the central theme, and the course sets out to overcome a basic weakness that initial training has bred into pilots. Pilots have been taught to fly aircraft as sole crew members. This is of crucial importance. The course teaches the crew to use all the resources at their disposal to gather information, revise and analyse that information, develop solutions, implement the decision and evaluate the performance as an ongoing process of education.

There are role-playing sessions, each crew member taking the different positions of captain and co-pilot in such situations as all engines failing, a bomb on board, and the co-pilot at loggerheads, a tired crew and take-off in a thunderstorm. Transcripts of the cockpit voice recorders from crashed aircraft are also analysed, showing very clearly the personalities of captains and first officers involved.

Another course has the following issues: the meaning of human error, the nature of human error and meeting the challenge of human error, fatigue, body rhythms and sleep, vision and visual illusions, fitness and performance, motivation and leadership, communication, language and speech, attitudes and persuasion,

training and training devices, displays and controls, space and layout, documentation, passengers, the human payload, awareness and application.

There is a course, which shows a thirty-minute videotape on the most current safety issues. There follows a group discussion. Working from examples, the 3 presentations are concerned to make crews aware of typical danger situation and how they might evolve.

14. Additional Management Background

14.1. Share of Responsibility

There are two kinds of error: active error, the effects of which are felt almost immediately, and latent error, the adverse consequences of which may lie dormant within the system for a long time. Pilots at the sharp end make an active error, while latent error lies behind the lines within the management support system [2, 5, 6].

No aviation accident can be justifiably blamed on one individual. The mistake is a collective mistake, and the responsibility should be a collective responsibility.

Yet it is only recently that very dubious management malpractices are being identified and their contribution to accidents is given sufficient weight. For though the pilot's actions are on the tip of the iceberg of responsibility, many other people have had a hand in it – faceless people in aircraft design and manufacture, in computer technology and software, in maintenance, in flying control, in accounts departments and in the corridors of power. But the pilot is available and identifiable, and, if he is not conveniently dead, he probably feels himself responsible. Besides, he has no powerful financial lobby like the aircraft manufacturers or the big airlines. What should be stressed is that the pilot is not alone in his human condition. Nor is aviation in its management errors. A high proportion of accidents have occurred mainly as a result of latent management errors.

There is a growing evidence that cost-cutting in general, cost-cutting in fuel, practices to prolong engine life, improper checking of pilots by unqualified staff, corner-cutting on maintenance, the installation of extra seats to make a commercially more profitable load, the sealing of escape hatches, over-scheduling and crowded conditions at airports – may be eroding safety margins and posing a growing threat to the travelling public.

Competition has become a slogan, but instead of providing better service this has resulted in a greater concentration of the market in fewer hands. On the other side there are a lot of new airlines appeared with discount fees.

Problems with safety multiply as finances dominate operations. Staffing changes resulting from economic reorganization could provide opportunity for operational error.

Cut-throat competition reducing employee costs, and aircrew free-wheeling from one company to another, were all now causing great concern to organizations like ALPA.

Airlines are forced to survive in a cut-throat environment. Passengers, encouraged by newspapers and television, demand lower and lower fares.

14.2. Impacts of Deregulation

Deregulation [2], allows anyone to start an airline and operate it anywhere at whatever fare he likes. Economists' accountants' and management's pressure sometimes causes operators to economise, sometimes unsuccessfully.

The price of fuel is erratic. The ageing fleets need replacement. Experienced pilots are becoming difficult to obtain. The tourist market fluctuates.

Safety and economy are opposing sides of the same coin. Balancing them is very difficult, particularly as the general public do not understand that this is so. You can not yet sell airline safety – the public take it for granted. 'The public is not saying to airlines: 'We will not fly, it is too dangerous'. It is saying to government: 'We will not fly – it is too expensive.'

It is usually the pilot who is in the dock. It is far easier to attack than to defend.

Aviation should earn enough to devote enough money to the safety.

Where there is money, there's muck - and a lively breeding ground for human error.

Overcrowded and insufficiently supervised and controlled airspace with more and more companies, with increasingly old aircraft, manned by sometimes inexperienced, hastily recruited and minimally trained crews, causing more stress, fatigue and motivation problems for all in the system.

Worries over fatigued pilots have been joined by those for fatigued air controllers and fatigued maintenance staff. The airspace in more intensively utilized by RVSM.

15. Post-Accident Assessment

An extra time, needed to assess management factors, will inevitably be added to the already much criticized length of time, until aircraft accident reports appear. Already, because maximum agreement between the participating bodies has to be achieved before they do so, accident reports take far too long [1] .

In one case the final report on an accident took three and a half years to appear and contained thirty-one recommendations. These included the need to position an aircraft on the ground with the fire downwind of the fuselage, the provision of the device whereby the crew could obtain an external view of the aircraft, the provision of an evacuation alarm, a mandatory international code of practice for promulgating manufacturers' safety information, the removal of all 'row ten' seats to facilitate overwing exit, the distribution of the most experienced cabin crew throughout the

cabin, a more management-orientated approach to fire officers with the chief wearing high-visibility clothing, the introduction of on-board fire-extinguishing systems, the provision of smoke-hoods for passengers, a recommendation that cabin furnishing materials should have limitations on smoke and other toxic emissions, and the provision of audio-attract devices to guide passengers deprived of sight and hearing to viable exists.

All the recommendations were implemented, the manufacturers took them into consideration. Operators and manufacturers should have a good co-operation.

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