



The Human Factors Implications for Flight Safety of Recent Developments in the Airline Industry

A Research Study for the JAA

EXECUTIVE SUMMARY

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Project Team:	Martin Anderson	Human Reliability Associates
	David Embrey	Human Reliability Associates
	Chris Hodgkinson	Independent Consultant
	Peter Hunt	Independent Consultant (Until 18 August 2000)
	Bernard Kinchin	Icon Consulting
	Peter Morris	IATA Aviation Information & Research
	Mike Rose	Icon Consulting

Consortium Leader: Icon International Services Limited
31 Old Burlington Street, London W1S 3AS
Tel: +44 20 7494 9994, Fax +44 20 7494 9995
E-mail: enquiries@icon-consulting.com

www.icon-consulting.com

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Introduction

The Study was carried out during 2000, on behalf of the JAA, by a team led by Icon Consulting and including Human Reliability Associates, IATA Aviation & Research¹ and experienced pilots. The aim of the study is to consider the human factors implications of recent commercial developments in the airline industry and to assess their potential impact, if any, on flight-deck safety.

Approach

The overall approach was as follows:

- to investigate whether there is a theoretical possibility of commercial developments having a safety impact on the flight deck – it was concluded that there is a possibility;
- if there is a theoretical possibility, to identify whether the conditions exist for a safety impact to occur – it was concluded that the conditions do exist and that continuing changes in the industry are increasing the likelihood of their occurrence;
- if the conditions exist, to seek evidence on whether incidents are occurring as a consequence – relevant incidents were identified but it was concluded that there is insufficient evidence to link them directly to this cause
- and to identify any mitigating factors that could be used to reduce the threat – it was concluded that there are factors and that they should be enhanced to deal with this threat.

A wide range of people were consulted for the study, including airline management, management pilots, line pilots, safety regulators, an airframe manufacturer, a flight crew agency and pilots representative organisations. The airlines consulted included national, regional and cargo carriers, charter airlines and new entrants in the low-cost sector. The countries represent a broad cross-section of the whole of the JAA region and are not biased towards any one part of Europe.

All contributions to the study are confidential to the study team.

At the beginning of the study, the team reviewed commercial developments in the air transport industry and the published literature on possible human factors impacts. The following paragraphs provide a very short summary of the principal dimensions in which commercial developments potentially have a human factor impact.

Culture

The impacts of national, professional and organisational cultures were investigated.

A link between national culture and potential flight-deck behaviour was established. National differences were identified in the dimensions of Individualism-Collectivism (achieving individual desires as opposed to group harmony), Power Distance (relationship between subordinates and superiors) and Uncertainty Avoidance (tolerance to risk and uncertainty). These differences may result in different attitudes to following Standard Operating Procedures, to the use of automation and to relationships and management on the flight deck.

¹ IATA-AIR input was related to describing and analysing commercial trends in the industry

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In terms of globalisation, therefore, flight deck crews composed of individuals from different cultural backgrounds might experience conflict in the dimensions identified.

The professional culture of the flight crew is strong. However, the satisfaction level achieved is largely determined by the organisations that they work for and the conditions under which they work. In addition, the sense of professional pride can result in an unrealistic denial of vulnerability to factors such as fatigue.

A link between a negative organisational culture and negative attitudes and behaviour was established which would not necessarily be mitigated by the high level of professionalism of flight crews.

Flight Deck Error

Researchers have recorded that errors were made on 68% of flights they observed, with an average of two errors per flight. Not all crew errors will lead to adverse consequences. This report identifies the types of error and their causes.

Direct causes of failures are primarily due to a breakdown in crew-related interactions such as decision-making, verbal communication, team organisation and workload distribution rather than a lack of technical proficiency. Team skills are, therefore, vital to a safe flight. The indirect or latent causes of failures can be due to inadequate training, supervision, resources or oversight, and faulty procedures and policies.

Commercial Developments

The report describes past, recent and possible future developments in the air transport industry, which have been motivated by deregulation, liberalisation and privatisation.

Alliances are formed partly to improve market access and partly to reduce cost. Cost reduction mechanisms include:

- Management contracts, leading to the reduction in the management head count of members;
- Joint ventures in areas such as ground handling and aircraft maintenance, which allow alliance members to enjoy the benefits of bulk purchasing from key suppliers;
- Sharing of facilities such as training, maintenance and aircraft spares; and
- Higher utilisation of aircraft.

Cost efficiency does not automatically mean a loss of safety, particularly as all carriers are subject to the same regulation. However, the emergence of numerous new entrant airlines, each of which requires specific regulatory effort, may stretch the resources of the regulators.

While previous airline mergers generally took place between airlines within the same country, mergers that cross national boundaries are becoming increasingly common. This is likely to give rise to a more complex mix of cultural factors to be dealt with by the new companies. Further mixing is likely to result from an increase in the number of pilots from the former Soviet Bloc seeking improved employment conditions in western airlines.

The growth of the low cost carriers has generated new demand for air travel, a new market sector, and new commercial pressures. Not all low cost carriers have survived and those that have face increased costs, not least because they now have to compete in the market place for the considerable number of pilots they require. Overall, they have contributed towards an increase in volatility in the employment of pilots.

The Effect of Commercial Developments

The consequences of recent developments have the potential to affect flight deck performance. Airline mergers and alliances will change the organisational culture in which individuals work, and this in turn may influence individual performance. They are likely, also, to increase the incidence of multi-national flight crew. As more flexibility is required of airline staff, effects such as changes in morale and increased fatigue may be seen.

Of all the potential problems arising from multinational flight crew, differences in language are an obvious concern and an increase in mixed language operations is likely to have a negative effect on safety. Language is also a social issue affecting both duty and off-duty time. Social interaction may help to reduce fatigue, maintain alertness between the crew and contribute to team working during flights. A lack of conversational or colloquial ability in a common language may have an adverse effect on interpersonal relations during off duty periods, which will reduce the likelihood of the crew building up a shared knowledge base and a shared set of assumptions about how the team should work together.

Other factors that are thought to cause difficulties are different religious beliefs, membership of different trade unions, different safety or CRM philosophies and concerns over flying skills and technical knowledge.

Commercial Pressure

In some instances there is strong pressure to increase flying hours up to the legal limits. Many airlines treat the legal limit as a performance target to be achieved if utilisation of flight crew is to be maximised and operational costs reduced. In addition, some airlines allow very little, if any, reduction in flying hours for management pilots, some with critical responsibilities such as flight safety.

Unsympathetic rostering increases fatigue, upsets sleep patterns, reduces morale and has a detrimental effect on the personal life of crew. In some cases this is combined with a reduced ratio of crew per aircraft, leading to a loss of flexibility and pressure to fly despite personal welfare.

Many pilots interviewed in a wide range of airlines observed that there is a tendency for business people with no flying experience to fill senior operational positions. Their concern was that these managers might not understand the implications of their decisions.

Training is an expensive activity and there is a fear that training budgets might be reduced to achieve cost savings.

Captains are increasingly being required to make economic decisions, which is often counter to their traditional role of safely flying the aircraft. There is sometimes a dilemma between safety and economics: a Captain has the responsibility for the safety of a flight but may be blamed by management if he or she is thought to have taken a commercially detrimental decision. If a pilot succumbs to commercial pressure and as a result is involved in an incident, he cannot, in law, defend his position by saying that the company pressured him to take the actions that he did. Some pilots find this dilemma difficult to resolve on a day to day basis.

Mitigating Factors

During the research, a number of factors that might mitigate the effects of globalisation were identified. These factors have been classified into three categories: CRM Training, Standard Operating Procedures (SOPs), and Professional Culture. Safety Regulation is also available as a controlling measure. The report identifies to what extent each category is likely to produce effective mitigation and whether other control measures can be brought to bear.

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CRM training is the approach used within aviation to tackle issues of teamwork amongst flight crew. Whereas benefits have been claimed by the industry from the use of CRM, there is little hard evidence that CRM has a measurable effect on safety. There are particular concerns that behaviour in training sessions is not correlated with behaviour under real circumstances. In addition, CRM cannot deal with other causes of error such as fatigue, poor interfaces, cockpit automation issues and problems related to SOP quality and compliance.

The use of a standard, outsourced CRM “product” which has not been adapted for the particular culture in which it is applied, may also reduce its effectiveness. There appears to be no process in place in the industry to spread to others either the experience gained in developing appropriate CRM training or best practice.

The scope of CRM is being extended in some airlines. While the previous emphasis was on team-building skills and communications, other aspects are now being introduced such as monitoring skills and the management of time and workload. Some airlines run CRM training for mixed groups of cabin and flight deck crew and in one case also maintenance personnel.

However, there is a serious danger that CRM will be seen as the solution to all human factors issues in commercial aviation. This is reflected in the fact that the Human Factors Departments of airlines are often staffed by CRM specialists rather than by human factors professionals .

The emphasis on CRM may in some cases lead to a culture where all errors are considered to arise (and be contained) in the cockpit environment. However, many factors that may adversely influence flight safety originate, as in all other industries, from management and organisational failures that occur deeper in the system and are outside the control of individual flight crew members. High levels of flight crew training, experience or personal capability will not automatically mitigate the adverse effects of such factors.

The CRM industry is responding to changes due to globalisation and no doubt the more recent versions of such training will improve its effectiveness.

SOPs form the basis for the operation of the aircraft and it is thought by the whole industry that very few incidents would occur if SOPs were adhered to rigidly. However, it is clear that, in common with most safety critical industries, absolute compliance with the letter of all written procedures is not regarded as feasible. The extent of the non-compliance is influenced by the prevailing safety culture in the company. In addition, pilots who have experience of more than one set of procedures may inadvertently revert to a previously familiar procedure, particularly under conditions of duress. In a multicultural environment, a flight crew member’s knowledge of an SOP may lead them to interpret ambiguous communications in terms of SOPs with which they are familiar.

Several airlines stressed the highly proceduralised nature of the flying task, claiming that procedures existed for every eventuality. However, crew working in highly proceduralised environments may encounter difficulties when faced with a situation that is not covered by a procedure. Furthermore, crew who normally use SOPs when working for an airline that strongly adheres to procedures may experience difficulties should they then operate in an airline which allows a greater degree of individual interpretation of SOPs.

Airline personnel display strong ownership towards their own SOPs. It would appear that new entrant airlines tend to adopt manufacturers’ SOPs with little, if any, modification, whereas established airlines will often have adapted these SOPs quite considerably. Problems may arise if there are differences in the degree of compliance to SOPs by flight crew from different airlines.

Safety Regulators do not allow the operation of mixed SOPs within a single aircraft type under an AOC. Therefore, it would be difficult to mix crew within an alliance unless all partners of the alliance were using the same SOPs.

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The **Professional Culture** in aviation is strong and distinctive and this is particularly apparent in the professional culture among pilots.

Flight crew were described as intelligent, although not necessarily formally educated, with a high degree of self-confidence. Strong self-discipline and self-motivation were said to be essential to cope with the working environment. Flight crew tend to be conservative in nature and are generally uncomfortable with change unless it is long term and gradual.

A strong professional culture has both strengths and weaknesses. On the positive side, pilots take great pride in their profession and have a strong motivation to perform to the best of their ability. On the negative side, there may be an unrealistic denial of vulnerability to factors such as fatigue, stress or personal issues. Given the great responsibility of pilots, this may be a psychological defence mechanism to avoid performance anxiety.

There is a danger that globalisation may degrade those aspects of professional culture that do act as a control mechanism. For example, the movement of crew between countries and companies may diminish the perception of a common identity.

Safety Regulation in Europe is not yet harmonised. Differences among member states mean that European airlines are not overseen by a coherent legal entity, unlike the situation in the US. Given that overall regulation is the remaining control mechanism to deal with conditions not controlled by the other three identified mitigating factors, this has to be a matter of concern to the JAA.

Some Regulators are taking a less active role in enforcing standards by allowing airlines to take greater responsibility for their own oversight by means of self-audits. However, it is apparently becoming increasingly difficult for airlines to recruit suitably experienced people as nominated post holders to carry out this important role.

Conclusions

The aviation industry in Europe is developing rapidly and a number of human factors effects that can arise from these commercial developments have been identified. Some of these effects have the potential to impact negatively on flight safety and this threat is likely to increase as the pace of commercial developments increases.

There is a belief in the industry that the control measures of CRM, SOPs and Professional Culture will mitigate these threats. This report suggests that these measures may not be fully effective in preventing or controlling the issues. An evaluation of the extent to which the three measures are thought to be effective is presented in the following table.

Human Factors Issue	Mitigation Effectiveness		
	CRM	SOPs	Professional culture
Team working / power gradient	Medium	Medium	Medium
Communication	Medium	Medium	Low
Fatigue	Low	Medium	Low
Morale and job satisfaction	None	Low	Low
Experience / competence	Medium	Medium	None
Situational awareness and mental models	Medium	Low	Medium

Table 1: Tabulation of Human Factors Issues and Mitigating Factors