Putting air safety management into practice demands a positive corporate safety culture

Active safety management can be achieved by an airline by introducing a carefully designed "core safety management system" that is functionally apart from a company's quality assurance processes. At British Regional, the formation of such a system is proceeding hand-in-hand with a change in safety culture.

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IN THE MIDST of a rapidly evolving trend towards active airline safety management, the British Regional Airlines Group has grown steadily over recent years and has introduced its own safety management system. The associated process of changing from a compliance culture into a safety culture has begun in earnest, a change that is perceived within the group's airlines as a vital contribution to overall business success.

The example of safety management and practice described in this article is considered to be workable and effective in the context in which it has been applied at British Regional, but many key points are likely to apply to any airline safety management process.

Why manage safety?

Safety has always been a key requirement for airline business success, so there has never been any lack of management desire to achieve safety, although there has existed a lack of effective focus on the need.

A great deal is learned about system safety deficiencies from accident investigation, but new accident scenarios arise continually. It has often been observed that the specific combination of circumstances in an accident chain may not be known but the causal elements are often familiar. Since the ultimate purpose of safety management is the avoidance of low probability/high hazard events, and there is little prospect of being able to influence random elements in accident chains, it is reasonable to claim that safety is being managed if most of the systemic deficiencies are being actively identified and eliminated. It is now widely accepted that the way to achieve this is to strive to learn from the experience of lesser safety events and issues.

For airlines to learn from experience, they must employ a system for acquiring and using safety data. Three key characteristics of such a system are:

- it must collect sufficient data on safety events and issues to allow analysis and use of that data to constitute the principal means of routinely controlling future risk exposure;
- it must operate across all parts of the business where performance and procedures affect the degree to which safety is achieved; and
- it must be used to monitor the effectiveness of responses to captured data.

This process can be described as active safety management. It both complements and assumes good overall business management.

Active safety management can function properly only if the operator has achieved and maintains a positive safety culture. The introduction of safety management can assist this process, but cannot initiate or sustain it alone. No safety management initiative can succeed simply because it is put in place. It requires the communication of management priorities from the highest corporate levels to every person involved.

Two carriers operate throughout Europe

British Regional Air Lines Group consists of two carriers that offer predominantly scheduled services. Manx Airlines is the flag carrier for the small self-governing British dependency of the Isle of Man, and British Regional Airlines is now one of Europe's largest regional carriers.

British Regional operates mainly in association with British Airways and is currently that airline's largest franchise partner. Both Manx Airlines and British Regional are wholly owned by British Regional Air Lines Group plc. The two airlines are operated together by a single head office management team based on the Isle of Man.

The operation currently comprises about 85,000 flights each year using a fleet of over 40 turbojet and turboprop aircraft with up to 115-seat capacity. Approximately 70 destinations in six countries are served. Flight times vary from 15 minutes to over three hours, with the average flight of approximately one hour duration.

Most aircraft maintenance is carried out within the group, but there are significant subcontract arrangements in place. Ground handling is substantially subcontracted.

The company safety department has a remit to cover all aspects of air safety, not just those arising within flight operations. This is accomplished by using a team of four dedicated staff responsible to the Head of Safety, who reports on a day-to-day basis directly to an airline board member (see flow chart, page 12).

A comprehensive ASR system introduced by British Regional during 1995-96 has formed the data source for safety management, so far with over 4,000 reports on file.

Safety management system

A "core safety management system" is a practical mechanism for managing safety, a concept requiring and presupposing a foundation of total quality management throughout the airline operation. At British Regional, it is the goal of the core safety management system to monitor the effectiveness of system safety performance and provide a means by which line management is both obliged and able to put modified safety defences in place. Separate quality assurance audit systems are in place which have two-way links to the Safety Department. This important distinction between quality and safety provides an essential focus on safety management which builds on, but does not end, with quality assurance.

One of the problems that has arisen from a failure to distinguish quality from safety is that the phrase "safety assurance" is beginning to be used. Safety cannot be assured. Quality assurance assures quality, but cannot assure safety; that is where active or core safety management must take over.

The limited and practical definition of the scope and purpose of a safety management system described here is in contrast to other models in which all-embracing theoretical structures for system safety are being imported from other industries or from other aviation sectors such as air traffic management (ATM) and airport operations. These are being proposed as frameworks which are necessary for airline system safety.

Use of a core safety management system to respond to safety issues and events identified in operations is likely to be sufficient for controlling risk exposure at airlines whose operations exceed 50,000 flights per year. The wider definition is not a requirement for meeting this objective provided that good general management monitored by effective quality assurance systems is in place. Indeed, the possible danger of the widely defined safety management system is that it will detract from "ownership" of the safety priority by line management and that it will be implemented without changing a compliance culture into a safety culture. There are absolutely no short cuts to developing a safety culture because it must embrace all personnel. A system safety structure may help, but it is not essential and should be applied with care.

The introduction of safety management obviously is influenced by the prevailing regulatory environment. In the United Kingdom there is a mature tradition of air safety regulation by the government's civil aviation authority (CAA). So far, there has been a very supportive environment for the development of active safety management from within airlines rather than by prescription. There has also been a scheme for mandatory safety incident reporting for over 30 years, and the independence of the U.K. Air Accident Investigation Branch from the regulator has complemented this. Implementation of Joint Aviation Authorities (JAA) requirements for quality systems, and forthcoming U.K. CAA guidance on safety management systems for U.K.-based operators, are imminent.

The first consideration for new-style safety management is to identify whether the elements of such a system are already in place. Until recently, few airlines could claim to have seriously and singularly addressed safety management based on the use of safety data acquired from actual experience. Safety data was also regarded as essentially a flight operations matter; serious operational incidents were already investigated, often using flight data recorder (FDR) information. In a few cases, some sort of system for routinely downloading such data for use beyond recorder validation was in place, and sometimes there was also an established corporate invitation to submit written safety reports. In both instances, however, data capture was usually inadequate and the extent to which the data was used was extremely limited and not very effective.

A system to comprehensively collect written safety reports will usually have preceded routine capture of FDR information but British Airways, as pioneers of the latter, represents a notable exception. At British Regional, a comprehen-

sive air safety reporting (ASR) system was progressively introduced during 1995-96 and has formed the data source for safety management, so far with over 4,000 reports on file. The current rapid improvements to FDR data analysis software and major constraints on FDR data acquisition arising from aircraft types operated and fleet development plans have meant that the additional safety data potentially available from this source have not yet been realized.

Principal changes

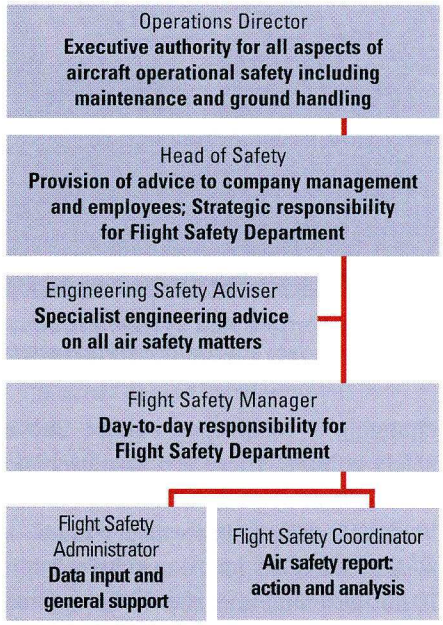
Since the control of risk exposure by means of a core safety management system depends on capturing safety data comprehensively, the first requirement is that data capture works. This requires an across-the-board commitment from everyone concerned with the operation, ground handling and maintenance of aircraft. For this to happen, it is essential that powerful statements in support of positive safety culture cascade down from the highest levels of management and that the system be designed to receive large numbers of safety reports and facilitate their use.

From the outset, British Regional Airlines Group perceived transparency as an essential plank of support for the development and maintenance of a good safety culture among all employees of both the airlines and their subcontracted service providers. To oversee the whole process of active safety management, British Regional set up a new high-level airline safety review body chaired by the company director, with overall executive responsibility for safety.

This body meets periodically for mid-week morning sessions on a no-substitutes basis to keep senior management on track and indirectly to guarantee the day-to-day activity of the Safety Department and its operation of the core safety management system. By contrast, the membership of the committee which preceded this new review body had been restricted to engineering and flight operations personnel and was usually attended (always on a Friday) by middle-level managers rather than senior managers and directors. The purpose, even given the limited safety data then available, was principally the review of what had happened instead of what was going to be done about it.

Safety event data

An ASR system must seek to capture reports on all individually significant events and issues and on a representative selection of lesser events. It must collect reports from all parts of the business and it must apply to subcontracted service providers in all areas. Apart from the need to capture individual events, a comprehensive data capture system means that some ground events will attract safety reports from more than one source. An aircraft ramp damage incident reported independently by the aircrew on board, the station handling agent and the engineer who saw it happen provides useful perspective.



Safety oversight responsibility at British Regional Air Lines Group.

A number of specific requirements have been met by the British Regional ASR data capture system and have been crucial to its success. First, the extent of ASR data capture invited must be considerably wider than the level for which capture is required, because the propensity of individuals to report events and issues which are perceived to fall at the lower end of the scale of significance will vary. It is important that the specification of reporting criteria reflects corporate interests and not merely regulatory compliance.

Second, the design, availability, guidance for use and ease of submission of reporting forms must provide a transparently simple interface with prospective reporters. Pads of A4-sized forms with instructions printed on the inside front cover, as pioneered for British Airways flight operations reporting, are difficult to improve on.

The data captured by an ASR system must be used — and seen to be used — only for safety management purposes. Other requirements for event data, such as insurance claims or personnel discipline, should be met separately so as to preserve confidence and encourage the full disclosure which provides quality safety data.

Separate but complementary ASR schemes must be operated for flight operations, maintenance and ground handling. Confusion would follow from any attempt at a combined scheme.

The responsibility to submit an ASR in a flight operations or maintenance scheme must rest directly and personally upon the individuals involved. For ground handling, the situation is open to judgement. In the British Regional system, company and station duty managers are jointly charged with a parallel responsibility for making reports. They are therefore responsible for ensuring that all of their personnel comply with the reporting criteria.

Simplicity dictates that the ASR system should be the only safety event data capture system in which staff participate. Any regulatory requirements or other external requirements for safety data capture and communication can easily be met within the ASR framework.

Finally, a unified reporting system must be structured to provide as much confidentiality for reporter identity and original reports as practicable. A sepa-

rate airline confidential and/or anonymous reporting channel is contrary to the safety culture which underpins effective safety data capture.

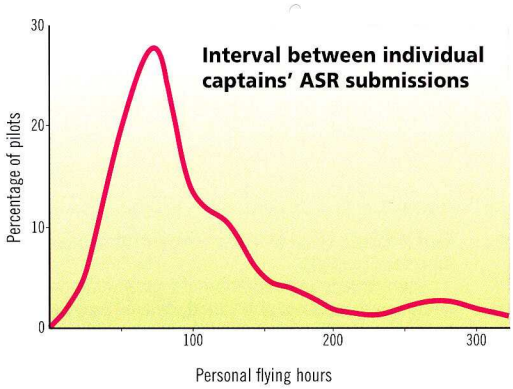
A successful airline ASR system will of course attract all the safety reports which operational personnel are inclined to make. This will usually allow specific or general responses by the organization that is in charge of the issue. By definition, the need for reporting to any national or supranational confidential reporting system should be low although this in no way removes the value of such a safety net.

Systematic tracking

The system used to collect ASR events and record the actions which follow has to meet several objectives. Clearly, it must record:

- the facts as reported;
- all relevant circumstances;
- the causal factors;
- the positive and attributable statements confirming review of the facts established and the intended action;
- auditable detail on the action taken; and
- formal closure, with source of authority taken from a specifically corporate perspective.

To achieve effective communication between all those involved requires a suitable software package run on a networked computer system. A paper system at this scale is completely untenable. The British Airways safety information system (BASIS) adopted by British Regional is a good example of what is needed. Of course, such software packages are a tool; they can facilitate effective data-based actions if applied properly but they cannot guarantee the outcome.



Networking reported safety event data to all potentially concerned middle management both informs and demands response. In addition, networking the system to at least two higher tiers of management at an essentially "for your information" level keeps more senior management aware of progress in addressing safety deficiencies. Networking achieves monitoring by both peers and superiors and thereby underpins personal performance.

The level at which data access is granted can be controlled so that information such as the reporter's identity is disclosed only where required. At British Regional, some 70 people have access to the safety system. This number is high because no department charged with taking action is permitted to have less than two people involved with the safety system (this rule is meant to prevent delays that could result from staff absences).

The importance of categorizing the risk which individual safety events or causal factors represent to future operations is well accepted. So, too, is the general principle of linking together the relative severity and relative probability of recurrence in a simple matrix. Anything more than a three-by-three matrix of this sort is likely to be difficult to apply consistently.

The achievement of consistency requires that only one or possibly two people from the Safety Department determine the level of risk. The level of risk will remain changeable during the period between the initial determination based on first reports and the point when all the information on exactly what happened, and *why*, is available. Assessment of the likelihood of recurrence may be affected by whether or not the controlling mechanism is ultimately in the hands of those directly employed by the airline or personnel working under contract.

Routine flight data analysis and safety management

The situation at British Regional mirrors that of most airlines at present in that there is no programme for the extraction and processing of data on significant operational events identified through FDR monitoring. However, a considerable amount of thought has been given to this possibility because of its potential.

The elite group of airlines already operating such a system, of which British Airways is a longstanding member, may wonder why the move by other airlines down this road has not been as rapid as may appear warranted.

There are a number of reasons: for one, current developments in database architecture mean that major improvements in data management capability are close at hand. Technological advances will allow reliable automated identification of defined safety events based upon the detection of both individual and collective breaches of set flight operations parameters. They will also allow the data which are checked for the occurrence of specific safety events to be used for the computation of general flight operations management statistics. The potential has been clearly demonstrated, but a straightforward path to such products is not yet available.

In the absence of an effective data processing interface capable of handling the vast quantities which FDR programmes generate, a sampling using simple manual analysis might be proposed. The main problem with this approach is that FDR safety events unreported by ASR are relatively infrequent.

The aircraft type in use is an important factor. For example, the principal aircraft type destined to remain in the British Regional fleet for the long term does not have a flight data acquisition unit with sufficient parameter input (or even input capability) to produce the range of flight data required to start a monitoring programme. Many other mid-size airlines would be in a similar position.

Safety performance assessment

A core safety management system must be a source of simple overall safety performance indicators. Ideally, these indicators will be risk-based because it is risk indication — with explanation — which is required. To measure safety performance using ASR event data, all events below the individual level of severity at which guaranteed reporting can be assumed to take place must be disregarded. The remaining number of significant risk events can then form the basis for statistics. One of the simplest is the rate at which significant safety events occur.

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For an operation such as British Regional, where the average flight time is close to one hour, it makes little difference whether the rates are based on the number of flights or number of hours. Rates could be incidents per flight hour or per flight, but are best computed as intervals between significant incidents.

To identify the reasons for any variation in the rates for different aircraft fleets would of course require the figures to be broken down into related event groups. Good software packages allow such statistics and production of graphs directly from the data. Others mix up cause and effect, and this process becomes less straightforward.

Safety performance indicators must be defined so that the absence of accidents is not the only measure of success.

Theoretically at least, a number of possibilities exist for assessing the host environment from which safety performance arises:

- measurement of the observed variation in the propensity to raise an ASR;
- use of a carefully structured questionnaire to elicit the level of safety awareness and perception; and
- the rate of safety reporting outside the company ASR scheme.

It is the first of these, the variation in ASR submission rates, which has so far been employed at British Regional. An example of its use is provided in the accompanying figure (page 13), which shows the personal flying hour interval per ASR submission for a representative sampling of captains during the 12 months ending 31 August 1998. The sample mean for this distribution (which is in fact 92 hours) has no immediate significance for the required purpose, but the pattern of spread about the mean does because a tendency towards a uniformly effective safety culture could be expected to reduce variation towards a bell-shaped normal probability distribution. In such a distribution, 67 per cent of measurements are found within one standard deviation from the mean, whereas in the example shown, the equivalent figure is only 52 per cent, which suggests room for improvement.

While this illustration has used captains' ASR rates, the same approach can be applied to line engineering bases or ground handling stations.

Awareness of air safety issues can be gauged by carefully structured questionnaires. Several agencies, including the U.S. National Aeronautics and Space Agency (NASA), U.S. Federal Aviation Administration (FAA) and, in Australia, the Civil Aviation Safety Agency (CASA), have promoted methods for measuring safety culture as well for introducing and developing it. The CASA approach is based on using the results from a set of 25 questions completed by a sample of personnel to calculate an airline safety culture index.

The advantage of this statistic over the ASR rates is that while it can be similarly applied to all or part of the airline community involved directly in contributing to air safety, the mean score as well as the distribution about it has a positive significance as an indicator. An approach along these lines is under review for possible use at British Regional and at least one other U.K. airline, but it is too early to judge its possible value as an indicator.

A further hypothesis in respect of safety culture is that the lower the proportion of safety reports made directly to the regulator and/or to a national scheme where reports are protected, the more successful the company ASR scheme in terms of being comprehensive. In practice, it is not surprising that source data for such statistics has not been readily available and this method has not been used, but it remains of theoretical interest.

Summary

Airline safety risk exposure can be controlled by a carefully designed core safety management system, and a number of important guidelines on how to capture safety data and use them to best effect now exist.

It is essential to have an integrated approach across all relevant parts of the business. The Safety Department must be independent and have access to dedicated engineering expertise.

Functional disengagement of the core safety management system from the foundation quality assurance processes contributes to an effective focus on safety risks and their active control. Safety performance indicators must be defined so that the absence of accidents is not the only measure of success.

Finally, the achievement of a positive corporate safety culture and a visibly effective core safety management system go hand-in-hand. □

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This article is an adaptation of a presentation at a safety conference organized jointly by the Flight Safety Foundation (FSF), International Federation of Airworthiness (IFA) and International Air Transport Association (IATA) in Cape Town, South Africa in November 1998.