How to fly

While professionals in the aviation industry have a different motivation for minimising risk, many of issues they deal with are similar to those faced by banks. Nick Kochan finds out what an airline's op risk framework looks like, and whether they contain anything the finance industry could emulate

Turbofan engines and mid-air collisions are a long way from credit card fraud and rogue traders, but the basics of operational risk management in the airline industry are much the same as in finance – and the people responsible deal with issues such as regulatory compliance, training and alert processing that any bank op risk manager would find familiar.

Regulatory compliance is the key to safety across the airline industry. Technical and component management, staff fitness, competence and training, aircraft preparation, flying conditions and performance are all covered by detailed sets of rules, regulations and recommendations, which circumscribe the operational risk taken on by an airline.

These rules are laid out by the aircraft makers, implemented by the aircraft operators and supervised by national and international airline regulators and supervisors. Ben Alcott, head of safety at the UK's Civil Aviation Authority (CAA), explains: "We have less of an 'as low as reasonably practicable' approach and more of a compliance framework that is not necessarily rigid, but is extensive. Everything we do is trying to manage risk; the compliance rules are there as part of the risk management framework. The work we do is to look at safety data coming from the industry and assessing it. It is about managing that risk better in the future."

While compliance is important, regulators tend to give some latitude to airline operators in implementing the rules. "Operators have to set the right balance between objective-based rules and prescriptive-based rules," says Alcott. Even geography can make a difference: airlines that operate in extreme temperatures will see greater amounts of wear on their aircraft, and airlines that fly to high-altitude destinations – where the air is thinner and lift is more difficult to generate – might also find their airframes being worked harder.

Airline operators receive detailed manuals from manufacturers indicating the life span and performance characteristics of each component, in terms of the number of take-off and landing cycles the part can safely handle. Alcott explains: "There is a whole mechanism around ensuring the integrity of parts. Parts need to be removed from service after a fixed number of cycles, and the airline is required to monitor that. Some parts are safety-critical, so they are more closely controlled."

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EasyJet executive

Data on performance is channelled back to the manufacturers, sometimes as frequently as after every flight. They in turn circulate it to operators and to national aviation safety authorities such as the CAA. The result can range from the issuance of guidance to a mandatory requirement from a national authority to change or adapt the part. Alcott says the CAA does spot checks on the quality of airline safety codes and implementation, and manufacturers also hold regular discussions with operators to gather feedback on the aircraft they use.

In the financial sector, the issue of systemic risk – and practical considerations of affordability – mean large institutions are often held to higher regulatory standards than smaller ones. By contrast, the principles of safety compliance do not differ from one airline to another, Alcott says: small or low-cost airlines are "held to the same standards as any other airline. The system has a comprehensive compliance framework. So the rules for being an operator are the rules – there aren't different rules depending on your pricing model. You can still only use aircraft that have been certified. Whatever your model for running your airline, the safety framework you are working in is the same."

EasyJet is one of the world's biggest low-cost airlines. It runs around 850 flights a day during the quieter season and 1,350 a day during the peak. The airline organises about 55 million separate passenger journeys every year, making it the fifth biggest carrier in Europe.

Jim Pegram, its UK-based head of safety performance, explains the airline's approach to operational safety. "When we founded easyJet, we knew we had to manage risk and make a profit. We solved this dilemma by defining a space within which the business can operate safely. If your production is too high, or in our case, if you try to fly too many aircraft or carry too many passengers, you increase the risk of something going wrong along the line. You might then simply be unable to run your services; but it can also end in a catastrophic accident. One the other hand, if your protections are excessive, then of course you are not going to make a profit. Obviously the only occasion when there is absolutely no risk is when the aircraft is defuelled and parked in a hangar."

The core of easyJet's operational risk measurement and assessment is its Airline Information Management System. AIMS powers the airline's Operations Movement Control Screen, which collects information on

aircraft, flights, times, schedule control, delay tracking, aircraft allocation and engineering planning. According to Tim Garnett, network operations manager in the airline's Operations Command Centre (OCC): "This allows the user access to a huge amount of historical, current and future data. It is the main tool to track the movement of each aircraft at any given time. It also holds the crew rosters that are correlated with where the aircraft are at any time. That enables us to say where everything is, where it should be, and what element has gone wrong, and why."

Garnett says much of the OCC's work can be described as "management by exception". With the daily flying programme planned many months in advance, and each flight already allocated to one of the airline's 204 aircraft, "if no external or unplanned events impact this plan there wouldn't be much to do other than the support, tracking, monitoring and compliance aspects of the OCC functions. However, we manage by exception when things don't go according to plan more often than not." The list of potential complications includes adverse weather, volcanic ash, air traffic control problems, industrial action, problems at an individual airport, aircraft defects, crew sickness, late passengers and sick passengers.

"My team manages these situations and exceptions to ensure that safety, compliance, on-time performance and customer satisfaction are never compromised, and that the integrity of the flying schedule is maintained," says Garnett.

The use of data and reporting from the logistic chain through to the management is central to easyJet's approach to operational risk. The challenge is to run a system that covers both long-term planning and crisis notification. According to one easyJet executive: "You have a warning system to alert you when you are getting close to danger, at which point you need to take preventative action. There are also hard warnings when you are at the edge. We have a systematic approach that is evidence-based and integrates all our safety activities. Data and getting good quality safety information are key.

"We have different mechanisms to ensure we receive data. The first one is safety reporting. This is where all our staff, whatever department they are in, write safety reports on issues that they observe in their normal working practice. These are issues even if they haven't observed them yet. We have a robust process for allowing people to report safety issues. They are investigated against a standardised methodology we have developed. That is our first source of data and hazard identification."

He identifies one such warning sign: a 'go-around' or aborted landing. "If an aeroplane is on the approach, and there is another plane on the runway that hasn't received its take-off clearance, the pilot will initiate a go-around. There is no immediate risk of collision, because the whole sequence of events is being controlled. But we want to know what has happened, and why, because it is not a desirable situation to be in – and from a trend point of view, if we saw that happening a lot, it would suggest that there was a breakdown in process."

The value of the report is that it enables the airline both to understand a trend, and to correct it before it leads to a deterioration in procedures, and ultimately to an accident. "There is never a single point of failure in an accident. There is always a sequence of events that leads to an accident," the executive says. "Effectively you want to make sure there are as many barriers as possible in place to prevent an accident from happening. If we see a trend, this will alert us to a potential breakdown in air traffic control procedures. That is why we will go to an air traffic provider and understand what is going on, and try to resolve that."

The same approach is applied at national **[in the UK?]** level by the Confidential Human Factors Incident Reporting Programme (Chirp), which collects confidential reports of safety-related incidents from pilots, aircrew or anyone else involved in air transport. Reports are confirmed by Chirp and then passed on – in anonymous form – to anyone, whether airlines, service providers or regulators, who might be able to act on them. While Chirp has some similarities to the external loss databases used by the financial industry, it spreads its net wider – taking reports directly from anyone in the industry, rather than just those submitted by institutions – and collects data on relevant incidents that might not result in any actual loss. The financial sector equivalent, the collection of near-miss data, is still the subject of debate (*www.risk.net/2135853*), with some database providers arguing that near-miss data is inherently subjective and undermines the database's statistical value.

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While human reports provide essential data for analysing a trend, the flight data monitoring equipment on all planes also provides evidence of an incident or malfunction. EasyJet's Garnett says: "When the plane lands and taxis in, the onboard telemetry equipment squirts a signal to our offices, and our system reads that telemetry and flags any significant deviations. That forms an investigation and we get data for trending. We get flight data recorder information in real time; when the plane lands, all that data comes to us wirelessly and we pick it up and read it for every flight. We have about a 96% recovery rate, which is enormous [considering] our volume of traffic. We know exactly what goes on in all our flights, pretty much all the time."

The company also uses the Airbus Aircraft Maintenance Analysis (Airman) system to monitor key aircraft systems while the plane is in flight and send signals back to easyJet's engineering department. Garnett says the engineers can receive signals warning of a problem without the crew knowing the aircraft has sent a signal. But that creates another challenge, one that would be familiar to op risk managers in the financial sector: extracting meaningful information about risks and potential failures from a vast number of alerts, most of which do not merit action.

"The challenge for us is to gather all that data and understand how it relates, to give us the best holistic view of the safety performance of our operation," he says. "We want to be able to react to very weak signals, that perhaps are not telling us there is a problem but are identifying the point where they are predicting an issue might arise in the future. Then we can act to mitigate those risks. We monitor these weak signals to give an indication of any temperature change in the engine, for instance, so we can put a mitigating strategy in place. But there is no question of the engine being outside the safe operational criteria."

Safety-relevant information comes in many forms – as well as automated engine reports, an airline might also receive reports from flight crew about, for example, an inaccurate weather report. Flight crews check weather conditions before making an approach to an airport – if there is a mismatch between the crew's physical experience and the evidence of the computer, they will need to understand and report the fact, for clarification from the ground. Even if the mismatch itself doesn't threaten safety, it could be a sign of a wider problem in the weather reporting system that needs to be addressed.

"It might have been a local atmospheric anomaly, or a problem with the recording equipment. Or it might be that processes are not working and the weather is not being updated as routinely as it should do. Taking care of all these apparently minor things is absolutely crucial to a robust safety system," says one company executive.

Operational risk management of the crew does not only apply when they are in flight. For example, the CAA lays out strict rules about the hours and conditions under which captains and staff may operate. EasyJet, Garnett explains, has also introduced its own fatigue risk management system, based on a study in conjunction with Nasa in which several aircrew wore physiological monitor harnesses while working. Garnett says: "We were able to ascertain the measure of fatigue. So we get a lot of evidence-based feedback

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in applying this additional risk control beyond the baseline regulation."

Another aspect of human factor management is continual training and requalification. Each six months, pilots undergo a simulator test to retain their licences. Pegram, who is himself a qualified and serving captain, says: "The fidelity and accuracy with which the simulator replicates the aeroplane is startlingly good. The full visual, the detail, the equipment, the noises, the heat, the smell are all simulated. It even has hydraulic jacks to simulate the movements. The only difference is there are no wings or engines on it." The simulator test replicates dangerous situations such as engine failure during take-off, an engine fire, or ground draughts from a thunderstorm during approach.

Pilots are also trained and tested on updates and system changes to the aircraft they fly. "These additions come on these aircraft fairly regularly. So there are constantly evolving pieces of equipment, and pilots have to do that as well," says Pegram. First officers must also show they can pass these tests, as they sit at the captain's side and must be able to take the controls in the event of an emergency.

Regular maintenance is essential, but it's also a significant source of operational risk, says Tendai Mutambirwa, easyJet's fleet engineer. "From an engineering point of view, the greatest risk is that an un-airworthy aircraft is released into service. Those risks tend to manifest when there is interaction between the operative and the actual equipment. That is, if an error is made during maintenance or any other engineering activity."

Maintenance and replacements are supervised at different levels of authority, depending on how critical they are to the plane's functioning. Maintenance carried out on a critical flight system is subject to checks both by a suitably qualified individual and a thorough system of supervision and double-checking. "The aircraft has got quite good test-function capability. The aircraft mechanics need a supervisor or a certified licensed engineer to inspect their work, and to ensure they have made the connections correctly," **[says Mutambirwa?]**.

Manufacturers provide regular maintenance schedules to guide operators. They also act as a hub for engineers to share comments about the performance of their planes. "Airbus might issue a document about a modification that is not mandatory, and an operator who implements that might start to find the modification does not have the desired effect, or does not provide the solution advertised," says Mutambirwa. EasyJet is often consulted by smaller operators for advice on operating these planes, as it is one of the world's largest users of the Airbus A319.

Maintenance happens under considerable time pressure. Airline operators generally place a high price on availability, and this is particularly true for easyJet, whose strategy depends on high use rates. This means it needs to have effective logistics operations, ensuring the appropriate part is available to the engineer when the aircraft is in the hangar. Mutambirwa comments: "The weakest link in the engineering chain is in logistics, that is, the movement of spare parts. We need to have serviceable components on hand so we can make the required changes, and clear faults and defects. Engineers have to take technical decisions about what can be done with the aircraft all the time, and these should not be affected by the availability of parts. You can understand how the guys manage risk just by listening to the calls they make on a daily basis, in how they deal with defects. Logistics is another added pressure they have to handle."

THE 'SIGNIFICANT SEVEN' – THE UK CAA'S TOP SAFETY ISSUES

The UK Civil Aviation Authority (CAA) began a study into common causes of safety problems in June 2009. In a report published in March 2012, the CAA listed its conclusions as the *Significant seven safety issues*. They are listed here in order of importance:

1 Loss of control
Linked to inadequate attention or monitoring by flight crew, or to a lack of manual flying skills – and often related to improper use of flight deck automation by the crew.

2 Runway excursion
Overrunning or veering off the runway on landing. If captains have received inadequate information about the state of the runway, or incomplete runway contamination data, this could lead them to land outside the touchdown zone or leave the runway after touchdown.

3 Controlled flight into terrain
Aeroplanes have 'terrain awareness and warning systems' to mitigate the danger, but the CAA found most incidents occurred on non-precision approaches and were linked to a lack of situational awareness or poor communications between flight crew.

4 Runway incursion
This occurs when an unauthorised aircraft, vehicle or person is on a runway, creating the risk that an aeroplane taking off or landing will collide with the object.

5 Airborne conflict
Mid-air collisions occur either through errors in ground control, or pilot navigation errors. Airliners are now fitted with 'traffic collision avoidance systems', automated radar systems that warn pilots of an impending collision and tell them how to manoeuvre to avoid it.

6 Ground handling
This has the potential to cause risk when ground handling-equipment – such as fuel bowsers or towing tractors – collides with a plane and the damage that results is not traced until the plane is airborne or taxiing.

7 Fire
While most aircraft fire incidents occur in galleys and passenger areas and are relatively low-risk, the most dangerous occur after a crash – often in the aftermath of a runway excursion.