Flight Data Monitoring (FDM) for Business Jet Operators

Quality Service Deserves Quality Safety

Hilton London Gatwick Airport, 14th November 2012

NOTES

A summary of the main points made during the day.

Introduction

There are over 30,000 Business aircraft globally. The average age of business aircraft in the EU (>7% of European IFR traffic) is relatively young at 8 years versus the 18 year average worldwide. In general a high degree of serviceability is needed as well as good performance planning. There is room for improvement in safety for Business aviation, particularly the commercial operations sector, which has an accident rate that is much greater than corporate sectors (which achieve a level of safety comparable to airline operations).

One of the key ways to improve safety is through the use of an effective Safety Management System (SMS) with Quality Management. A proactive Flight Data Monitoring (FDM) programme can be an integral component of this and provide the necessary data to enable a proactive SMS, which in turn will feedback into the FDM programme for continuous monitoring. A similar approach can also be taken in exchanging information gained through an FDM programme with flight training departments. An SMS does not need to be overly complex and can be scaled accordingly. It was highlighted that SMS are not 'tick box' exercises that are implemented as 'stand alone' setups for the sake of compliance. These must be proactive and an integral part of the operation.

It was highlighted in the 'Woodhouse Report' on the International Business Aviation Council (IBAC) website (http://www.ibac.org/Files/Safety/Woodhouse_Report_V11.pdf), that following analysis of 297 Business aircraft accidents it was found that at least a third of them could certainly have been prevented by the implementation of IS-BAO (International Standard for Business Aircraft Operations - a 'code of best practice' developed by IBAC and its member associations). It is reasonable to expect that similar results would have been found with the implementation of good SMS in general. SMS works if done properly.

Q & A

- *The question was raised on how difficult it is to implement a change in procedures for safety reasons and get it included in the Ops Manual.* It was answered that it can often

be the case that safety issues arise simply because people are not following the Ops Manual in the first place. Thus one needs to establish whether this is the case or not. If a change is required, it is important to convince people of the reasons for any changes by rationalising these from a safety perspective. In terms with compliance with these changes or the Ops Manual in general, it is always beneficial if pilots are aware that they are being monitored through FDM. The 'peer pressure' effect of internally publishing de-identified statistics of key issues drives improvement. Although it is more difficult with smaller Operators where everyone tends to be very familiar with each other, a similar approach can be utilised to justify change and monitor compliance.

Aircraft Operator Perspective

TAG Aviation

They currently operate 130 aircraft worldwide with 18 different types and 70 bases. 25 of their aircraft are part of their FDM programme covering the G450/550, Dassault 7X and Bombardier Global aircraft. A good safety culture was underlined as an important aspect in ensuring good take up when introducing an FDM programme. Following implementation of their FDM programme they had good dialogue with their pilots due to the prevalence of a good safety culture within the company, with many pilots requesting to view their own data. As their company's FDM programme expanded they have had to ensure that their software capability has grown with it.

They have been able to spot a number of trends for various safety areas through FDM and have also been able to investigate specific incidents by feeding FDM data into simulator training to recreate the event. As a result of this they were able to gain a better understanding of the performance limitations of a particular aircraft type.

A number of Business Operators have very small fleets of aircraft; therefore it is difficult to trend data. Initiatives such as the Corporate Aviation Safety Executive (CASE), which is about collaborative working and sharing data, can help address this by providing a larger pool of data to trend and establish what the barriers are to serious incidents/accidents. At the moment, only ASR data is shared, however it is hoped to include FDM data in the future. By using the collective wisdom of a group there is an opportunity to share best practice and potentially harmonise SOPs (Standard Operating Procedures). The Air Safety Central (ASC) reporting system community was highlighted to be an effective way of spreading awareness among the Aviation community by sharing individual Operator experiences. An example was given relating to the procedures for accessing the toilet of the Dassault Falcon 7X when someone had collapsed inside. Prior to one Operator's investigation, this was not generally known.

<u>Q & A</u>

- *What is the manufacturer attitude towards FDM?* It was answered that some manufacturers are less than helpful when it comes to fitting QARs or providing data frame information for types that fall outside the current requirements (< 27 tonnes).

- *Are there any other benefits beyond safety to be gained through FDM, such as tyre wear reduction or savings through planning maintenance cycles based on data?* One of the main safety benefits was from FDM analysis quantifying fuel saving measures whilst monitoring any implications on operational safety. In addition to this, other Operators have used FDM for maintenance related aspects such as engine health monitoring and monitoring brake wear.

NetJets Europe

It was pointed out that a larger unified community of Business Jet Operators should bring about the additional benefit of having greater leverage with aircraft manufacturers regarding matters related to FDM such as the fitting of recorders, logical frame layouts (LFLs) etc.

NetJets fly to 800 airports a year. In general FDM has been a key tool for NetJets in establishing how close their real life operations are to their SOPs and the assumed norm. Although at the beginning FDM was not well received by all of their pilots and their FDM team lacked experience, things improved as the programme matured. However one of the challenges still encountered is the efficiency and reliability of manually downloading flight data.

FDM has been used proactively to help with reports of hazard identification at special airports, where this information is used to pre-brief pilots before visiting these. Performance reports are sent to pilots on a regular basis via email (400 +/month). These have proved particularly effective in reducing the number of unstable approaches made. NetJets is also an active member of the joint EASA-industry European Operators FDM (EOFDM) Forum. This is comprised of four different working groups (A, B, C and D) looking at (A) monitoring operational safety issues with FDM (NetJets have been involved in this, looking at issues such as Runway Excursion, Loss of Control etc.), (B) the required programming and equipment needed for this, (C) integration of FDM into Operator processes and (D) the organisation of FDM conferences.

From a business perspective, fuel savings brought about through procedural changes on a large fleet of aircraft can be significant and FDM plays a key role in monitoring these are followed safely. FDM has been used to compare data with their Flight Planning Software, which has resulted in identifying limitations in the software, such as it not accounting for SID (Standard Instrument Departure) climb out restrictions. Commercially, they have also found that ‘safety sells’, especially with knowledgeable customers, who have been known to ask specifically about FDM.

When starting an FDM programme, an Operator should identify what is already recorded on an FDR (Flight Data Recorder) and what parameters are available from the aircraft via QAR (Quick Access Recorder). Fitting a QAR to an aircraft is significantly easier if it is already equipped with an FDR. The number of parameters available affects the capability of an FDM programme and Operators must understand which specific parameters are required to monitor what they want, ahead of implementation.

At the beginning an Operator with a small fleet may find it easier to start an FDM programme with an outsourced solution, where service provider replays, analyses and presents the data for the Operator's FDM analyst to assess and act upon. It is important that the Operator has easy access to the detailed FDM information for their investigations. FDM programme policies should be set in advance of implementation and bought into by the pilots in order to avoid any surprises and disenchantment once the programme begins. The Operator should have decided in advance how they are going to progress SOP violations and airworthiness events found through FDM ahead of implementation. As an Operator's programme matures, so should the overall skill set of the personnel involved in the programme. Areas such as operational expertise, data handling (for Safety Performance Indicators aka SPIs), Maths and Statistics, Quality Management (e.g. new FDM algorithms, data quality) and Project Management (managing change) are all key qualities that must develop with the programme.

<u>Q & A</u>

- *How does the information from your 37 monitored aircraft help with your unmonitored fleets?* Special airport procedures developed from FDM translate well to the other fleets; however it is more difficult for fuel saving procedures, as these tend to be more type specific. A degree of extrapolation from the information gained through FDM can be used on training aspects for the rest of their fleets.

- *The CAA was asked whether there were any plans to reduce the FDM weight limit requirements (> 27,000kg).* There are currently no plans for this, but David Wright noted that the ICAO *recommendation* for FDM states that all aircraft above 20,000kg should have an FDM programme. Further to this, the technical ability to equip even smaller aircraft with QARs is less of an issue nowadays than it was in the past.

- *Are there any regulatory advantages for those who operate FDM e.g. such as the use of a fuel planning system allowing for a reduction in contingency fuel from 5% to 3%.* It was answered that it was actually through FDM that NetJets found that they needed to improve their fuel planning system first before reducing fuel contingency.

Shell Aircraft International

Shell Aircraft International has three main bases: Rotterdam, Houston and Calgary; operating three Dassault Falcon 7Xs, one Dassault Falcon 900EX as well as Embraer 175 and Dornier 328 aircraft. Brunei Shell (a joint operation) operates three Sikorsky S92 helicopters on very short sectors.

In general, "you don't improve what you don't measure". It is important to know how close you are to an accident. FDM was identified as one of the main initiatives to reduce the number of fatal helicopter accidents.

At the beginning, when they were trying to sell the idea of FDM, there was some scepticism regarding the need for it, due to complacency of having a 'good' safety record. It was highlighted that it is important to have a just culture and respect for people within the company when implementing FDM. Confidentiality is important – an incident in the past that was poorly handled nearly derailed their programme and pilots were uneasy for some time after the incident.

Some of the initial difficulties they experienced with FDM related to the time required to process and analyse data. There was little or no trending and the data was not used as much as they would have liked. However, time passed and the programme matured, this improved. They have found that it is very important to give feedback to crew as quickly as possible following an occurrence, when the incident is still fresh in their minds in order for the feedback to be as effective as possible. Their Safety Officers review data and are able to give input to their Operations and Training departments. Since they implemented FDM in 2006, their FDM event rate has steadily decreased each year.

It was emphasised that it was important to be proactive with FDM, rather than just collect data. Some of their smaller contracted operations have struggled with FDM and they are encouraging them to make better use of the data.

In order to expand their knowledge, they have been in contact with Dassault regarding looking at pooled FDM data of the Falcon 7X from multiple Operators.

In general, for an Operator who is new to FDM, it is advised that they start simple and then gradually grow the programme.

<u>Q & A</u>

- *It was questioned how they deal with their contractors who may be struggling with FDM.* It was answered that they have struggled with their smaller Operators and have encountered resistance to the implementation of FDM and then how the data is used. To combat this they have invited these Operators to their main bases, so that they can look at the data and see how it is used and at times have also spent time at their operating bases to help them with FDM.

- *Has any sort of benchmarking been done with Dassault using pooled data?* None yet, they will have access to Falcon 7X data from other Operators, so there is huge potential. They are currently awaiting data from Dassault.

VistaJet

They operate over 35 aircraft across four different types all monitored through FDM: Challenger 850, 605, Global 6000XRS and Learjet 60XR. They are the only Operator who monitors the Learjet 60XR with FDM. Their fleet is young and has a high level of utilisation. In the past 24 months they have visited 873 airports. They have a big presence in Russia and are the largest foreign Business Jet Operator in that country

When starting an FDM programme they found that it was important to ensure willingness of crew/management and get commitment in advance. This involves being realistic about what can be achieved in the short term, having a plan and getting the right resources allocated. This commitment is essential in order to drive the implemented FDM programme forward and to provide support should there be any setbacks.

FDM event rates are regularly monitored and comparisons are made against their own previous performance and also against their Operator peers via their FDM Service provider. Following implementation of new SOPs, such as for stable approach gates, they monitor their FDM events to determine whether there has been any tangible improvement or adverse trends. When reviewing events they are able to assess these in context through FDM system links to weather and airport information.

When looking at their programme, they have had to determine appropriate levels of intervention when monitoring performance. In general there will be an 'operational drift' from their required baseline performance. Therefore, it is important to establish a balance between the two that is acceptable. In order to minimise deviation from baseline performance, one should be proactive (and if feasible predictive) with data rather than just reactive. Accident data has indicated that the most risky phases of flights are during take-off & climb and particularly approach & landing and it follows that those phases of flight have smaller margins for error. Therefore deviations from SOPs in these phases should be assessed accordingly.

It was emphasised that it was important to start simple. Normally a small aircraft (with an FDR) can get a QAR fitted relatively easily and even if not fitted, regular downloads from the FDR during maintenance can give the Operator an idea about their operation. FDM is a good investment when compared to the cost of an accident.

FDM Service Provider Perspective

Flight Data Services

One of the key aspects to Flight Data Monitoring is an efficient means of retrieving data from the aircraft. Out of 112 of FDSL's customers only five had wireless data transfer systems fitted. At the moment only one of those is working reliably; the other four are no longer in use. Therefore, if looking to use wireless technology, it is important that Operators are satisfied with their equipment before fully implementing it across their entire FDM fleet. If downloading data manually, the process can be more time consuming. Data transfer systems such as those offered by FDSL can help streamline the process.

When validating events, Operators should treat each FDM event that is produced by the system with a degree of suspicion. Trace (a graphical representation of flight data) analysis forms an important component of this, in determining whether certain values are sensible and that there is no 'bad data' involved in producing the result. Therefore it is important that Operators ensure that they have appropriately knowledgeable and proactive staff involved when it comes to analysing FDM data. Some Operators may find it easier to outsource their FDM programme due to a lack of such a resource. However, overall responsibility and oversight of the FDM programme still lies with the Operator.

Safety margins cannot be measured solely through FDM data. An Operator first has to establish what level of safety is acceptable, which can be difficult. This could be based on a 'yesterday was acceptable' or a 'today is unacceptable, we must improve' approach. Another possible method is to review data from industry peers on the assumption that they are acceptably safe. FDSL currently produce de-identified aggregated summaries of their customer FDM event data for individual customers to be able to benchmark themselves against. It was pointed out that the events used for comparison need to be standardised in order for the comparisons to be valid. Some Operator events may have significantly different event limit thresholds, which needs to be taken into account. It was agreed that the current setup isn't ideal, however FDSL intend to improve this through their new product which will allow an Operator to compare them self against pooled data of other Operators that have had their local event threshold applied, thus making it more directly comparable.

Legal and Insurance Perspective

When recording information, it should be understood that this can be used both in an Operator's defence and against them e.g. during an investigation into an accident, if the information reveals them to be doing right or wrong. If the investigation is a formal legal investigation, this could include being required to give access to previously confidential information. More often than not, an Operator may defend itself by using this same data to show that they were doing all that was reasonably practicable in the circumstances.

In recent times there has been a growing trend, particularly in Europe, of using investigation reports (which are created for the purposes of safety) for criminalisation following serious incidents/accidents. This is particularly concerning given its potential to damage just culture in aviation. Different locations may mean different legal jurisdictions; therefore Operators should be familiar with these. It was emphasised that not reporting incidents or leaving out important information does not protect the pilot/organisation, during an investigation. On the contrary, it can make things worse. If an Operator is taken to court, legal costs can be very expensive. It was recommended that Operators check with their insurers to ensure that their insurance covers legal defence.

Having a robust, demonstrable safety system in place is a very important aspect in an Operator's defence should an investigation occur. This would include a good level of reporting and a system in place where the Operator takes reasonable/appropriated action in response to that information and maintains safety oversight. A proactive FDM programme within a robust SMS would be very beneficial in this regard. Being proactive or sufficiently reactive means that information should be retrieved in good time e.g. a lag of one month before FDM data is downloaded and reviewed could potentially be dangerous, as a lot can occur in one month.

An Operator needs to be aware of exactly what information is stored and should liaise with their IT departments to understand their system. Given that a lot information gets retained within an Operator, personnel working there need to be aware of their own communication e.g. emails or communicating externally via an internet forum. In general casual written communication about an incident/accident that is misinformed or speculative is ill advised. This information can also potentially be used against the Operator during a legal investigation. In general preservation of electronic evidence is part of the duty of the Operator. Data is often used to defend a company in a dispute and in some cases resolve it before any litigation takes place and therefore it is in the Operator's interest to retain such information.

<u>Q & A</u>

- *Is an MOR protected against disclosure for legal action/prosecution?* It was answered that an MOR is not necessarily protected against being used as evidence for

prosecution, which is why it is important that Operators' reporting systems and SMS are robust so their actions are defendable. This can only be disadvantageous to the Operator if they have been grossly negligent and done something wrong. Not reporting an occurrence/incident as an MOR will not protect the Operator.

Regulator Perspective

UK CAA - SRG

Most accidents comprise of a number of causal factors, therefore it makes sense to learn about these rather than throw away useful information from flight recorders. Thus FDM is a powerful tool in monitoring safety. FDM should be both systematic and proactive in order for it to be fully effective.

Under the current ICAO Standards and Recommended practices in **ICAO Annex 6, Part 1 Commercial Air Transport – Aeroplanes**, it is a standard for FDM for all aircraft over 27 tonnes MTOW to have an FDM programme and a recommended practice for all aircraft over 20 tonnes to have one. The intent such programmes is for them to be non-punitive and for the purposes of safety, although an Operator should not expect to be protected against gross negligence. The ICAO standard for FDM translates to the current EU requirement for FDM, which adopts a near identical stance in that the programme should be non-punitive and contain adequate safeguards to protect the source(s) of the data. In addition to this acceptable means of compliance and guidance material related to FDM have been produced under '**AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes' and 'GM1 ORO.AOC.130 Flight data monitoring – aeroplanes'.** More detailed guidance material can be found in CAA's **CAP 739.** This useful document is based on over 40 years of CAA's involvement with FDM and is currently being updated to include aspects on small Operators and Business Jets.

The CAA believes that good FDM provides:-

- Assurance of operational standards
- Traceable feedback into training & continuous improvement
- Proof of state of reporting culture
- Risk identification and quantification within your SMS
- A proactive driver to reduce risks

In essence the FDM process of continuously identifying, quantifying, monitoring risk and taking action where necessary is very much aligned with the principles of SMS. When taking remedial action an Operator must always be wary of any unintended consequences as a result.

The CAA has regularly liaised with UK AOCs on FDM over the years and in 2001 formed the FDM Operators Group. This invaluable forum allows the exchange of sometimes sensitive information between Operators and the CAA. This is done with the assurance that although information may be used for safety purposes outside the group, the identity/affiliation of the source of the information will not be revealed unless given explicit permission to do so. All the major UK airlines required to have an FDM programme are members. In addition to this, a number of Business Jets Operators are members of the group, as well as representatives from BALPA, UKFSC and on occasion organisations such as NATS and EASA.

In conclusion FDM is very powerful safety tool for Operators and provides a great potential for learning. It is important that it is part of an open and just safety culture. FDM isn't necessarily just for large Operators, since the same benefits may be realised with smaller Operators. A low number of parameters do not mean FDM won't be useful, as a number of aspects of flight operations can still be covered. Operators should also consider pooling their data with others to maximise the potential of what they can learn.

David Wright extended an invitation to any Operator attending the conference to join the FDM Operators Group once they get an FDM programme. If anyone would like further information about this or has any questions relating to FDM, please contact: David.Wright@caa.co.uk

Panel Session:

- *It was asked whether anyone had taken their data to an insurance provider and obtained a reduction in their premium.* TAG responded that they have received reductions in their premium, primarily due to their overall SMS and that their insurer was impressed with FDM. David Wright pointed out that it is important to show proactive use of the data to reduce risks – a major UK AOC has commented in the past that FDM is a good tool to reduce insurance premiums. VistaJet commented that there is a strong argument insurance premiums should be less for an Operator that uses FDM versus one that does not, since a reduced risk of accidents means that an insurer will have lower projected costs. NetJets Europe is currently unable to do this due to their insurance being based on the entire NetJets group, who apart from NetJets Europe do not use FDM.

- *The suggestion was made that FDM data should be regularly used to feed into simulator training and vice versa.* TAG is currently exploring this type of thing with its simulator provider. TAG is also looking to match their SOPs to their simulator training.

- *The question was raised on whether there will ever be a time when all commercial aircraft will need to have FDM, as an aircraft weighing more than 27 tonnes does not make it more commercial than one weighing less.* David Wright agreed with this

sentiment and remarked that it could be argued that FDM is even more useful for smaller Operators as the aircraft are just as complex as larger ones and their route network can be very diverse. A lot of regulations based on weight are legacy issues and are not always based on current technology. Joji Waites remarked that the opportunities for Business Jet Operators with an initiative such as CASE alone are good enough to get involved with FDM, even if it is not currently required by regulation.

- *Is it disadvantageous to keep data for too long?* The positives of retaining data in the long term generally outweigh the negatives. FDSL pointed out that they have retrospectively used old data for a number of legal defences and safety investigations.

- *One Operator remarked that it is difficult to keep faith, among pilots, in the confidentiality of the data.* David Wright suggested that Operators should show their pilots how the data is used to remove the fear factor of being monitored. Senior managers also need to be wise as to when they ask for data if it doesn't involve a safety related matter.