

## **Breaking Airlines Flight Data Monitoring Barriers: A Pilot's Perspective**

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### **Some FDM pioneers**

If someone tells you that fog in France and UK helped to develop the first FDM program in the early 70s, you will probably not take that very seriously. Yet this is part of the real story.

Until the mid-60s, flight data recorders were exclusively used for accident investigations. Things started to change when data recorders began to be used for aircrafts airworthiness aspects related to autopilot performance. New separate digital recorders apart from crash recorders were developed together with software on the ground to automatically monitor and detect specific parameters or flight path exceedance. This use was soon extended to certifying the first CAT III Autoland operations for the Caravelle in France and Trident in the UK. Thanks to this data monitoring program, passengers could be flown into foggy airports on days where manual landings would have been impossible.

This went soon much further, as it appears that the nature and the amount of data made available could be used to monitor much more types of exceedances. Therefore, why not using it to detect near accident of many types? This was an excellent idea... but in the early 70s, human factors knowledge as well as "just culture" were not as mature as it is today. The notion of "right stuff" was dominant. For many, events detected through these programs had to necessarily be the result of a bad pilot's decisions and actions. For some, such a tool could have been very efficient to detect, judge and discipline those bad pilots, the perfect way to prevent future accident. These perception and fears - a bit caricatural - were nevertheless widely shared. And these fears were not totally unfounded.

Using recorded data for the benefit of CAT III operations was not an issue but doing so to monitor all phases of flight from all flights meant something different for the pilot community. Any flight (i.e. any pilot) could be monitored by anyone who had access to the records, even by those who had little or no flight operations expertise. Flight data monitoring programs had great value and deserved to be implemented but this had to be done with great precaution. This was discussed within the IATA Safety Advisory Committee and more particularly by British Airways, Air France and TAP representatives who were all from airlines involved in Autoland CAT III certification programs at that time.

Eventually, people of goodwill from pilots' organisations and airlines management were able to overcome these very real obstacles. They were deeply convinced that, if properly used, recorded data could contribute efficiently to prevent accidents.

At Air France, an FDM agreement was signed in April 1974. And in order to demonstrate to all pilots the value of the program, an FDM bulletin was created and published four month later, in August 1974, in order to share the most interesting events. But without input from the pilots involved, the lessons were limited and sometimes only hypothesis. In 1984, the FDM agreement has been modified in order to have access to pilot's feedback. A non-pilot trusted person - at this time there was no notion of gatekeeper - was assigned to contact pilots and was responsible for keeping their anonymity.

At BA, very similar programme and solutions were developed - still in use today - known as SESMA, which is Special Event Search and Master Analysis. An agreement was made with the BALPA union such as only the fleet specific BALPA SESMA representative was able to identify the pilot (in fact an independent trusted flight ops manager had the ability to find out which crew was involved in a SESMA event and pass that name to the union rep).

This was a major innovation for flight safety. Nevertheless, it remains limited to a small number of airlines for decades, mostly European, before beginning to be adopted slowly across the world. This process required on-board equipment as well as software and human resources on the ground. And above all, it needed strong internal rules to maintain a minimum level of trust. FDM program worked but flight data monitoring programs remained perceived as a threat by most pilots. While they understood perfectly the need of recorded flight data analysis in case of accident, they were very cautious about its use for daily flights. Because “confidentiality” and “anonymity” barriers were robust enough, they simply trusted the program.

As necessary as they were, these barriers had serious drawbacks mainly regarding FDM information sharing and innovations. FDM rules in place within the agreements were so efficient and so well respected that no one dared to change anything. Many initiatives to make it more flexible for the benefit of safety, or to introduce some innovation were always feared to undermine the precious agreement. As said before, it took 10 years to Air France, one of the FDM pioneer airline, to be able to communicate FDM events to the interested crews and get in return, anonymously, their valuable feedback.

Having in mind that any misuse could have jeopardized the whole program, what had been put in place was most often considered as enough and interesting suggestions were dismissed. Although these FDM programs worked well in some airlines, they were nearly frozen and stayed resistant to any change. In the meantime, year after year the digital digitalization was transforming all compartments of flight operations including many other safety processes. As a result, during more than 40 years of the AF, BA and TAP initiative, individual pilots were kept away from their flight data. It is only when something wrong had happened, and an FDM event had been identified, that pilots could receive their data. It is no surprise that pilots and airlines attitude regarding everything related to flight data monitoring remained defensive to the point that FDM potential stayed largely underexploited.

### **Who owns the QAR data?**

During the recent EASA/FAA conference in Cologne, a participant to a conference session dedicated to safety intelligence asked: “Who owns the QAR data?” The question is simple, but the answer is not. The session panellists did not really answer it. However, it deserves more attention, at least in the context of this article. One pragmatic approach is to say that recorded flight data “belongs to those who use it”. So, let’s have a look at these users. First, we have experts from airlines safety departments who may process the data either directly through their own program or through FDM subcontractors. We also have experts from large organisations such as the FAA through its ASAP program where its subcontractor is processing large amounts of aggregated data provided by airlines. Experts from manufacturers are also collecting and processing operational recorded data as well as experts from research team working closely with airlines on very specific safety topics. There are also consulting companies specialized in fuel cost reduction having contracts and agreements to use aggregated data. All these programs and contracts are formally defined in order to guaranty the anonymity of data. Individual pilots are never identified, and airlines anonymity is also part of the agreements in programs such as the ASAP program in the US and more recently, the EASA Data for Safety (D4S) program. All experts involved in these activities can be considered as users and could be considered as detaining a part of a shared data ownership, not the pilots.

Individual pilots of these flights are simply not part of the list of users.

Some may say that pilots benefit from this flight data indirectly and collectively through training programs oriented through or safety awareness bulletin based on deidentified data analysis. Regarding individual access to data, some may also say that pilots may ask their airline whenever they want to look at part of their data. As this is true for only a limited number of airlines, these airlines have no resource to answer if requests become too numerous. And to be honest, when this happens, pilots are often given non-intuitive lists of figures and curves with little explanations. This does not encourage pilots to do it again. In some cases, pilots could visit the department and have a look at the 3D animation tool detained by the safety department, when the safety managers have time to do so. And we could add that pilots are also hesitating when they ask for recorded data coming from their own flights, even when there is no deviation, just because they fear to be suspected of having made some errors and not reported them. Again here, the same defensive attitude regarding recorded data is dominant.

The truth is that, well into the digital age, more than 40 years after the first FDM programs, individual airline pilots still do not have a direct access to their own flight data. Today, even general aviation pilots can look at a record of their flight path on their tablets (Fig X).

## Breaking the barriers

In 2017, by its decision to give their pilots a direct access to their flight data on their professional tablets, All Nippon Airways (ANA) broke the barriers. This has been made possible thanks to a powerful and well thought combination of internet and data processing tools. Flight data is translated and displayed under an intuitive format consisting in very detailed video animations of the cockpit instruments simultaneously with the aircraft flight path. Thus, each of the 3000 ANA pilots could freely replay key animated periods of their own flights. Since then, a daily average of 200 video animations per day are reviewed.

Tomorrow, in addition to the very first users (ANA and Ryanair), other airlines will use similar programs. This can be considered as a major and long-awaited step, comparable to the birth of FDM in the early 70s in Europe.

First, how does it work? After each flight or series of flights, QAR data is sent as usual to the airline FDM server through a wireless communication channel. But in addition, this QAR data is now encrypted and uploaded into a dedicated secured server where high-performance video animation software is placed. When a pilot needs to review one of his take off or one of his approach and landing, whenever he wants, he just opens the list of his previous flight numbers displayed on his tablet through the application and click on the flight he wants to see. The animation is then created in the cloud and made accessible (Fig. 1)

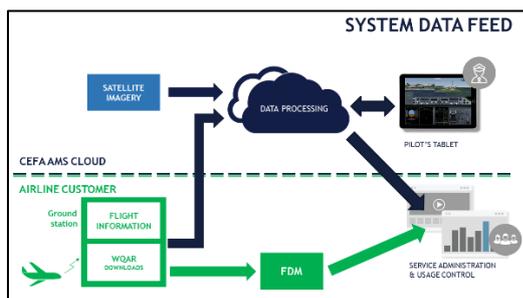


Fig. 1: QAR data processing for both mobile service and FDM program. (Courtesy CEFA Aviation)

Each commercial aircraft type is available in this mobile service in order to make images as realistic as possible, particularly regarding cockpit controls and instruments displays.

Various security measures have been developed. Pilots have an access only to their own flights on a personal account. No one else can see it. The animations must be reviewed on a streaming mode and cannot be downloaded on a tablet. Data is deidentified. The airline Flight Data Monitoring program remains unchanged: FDM events are monitored and addressed by safety team the same way. The same confidentiality and anonymity rules which made possible the very first FDM programs in AF, BA and TAP in 1974 are still in place. Individual pilots are still protected from any misuse. More protections can be applied depending on each airline policy.

How far is such an innovation justified? Pilots could answer: "Hundreds of experts from various organisations are looking at "their data", why not us?" If it is technically feasible today, at a reasonable cost while complying with anonymity and confidentiality rules, access to their own flight data by pilots will be perceived as a "right" and does not need to be justified further. But there is more than this.

A premonitory article published in 1966 by Flight International suggested that more use should be made of FDRs in normal service to "monitor pilot approach performance" and that airline managements should be persuaded that "flight recorders aren't just crash recorders"... they are pilot training aids". Today, we could write it this way: "QARs tool are not only there to detect FDM events, they are pilot training aids". This is exactly the point.

From the very first flight hours experience, every single pilot is mentally reviewing each of his flights to understand what went well and what not. When it relates to his first solo flights, it is not exaggerated to say that it is a very personal question of life or death. Pilot culture is made of that. Airmanship, experience building, learning processes is based on this capacity to question his own performance and identify potential ways of improvement. After a flight, this process is essentially based on pilot's memory, and when it comes to flight training, to flight instructor's memory.

In modern and complex aircraft, many situations happen in such a way that they are impossible to be memorized correctly. Even experienced flight instructors are missing significant aspects of a pilot performance. As an example, autopilot mismanagements scenarios are often very dynamic and complex. By having access to their own data, pilots can review, understand better a sequence of actions, not only by memory but from what has really been recorded. Doing so while the crew is still together will make debriefing possible and much more efficient. We are not far from Evidence Based Training principles, brought to an individual level. In a way, such a tool can be compared to videos tools used in sports to make progress. Any better understanding of things that went well or not help to improve and to build sooner the right level of self-confidence.

This "digital age approach" is going to be beneficial to pilot performance at the front line. Because it is much less visible and difficult to measure, we may tend to underestimate it but we must recognize it as a key component of airline safety performance.

On the other hand, at safety management level and as regards to possible benefits to reporting programs, we may use the same example. Automation mismanagement is hardly reported on when there are no visible effects on a flight either because they are detected and corrected early enough or because the circumstances at the time prevented them from having any consequence. Being able to replay a sequence of events will give factual evidences and encourage pilot to report.

### **What about the future?**

Hideo Morioka, All Nippon Airways Senior Director at Safety promotion and Flight Data Analysis, said: "*It has revolutionized the company culture regarding the debriefings and the use of flight data*" (...). "*It has freed pilots' speech*". By empowering pilots around the world to learn from their own flight data, daily, and not only after a visible incident or a deviation detected through FDM/FOQA programs, this change has the potential to change pilots' attitude regarding recorded flight data. From defensive, it could become more constructive. Not only because they are now sharing part of the flight data "ownership", but also because they are benefitting directly from it. In addition, new generation of pilots are more familiar and positive about new IT tools which make them more autonomous. This could unlock historical barriers and make possible future developments beneficial for the airline SMS.