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

by **Capt. Bertrand de Courville -** bdecourville@gmail.com

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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 exceedance or flight path deviation. 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 were 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 many 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 they are 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 identify and discipline those bad pilots … a supposed perfect way to prevent future accidents. 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 during IATA Safety Advisory Committee meetings, more particularly with British Airways, Air France 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 all deeply convinced that, if properly used, recorded data could contribute efficiently to prevent accidents.

At Air France, an FDM agreement was signed in January 1973 an officially put in place in April 1974. And in order to share the most interesting events and demonstrate to all pilots the value of the program, an FDM bulletin was created and published four month later, in August 1974. But without input from the pilots involved, the lessons were limited and only probable scenarios could be drawn from the data. Some years later, the FDM agreement was modified and access to pilot's feedback was made possible. A trusted person - at this time there was no notion of gatekeeper - was assigned to contact pilots and was responsible for keeping their anonymity.

At British Airways, a very similar programme was developed - known as SESMA, which is Special Event Search and Master Analysis. An agreement was made with the pilot's union BALPA, so that 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 representative).

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 an absolute 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 several years at 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. In the meantime, year after year, the digitalization was transforming all compartments of flight operations including many other safety processes. As a result, during more than 40 years of the AF and BA pioneering initiative, individual pilots around the world were kept away from their own 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 mostly defensive.

Who owns the QAR data?

During the recent EASA/FAA conference in Cologne, a participant to a 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/FOQA 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 can 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 more than a limited number of requests. 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. And we could add that pilots are also hesitating to ask 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 free and direct access to their own flight data. Today, even general aviation pilots can look at a record of their flight path on their tablets.

Breaking the barriers

The change came in 2017 when All Nippon Airways (ANA) decided to break the barriers.
The airline gave their pilots a direct access to their personal animated flight data on their professional tablets and, by the way, won a digital innovation award from the Japanese Ministry of Economy.

This has been made possible thanks to a powerful and well thought combination of internet and data processing tools developed by CEFA Aviation, a French based aviation software company. Flight data is translated and displayed under an intuitive format consisting in very detailed video animations of the cockpit instruments simultaneously with the 3D aircraft flight path. Thus, each of the 3000 ANA pilots could freely replay key animated periods of their own flights. Since then, nearly 250 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.

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)

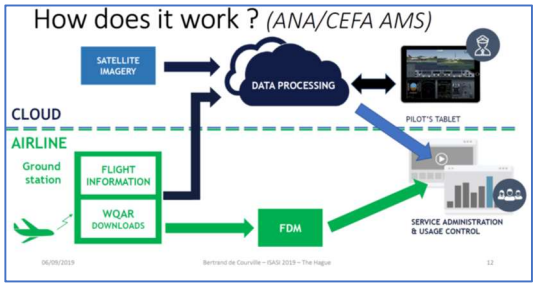

Fig. 1: QAR data processing for both mobile service and FDM program. (Courtesy CEFA Aviation)

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 in the early 70s 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.

Regarding training aspects, in1966 Flight International magazine published a premonitory article suggesting that "*airline managements should be persuaded that flight recorders aren't just crash recorders*" …" *they are pilot training aids*". This is exactly the point.

From his very first flight hours experience, every single pilot mentally reviews each of his flights, trying to understand what went well and what not. Pilot culture is made of that. Airmanship, experience building, learning processes are based on this capacity to question his own performance.
After a flight, this process depends essentially on pilot's memory, and when it comes to flight training, also 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 dynamic and complex scenarios. Providing pilots with animated data help to understand better a sequence of actions, not only by memory, but from what has been recorded. This make debriefing less subjective and much more efficient. We are not far from "Evidence Based Training principles".

Regarding safety reporting aspects, automation mismanagements are common. Most often they are quickly detected and corrected early enough to prevent any consequence. This does not mean that the crew have understood or even memorized in detail the events which are unreported in most of the case. It is never comfortable for a pilot to report that has not understood something he has done in a plane. Being able to replay a sequence of events give factual evidences and encourage to share and report it.

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 modify 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 Safety Management Systems and, as such, for passenger safety.

Conclusion

Self-data animation is transforming the learning and debriefing practices for every pilot. In order to take the best out of this change, the following steps are proposed to the FSF.

1. ***Approach airlines organizations and/or aeronautical universities for further research regarding the benefits of self-data animation concept.***
2. ***Assemble an AeroSafety World article to highlight the benefits of self-data animation.***
3. ***Approach relevant organizations (EOFDM?) for examining the implementation framework in airlines.***
4. ***Construct workshops dedicated to best practices for self-data animation tool (implementation and use).***