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## **Airborne Image Recorders**

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## EXECUTIVE SUMMARY

1. The Australian Airline Pilots' Association (AusALPA) represents more than 5,000 professional pilots within Australia on safety and technical matters. We are the Member Association for Australia and a key member of the International Federation of Airline Pilot Associations (IFALPA) which represents over 100,000 pilots in 100 countries.
2. Our membership places a very strong expectation of rational, risk and evidence-based safety behaviour on our government agencies.
3. Within IFALPA's Accident Analysis and Prevention Committee, there are a number of subject matter experts, all of whom are qualified as Accredited Accident Investigators. Likewise, within AIPA, there is also a pool of trained and accredited aircraft accident investigators, most of whom have completed of courses provided by the Bureau. Consequently, the Association has both expertise as well as the direct interest of its members in considering whether Airborne Image Recorders (AIR) should be installed in Regular Passenger Transport aircraft.
4. The Association confirms its support of the IFALPA position [2], which highlights the fact that the disadvantages of installing AIRs far outweigh any possible benefits. This is based on a number of factors, which have also been highlighted by the study conducted by the UKCAA [1] which states that:

*"The research indicated that the benefits of image recorders are:*

- a. They **may** enable investigators to see whether flight deck instruments have gone blank;*
- b. They will, under certain circumstances, allow investigators to see smoke in the flight deck; and*
- c. They may enable investigators to see if a flight crew member tried and failed to resolve a problem, resulting in no record in the traditional "black box" recorder.*

*The results of the research and the associated literature review on the detection of stress and workload indicate that the disadvantages of image recorders are likely to be:*

- a. If inappropriately installed, they can pose a significant and potentially detrimental intrusion in to flight crew privacy. ;*
- b. The behaviour of a flight crew may be affected by the knowledge that they are on camera;*
- c. Installing them will incur cost and weight penalties;*
- d. Protecting the data generated by them from inappropriate use and access may require changes to the data protection legislation that currently applies to flight recorders, both in the UK and abroad; and*
- e. Use of image recorders in isolation could be actively misleading."*

ICAO Annex 6 SARPs currently provide for the optional fitment of an AIR in small aircraft (5700kg or less) for which the application for type certification is received on or after 01 January 2016, but only where it is not practical or is prohibitively expensive to record on an FDR or an ADRS, or where an FDR is not required. [10] Notwithstanding the limited application of this standard, Australia has filed a difference with ICAO against the ICAO Annex 6 Part 1 Chapter 6 Para 6.3.1.2.1 which states: "There are no requirements for Airborne Image Recorders in Australian legislation." [12]

Requiring AIRs to supplement the information captured on FDSRs and CVRs has not been extended to larger commercial aircraft because the ICAO Safety Information Protection Task Force (SIPTF) (and its successor, the Group of experts on the Protection of Accident and Incident Records [GEPAIR]) share IFALPA and this Association's concerns regarding the protection of the data from AIR as well as that of FDR and CVR. This position has also recently been reiterated by the European Union, the European Civil Aviation Conference and Eurocontrol at the ICAO Second High Level Safety Conference [13], as well as previously by the Flight Safety Foundation.

5. It is understandable that there was a public outcry (fuelled by a media frenzy and political expediency) to react to the terrible tragedy of German Wings Flight 9525. That outcry has abated in response to the news cycle shifting to new events. Critically, an AIR would have added no technical value to the outcome of that investigation beyond that provided by the FDR and CVR. Any politically motivated reaction to that tragedy has now lost its impetus and the Association wishes to ensure that there is no consequent change to international and domestic legislation on such a specious basis.
6. While the Association has great faith in the legislative protection for safety data in Australia, Australian designated international airlines and other classes of Australian operations take place daily around the world in jurisdictions that neither reflect the Australian Government's approach to holistic flight safety or its approach to privacy and human rights. The abuse, misuse and lack of protection of Cockpit Voice Recorder (CVR) data by the media, together with the judicial impounding of both FDR and CVR data for criminal investigation and/or likewise subpoenaed for civil action in certain jurisdictions provides no confidence that image recorder data will be protected or used for its primary purpose in aircraft accident investigation.
7. **The Association's position is that the human and financial costs of installing AIRs far exceed any technical investigative benefit and that any suggestion of changing international standards to implement mandatory fitment is extremely premature.**

## **AIRBORNE IMAGE RECORDERS**

### **1. Introduction**

The Australian Airline Pilots' Association (AusALPA) is presently comprised of the Australian and International Pilots Association (AIPA) and the Australian Federation of Air Pilots (AFAP) and represents more than 5,000 professional pilots within Australia on safety and technical matters. We are the Member Association for Australia and a key member of the International Federation of Airline Pilot Associations (IFALPA) which represents over 100,000 pilots in 100 countries.

AusALPA, through its Safety and Technical Sub-Committee, is committed to protecting and advancing aviation safety standards and operations. We are grateful for the opportunity to provide the Australian representatives to ICAO with an understanding of our position on airborne image recorders. Although IFALPA is a permanent observer to ICAO and will represent the global view, we think that it is appropriate to supplement that view with a more specific national view – after all, the position of the Australian Government must be contextually aligned with not only our international operations but also with the impact of any flow-on to our domestic legislation and policies.

### **2. Rational Risk and Evidence-Based Safety Behaviour**

AusALPA members have an expectation that changes to international standards and the flow-on changes to domestic legislation and policy must originate in rational rather than emotional decision-making that is a balanced response to verified risks identified by direct evidence or, at worst, predicted by credible experts based on emerging trends in the historical evidence.

We acknowledge that there are times that political decisions are made in very short timeframes that are designed to enhance or sustain public confidence or even to moderate public concerns in other circumstances. However, it is our firm position that all such decisions should be accompanied by a timely review or a fixed period for any imposition to be removed.

In the present case, AusALPA also acknowledges that changes to the ICAO standards in relation to Airborne Image Recorders (AIRs) are not being led or even proposed by Australia. Nonetheless, our expectation is that Australia's representatives will strongly resist changes driven by other country's politics or when the case for change is not adequately made out.

### **3. Accident Analysis and Prevention Capabilities**

The worldwide professional pilot community is well populated with subject matter experts in all facets of aviation. AusALPA, like IFALPA, has members who have world class knowledge in human factors, training, aviation infrastructure, route analysis, aviation economics, experimental test flying, etc. who have supplemented that knowledge with internationally recognised and accredited training in accident investigation, analysis and prevention. Many IFALPA members have practical experience as observers and advisers at significant aviation accidents.

To the greatest extent practicable, AusALPA members avail themselves of the various courses offered from time to time by the ATSB and other international bodies. AusALPA maintains an Accident Analysis and Prevention (AAP) Committee, mirroring the AAP Committee of IFALPA, through which we remain in touch with AAP related matters both internationally and locally. Importantly, AusALPA has access to global resources as well as a relevant level of expertise to comment and assist in AAP matters such as, in this case, AIRs.

Unlike most of the decision-makers, we are immersed in the operating aviation system and exposed to the real risks every single day. There should be no quibbles about our self-interest – we exist to protect our members where and when the aviation system does not. The self-interest extends not only to preserving a safe working environment but also to broader economic issues where the imposition of unjustified costs and operating constraints unduly restricts industry growth and public benefit.

#### 4. IFALPA Position

The IFALPA position paper is attached as Appendix 1. The final two paragraphs clearly enunciate IFALPA's position:

*Considering the extremely low rate of accidents in commercial aviation, the theoretical gain provided by AIR use in an accident investigation would be minimal and has not been proven to enhance safety. This is to be weighed against the massive infringement of privacy represented by video recordings, as well as the fundamental personal rights of the flight crews.*

*Therefore, until the misuse of recordings and transcripts has been effectively prevented, IFALPA will remain strongly opposed to the installation of AIRs. The Federation supports expanding the existing technology of the Flight DATA Recorder (FDR) to provide a better understanding of the state of the aircraft and believes that Safety Management is the most effective way ahead for proactive safety improvement.*

#### 5. AusALPA Position

AusALPA has reviewed and confirmed our support for the IFALPA position. We have set out in the following paragraphs our analysis in the Australian context that underpins that confirmation.

Furthermore, based on our contextual review, **AusALPA's position is that the human and financial costs of installing AIRs far exceed any technical investigative benefit and that any suggestion of changing international standards to implement mandatory fitment is extremely premature.**

#### 6. Our Concerns for the Implementation of AIRs

In reaching our respective positions, both the Association and IFALPA have compared the potential benefits and disadvantages of AIRs. The Association is aware that a number of aviation accident investigation agencies have or continue to support AIR implementation, including the NTSB, TSB and the UK AAIB. These proposals are for AIRs to supplement the existing FDR and CVR requirements.

It is important to distinguish these proposals from the Annex 6 SARPs that ICAO enacted in 2010 and which provide for the optional fitment of an AIR in small aircraft (5700kg or less) for which the application for type certification is received on or after 01 January 2016, but only where it is not practical or is prohibitively expensive to record on an FDR or an ADRS, or where an FDR is not required. Those AIRs are very basic and need only be "*capable of recording flight path and speed parameters displayed to*

*the pilot(s)*".[10] To the best of our knowledge, neither the FAA, TC, UKCAA nor CASA [12], have to date mandated that Class C AIR requirement

The proposal we are concerned about is far more invasive than the "goPro is better than nothing" option mentioned above. It is driven by a search for data, potentially useful but not guaranteed to be so, that the existing onboard recorders do not currently capture. It seems to be incontrovertible that the more esoteric the data sought becomes, the more astronomical the cost of capturing it, so we need to note some of the outcomes of the research project conducted by the UKCAA:

*"Although the accident investigation agencies believe benefits could be obtained from flight deck image recording, it has, so far, been difficult to define exactly what information they could provide that is additional to the information provided by FDRs and CVRs."* [1]

**a. Potential Benefits in Enhancing Accident Investigations**

**(i) Recording of Instruments, Datalink and Switch Positions**

US ALPA clearly identifies the downside of one of the often touted potential benefits:

*"Contrary to popular opinion, compared to the precise data provided by the DFDR and forensic evidence, video imaging is an imprecise form of information. If an image shows a pilot's hand moving toward a switch or moving his or her leg that does not prove that he/she activated that switch or made an input to the rudder, whereas the DFDR will show the exact state of each switch, the exact amount of rudder input. Given the proper sensors, the DFDR can even distinguish between the pilot pushing on the pedal and the pedal pushing on the pilot—a distinction impossible to determine with video."*[3]

**(ii) Smoke Detection**

It is possible that smoke could be detected. However, in the analysis of Scenario 4, the UKCAA research project report concluded that:

*"...the initial analyses of this scenario would appear to indicate that an image recorder is not guaranteed to detect smoke in the flight deck, even if it is visible to the crew. This implies that one of the proposed uses of image recorders cannot necessarily be achieved."*[1]

**(iii) Crew Behaviour (non-verbal communication)**

One of the prime benefits claimed by supporters of AIRs, including investigators, is that non-verbal crew communications and crew behaviour could be recorded. Whilst the research trials did not specifically address this subject, a "literature review" was carried out by the UKCAA to determine the use of image recorders in analysing crew behaviour.

The UKCAA research project notes that:

*"...it is not possible to determine how stressed a person is from looking at their face and, although in some cases it can be possible to determine it by listening to their voice, it is very difficult. However, human beings do display predictable behavioural patterns in response to stress and/ or high workload."*[1]

*"It further notes that detection of any of the (following) behavioural patterns is dependent on a forward facing image recorder system (i.e. one whose cameras point from the rear of the flight deck to the front of the flight deck). This is because detection of these behaviour patterns relies on looking at physical actions performed by the crew together with the relevant flight deck*

*instruments they are interacting with. Views such as these could not sensibly be gained from rear facing cameras.” [1].*

However, The report also concludes that, based on evidence, rear-facing cameras can have a negative effect on crew performance, especially in high stress/high workload situations such as emergency situations and should, therefore, be prohibited.[1]

## **b. Potential Disadvantages in Enhancing Accident Investigations**

### **(i) General**

It should be understood that the installation of Airborne Image Recorders is not a new issue to IFALPA and its Member Associations. It has been discussed and debated over many years, since the potential technology became available. The disadvantages have not altered, except that the increased abuse and misuse of CVR data over this recent period has provided the evidence that the reservation of the pilot body is justified.

### **(ii) Protection of Data and Pilots Privacy**

Commercial pilots are already appalled by the leakage of the CVR data for some recent events. The data has been openly aired by the media despite this being a clear abuse and misuse of such data under the provisions of the ICAO Annex 13 – Aircraft Accident Investigation. ICAO Annex 13 states that:

*“The State of Occurrence shall take all reasonable measures to protect the evidence and to maintain safe custody of the aircraft and its contents for such a period as may be necessary for the purposes of an investigation. Protection of evidence shall include the preservation, by photographic or other means, of any evidence which might be removed, effaced, lost or destroyed. Safe custody shall include protection against further damage, access by unauthorized persons, pilfering and deterioration.”*

Furthermore, it states:

*“...inappropriate use refers to the use of safety information for purposes different from the purposes for which it was collected, namely, use of the information for disciplinary, civil, administrative and criminal proceedings against operational personnel, and/or disclosure of the information to the public.”*

*“Considering that ambient workplace recordings required by legislation, such as cockpit voice recorders (CVRs), may be perceived as constituting an invasion of privacy for operational personnel that other professions are not exposed to:*

- a) subject to the principles of protection and exception above, national laws and regulations should consider ambient workplace recordings required by legislation as privileged protected information, i.e. information deserving enhanced protection; and*
- b) national laws and regulations should provide specific measures of protection to such recordings as to their confidentiality and access by the public. Such specific measures of protection of workplace recordings required by legislation may include the issuance of orders of non-public disclosure.”*

It is extremely likely, indeed almost a certainty, that image recordings would be similarly misused and abused, if given the chance. This may well result in images of the crew’s last moments behind the controls of the aircraft being broadcasted on prime time television or going viral over the internet

to the utter distress of the aircrew's families and friends, whilst not assisting the investigation in any substantive manner whatsoever.

This misuse and abuse may result in surviving pilots taking steps to erase both CVR (and image recorder) data, even though this may be unlawful, in order to protect their privacy and basic human rights. Clearly, ICAO recognises this undesirable outcome from poor policy by its constant attempts to isolate the flight crew from access to recorder circuit breakers.

As a final note on the potential benefits, the research project by the UKCAA has shown that in the majority of accidents, the use of CVRs and DFDRs provide sufficient evidence for accident investigators to be effectively and accurately investigate an accident.

#### **c. Effect of Cameras on Crew Stress Levels**

The research project reaffirmed that cameras can increase the crew's stress level, especially in emergency situations:

*"There is definitive psychological evidence that monitoring people whilst they perform complex tasks has a negative effect on their ability to perform those tasks. There is also evidence that people perceive having images of their faces and facial expressions recorded to be more personally intrusive than just having their voice recorded. This means that their reactions to cameras recording images such as this are likely to be more pronounced."* [1]

The research project report concluded:

*"...that cameras can affect the way in which flight crews address situations, and their effect is potentially detrimental should they be rear facing. Since this research has already concluded that rear facing cameras do not provide useful information for accident investigation, this additional finding leads to the conclusion that they should be actively prohibited."* [1]

#### **d. Use of image recorders in isolation could be actively misleading**

Separately from the US ALPA quote above, the UKCAA research project has highlighted that image recording interpretation requires very specific training and is only useful when used in conjunction with the DFDR and/or CVR. When used in isolation or by personnel not suitably trained, it can be easily misinterpreted. Also, video images are very compelling, so it may be difficult to recognise if a misinterpretation has occurred, especially if the image is viewed without reference to other data sources and/or information.

### **7. Design and Installation of Camera Systems**

Non-proprietary information is not available on the costs of the equipment and its installation together with its maintenance. There are, however, a substantial number of factors that have been identified in the installation and performance, including:

- a. Position of cameras: these must be forward facing [1] and should "exclude the head and shoulders of the crew whilst seated in normal operating positions" [10]
- b. More than one camera may be required in order to resolve both resolution and field of view issues. [11] (see also Appendix 3)
- c. Mike Horne, managing director of AD Aerospace, a UK manufacturer of video surveillance equipment is reported as saying "Putting video cameras on aircraft is not a trivial thing" [11]

- d. “As in the case of FDR/CVR boxes, an AIR would have to be hardened against shock, heat and water penetration. Likewise, the AIR would need a recorder independent power supply (RIPS) to guard against gaps in the data.” [11].
- e. Colour recording is essential in order to accurately capture “glass cockpit” instruments and this, in turn, requires a lot of recording memory. Furthermore, it is required to be able to record clearly in all light conditions.

Finally, as the UKCAA research report noted:

*“To withstand the harsh aerospace environment, all components need to be designed and manufactured specifically for use in that environment. Taking standard off the shelf cameras and recorders designed for the office environment and using them in the air, while economically attractive, will result in early problems and many failures. Specifically, cameras need to be small, light, and reliable using solid state electronic shuttered light control.”* [1]

## 8. FAA Proof of Concept of AIR Test

In 2005, the FAA carried out a “proof of concept” test using a Beech King Air aircraft in “*which the airplane was operated in specific flight scenarios.*” The camera used was designed to provide a clear picture of the flight deck instrumentation and had resolution sufficient to read instruments and indicators. The images recorded were then sent to the NTSB in “*a format suitable for accident for accident investigation and analysis*”. [14]

The FAA reported:

*“The results of the test were favourable. The NTSB derived 51 parameters from the recorded images and in most cases, did so within the parameter range and accuracy tolerances of the regulations. In fact, the data from the images identified a FDR altimeter data correlation issue. **However, the test did reveal several challenges associated with image recording. The FAA had difficulty finding a single camera installation that operates within the tolerances of ED-112. In order to comply with ED-112 resolution requirements, our test would have had to install four to five cameras at various locations in the flight deck. The FAA also had difficulty meeting the stringent lighting condition requirements of ED-112. Another challenge was in the analysis of the images. Deriving the parametric data from the recorded images was very time consuming. It took several weeks for the NTSB investigators to derive the 51 parameters they obtained, from five minutes of image recording.**”* [14]

## 9. Cost Benefit Analysis

Regardless of whether an AIR system is designed-in or retrofitted, the cost to the industry will be enormous.

An aircraft cockpit is a forbidding environment for the capture of useful imagery. It can suffer from a wide range of vibrations, both from aircraft systems as well as the environment. It can be very smooth or to the point where the human eye cannot satisfactorily discern the required information to properly manage the system. Most importantly, the variation in lighting is extreme as it moves from strong sunlight to dead of night, punctuated by varying light intensities within the cockpit and the occasional lightning flash from outside.

The displays and switches of greatest interest are widely dispersed physically and designed predominantly to be seen from the pilot’s eye position, rather than from whatever physical location may be available for the safe fitment of an imaging device. Current technology may require the installation of multiple devices to cover the spectrum of available light at each recorder location and even the simplest of approaches would require around 5-7 locations. It is likely that the extreme cases that

attempt to record all visual data within the cockpit may require as many as 15-20 recording locations.

Importantly, image data capture is intensely data “hungry”, particularly at the higher resolutions required to ensure valid data. Robust and crash-worthy AIRs will require significant space, despite the advances in memory technology, within what is currently a highly packed airframe.

The Association is of the strongly held view that, if it is possible to set aside a budget for the installation of image recording systems, these same funds could be redirected to areas which result in considerably more safety benefits and enhancements to accident investigations, including locating aircraft in remote and/or overwater areas and recovering recorded data. In the latter case, the accidents involving Air France, Malaysian and Air Asia aircraft serve as a reminder and a principle motivator for the introduction of new technologies and the enhancement of those currently in existence. These include, but are not limited to:

**a. Extension of CVR Recording Time**

- (i) IFALPA supports the extension of CVR recording times, subject to it being predicated on current sector length only rather than an arbitrary time of 25 hours that is being proposed [6]. At present the requirement is that the CVR records 2 hours of data, but, due to this duration, in certain accidents or serious incidents, CVR data has been overwritten and relevant information has not been available to the investigation.

**b. Triggering the transmission of Flight Data When an Emergency Situation is Detected**

The French accident investigation agency Bureau d'Enquete d'Accidents (BEA) and British Airways have both carried out research which shows that the transmission of such data could be successfully triggered if certain aircraft parameters are exceeded in a similar fashion to that used for routine monitoring under a Flight Data Analysis Program (a.k.a. Flight Data Monitoring or Flight Operational Quality Assurance):

*The concept of triggering the transmission of flight data consists of:*

- *Detecting, using flight parameters, whether an emergency situation is upcoming. If so,*
- *Transmitting data automatically from the aircraft until either the emergency situation ends, or the aircraft impacts the surface. The buffered data containing the moments prior to the emergency could also be sent.” [5]*

**c. Streaming of Flight Data**

Meanwhile, according to a Bloomberg report:

*“Qatar Airways Ltd. plans to equip its fleet with an automatic tracking system amid an industry-wide push to prevent incidents like the disappearance of Malaysia Airlines Flight MH370 last year in the Indian Ocean. The system will transmit data from the plane’s flight-data recorder to the airline operations center, Chief Executive Officer Akbar Al Baker said in Doha. The technology is being tested now ahead of a fleet-wide roll-out.” [4]*

**d. Global Tracking**

- (i) The BEA has also recommended that position reports be sent from the aircraft’s Airborne Communication and Reporting System (ACARS) every minute instead of every 10-15 minutes in order to be able to locate an

aircraft within 6 nm. This stems from the difficulties in locating AF in a 40nm area, which although large, is small in comparison with the search area for MH370.

- (ii) In response, AF has already modified its fleet to provide 1 minute (approximately 6nm) position reports. In 2011, Air France modified the data link communications systems on its long-haul aircraft to report position once every minute under certain conditions [10].
- (iii) Australia has conducted a trial for certain Qantas and Virgin aircraft in the Brisbane FIR and Pacific area, providing 15 minute interval position report updates, increasing to 5 minutes intervals if an emergency situation arises. This trial is to be extended to other aircraft and to the Melbourne FIR in late 2015.

**e. Supplemental Methods to Recover Flight Data**

The NTSB has recommended that a number of supplementary measures be introduced for the recovery of flight data especially for aircraft with “Extended Over Water” (EOW) sectors [7]. These include:

- (i) Deployable recorders (presently used in military aircraft)
- (ii) Triggered flight data transmission (supporting the BEA concept)

**f. Easier Location of Recorders**

The NTSB has also made recommendations for More Effective Location of Underwater Wreckage, including:

- (i) Lower Frequencies for Underwater Locator Beacons (signal range is improved and civil/military ships/aircraft are able to detect these signals)
- (ii) Longer Battery Life (resulting both from better batteries and use of lower frequency ULBs)

**g. External Cameras**

In addition, IFALPA has long called for the installation of external cameras to all commercial aircraft to enable pilots to monitor the condition of the airframe and systems which are not visible from the flight deck (or the cabin).

**10. Regulatory Impact Assessment**

To date, no regulating authority, including CASA, has carried out a Regulatory Impact Assessment (RIA) and/or cost benefit analysis (CBA). This must be accomplished before any regulation is introduced. The UK CAP 762 recommends that any RIA “*should focus on this report plus input from the Pilot Associations and Investigators*”. It also recommends that:

*“...a further regulatory impact analysis be performed that, as a minimum, addresses the following issues:*

- (i) Protection of flight crew privacy;*
- (ii) Installation issues;*
- (iii) Maintenance issues (including those associated with maintaining camera angles subsequent to maintenance - this may require similar evidence to that required by reference document 9);*
- (iv) Replay issues (including the control of replays); and*

(v) Possible legislation issues associated with data protection.”

## 11. ICAO Position

Distinguishing the Class C AIR for small aircraft, ICAO noted:

*“ICAO received several recommendations to develop provisions for airborne image recorders and the Flight Recorder Panel has proposed amendments to Annex 6 — Operation of Aircraft for the carriage of airborne image recorders in large passenger aeroplanes. Due to concerns regarding the protection of airborne image recorders’ data, the ICAO Air Navigation Commission (ANC) deferred the discussion of the proposals pending the conclusion of the work of the Safety Information Protection Task Force (SIPTF), which was finalized in January 2013.”*[15]

The SIPTF, which was chaired by Dr Jonathan Aleck (Associate Director of Aviation Safety, CASA), put forward a series of recommendations for changes to Annex 13 – Aircraft Accident to enhance the protection of “*accident and incident records*”, including recorded data.

Similar recommendations were attributed to the Group of Experts on the Protection of Accident and Incident Records (GEPAIR) at the recent ICAO “Second High Level Safety Conference” held in February at the ICAO HQs in Montreal. [16]

At the same meeting, the concerns over the protection of recorded data were reiterated by the European Union, the European Civil Aviation Conference and Eurocontrol at the ICAO Second High Level Safety Conference [13], as well as previously by the Flight Safety Foundation.

## 12. CASA Position

In CASA’s Project OS 10/01 – Flight Data Recorders, it notes that:

*“Airborne Image Recorders (AIRs) will not be considered as part of this project (but may be considered by CASA at a future time pending the results of a Cost Benefit Analysis (CBA)”* [9].

Australia has currently filed a difference with ICAO against ICAO Annex 6 Part 1 Chapter 6 Para 6.3.1.2.1 which states:

*“There are no requirements for Airborne Image Recorders in Australian legislation.”* [11]

## 13. Conclusions

a. The results of the UKCAA research project have established that:

*“...although image recorder systems do provide some benefits, this research has not (our emphasis) found them to be as effective as has been postulated by some accident investigation agencies”. “Although the accident investigation agencies believe benefits could be obtained from flight deck image recording (for example see UK AAIB report N30LT 6/12/03), it has, so far, been difficult to define exactly what information they could provide that is additional to the information provided by FDRs and CVRs.”*

b. The UKCAA research was carried out to establish whether image recorders would assist an accident investigation and to what extent. The methodology was rigorous within the resources and scope of the project and the use of three experienced investigation agencies (the UK AAIB, the German BFU and the French BEA) provided a proven panel of experts to test the hypothesis. [1]

- c. The conclusions outline in UKCAP762 support IFALPA and the Association's position that any benefits are outweighed by the disadvantages. No similar research has been conducted, so that some aircraft accident investigation agencies are therefore only postulating on the possible benefits of image recorders. (The FAA Proof of Concept Test only established that parameters could be extracted from image recorders.)
- d. In particular, the open abuse and misuse of CVRs provides no confidence to the pilot body that the image recordings would be protected from unauthorised use and media broadcasting.
- e. There should be no amendments to ICAO SARPs contained in Annex 6 to mandate the carriage and fitment of AIRs in large commercial aircraft until the proposed enhancements to Annex 13 for the protection of accident and incident records, including recorded data, have been adopted and shown to work in practice.
- f. In addition, no RIA has been carried out. This is one of the recommendations from the UK CAP762 to assess the cost benefits of the installation of image recorders. The UK CAP 762 also recommends that any RIA "should focus on this report plus input from the Pilot Associations and Investigators". It follows that any regulatory discussion must include AIPA/AFAP representatives.
- g. Finally, should funds be available or mandated measures introduced to enhance safety and/or accident investigation, there are many other improvements that should be implemented before Airborne Image Recorders.

- Appendices:
- 1. IFALPA Position Statement 15POS16
  - 2. CAP762 Introduction and Background
  - 3. Factors to Be Considered in Regards to the Design and Installation of Airborne Image Recorders

## References

## Airborne Image Recorders (AIRs) and Recording Systems (AIRS)

AIRs and Airborne Image Recording Systems (AIRS) have been recommended by some Accident Investigation Authorities as an additional tool for accident investigations.

Whilst IFALPA strongly supports initiatives to improve safety, the Federation recalls that the extensive UK CAA study on the subject published as CAP 762 (2006) demonstrates that the use of AIR data would not provide any significant added value to an accident investigation. This study also shows that, regardless of any additional information that AIRs might give, visual data is always subject to misinterpretation, which can lead the investigation astray.

Moreover, IFALPA has identified that, when flight crews are subject to video recordings, even for training purposes, they behave very differently. There is clearly a fear of cameras, in front of which flight crews mostly focus on avoiding behavioural mistakes, to the detriment of decision-making and problem-solving. The presence of AIRS also has an adverse impact on the willingness of the crew to report events, which in itself has a negative effect on safety and accident prevention, and makes the installation of such recorders counterproductive.

The on-going misuse of audio recordings, which often end up being leaked to the media and on the public domain, with examples including American Airlines flight 965, GOL flight 1907 and more recently Germanwings flight 4U9525, clearly shows the limitations of ICAO Annex 13's provisions on CVR data protection. In light of the general public's desire for sensational pictures, IFALPA has absolutely no doubt that AIR data would follow the same path and that the protection of video recordings could not be ensured. Should AIRs be allowed, it would only be a matter of time before videos of the flight deck appear on various media.

Considering the extremely low rate of accidents in commercial aviation, the theoretical gain provided by AIR use in an accident investigation would be minimal and has not been proven to enhance safety. This is to be weighed against the massive infringement of privacy represented by video recordings, as well as the fundamental personal rights of the flight crews.

Therefore, until the misuse of recordings and transcripts has been effectively prevented, IFALPA will remain strongly opposed to the installation of AIRs. The Federation supports expanding the existing technology of the Flight DATA Recorder (FDR) to provide a better understanding of the state of the aircraft and believes that Safety Management is the most effective way ahead for proactive safety improvement.

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## CAP762 Introduction and Background

1. Several accidents and incidents in the recent past have indicated a possible need for the provision of flight deck image recording systems. The most significant of these accidents have been those where the accident investigation agencies have found it impossible to determine the exact nature of the events that led to the accident. In many of these accidents/incidents the investigators suspect that the causes stemmed from a series of human factors related events (e.g. distractions, errors) but they have been unable to substantiate this using the flight recorder data currently available to them. They have, therefore, postulated that flight deck image recorders would assist in this kind of situation.
2. Although the accident investigation agencies believe benefits could be obtained from flight deck image recording (for example see UK AAIB report N30LT 6/12/03), it has, so far, been difficult to define exactly what information they could provide that is additional to the information provided by FDRs and CVRs.
3. While flight deck image recording systems may be able to provide additional information, flight crews have expressed the concern that these systems would constitute a significant invasion of their privacy. As a result of this concern, the pilot associations require assurance that the benefits to accident investigation of the provision of such equipment would justify the potential invasion of privacy.
4. The purpose of this research project was to compare the data provided by flight deck image recording against the data provided by FDRs and CVRs and determine what, if any, additional information is provided. [1]

## Factors to Be Considered in Regards to the Design and Installation of Airborne Image Recorders

The following factors are extracted from an article by David Evans in Avionics Magazine dated August 2003. In this article, Mike Horne, managing director of AD Aerospace, a UK manufacturer of video surveillance equipment is reported to have pointed out the following factors that need to be considered:

### a. Installation and Performance

- (i) The light range: Even within a single picture, the range of illumination can vary by a factor of 100,000 between the brightest scenes above the clouds to a dimmed passenger cabin.
- (ii) The temperature range: The temperature can vary from -140 degrees F on the aircraft's exterior to more than 120 degrees F inside an aircraft parked in the desert.
- (iii) The power supply: This can vary and is subject to dropouts during engine start.
- (iv) Cabin pressure changes: The rate of change in cabin pressure can be rapid, should decompression occur.
- (v) High reliability and ease of maintainability: These are factors that must be considered.

### b. Picture Quality

Picture quality is a major issue:

- (i) To record the instrument panel, a high-resolution camera operating at a low frame rate (one frame per second) is preferred, but that capability requires a great deal of memory.
- (ii) To record human and other activity, a lower resolution and four to five frames per second is preferable, as the imagery eats up less storage.
- (iii) "You almost need two separate cameras" to cover the cockpit, says Horne. There also is a trade-off between field of view and resolution. As the area covered by the camera widens, fewer cameras might be needed, but at a "cost" of lower resolution.
- (iv) A colour capability requires more memory and is less versatile than black-and-white video. Horne explains that "black and white is more sensitive, so you get higher resolution, and it works better in low light." However, to best capture multi-coloured glass cockpit displays, a colour recording would be essential."

## References

1. Civil Aviation Authority, (2006). *CAP762: Research Project into the Effectiveness of Image Recorder Systems in Accident Investigation*.  
<http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=2527&filter=2>
2. IFALPA, (2015). *Position Paper 15POS16: Airborne Image Recorders (AIRs) and Recording Systems (AIRS)*  
[http://www.ifalpa.org/downloads/Level1/IFALPA%20Statements/Accident%20Prevention/15POS16%20-%20Airborne%20Image%20Recorders%20\(AIRs\)%20and%20Recording%20Systems%20\(AIRS\).pdf](http://www.ifalpa.org/downloads/Level1/IFALPA%20Statements/Accident%20Prevention/15POS16%20-%20Airborne%20Image%20Recorders%20(AIRs)%20and%20Recording%20Systems%20(AIRS).pdf)
3. ALPA, (n.d.). *Investigating Airline Accidents: Cockpit Video is not the Answer*.  
<https://www.alpa.org/portals/alpa/pressroom/inthecockpit/CockpitVideo.htm>
4. Kamel, D., Bloomberg Business, (2015). *Qatar Air to Test Flight Tracking After Malaysian Disappearance*.  
<http://www.bloomberg.com/news/articles/2015-01-08/qatar-air-to-test-flight-tracking-after-malaysian-disappearance>
5. Bureau d'Enquêtes et d'Analyses, (2011). *Triggered Transmission of Flight Data Working Group Report, Technical Document*  
<http://www.bea.aero/en/enquetes/flight.af.447/triggered.transmission.of.flight.data.pdf>
6. IFALPA, (2015). *Position Paper 15POS15: Extension of Cockpit Voice Recorder (CVR) Duration*  
[http://www.ifalpa.org/downloads/Level1/IFALPA%20Statements/Accident%20Prevention/15POS15%20-%20Extension%20of%20Cockpit%20Voice%20Recorder%20\(CVR\)%20Duration.pdf](http://www.ifalpa.org/downloads/Level1/IFALPA%20Statements/Accident%20Prevention/15POS15%20-%20Extension%20of%20Cockpit%20Voice%20Recorder%20(CVR)%20Duration.pdf)
7. NTSB, (2015). *A-15-001-008 Safety Recommendation, Reply to FAA*  
<http://www.nts.gov/safety/safety-recs/reclatters/a-15-001-008.pdf>
8. ICAO, (2014). *Global Tracking 2014-WP/8, Multidisciplinary Meeting Regarding Global Tracking, Aircraft Tracking*  
<http://www.icao.int/Meetings/GTM/Documents/WP.08.France.Aircraft%20tracking.pdf>
9. CASA, (2011). *Project OS 10/01: Flight Data Recorders*  
[http://www.casa.gov.au/scripts/nc.dll?WCMS:PWA::pc=PC\\_93551](http://www.casa.gov.au/scripts/nc.dll?WCMS:PWA::pc=PC_93551)
10. ICAO. *Annex 6 Operation of Aircraft Part 1 International Commercial Air Transport- Aeroplanes*
11. Evans, D., Avionic Magazine, (2003). *Safety: "On Camera: Inside and Out"*  
<http://www.iasa-intl.com/folders/belfast/cctv/CCTV-1.html>

12. Airservices Australia, (2015). *Australian AIP Supplement H15/15: Differences from ICAO Standards, Recommended Practices and Procedures.*  
<https://www.airservicesaustralia.com/aip/current/sup/s15-h15.pdf>
13. ICAO, (2014). *ICAO Working Paper No 38: Second High Level Safety Conference (HLSC 2015) Planning for Global Aviation Safety Improvement.*  
[http://www.icao.int/Meetings/HLSC2015/Documents/WP/wp038\\_en.pdf](http://www.icao.int/Meetings/HLSC2015/Documents/WP/wp038_en.pdf)
14. ICAO, (2007). *A36-WP/300: ICAO Assembly — 36th Session Technical Commission, An Outline Of The Development Of Work On Flight Data Recorder Systems*  
[http://www.icao.int/Meetings/AMC/MA/Assembly%2036th%20Session/wp300\\_en.pdf](http://www.icao.int/Meetings/AMC/MA/Assembly%2036th%20Session/wp300_en.pdf)
15. ICAO, (n.d). *ICAO Action*  
[http://www.icao.int/safety/airnavigation/AIG/Documents/Safety%20Recommendations%20to%20ICAO/ICAO%20actions/f-zf100701\\_Action.pdf](http://www.icao.int/safety/airnavigation/AIG/Documents/Safety%20Recommendations%20to%20ICAO/ICAO%20actions/f-zf100701_Action.pdf)
16. ICAO, (2015). *HLSC/15-WP/104: Second High Level Safety Conference (HLSC 2015) Planning for Global Aviation Safety Improvement.*  
[http://www.icao.int/Meetings/HLSC2015/Documents/WP/wp104\\_en.pdf](http://www.icao.int/Meetings/HLSC2015/Documents/WP/wp104_en.pdf)