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incorporating Air Navigators

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DISCUSSION PAPER

FATIGUE WORKING GROUP REPORT

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The Honourable Company of Air Pilots publishes Position Papers to convey its official opinion and policy on what often may be contentious matters. It also publishes Study Papers to provide guidance on a variety of aviation topics and Discussion Papers to inform public knowledge of often-contentious areas that remain the subject of debate within the Company's committees. Prior to publication, Position Papers and Study Papers are formally endorsed by the Court of the Company, its governing body, and therefore represent the Company's official stance or guidance on a given topic. However, Discussion Papers are not formally endorsed by the Court of the Company and therefore are not necessarily reflections of the Company's current or future policy.

Position Papers - official Air Pilot opinion on the matters concerned

Study Papers - helpful guidance notes on a variety of aviation topics

Discussion Papers - illustrate areas under discussion in the Company's professional committees and Working Groups. Discussion Paper contents remain the subject of debate and therefore are not necessarily reflections of the Honourable Company of Air Pilots' current or future policy.

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INTRODUCTION

Fatigue has been recognized as a problem for several decades. The scientific and medical evidence driving the thinking behind regulations governing fatigue in aviation is continually improving. Up to February 2016, the UK airlines operated using Flight Time Limitations (FTLs) detailed in CAP 371. These FTLs were derived from the Bader Report in 1973, and were a set of prescriptive limits for pilots and Cabin Crew. Though complex, crew and schedulers had a reasonable grasp of these rules which had evolved over time. Following the Colgan Air accident, the cause of which was attributed to fatigue, the FAA updated their regulations based on the latest scientific (NASA et al.) and medical evidence. CAP 371 was replaced by the European wide EASA FTL regulations in February 2016. These represented a step change into Performance Based Management (PBM) that required every operator to have a Management System (MS, previously referred to as SMS and FRMS and often in error even within EASA's documentation) in place that could address fatigue issues through a reporting system that was underpinned by a Just Culture. The EASA FTLs might appear prescriptive, but operators were expected to moderate their schedules both in response to fatigue reports and the predictions of scientifically based models.

There have been widespread concerns expressed by the pilot and CC community about commercial pressures overriding the threat of fatigue. Not only have there been incidents where crew have involuntarily fallen asleep in flight, there is growing evidence that fatigue has a detrimental effect on pilot and crew vigilance, alertness and CRM capabilities. Industry has accepted that good CRM brings safety and commercial benefits. Therefore, since there is such a strong correlation between the two, the public would reasonably expect a similarly robust attitude towards fatigue.

Regulatory authorities (EASA, FAA, Australian, NZ, HK and Far Eastern) are moving towards a common risk level in fatigue. Despite using different models, their vision is a level playing field on fatigue regulation so that all operators provide an acceptable level of safety. The FAA has also conducted a study that shows that sound fatigue management actually has financial benefits for the operators (Ref 1).

With regard to the new EASA FTLs, the UK CAA believes that they provide an appropriate level of protection against fatigue for UK operators and those of all other EU Member States, and that these FTLs significantly strengthen the previous EU requirements on flight and duty time limitations contained in Sub-Part Q of EU-OPS.

The EASA view on these regulations was given in 2012 by their spokesperson, Mr. Jean Marc Cluzeau, the Head of Flight Standards Rule Making Directorate:

".. fatigue, in terms of contributory factor to accidents as we see in Europe, is not what we would qualify as a safety issue."

Such a statement provides a valuable insight into EASA's approach to fatigue when formulating these regulations.

The CAA has indeed a noble vision. However, it is dependent upon the adoption of a common culture and a proactive, balanced and safety-focused approach by both operators and regulators. Those NAAs that are funded by the industry that they regulate or oversee, such as the UK's CAA which derived a large portion of its income from UK commercial airlines, are vulnerable to the challenges of "conflict of interest".

The MS required for the EASA FTLs needs a holistic approach that includes the principles of a Just Culture, if a Performance Based System is to, be effective, and for safety margins to be maintained. It is crucial that the operator has an MS that is beyond a 'box-ticking exercise' and is one that is capable of addressing the real issues of fatigue. The MS is meant to be both anticipative and reactive. The operator's FRMS/MS is expected to 'learn' through crew reports, thus to mitigate against fatiguing schedules. However, this is reliant upon a Just Culture being in place, where the workforce trusts their management. Without this there will be a paucity of reporting which itself can be taken by the airline management as an indication that its operation holds no crew fatigue issues. This is a current concern of the CAA, and there is evidence that the implementation of a Just Culture is patchy and variable within and across operators.

The safety of an aircraft is dependent on a team of people each with different expertise. The present EASA regulations only cover crew, schedulers and responsible managers. Engineers, load controllers, ground handlers and others all have a function in the safety chain of a responsible MS. The omission of these groups from fatigue training and regulation deserves comment. A concern already raised by ETF (European Trade Union)

The CAA disbanded its department assigned to focus on FTL. This is a retrograde step that leaves the operators no clear point of contact with the authority to resolve complex and ambiguously worded regulations.

This paper outlines the current situation which indicates that the move towards a holistic and effective fatigue management system that employs PBM and a Just Culture is inconsistent, and that the introduction of the EASA FTLs was a step too far.

THE ISSUES

Medical

When the EASA regulations were introduced, concerns were raised about the complete lack of medical input and the selective use of science. Under Article 8a of Council Regulation 3922/91 EASA the committee drawing up the new legislation was given a clear mandate to review Subpart Q of EUOPS in the light of the most recent scientific and medical evidence

There has been no medical evidence to support these new regulations. EASA's own Medical Expert Group was never consulted. There has never been an in-house medical advisor who had any expert knowledge. It is understood that no one NAA or individual can make recommendations without discussing the subject with the whole group. It has to be a harmonised opinion. The MEG is made up of the CEO's of all the constituent NAA's plus the appointed medical representatives of all the official aviation organisations within the EEC. Examples such as the European Cockpit Association, IFALPA, IAOPA, and the Aviation Sport Groups are included. As the Regulations came basically from the old JAA, they never consulted what was then the Medical Committee.

The indications, based on feedback from crews and medical knowledge, are that by increasing the limits of the FTL's, the safety bar has been lowered. This casts doubt on the assertion by the CEO of

the CAA to the TCR (Ref 2) that the safety bar would not be lowered for UK operators with the introduction of the EASA FTLs

There are basically two types of fatigue, Acute and Chronic.

Acute Fatigue is that experienced in a sequence of duties that may be within prescriptive limits, but should be recognised by the operator's FRMS. It is rectified by allowing a suitable period of rest for the crew member concerned.

Chronic Fatigue has long term medical consequences. It is bought on by irregular sleep patterns, Circadian Rhythm changes, eating at odd times, plus a whole host of domestic and personal factors. As this disorganised time progresses, the normal pattern of life begins to break up and minor irrelevant things become to the affected person, very important. The very important things become minor, so safety procedures, normal balanced speech and temper can change. Some of the behaviours and symptoms of an affected person can include aggression, ignoring warnings, feeling very depressed, crying, laughing at the oddest thing, and keep falling asleep. This has direct bearing on CRM. There are a myriad of symptoms frequently misunderstood and misdiagnosed by those with limited knowledge. If left unchecked and undiagnosed, it can take many months, even years, to correct.

"Chronic Fatigue Syndrome" (CFS) does not appear on any Insurance Underwriters list of medical conditions. An airline which runs any medical insurance/loss of license scheme for its employees has to specify which conditions are to be insured. Many if not most mental illnesses are excluded. We maintain that CFS is different. It is not a mental illness as such, but is an occupational medical condition, bought on by the working conditions imposed by the airline. This argument is under discussion at this time by one of the Underwriters. Physical accidents at work are covered, but CFS is taking a little longer to be understood as a work related illness, which it is and should be recognised as such. CFS should also be in the medical section of the EASA manual.

Both Acute and Chronic fatigue are part of an operator's responsibilities for "duty of care". This has been recognised and achieved by one operator in the following case:

> A Training Captain with a major airline, who showed marked symptoms of CFS, is now fully recovered. It took 3 months. Following medical advice, the individual's roster pattern and training schedules were modified to reduce the likelihood of recurrence. The management have been very sympathetic.

Whether there are examples of such fatigue management being applied to less senior crewmembers is not known. Perhaps it would have been better if this airline's MS had been able to anticipate the CFS rather than be reactive.

In April 2011, a survey was conducted with 50 UK registered Aviation Medical Examiners. This exercise revealed that most AMEs (66%) considered fatigue as one of the two systems areas with the greatest potential to cause an airline accident, and the overwhelming majority of AMEs (94%) were concerned about the impact of the new regulations proposed in the European Aviation Safety Agency's Notice of Proposed Amendment on Flight Time Limitations. (Ref 3) The question arises as to what these specialists, who are not without influence, have done to address their concerns, particularly as there is supportive evidence from medical renewal examinations.

The subject of medical confidentiality has been raised many times at the JAA Medical Committee. There was never a satisfactory conclusion being regarded as too difficult, and no national authority wanted to be seen addressing the problem. In the light of the German Wings disaster, and more recently another fatal aircraft crash, this issue should be addressed. Though already in place in the UK, legislation should be put in place in the wider regulatory community that defines the Duty of Care that the physician has to the general public, flying or otherwise, not just their patient. Thus, if an employee is definitely suffering from an illness or medical condition that can affect the safety of the public, the physician must inform and discuss with the employer immediately. There is no point in making more regulations for more examinations and tests for mental health. The answers lie with the primary health professional communicating with the employer. In the case of the German Wings tragedy, had the communication channels been opened, the accident would most probably never have occurred. The employers must also respond. A recent fatal accident most likely occurred, because the employers ignored reports about their pilots' health. The national authorities involved also chose to ignore the problems, as they had commercial links and outcomes. The regulatory authorities have their part to play. Whoever fails to act on information received about a genuine, not an alleged, medical problem must be made responsible for the outcome. This seems to be just as applicable to fatigue related symptoms, and we believe that it would be reasonable to quote the concerns arising from the German Wings accident in making a case for a similar approach to fatigue.

The view of the German medical community on sickness at the time of the formulation of the EASA FTLs was that "you were either fit or unfit to fly". The "why" was not considered to be important. It is possible that this "old school" culture is still existent in some medical communities, and if so, would mask fatigue related problems.

Very significantly, many operators do no not differentiate between fatigue and sickness, requiring crew (particularly cabin crew) to report sick if fatigued. A company's disciplinary process penalises a crew member for excessive absence due to sickness – for example, the Bradford Scale is used as a metric within a sickness absence policy. This is an active discouragement for the reporting of fatigue, and is contrary to the requirements of the regulations.

The regulators should require companies to have a definite scheme to properly deal with and manage absence through fatigue.

Both Acute and Chronic Fatigue can result in mood changes, the ability to communicate effectively, decision making and teamwork that are all core elements of CRM. Fatigue will also degrade attention and vigilance, points made in Annex B, one of the consequences of which is the reversion from active to passive monitoring. This Annex also points out that other causes of fatigue include boredom, which demonstrates the multifaceted nature of the subject.

Science

EASA's use of "operational experience" seems to have allowed commercial considerations to over-rule the science of fatigue available not only in the Moebus report (Ref 4) but also NASA and others However, The CAA hold the opinion that EASA has struck the right balance in taking account of both scientific recommendations and operational experience. In addition, the CAA maintains that a "lot of science" was incorporated into these FTLs. We strongly claim that there are significant omissions in the science.

Earlier studies (Ref 5) have shown that there were decrements after 13 hours awake (not duty) and 17 hrs was as serious as produced by significant amounts of alcohol. A ship's master is only allowed to be on duty for an aggregate of 10 hours in 24 (Ref 6). If the time taken for physiological needs and travelling time are included into the equation, the FDPs permitted by the FTLs can exceed the above figures and this is without taking into account the additional time for commuting home.

Much of the Moebus report has been ignored. For example with respect to cabin crew rest breaks:

> "In addition to the 30-minute meal break in a six hour period, it is proposed that cabin crew are given adequate short breaks to ensure that they remain hydrated and as a break from continuous duty. Therefore, it is recommended that 10 minute breaks are provided in each three hour period that does not contain a meal break."(Ref 4, Q17)
>
> And: "it is recommended that night duties and duties that encompass the WOCL are limited to 10 hours. It is also proposed that the number of consecutive duties starting or ending in the WOCL should be limited. Subsequently, there should be a rest period that includes at least one local night." EASA have set the limit at 11 hrs.(Ref 4, Q 4)
>
> And: the use of calendar year rather than calendar months can lead to abuse of the system and fatigued pilots.(Ref 4, Q1)

The implications of this report and the comparison with other well established risk industries seem to have been ignored by EASA. It would appear from the industry response to the House of Commons (H of C) TCR (Ref 2) that some parties invested in attempts to decry the Moebus reports and other science so that they could drive the new rules using their "operational experience". EASA was subject to significant lobbying by the Association of European Airlines (AEA) for operational experience to dominate the inputs from science and medical. Thus the vested interests of the industry seem to have had disproportionate influence over medicine and science in the construction of these new FTLs. This was reflected in comments made by Mr Cluzeau that included "economically less damaging" and "followed what the airlines wanted". Similar pressures have been seen to degrade other transport related legislation in the USA.

In addition, the regulations were constructed around Duty and Flight Time with scant regard for time awake. This is particularly relevant where the housing costs may dictate a sometimes fatigue-inducing commute of up to 90 minutes, compounded by the additional requirement for the majority of crews to pass through airport security before they are able to report. This, coupled with an operators' ability, within the Rules, to reduce rest periods may have a significant and detrimental impact on the onset of fatigue in aircrew. This is particularly relevant following the outcome from the inquest into and subsequent trial of the driver who caused the Selby rail crash (Feb 2001, fatigued driver came off the M62 onto a railway line and caused two trains to collide. 10 people were killed, and the driver was jailed for 5 years).

The EASA regulations reduce the restriction on the number of consecutive early starts without any scientific support. The CAA's own research has shown that this can cause unsafe levels of cumulative fatigue (Ref 2,Ev 81) and the view taken in CAP 371 7.1. It would appear that the operators, mindful of commercial pressure, pushed this change through under the guise of "operational experience". Even with the extension to 60 hours free of duty following 5 early starts now allowed under EASA, it is likely that acute fatigue will be an issue towards the end of this duty sequence.

One low cost carrier carried out cortisol tests on their crews and found that there was a spike during the transition from earlies to lates in a week. Though a cortisol test by itself is not a valid test for fatigue, it is not known as to what other tests were carried out by the airline to support the results of the cortisol tests.

The science on fatigue is notably lacking in some areas, and the computer models such as SAFE, FAST and BAM are helpful but not a complete answer. Some of the limitations or the computer models have been noted in (Ref 7). They are valuable tools for scheduling but require an integrated approach to form part of an effective Performance Based Management system. The CAA commissioned research into fatigue assessment tools which was conducted by Netherlands Aerospace Centre (NLR) to advance understanding of how to assess fatigue. The finding show that fatigue was subject to a number of factors and that no one assessment tool will act as a definitive measure for assessing safety risk associated with fatigue.

A number of different fatigue management and mitigation systems are being used worldwide (not to be confused with computer models such as SAFE, BAM etc). All have a holistic approach and may be constructed using differing scientific and medical guidance. For example, the FAA has a different route to fatigue management when compared with either EASA or the CAA. The CAA regard all as comparable, but that one should not "cherry pick", because the mitigations selected in each system are interdependent on each other in order to deliver the required acceptable level of safety.

A problem arises when one model / FTL combination used by one operator may allow a particular sector pattern because of built in protections, whereas another operator, quite correctly, will not be allowed to do so because their own model does not provide adequate protections. This could bring commercial pressures to bear on risk assessment for the approval of an Alt MoC when operators wish to compete on the same sector pattern – the Commercial Imperative enhanced by political pressure and compounded by the probable lack of expertise within an NAA.

A further difficulty that is arising in this subject area is that the science is becoming proprietary and having a commercial value. This could act as a handbrake on the development of fatigue management.

It is noted that one UK operator uses a variant of SAFE to help construct rosters. However, if their schedule is delayed by more than 15 minutes, this safeguarding tool is not applied as it is considered to be a time of disruption. This policy reduces the protection against crew fatigue and reflects adversely on the company's safety culture, and is a cause for concern.

The CAA said that "the EASA FTL regulations require a review in 3 years. This review is expected to go out to tender this year. No changes will be made until the review is complete and approved by the EC. This is the point where new / additional science would be introduced to influence the regulations." In the light of feedback from crews on the present use of the FTLs, this timescale is inadequate.

The regulations impose responsibility for the management of fatigue on both the operator and the crew member. There is well documented science based information on nutrition and its relationship to sleepiness, either as an aid to sleep or a means of promoting alertness. Similar information is available on exercise. The holistic approach for providing guidance for crews on rest, nutrition and exercise has not been employed by the majority of airlines and reflects adversely on the regulators. The GCAA appear to be one of the main drivers in this work, though this is currently

limited to ULR operations. One UK operator does touch on this subject, but only in their “Fatigue Avoidance Countermeasure Training” when joining the company. The pilots have to rely on any more comprehensive guidance, if available, from their Union. The training for the cabin crew in this airline is unknown, but unlikely to be better. Annex A outlines the scope of knowledge, much based on UK Government publications, in this subject area. Though this should have all been in place before the regulations came into effect, the regulator should now standardise the guidance available to crews for all off duty time, including leave. This would give crew members a basis for planning their rest prior to a duty, for which they are now responsible. Individuals would then be able to adapt the guidance to suit their own body clocks.

Corporate Operations.

In the context of FTLs, the comparison of Corporate verses Airline reveals a situation of "two nations divided by a common language". FTL guidance has always been written to address the scheduled airlines, which are the highest percentile of users. This raise the issue, that is very difficult to quantify, of company and specific sector culture.

The airline flight deck is customer aware, but insulated from any direct influence by passengers. This provides a more sterile operating environment for the flight crew In contrast, in many corporate operations, a small core of crew will regularly cover one particular owner, be it an individual or entity. This will inevitably lead to a fair amount of either direct or indirect (via the management company) contact and familiarity. Pilots, being goal oriented, in many cases this relationship can build into one of a real personal desire to go that extra mile for the client, as their mission becomes absorbed by the crew themselves. Being a very competitive sector, this can sometimes result in a failure or extreme reluctance to flag FTL and other Human Factor issues, for fear of negative reaction from the client or company, and even dismissal for perceived 'inflexibility'.

Similarly on Ultra Long Range Operations (ULRO) when flying heavy crew, although provided with a dedicated private area, some resting pilots can occasionally feel subtle psychological pressure (as if the client were wondering why they are paying for flight deck to sleep). Inevitably this will result in a poor quality break. Whilst not solely related to the private world, it is worth mentioning that even though these periods are planned, most flight deck will find it hard to completely 'shut off' from operations. A pilot will tend to monitor the aircraft, even subconsciously. This degrades the effectiveness of the rest.

Another major difference between these types of operation is scheduling. Omitting standby duty, in the Airline environment crews generally know their roster a while in advance, including report times and always the type of sector to be flown (long or short haul) dependant on fleet. This can allow them to plan their activities to ensure they are as rested as possible before report. In corporate on the other hand, one frequently encounters the situation where there is a duty period rostered, but often no knowledge of when you will be called in that window (if at all) and, more importantly, the anticipated sectors. This again makes planned, quality rest difficult to achieve as one is constantly waiting for the phone to ring. For example a short sector on day 1, LRO on day 2 and perhaps another short flight soon after, will not allow any consistent rest pattern to emerge even remaining completely within the FLT regs. With clients having the whole globe to 'play with' in an unpredictable manner, circadian rhythms are badly impacted. Similarly, cargo crews operating on a similar “no-notice schedule” find that the FTLs are not well suited their style of work.

There is a paucity of science on crew fatigue related to these types of operation. Their current FTLs would be improved with the use of existing science and medical knowledge, but more research is needed to adequately address the special challenges that exist in corporate and equivalent cargo operations. Education of corporate clients might also be necessary; it is their safety that depends on their crew's fatigue level.

Regulations

The CAA have emphasised that a holistic approach is required to the EASA FTLs and that they are not designed to be used prescriptively. They require an effective MS that, depending on the requirements of the operator, may have a FRMS in the MS structure. Regardless, it a requirement that all operators have an MS that is capable of addressing and managing fatigue. The operator's management system is expected to learn from crew reports through their MS (SMS / FRMS), and so mitigate against fatiguing schedules (Ref 1, Ev 78 para 14). Other operators outside EASA, such as Emirates and Etihad who, as part of the UAE GCAA, have adopted the EASA regulations, need to understand this requirement. In addition, the MS and rostering system should be sufficiently flexible to help a crew member manage their own fatigue – for example by giving preference to either early or late starts.

However, the EASA rules were also designed to be flexible providing that the operator could demonstrate to the EC / EASA / NAA (depending on the change required) that safety was either maintained or improved – the basis of Derogations, Alleviations and AltMoCs. Fatigue regulation was viewed as the operator not just being in compliance, but also the context of the operation was relevant. This was needed to address issues faced by some operators. For example, those providing essential services north of the Arctic Circle.

Even though the CAA contributed to the wording of these documents (EC376/2014 and the IR on reporting) to try and make them comprehensible, some of the wording in these documents could be misinterpreted because the use of "European Legal" language. However, "the CAA inspectors were trained in explaining the spirit of their meaning, and operators could refer back for support from the relevant CAA department". The CAA no longer has a department dedicated to FTL.

The attitude of a number of operators to the current EASA regulations would appear to indicate a disregard of the importance of fatigue. This was apparent on the implementation date for the new regulations of the 18th February 2016. A number of major European airlines found a clause that said that the implementation could be delayed by two months if the regulations were a "surprise". Once one operator within an EASA NAA had claimed these regulations were a "surprise", then all the operators within that NAA were entitled to the alleviation. These regulations had been available to all operators since 2014. In addition one IAG airline did not give their cabin crew trainers any notes or guidance on the new regulations until the night before the implementation date. Culture comes from the top down.

None of the concerns raised by the H of C TCR (Ref 2) were addressed prior to the introduction of the EASA FTLs. The CAA response was: "This was because the UK was a single Member State in the European collective, and the member states, not the NAAs, are the focus of the legal system. The CAA believes that it has met obligations by providing more guidance on OR and publishing its audit tool (Recommendation 1); a study on under reporting has been conducted and further work will be done (Recommendation 3); additional fatigue management requirements were added to the

regulations for the management of night duties over 10 hours but maximum of 11 hours remains (recommendation 4)."

The H of C TCR was available in 2012. In the light of what is happening now, the observation on the European collective casts doubt on the assertion by the CEO of the CAA that the safety bar has not been lowered. There has been little sign of an improvement in reporting since the TCR was published, as noted in the section on Culture in this paper, and the 10 hr limit on night flights recommended by both scientific and medical studies, has been ignored. Finally, the union representative from one UK airline commented that there had been an increase in levels of fatigue, and that this appeared to be common across other airlines.

The EASA FTL regulations are difficult to understand the intent in places and will be open to misinterpretation, either inadvertently or deliberately. (Ref 2, EV 21 and Ref 2). This is has been confirmed by the UK line pilots that we have spoken to, and these regulations are particularly challenging when fatigued. Because the operations staff on the ground have similar difficulty, this can result in a crew inadvertently operating beyond the prescriptive boundaries of the rules. We understand that this problem applies to a number of NAAs and airlines within EASA.

The law cannot be implemented and an adequate level of safety maintained if any of the regulators, operators, or crew do not understand the regulations.

The application of the rules and guidance on nutrition are lacking with a significant number of operators. Cabin crew may well not be allowed to have a meal break for the duration of their duty, and we understand that there is an ongoing court case on this issue at the moment. Other airlines may provide a break, but at the end of the first short sector followed by several longer sectors with no break. Meals should be provided at appropriate times to coincide with the natural rhythm of the body.

Without fast track financial penalties for non-compliance, the operators and NAAs will have little incentive to adopt the new regulations. As has been seen within the EU, court proceedings can take many years, by which time the operator would either be out of business or taken over by another airline. Current penalties are ineffective, and the regulators very reluctant to use the ultimate sanction of withdrawing the AOC, allowing the regulations to be flouted by the less scrupulous operators.

There is a lack of a standardised approach for measuring and reporting fatigue within aviation (Ref 3). This will reduce the metrics available to those reviewing the regulations in 3 years. This issue should have been addressed prior to the introduction of the new FTLs.

The regulations dictate that a crew member should not fly when fatigued. The decision on the level of personal fatigue is known to be unreliable (Ref 8). The Regulators should recommend a tool(s) to help crews measure their fatigue state. The options include the Karolinska Sleepiness Scale (KSS)63, the Samn-Perelli Seven Point Fatigue Scale and the Visual Analogue Scale (VAS). All these have been scientifically validated for self-assessment rating, and the appropriate ones should be incorporated within the regulations.

The safety of an aircraft is dependent on a team formed of people with different expertise. The present regulations only cover crew, schedulers and responsible managers. Airline Maintenance Engineers (AMEs), Load Controllers, Ground Handlers and others all have a function in the safety chain. Considering the increase in the use of datalink uploads of load sheets and other flight data,

the staff with such critical inputs should also be subject to fatigue management. Similarly, the cost of ground incidents is such that there is a commercial as well as a safety case for this element of the workforce to be included in the MS.

The UK continues to use the Opt Out clause from the EU Working Time Directive. AME's tasks are safety critical but they can work excessive, unregulated duty hours - some AMEs are still volunteering to work 16 hour days (Ref 9). This does not represent safe practice, and the CAA response is that the European Aviation Safety Agency (EASA) should have revised requirements in place by 2019. This might be regarded as a rather lethargic approach to a safety critical issue, particularly in the light of accidents and incidents that have been attributed to AME fatigue. ASG has already expressed the view, that we support, that it is inappropriate to continue to allow use of the opt-out and expose the travelling public to the consequential increased risk of maintenance error, until such time as an effective MS (FRMS) has been established. New regulations and the associated MS must harness the latest thinking on the medical and scientific thinking on fatigue.

The CAA confirmed that those airlines operating outside EASA that join a code share arrangement with an EASA airline need to be effectively audited to ensure that they comply with EASA regulations (Ref 10, ARO.OPS.115). This is not the case at the moment and is illustrated in the following article:

> "According to the new pay structure cleared by the Xxxx government, if a pilot refuses to operate a flight, which he has been rostered for, he would be liable for reduction of double flight hours from his flying allowance. In the event of refusal four hours prior to the departure, double the number of hours will be deducted for the scheduled flight of up to six hours. "For flights more than six hours, a flat deduction of 14 hours will be made from the guaranteed flying allowance," says the government order. "These steps will help instil the much-needed discipline in the airline. It would also help cut down delays and improve Nnn's on-time performance.
>
> Pilots can be told about ***roster changes*** through SMS, telephone, WhatsApp, email, said the new salary order. "Non-acceptance of change of flight communicated will amount to refusal of the flight. Non-acknowledgement will also be taken as refusal of the flight," the order added."

Our interpretation of this is that a pilot can be rostered for a flight at 4 hours notice, and if they refuse due to anticipated fatigue, they will still be subject to a punishment. This is not compatible either with the science of fatigue, the guidance given by ICAO (Refs 11 & 12) or the spirit of the Just Culture. There appears to have been no intervention over this ruling by the responsible airline managing the code share in accordance with their obligations under (Ref 10) for code share arrangements. If a passenger books with a code share, they should expect a consistent standard of both service and safety.

A similarly lax approach to FTLs by EASA, the NAA and the same airline managing the code share arrangements can be seen in another airline's FTL within that code share:

> "The flight time and duty time limitations in this section may be exceeded up to the limitations set by the law of the State for the following reasons:
>
> 1. To complete unavoidable operational delays (the monthly flight time ceiling shall not limit completion of the flight)
> 2. Seasonal variation in traffic load

3. Charters or short leases, if the undertaking is unable to operate within flight time limitations"

The law of the State is not given in these FTLs.

Breach of both ICAO guidelines and EASA regulations on fatigue by code share airlines could be addressed with the expansion of the Ramp Check and more rigorous auditing.

The wording of two organisations in the USA to the same regulation is of interest in that one is likely to have greater clarity to a fatigued pilot because it uses a "plain language rule" that is more readily understood. Regulations have to be readily interpretable to crew who are either fatigued or who are woken with a "can you do …" call from scheduling.

Flexible Working

The regulations do not take into account the potential masking of fatigue of employees who are on Part Time and Zero Hours working contracts

Part Time is probably the most widely applied form of Flexible Working. The temptation for the operator is to work the crew member to the prescriptive limits of the FTLs and assume that the recovery will be achieved in the longer period of time free from duty. Part Time work should be pro-rated compared to a full time contract. However, if this is not applied correctly, a crew member may find themselves actually doing relatively more work than a full time employee with an increased probability of either acute and/or chronic fatigue.

Flexitime usually provides the ability to choose the time of day to begin work 'early or late' and it is common among the low cost, short haul carriers. It is notionally a very good concept, but can have a fatiguing affect caused by disruption to circadian rhythms and working into and through the diurnal WOCLs.

Annualised Hours allows the employee has to work a certain number of hours over the year but they have some flexibility about when they work. There are sometimes 'core hours' which the employee regularly works each week, and they work the rest of their hours/days flexibly or when there's extra demand at work; this may well be affected by the seasonal work demands experienced by some airlines. Depending on establishment levels [within an airline] it may lead to periods of sustained flying to the limits of the FTLs.

Flexible Working is a very complicated issue. Given that the Regulator has now delegated so much authority to 'industry' there is bound to be a huge discrepancy between airlines that employ best practice and those that do not. Flexible contracts are prone to operating to the prescriptive limits of the FTLs that is both fatiguing and contrary to the intent of the FTLs. Furthermore, an employee may be reluctant to report that a schedule is fatiguing because it may prejudice their flexible working contract. On call/standby within any Flexible Working period may also be used to a greater extent potentially exacerbating any problems.

At present there is no publicly available data on either the number of crew members on flexible working contracts or any feedback on the relative fatiguing nature of these contracts.

Flag of Convenience.

Concern has been expressed by both the CAA and the Unions to the use of registering the AOC under a Flag of Convenience to avoid restrictive national labour / social laws. This practice goes against creating a level playing field and is likely to be used to avoid the need for effective fatigue management. This is similar to the practice of employing crew through agencies to avoid the company responsibilities' for social and legal employment law.

Regulators

The provision of adequately staffed and trained regulatory system lagged the introduction of the new FTLs. The whole process seems to have suffered from the lack of political will to invest in the support for these regulations – manpower, training and financial resources.

NAAs seem to be reducing their workforce as part of cost cutting and efficiency drives. This was supported by a recent ICAO report highlighted a 'chronic under resourcing of safety oversight personnel throughout the EU member states'. The quality of regulatory oversight is dependent on the appropriate training of inspectors. By the CAA's own admission, a number of EASA NAAs fall well short of the required benchmark. The advent of Performance Based Regulation (PBR) appears to have escalated this problem. The training assistance that the CAA is now offering to EASA and other NAAs, some of which is mentioned in the Training section of this paper, contradicts the view given by the senior management to the TCR (Ref 2). Similar training is being made available to the Unions and to AOC holders, some through CAAi and some as part of the normal CAA safety promotion with stakeholders.

When considering the effectiveness of the UK CAA , comment (Ref 3) has been made that indicate a number of operators have contravened the ANO & CAWTR. When CAP 371 was in force, it was known that some rosters constructed under the provisions of the CAP could be very fatiguing, and as such were unsafe, and therefore were illegal with respect to the articles 145 of the ANO. No airline has ever been prosecuted for a breach of article 145. It is uncertain whether the CAA, in its present form, has either the capability or the inclination to take remedial action on this issue. This is particularly concerning if operators schedule rosters to the prescriptive limits of the new FTLs.

The EASA regulations assume that all airlines have an MS that is operating effectively and as intended by the regulators. This is a risky assumption. If crew operate to the limits of the FTL, they are likely to be subject to fatigue. The operator will be using the principle that "it is legal, therefore it is safe". This is contrary to both the design and the spirit of the regulation. Furthermore, as seen with one leading UK operator, even if an operator intends to address schedules causing significant levels of fatigue, they are not given the resources to do so because the guidance from their higher management is that everything should be run at minimum cost. An effective regulator ought to be able to detect such situations and direct their rectification.

To help address the shortfall in expertise on fatigue issues within the CAA, the FTL department at the CAA should be reinstated. It should be supplemented by the establishment of a committee, based at a medical university, where appropriately qualified experts in fatigue would be able to offer advice and review specific issues for the benefit of all. Such a committee should include at least one person with expertise in occupational medicine. This is not a novel approach, as it is understood that Air New Zealand established a link with the University of Auckland (Ref 13).

Training

The training of both regulators and operators to meet the requirements of the new regulations has lagged their introduction in February this year. Many of the NAAs in EASA lacked the skills and knowledge to implement and oversee the new regulations. The CAA was prepared to provide training support and advice both within and outside the EASA's coverage. EASA believes that they are able to do this within the EU. This claim is somewhat suspect in the light of their approach to fatigue and that, for example, the number of cabin crew experienced staff at EASA has reduced from 3 to one. Because the CAA is funded by the UK aerospace industry, any training or consultancy outside the UK is undertaken on a commercial basis to recoup all costs. This support is driven by two considerations:

1. To help establish a level playing field across EASA airlines,
2. To provide a safer flying environment for those UK passengers who chose to fly with non UK operators.

In addition, the CAA has published more than was required on their website, illustrated by the guidance on Operator Responsibilities and the Audit Guide. It was the intent to be transparent in the CAA approach and offer operators and even possibly other NAAs with greater clarity of the intent of the regulations, which would assist with correct application / standardisation across EASA NAA's. The CAA acknowledged that the regulations were a minefield with continual cross-referencing further complicating their interpretation. This makes it particularly difficult, and can be prohibitively expensive, for small operators to self- provision an effective MS that includes the associated training and procedures.

A short time before the regulations came into effect the following program was put into place for the training of CAA Inspectors, including FOIs:

- 2 x 45min Computer Based Training (CBT) sessions(Just Culture),
- A 3hr briefing (Just Culture),
- 1 day training on the FTL regulations and 3 day training on FRM.
- The FOIs have a checklist of points to determine whether the AOC holder is compliant with EC law on Just Culture and the FRMS related regulations. For example:
    - Internal reporting processes are not acceptable unless they include meaningful feedback to the individual who made the report.
    - Roster stability metrics (such as planned versus achieved rosters) are included within the audit and are required within the regulations.

It would be expected that safety reporting, crucial to the effectiveness of the MS, would be encouraged throughout the organisation – from CEO to Janitor. However, reservations on the current Reporting Culture are discussed in the next section.

The timescale of this training was inadequate for the Inspectors to give much needed guidance to the operators.

With the lack of staff with appropriate expertise at EASA, EASA's declaration that they are able to provide training to support NAAs is hollow. With the probable variation in quality of training, and the likelihood of the applied outcomes of such training being less than uniform, establishing a level playing field is going to be a significant challenge.

Low Cost Training

Managers in the industry are still using the expression "you are not fatigued, just tired" to encourage personnel to accept a task. This demonstrates a lack of understanding of fatigue and reflects adversely on the quality of the training in the organisation

The training of appropriate personnel - from crew to responsible managers - has in parts evolved into a CBT based box-ticking exercise that reflects lack of commitment by regulators and operators. This has been seen in Flag Carriers. The fatigue training should cover prescribed educational material with a proper structure to the training that also encourages the reporting of fatigue. An approach similar to that detailed in CAP 737 (Ref 14) that incorporates facilitative training, would be a good start.

The observation was made by the CAA that the next year could be challenging for a number of UK operators in coming to terms with delivering what was required by the new regulations. Any shortfall could be expected to be apparent in the delivery, quality and scope of the training.

Culture

Some general points are worth making on culture with respect to FRM:

- In an autocratic, Top Down, organisation, there is unlikely to be either much understanding of fatigue or empathy with the staff on this problem.
- The implementation of a Just Culture is subject to barriers generated by the different behaviours and values held by different tribal/ethnic cultures.
- The application of a Just Culture is vulnerable to commercial pressures. Further degradation of the culture might also occur either when a company has to downsize or when management regard fatigue reports as a marker of a troublesome employee.

On this latter point, we know of two occasions when the submission of a fatigue report has been cited as one of the reasons for dismissal. Trust between employees with their management is crucial to the effectiveness of the Just Culture and such punitive action does lasting damage to trust within the workforce.

The regulators within EASA now have more powers to comment on the corporate culture of an operator:

- If an operator was resistant to implementing Just Culture, the NAA FOIs now have the "it is law" approach available, and so
- If the authority had reason to suspect that an organisation's Just Culture was fragile, then there would be greater probing in the subsequent inspection.

- However, one could expect there to be some variation on the manner in which this was applied across the EASA airlines. This could be further enhanced by the interpretation of the English used in the regulations when English is not the reader's first language

The MS (SMS, FRMS) policy statements of a number of operators seem to have grasped the concept of a Just Culture as defined in EASA law. Though some operators appear to implement this culture quite effectively, others are notable either in their disregard or their selective application of the culture when applied across the workforce. This statement includes some of the "Flag Carriers". A paper outlining the holistic nature of the Just Culture within an MS of an organisation is described in a Discussion Paper on the HCAP website (Ref 15).

On a positive note, one major carrier has:

- Encouraged the submission of fatigue reports.
- Established a proactive system whereby if a pilot submits 4 reports in 6 months, they are invited to discuss the problem with a line manager.
- If chronic fatigue support is required, there is an employee assistance program that includes counselling.
- Reports can be used to create bespoke roster patterns

The EU Reporting Directive 67, published 27th May 2014, to be adopted in the UK on 15th November 2015, describes Just Culture ambitions and protections for reporters as well as the European centralisation of reports. The CAA publication only gives protection to those matters that are firstly "in the public interest", and secondly, where the reporter has already brought the matter to the attention of the management. Unfounded allegations would not be regarded as protected and there should also be a sanction for those who may consider making a vexatious report for personal reasons. In our view, the Directive does not substantively change the protections for reporters that currently exist in the UK. Feedback indicates that this protection is ineffective (Ref 16), as can be seen for example in the lack or reports by probationary cabin crew. The USA has legislation in place to protect the employee from punitive action by the airline (Ref 17). Consideration should be given to this being implemented across ICAO operators.

Because an individual's genetic makeup can lead to a greater resilience to fatigue, some airline management may take the view towards a crew member who reports fatigue: "If you find this fatiguing, go, and we will find a crew member who does not have this problem".

A further challenge can arise when there is a conflict between good CRM practices and the prevailing national cultures (e.g. "Captain always right"). In the event of an incident the degradation of CRM could mask the source problem of fatigue in the subsequent investigation.

Reporting within a Just Culture

An effective reporting culture is a crucial part of the FTL regulations (REF 2,3,11 & 12) and, particularly in the context of fatigue, is lacking in the majority of airlines. This is a view supported by the ECA (Ref 16), and supported by a joint CAA and BALPA study (Ref 18), that notes that reporting not only inhibited by direct fear of retribution, but also subliminally by fear of reduced promotion prospects and also the job security of those pilots who are on a temporary contract. These factors cause

a “disconnect” between crew and management, and mean that the data on fatigue does not reflect reality.

It is understood that research is underway to look at ways of improving reporting. However, attempts to order the workforce to trust their management are historically unsuccessful. Instead, reliance has to be placed on the implementation of a Just Culture from the top down and across the workforce.

Notwithstanding the UK CAA’s concern for the underreporting of fatigue, if an Air Traffic Control Officer (ATCO) reports that they are fatigued then their licence is withdrawn by the CAA with immediate effect. This is a significant disincentive for the reporting of fatigue by ATCOs who are a crucial component in the safety of a flight.

A further problem can arise because there are ethnic cultures where if comment is raised by an NAA that there is a paucity of fatigue reports in an airline, then fatigue reports will be raised to meet the quota, but not reflect actual fatigue experienced.

Legal

There is a legal responsibility applicable to the operator for the people under the flight path of the aircraft. That came out in the discussion with the CAA and was illustrated in the Shoreham accident. There is still a lack of clarity on this point, but we believe that it could be an issue in the event of collateral damage as a result of an accident where fatigue is one of the contributory factors. One of the challenges on this point is that Accident Reports can be selective in their analysis, and issues relating to fatigue “buried” for convenience, with the expression “ … and the crew were rested in accordance with the regulations”. This concern could be valid when reading the interim report on FDB 981 Rostov accident, where the focus appears to be on go-around training, even though the first go-around was successful. The Fly Dubai (FDB 981 19.03.2016) accident at Rostov is expected to be subject to the same denial process on fatigue. With this in mind, the regulator and the airline managers ought to be held to account in law under when an accident occurs that has an identifiable component of fatigue. Precedent has been set with the use of the Corporate Manslaughter Continuum in the case of the Herald of Free Enterprise.

However, The Colgan Air accident in the USA triggered the FAA’s development of more robust rules on fatigue. The FAA also adopted a scientific methodology for calculating the Value of a Statistical Life (VSL) when constructing the current US FTL scheme. This appears not to have been employed by EASA regulations and the regulators should be required to demonstrate the quality of their risk assessment using the VSL or equivalent process.

CONCLUSION

Good CRM is crucial to flight safety and fatigue degrades CRM. Fatigue also degrades the Human Performance elements of vigilance and attention that not only have direct safety implications, but also implications in the realm of Automation Dependency. Fatigue should command the robust attitude that is currently applied to CRM. A holistic approach is required to the EASA FTLs, and that

it has to include the Just Culture if a Performance Based System is to be effective and the safety margins maintained. It is crucial that the operator had an MS (SMS / FRMS) that is capable of addressing and managing fatigue. The operator's management system is expected to learn from crew reports through their MS, and so mitigate against fatiguing schedules.

The committee drawing up the new legislation on FTL had a mandate to review Subpart Q of EUOPS in the light of the most recent scientific and medical evidence. Little science seems to have been used and was subordinated to the "operators experience", as illustrated by the disregard for the Moebus report. No medical evidence was used to support these new regulations. EASA's own Medical Expert Group was never consulted. In addition, the regulators were constructed around Duty and Flight Time with scant regard for time awake. Maximum permissible duty times should be revised to reflect the actual time and stress induced fatigue that crews experience both commuting to and from the airport and additionally for those who have to pass through airport security prior to report.

There are a number of FTL schemes being used worldwide. An operator must not "cherry pick" for commercial advantage, because the mitigations selected in each system are interdependent on each other in order to deliver the required acceptable level of safety.

CAA said that the EASA FTLs are not designed as a prescriptive set of regulations, but are there to underpin Performance Based Management. If not used correctly, safety could be impinged. The CAA's CEO made a statement to the TCR that "the safety bar would not be lowered with the introduction of the new FTLs". However, this was misleading and appears to be based on a hope, with no real evidence of sound fatigue management in place.

In essence, the new EASA FTLs are overly complex and ambiguous, and so confusing for the operators and crew. In addition, by the CAA's admission, the documents could be misinterpreted due to the use of "European Legal" language. The CAA no longer has a department dedicated to FTL for the resolution of queries. As a result of these factors, the regulations are open to potential abuse. The law cannot be implemented and an adequate level of safety maintained if any of the regulators, operators, or crew do not understand the regulations. Fatiguing rosters have been identified. Though there is some UK legislation regarding fatiguing rosters, it has remained unused. This reflects poorly on the capacity and intent of the regulator.

The regulations do not take into account the potential masking of fatigue of employees who are on Flexible Working contracts. They may end up working to prescriptive limits with the assumption that the individual will be able to recover in their time off. Data needs to be collected on the fatiguing nature of these contracts.

The regulations focus on CAT and are not well suited to corporate jet operators. The corporate pilots are a tight-knit community and have a closer relationship with their customer than airline pilots. This encourages a "can do" attitude that can be influenced by both commercial pressure and fear of dismissal that may lead to operations beyond the FTLs and reluctance to report fatigue. In addition, the rest breaks the corporate jet world are often degraded because of the proximity of the customer and the tendency for the resting pilot to keep monitoring the aircraft. The crew's duty period may be rostered but the nature of the operation means this will often be without real knowledge of either the expected or likely report time or the anticipated sectors, resulting in reduced quality and duration of rest prior to the duty and badly affected Circadian Rhythms. There is a paucity of science on crew fatigue related to corporate operations. Their current FTLs would be

improved with the use of existing science and medical knowledge, but more research is needed to adequately address the special challenges that exist in corporate operations. Education of corporate clients might also be necessary; it is their safety that depends on their crew's fatigue level!

Cargo pilots operating under similar no-notice style operations are also poorly served by the current regulations. This too needs to be addressed.

The combination of the problems outlined in this paper gives cause for concern that some operators will use the FTL rules prescriptively, and only pay lip service to the management of fatigue within their MS**.** The attitude of a number of operators to the current EASA regulations would indicate a disregard of the importance place by them on fatigue.

The regulations dictate that a crew member should not fly when fatigued. The Regulators should recommend a tool(s) to help crews measure their fatigue state. The options include the Karolinska Sleepiness Scale (KSS)63, the Samn-Perelli Seven Point Fatigue Scale and the Visual Analogue Scale (VAS). All these have been scientifically validated for self-assessment rating, and the appropriate ones should be incorporated within the regulations.

There is a lack of a standardised approach for measuring and reporting fatigue within aviation. This will reduce the metrics available to those reviewing the regulations in 3 years. This issue should have been addressed prior to the introduction of the new FTLs.

A quicker system for implementing change than that currently planned should be in place to compensate for the existing shortcomings of the EASA FTLs; the plan to wait for 3 years is not acceptable. In the meantime, UK should restore the safety bar to at least that provided by CAP 371 with additional measures to combat and deal with fatigue.

Within EASA, both the regulatory personnel and the operators were not suitably prepared for the new set of FTL regulations. Few operators had an effective MS capable of managing fatigue in situ by the start date of the regulations on the 18th February 2016.

A significant depth of expertise is required if an organization is to be able to take an informed view of fatigue management issues, that include rostering tools and practices. With late and potentially inadequate training for inspectors, there seems to be a lack of oversight across EASA. This also meant that the Inspectors were unable to give meaningful guidance to enable the operators to prepare for the new regulation. Delegating responsibility for the implementation of new fatigue management to untrained operators and crew members clearly carries an increased level of risk.

The training of appropriate personnel, from crew to responsible managers, has evolved into a CBT based box-ticking exercise that reflects the lack of commitment by both the regulator and the operator. The fatigue training should cover laid prescribed educational material with a proper structure to the training. An approach similar to that detailed in CAP 737 (CRM) that incorporates facilitative training, would be a good start. Such training could also be used to help address the endemic problem of under-reporting.

To help address the shortfall in expertise, the FTL department at the CAA should be reinstated. It should be supplemented by the establishment of a committee, based at a medical university, where appropriately qualified experts in fatigue would be able to offer advice and review specific issues for the benefit of all.

The UK continues to use the Opt Out clause from the EU Working Time Directive. As well as air crew,

AME's have safety critical tasks, but are allowed to work excessive, unregulated duty hours. Operator fatigue level needs to be addressed and expanded to cover other airport workers, from dispatchers and load controllers to catering truck drivers, all of whom have a role in the safe dispatch of an aircraft.

It is noted that ATCOs have an apparently punitive system embedded in their fatigue reporting in that they automatically have their licence withdrawn if they report fatigued. This must be rectified to integrate with the legal requirements of a Just Culture.

An enhanced Ramp Check combined with more rigorous auditing could help to address breaches of both ICAO guidelines and EASA regulations by code share airlines.

The practice of using Flags of Convenience to avoid restrictive national labour and social laws is increasing. Similarly, operators are using employment agencies for the same purpose. These practices go against creating a level playing field and are likely to be used to avoid the need for effective fatigue management. This should be addressed by EASA.

A holistic approach to rest, nutrition, exercise and wellbeing is required by the regulations and guidance is available. This guidance has not been provided by the majority of airlines for their employees. With the lack of effective training for the Inspectors, it has been allowed to default. Such guidance covering all off duty / rest periods should be given to crews.

Without fast track financial penalties for non-compliance, the regulations can to be flouted by the less scrupulous NAAs and operators. Such penalties should be used to supplement the ultimate sanction of the withdrawal of the AOC.

Both Acute and Chronic fatigue are part of an operator's responsibilities for "duty of care". "Chronic Fatigue Syndrome" (CFS) neither appears on any Insurance Underwriters list of medical conditions nor in the section of EASA regulations that cover medical issues. It should be.

Many operators do no not differentiate between fatigue and sickness. This often results in a crew member being penalised for reporting sick due to fatigue, a discouragement to report fatigue. The regulators should require companies to have a definite scheme to properly deal with and manage absence through fatigue.

With regard to medical confidentiality and the need for a "duty of care to the public", though already addressed within the UK, we believe that it would be reasonable to quote the concerns arising from the German Wings accident in making a case for a similar approach to fatigue where applicable.

The Shoreham display accident that resulted in regulatory action and the initiation of legal proceedings, and the Colgan Air accident in the USA that triggered the FAA's development of more robust rules on fatigue, highlight the operator's and regulator's duty of care to those under the flight path of the aircraft. Notably the issue of fatigue is usually bypassed in accident investigations. With this in mind, the regulator and operator ought to be accountable in law when an accident occurs that has an identifiable component of fatigue. Precedent has been set with the use of the Corporate Manslaughter Continuum in the case of the Herald of Free Enterprise.

The introduction of these regulations appears to be incomplete and dysfunctional; a view supported by European Cockpit Association. The delegation of responsibility from regulator down to the operator and crew member, combined with the seemingly dilatory, "low cost" light-touch oversight

by the regulator, might be perceived as a way for the regulator to shirk responsibility, and could be considered as a dereliction of duty. This is particularly concerning in view of the failings of the way in which the new regulations were both formulated and implemented, and is not acceptable.

RECOMMENDATIONS

1. The CAA needs to have a more “hands on” approach to regulation.
2. The regulator must not allow regulations to be introduced again without adequate staffing and preparation.
3. The department at the CAA that had oversight of FTLs should be reinstated.
4. A committee should be established, based at a medical university, where appropriately qualified experts would be available to review and comment on specific issues relating to fatigue.
5. The operators and CAA should be reminded of their liability for “duty of care” to third parties in the event of an accident or incident that can, in part, be attributed to fatigue.
6. The regulators should be able to demonstrate the quality of their risk assessment in relation to fatigue using tools that include the Value of a Statistical Life (VSL) or equivalent process.
7. Regulations need to be put in place to provide protection against fatigue amongst engineers; dispatchers and other airport workers who could make fatigue related errors that could affect the safety of a flight. These regulations must be embedded in the MS (SMS / FRMS) of a company.
8. Fatigue reporting by ATCOs must be aligned with the principles of the Just Culture and be non-punitive.
9. Maximum permissible duty times should be revised to reflect the stress induced fatigue and actual time that crews experience commuting to and from the airport. Time taken to process through security before reaching their report point should also be factored in where appropriate.
10. Breach of both ICAO guidelines and EASA regulations on fatigue by code share airlines should be addressed possibly through an expansion of the Ramp Check and more rigorous audits that addresses fatiguing schedules and the Just Culture.
11. Fast track financial penalties for non-compliance need to be established, supplementing the ultimate sanction of the withdrawal of the AOC, to deter the less scrupulous from flouting the regulations.
12. Data needs to be collected on those on Flexible Working contracts with a view to providing adequate regulation on fatigue.
13. New fatigue regulations that address the unique challenges of corporate operations should be produced using the best scientific and medical evidence available at the moment.
14. Such regulations should be applied as appropriate to cargo operations that have a similar style of operation to that of corporate crews.
15. The present regulations need to be made available in a simpler “plain language” format so that everyone has the same understanding of what is required to make an operation safe.
16. EASA should regulate both the use of Flags of Convenience and employment agencies as a means of avoiding effective fatigue management.

17. The practice of using Flags of Convenience and employment agencies as a means of avoiding effective fatigue management should be taken into consideration when allowing airlines to operate into UK airports.

18. “Chronic Fatigue Syndrome” should be included both on the Insurance Underwriters list of medical conditions and in the medical section of the EASA manual.

19. The responsibility for “duty of care” to the general public over-riding patient confidentiality already exists in the UK. However, pressure should be applied for this to be the case for all nations operating under ICAO as this ultimately affects the safety of the British public.

20. The regulators should recommend a tool(s) to help crews measure their fatigue state. The appropriate ones should be incorporated within the regulations.

21. The regulators should require companies to have a definite scheme to properly deal with and manage absence through fatigue, and that this is kept separate from absence due to sickness. CAP 371 should include this instruction.

22. Work should be commissioned to help standardize the reporting of fatigue.

23. The fatigue training should cover laid prescribed educational material with a proper structure to the training. The regulator should produce an equivalent document for fatigue to CAP 737 that incorporates facilitative training.

24. Guidance should be provided for crews on rest, nutrition and exercise for all their off duty time so that they can be best prepared for the start of the next duty. This should be embedded in their fatigue training.

25. Review of current EASA FTLs is required urgently; the plan to wait for 3 years is not acceptable. In the meantime, UK should restore the safety bar to at least that provided by CAP 371 with additional measures to combat and deal with fatigue in the light of the latest scientific and medical evidence.

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ANNEX A - CREW TRAINING: HEALTH AND WELLBEING

It is generally accepted that an unhealthy lifestyle combined with shift work may increase the likelihood of sleep problems and health issues. In a landmark paper by Atkinson and colleagues' (2008), "Exercise, Energy Balance and the Shift Worker", they found that shift workers - in comparison to day workers - are at increased risk of insomnias, chronic fatigue, anxiety, depression, heart problems, digestive complaints, impaired reproduction and obesity.

A good diet, regular meals and exercise can improve sleep quality, health and well-being. Training and assistance is needed for crew to help them alter their behaviour to make shift work more tolerable, and reduce health risks. However, scientific research on which to base training programmes is sparse.

In Atkinson et al's paper, they conducted a review of what research is available on the subject. Following are some of their citations which may relate to the field of pilot fatigue (please see original paper for full references): "It appears from the results of... dietary surveys that the timing of meals, rather than their overall content, is affected most by shift work (Lennernas et al, 1994)"; "Shift work may also increase 'snacking' of energy-dense foods, depending on the shift that is worked" (based on De Assis et al, 2003); Subjective alertness scores "improved significantly" with a 'test' meal containing increased dietary fat (Love et al, 2005); "...general tolerance to shift-work does vary considerably between individuals (Waterhouse et al, 1992; Wedderburn et al, 1993; Harma et al, 1996)"; "leisure-time physical activity is more amenable to those individuals who are generally more tolerant to shift work"; "Associations have been found between habitual physical activity and the alleviation of some clinical sleep disturbances" (Peppard and Young, 2004; Moerno et al, 2006; Vorona et al, 2005; Bonnefond et al, 2006); "It has been postulated that those shift workers who adopt active/engaging coping mechanisms... are better able to tolerate the stresses and strains of shift work, and are generally healthier (Lipovcan et al, 2004; Eriksen and Bruusgaard, 2004; Harma, 1996; Harma et al, 1988; Kivimaki et al, 2001)"; "Moderate physical activity... benefitted aspects of sleep... [and] general fatigue decreased significantly (Harma et al, 1988)"; Circadian rhythm disruption not only affects sleep, but also the biological responses to eating and physical activity; In addition to physical effects, shift workers tend to be more behaviourally restricted with diet, exercise, and in their personal lives.

Studies such as these form an excellent information-base but, as Atkinson et al point out, "despite a substantial proportion of people being involved in shift work... there is little specific research". There is an overwhelming need for a holistic approach to addressing the specific problems faced by shift workers, in particular, those performing safety critical roles. Recommendations should be produced which are based on scientific knowledge of the consequences of shift work, and which take into account individual and social barriers. Ultimately, solutions are required which promote the individual shift worker taking control of their own destinies (Atkinson et al., 2008).

With Atkinson's advice in mind, the following training points have been researched and compiled by this author in an effort to help crew to 'help themselves'. This guidance is widely available and has come from a variety of sources. It is mainly based upon advice by the UK Health and Safety Executive, and their international counterparts - with additional input from nutrition and exercise

experts, and various scientific research papers. Perhaps airlines could compose something similar for crew training.

It is worth noting that a recurring theme underlying this guidance is the importance of *life-planning* - with the main aims of staying alert at work; relaxing/sleeping when need rest; and eating quality food - thus to avoid the long term health issues associated with shift work.

Diet

- Generally, regular light meals/snacks are less likely to affect alertness or cause drowsiness than a single heavy meal
- Before work: Eat main meal, opting for proteins and wholegrain carbohydrates (eg big brunch or proper dinner). These give sustained energy and keep you feeling fuller for longer, so you are less likely to reach for high fat, high sugar snacks mid way through your shift. The B vitamins in the wholegrain carbohydrates will also help keep your brain functioning effectively throughout a night shift.
- At work: Eat light – choose foods that are easy to digest such as pasta, rice, bread, salad, fruit, vegetables and milk products. Avoid fatty, spicy and/or heavy meals since they can make you feel drowsy. Fruit, vegetables and nuts are good snacks as their sugar is converted into energy relatively slowly, and they also provide vitamins, minerals and fibre. Avoid sugary foods since they provide a short-term boost, followed by a dip in energy levels.
- Plan ahead: Have healthy foods readily available at home and work e.g. bitesize fruit and veg – so when you are tired and hungry, you make better choices; have healthy meals already prepared to come home to; make extra dinner for bringing to work the next day.
- Plan energy levels throughout shift – eat in advance of 'high demand' periods (eg approach) and also eat/snack before you feel too hungry
- Some general advice: In some cases it is preferable to eat in line with a regular day; Try to pause for meals; Try to be 'mindful' and not rush food – it is better to 'graze' on a meal across a number of 'quiet moments' than to rush it in one opportunity.
- Drink water continually to stay hydrated – keep your water in view to remind you. Dehydration can reduce both mental and physical performance, and if you end up trying to 'catch up' after work, then too much fluid before bed may overload the bladder and disturb sleep.
- Don't go to bed feeling hungry - have a light meal or snack (e.g. toast or cereal) before sleeping. Avoid fatty, spicy and/or heavy meals before bed, as these are more difficult to digest and can disturb sleep
- Food ideas: fresh, dried, tinned or ready-cut fruit and vegetables; juices and smoothies – these can count towards your 5 A Day intake (but only once) and give a quick and refreshing energy boost around the middle of your shift; apple and cheese pieces; wholegrain bagel with peanut butter; oatcakes and marmite; hard boiled eggs; yoghurt with mixed fruit and oats; porridge; veggie sticks and humous; tuna/salmon/egg rolls or sandwiches; chicken slices; dried fruit and nuts; vegetable soup; couscous salad; oat and fruit smoothie; wholemeal pasta salad; beans on toast.
- Try to eat with friends and family in your free time

Exercise

- Try to exercise regularly - You can improve your fitness by spending 30 minutes a day on a 'physical activity' including housework and walking.
- Exercise briefly before your journey to work
- Take opportunities for physical activity during work e.g. stretches, aircraft walk-round, walking up and down aircraft cabin or steps – these can all release brain chemicals to wake up body and mind. Plus, even a few minutes of sunlight on a turnaround will produce a significant amount of vitamin D.
- It has been suggested that *moderate* exercise should be performed several hours before the main sleep period when on a morning or day-shift schedule. If working over-night, physical activity is advised before an evening nap. Avoid *vigorous* exercise before sleep .
- Employers could consider worksite-based physical activity interventions

Emotional Wellbeing

- Find active/engaging coping mechanisms – e.g. habitual physical activity, 'mindfulness' and breathing techniques
- Both physical activity, and taking moments for 'time out' in the work-place have positive effects on mood and stress
- It has been shown that shift workers are at increased risk when driving to and from work – drive carefully and defensively; do not hurry even if you are late; stop and take a nap if necessary.
- Working shifts can leave you feeling isolated – keep in contact with family and friends, and talk to them about the problems you face so they can support you and include you in social activities
- Plan your time off and make the most of it e.g. plan mealtimes, social activities, exercise
- Plan your domestic duties around your schedule - try to ensure that you do not complete them at the cost of rest/sleep; perhaps change the times/days when some jobs are done
- 'Buddy' up with other crew/shift-working friends to support one another with shift-working issues, and enjoy activities together during time off

Alertness at Work

- Regular body movement – eg some long-haul airlines publicise 'inflight exercises' for passengers which can be done in the seat - perhaps these could be better promoted to crew:
- Keep the light bright
- Try to take short breaks during the shift where possible
- Manage your energy levels so that you are more alert when you need to be
- Plan to do more stimulating work at the times you feel most drowsy
- Keep in contact with co-workers and monitor one another – this may help each of you stay alert

Stimulants and Sedatives

- Manage the use of caffeine, 'energy drinks' and sugary foods – these can be good short-term solutions for improving reaction time and feelings of alertness. However, they should only be used occasionally.
- Do not rely on caffeine to keep you awake
- Limit caffeine to 400mg per day. Stop taking it 4-5 hours before the end of a shift, and/or 4 hours before bedtime.
- Remember there is often hidden caffeine in 'decaf' products and many teas. Try other types of hot drink – unsweetened herbal tea bags, hot water with lemon etc.
- Reduce your alcohol intake
- Avoid the use of alcohol (and sleep aids) to help you fall asleep. Although it can promote the onset of sleep it is also associated with earlier awakenings, disrupted sleep and poorer sleep quality.
- Use alternative methods of relaxation – e.g. hot bath after work, mindfulness techniques
- Cut down or give up smoking

Sleep

- Identify a sleep schedule which works best for you - keep a sleep and tiredness diary, and try different techniques for a better quality sleep. For example, try going to bed at different times for your various shift patterns, and try different relaxation strategies and environmental conditions. Maintain this schedule as best you can since it introduces a certain amount of routine.
- Follow a routine before bed. Try to use the same routine before naps and pre-shift early nights as it can promote sleep.
- Manage your Sleep Environment – always sleep in a bedroom, and avoid using it for other activities (e.g. watching television, eating and working); manage light, sound and temperature.
- Go for a short walk, relax with a book, listen to music, use relaxation techniques and/or take a hot bath before going to bed
- Remember that daytime sleep is usually poorer quality than night time sleep.
- Get the sleep you need and try to recognise if you are having to use caffeine to keep you awake
- If you cannot sleep, try to relax/rest as this is still beneficial.

ANNEX B - VIGILANCE, ATTENTION, FATIGUE, & BOREDOM

(section by David R. Hill, PEng, CEng, FBCS)

"No situation is too complex to be reduced to this simple, pernicious notion [it was human error].
'Human error' has become a shapeshifting persona that can morph into an explanation of almost any unwanted event."
(Steven Shorrock)

Introduction

The main feature of "vigilance" tasks is that an operator must respond to very infrequent signals, but may have to watch for them over long periods of time (Broadbent 1958). Vigilance requires alertness and task focus. Being "alert" is defined in the Oxford English Dictionary as:
1. "Quick to notice any unusual and potentially dangerous or difficult circumstances; vigilant."
2. "Able to think clearly; intellectually active."

The crew on the flight deck of a modern passenger aircraft are necessarily involved in one or more vigilance tasks when performing their duties. Various aids to performing such tasks successfully are provided by the aircraft systems (for example, the approach to a stall may be signalled by a "stick shaker" and by voice messages). The crew also have to keep a lookout for other flying objects or terrain with which they may collide, and they must be aware of potential system failures (fuel pumps, deicing systems, landing gear problems, and so on) and respond appropriately, if necessary. Modern passenger aircraft provide a comprehensive array of alarms and messages to assist with these vigilance tasks. However, the alarm systems themselves may fail (for example, warning lights burn out and the assistive software can contain "bugs"). One aspect of vigilance tasks that is shared with more routine tasks is the need to pay "attention" to the overall situation, including information from warning devices as well as very infrequent events. Vigilance and attention are two aspects of the required task performance.

It is generally recognised that, for a variety of reasons, fatigue can interfere with vigilance and attention performance, as well as the more routinely exercised flying skills. What is not so well recognised is that fatigue can arise from more than one cause. The most obvious cause of fatigue is lack of adequate rest and sleep, which has led to an increasingly determined effort on the part of those responsible to define, implement, and enforce regulations that require adequate time off and conditions for proper sleep periods, for both flight deck crew and cabin crew. There is considerable research on sleep and it effect on performance to back up the regulations. However, a number of serious problems remain. First, the crew members may choose not apply their rest and sleep periods to rest and sleep. This is a matter of professional culture, codes of ethics, and personal integrity, with provision for the professionals involved to note and report transgressions they may observe, since they are a safety hazard. Regrettably there can also be a problem with AOCs pushing the boundaries for economic reasons. Codes of ethics therefore require proper, possibly anonymous channels for reporting and encouraging such management lapses. Provision for exceeding the duty times and failing to meet the mandatory rest periods occur in many AOC Fatigue Risk Management Systems (FRMSs), which is an invitation to abuse. For obvious reasons, regulations have to have some flexibility, but such flexibility requires that a margin of safety should built in so that if the formal requirements can't be met, for whatever reason, the result at all times on the flight deck or in the cabin is still a sufficiently rested, alert crew member. The next problem is that there are "individual differences" in sleep needs. People really do vary from the norm in the amount and pattern of rest/sleep that they need to maintain optimum performance. Research is scarce, but Tucker *et al.* (2007) addresses the issue.

Then there is the serious problem that fatigue is all too often associated only with lack of rest/sleep, or a period of task overload. This raises the topic of "optimum stress" and leads us to the fact that boredom itself is a source of fatigue and less-than-acceptable performance. It is a particular problem with the increasingly automated aircraft that are flying passengers around these days. The flight deck crew spend the vast majority of their piloting time at a very low task load, since the aircraft is likely to be on autopilot and under the Flight Management System (FMS) for most of the flight time. Thus there is overlap between fatigue management requiring active engagement with the flying task, and the requirement for significant "stick time" as part of the safety and ongoing professional development regime. One approach to mitigating the lack of attention that is engendered by having no significant task duties for much of a flight is to develop a regime of checking flight parameters and the ongoing situation ("situational awareness") with the problem that this may simply be viewed as "busy work" and neglected. Another problem with a boring situation is that distractions that have nothing to do with the flying task may be devised (reading recreational material, for example, or falling asleep), which further reduces the likelihood of up-to-date situational awareness-leading to potential startle reactions if something does intrude, even something quite innocuous to an aware pilot. There was a recent well-known case where passengers and cabin crew were injured when a pilot fell asleep. When he awoke he nosedived the plane after mistaking the planet Venus for an oncoming aircraft. The pilot (a First Officer) was apparently "still groggy" from a nap (technically known as sleep inertia). http://www.tsb.gc.ca/eng/rapports-reports/aviation/2011/a11f0012/a11f0012.asp

Distracted flying is almost as dangerous as distracted driving, but with even more serious consequences, whatever the source of the distraction.

Five questions about boredom, fatigue, and vigilance (Steven Shorrock, 2012)

https://humanisticsystems.com/2012/11/07/five-questions-about-boredom-fatigue-and-vigilance/

1. How different are boredom and fatigue?

Both affect our ability to pay attention—to notice something that may need attention—but they are different in terms of their causes and can occur completely independently. A person can be bored during a period of low activity, but not fatigued. Prolonged boredom, tends to result in fatigue, but so can high workload, lack of sleep or disruption to sleep patterns, or stress. Other than sleep or rest, there is little that you can do to manage fatigue effectively while on position, while more can be done to tackle boredom and stay in the loop. So preventing and managing fatigue is a key priority to ensure that people remain able to deal with unusual events.

2. Is low workload more dangerous than high workload?

Attention is stretched by both 'overload' and 'underload'. Both require hard work and can be stressful, particularly if there are safety consequences when something is missed. Which is more dangerous will depend on the situation and the person (for instance personality, experience and levels of stress and fatigue), but skilled professionals tend to cope better with higher workload up to the point of overload, when performance degrades more dramatically.

3. How to remain aware and vigilant for unusual situations?

Ask colleagues—people develop different visual and mental strategies that may not be obvious from the outside. But applied research using eye movement tracking gives some tips in terms of scanning. So-called "active scanning" can help to counteract degraded vigilance under low workload situations. With active scanning, people scan displays proactively in sequences or cycles depending on the traffic situation, linking specific information from different information sources. The scanning is more strategic, and helps to anticipate developing situations.

4. When are we most and least vigilant?

In a non-shiftwork environment we could highlight some times of day when we are least alert, especially during the very early morning hours, but shiftwork is a fact of life for many workers working
a 24-hour operation. What we can say is that we are most vigilant when well rested, engaged and interested in the activity, not distracted (e.g. TV, radio, visitors) or preoccupied with other thoughts, well hydrated, and well supported by colleagues and supervisors.

5. Is the theoretical human performance knowledge adding value?

Yes, but not nearly as much as it should. So much is known about human performance that it seems that policy and practice are decades behind. But so much that is published is irrelevant to complex systems and activities, does not offer solutions, and technology and practices change fast and do not wait for research to catch up. Much theoretical knowledge in human factors comes from sterile experimental environments, normally focusing on one issue (e.g. vigilance) while 'controlling' (or ignoring) some of the most relevant real-life issues that interact to shape performance in the real world (e.g. motivation, risk, teamwork, supervision, background shift-fatigue). The hard part for practitioners is evaluating what aspects of the research are relevant, piecing them together and drawing out practical implications. With this in mind, the most directly useful human performance knowledge is gained by spending time with end users, listening to and observing them at work, and working with end users and other stakeholders to find solutions to human performance issues.

Industry/regulator statements

In the introduction to their document on Fatigue Risk Management Systems (FRMS) by ICAO (2016) the authors define crewmember fatigue as:
"A physiological state of reduced mental or physical performance capability resulting from sleep loss,
extended wakefulness, circadian phase, and/or workload (mental and/or physical activity) that can impair a person's alertness and ability to perform safety related operational duties.
… Fatigue management relies on identification of fatigue hazards and effective safety reporting. The operational and organizational context has particular influence on whether crew members consider the identification of fatigue hazards as part of their professional role and on whether they are prepared to report fatigue hazards. It must be acceptable for crew members to raise legitimate issues about fatigue without fear of retribution or punishment either from within or outside the organization. The issues associated with fatigue are difficult to detect if people are unwilling or unable to report them.
ICAO (2011) provides a rationale for the aviation industry to introduce FRMSs:
"The traditional regulatory approach to managing crew member fatigue has been to prescribe limits on maximum daily, monthly and yearly flight and duty hours, and require minimum breaks within and between duty periods. This approach comes from a long history of limits on working hours dating back to the industrial revolution. It entered the transportation sector in the early 20th century in a series of regulations that limited working hours in rail, road and aviation operations. The approach reflects early understanding that long unbroken periods of work could produce fatigue (now known as "time-on-task" fatigue) and that sufficient time is needed to recover from work demands and to attend to non-work aspects of life. In the second half of the 20th century, scientific evidence began accumulating that implicated other causes of fatigue in addition to time-on-task, particularly in round-the-clock operations. The most significant new understanding concerns:

- The vital importance of adequate sleep (not just rest) for restoring and maintaining all aspects of waking function; and
- Daily rhythms in the ability to perform mental and physical work, and in sleep propensity (the ability to fall asleep and stay asleep), that are driven by the daily cycle of the circadian biological clock in the brain.

This new knowledge is particularly relevant in the aviation industry which is unique in combining round-the-clock operations with trans-meridian flight. In parallel, there has been an increase in the understanding of human error and its role in accident causation. Typically, accidents and incidents result from interactions between organizational processes (i.e., workplace conditions that lead crew members to commit active failures) and latent conditions that can penetrate current defences and have adverse effects on safety. The FRMS approach is designed to apply this new knowledge from fatigue science and safety science. It is intended to provide an equivalent or enhanced level of safety while also offering greater operational flexibility. Prescriptive flight and duty time limits represent a somewhat simplistic view of safety — being inside the limits is safe while being outside the limits is unsafe — and they represent a single defensive strategy. While they are adequate for some types of operations, they are a one-size-fits-all approach that does not take into account operational differences or differences among crew members. In contrast, an FRMS employs multilayered defensive strategies to manage fatigue-related risks regardless of their source. It includes data-driven, ongoing adaptive processes that can identify fatigue hazards and then develop, implement and evaluate controls and mitigation strategies. These include both organizational and personal mitigation strategies. While an
FRMS is based on scientific principles, its application within various aviation contexts requires operational experience and knowledge. An FRMS should not be provided to an operator by a consultant; it needs to be developed, understood and managed by people who have comprehensive experience in the complex operational environment to which it will apply. In this way, various data analyses can be meaningfully interpreted taking into consideration particular contexts, and workable operational strategies can be developed.

Note that factors inducing fatigue are even more numerous than already introduced. A more complete list includes: lack of sleep/rest; disruption of the circadian rhythm; boredom/reduced stimulation; routinisation/ startle; noise; vibration; hypoxia; extreme temps; flickering light; stimulants, etc. (coffee, anithistamines, alcohol, ...); cheap hotels (unlike duct tape which costs x 4 times the regular price!); and stress.

Even if adequate provision is made for sleep/rest, stress (worry) can make adequate sleep/rest impossible, as can the circumstances of a cheap hotel.

Mark Printup states, quoting a 1992 book on “Basic Flight Physiology (Reinhart 1992):
“Symptoms of fatigue include a feeling of indifference to one’s performance, increased reaction time,
a decreased ability to concentrate on multiple tasks, fixation, short-term memory loss, impaired judgment, impaired decision-making ability, distractibility, sloppy flying skills, reduced visual perception, loss of initiative, personality changes and depression.”

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