Regulation Impact Statement

Review and Amendment of Flight Crew Fatigue Regulations

Proposed amendment to Civil Aviation Order (CAO) 48

March 2013

Summary

The current regulations relating to the fatigue of flight crew have been in place for over 50 years without significant review. A recent review in the light of advancements in the science of fatigue and evidence of accidents and near misses, both within Australia and internationally, has found that there are some areas of the current regulations that are deficient.

The current regulations for fatigue have essentially created an informal three tier system. The preferred option is to retain this system but correct the deficiencies and is best seen as an evolution of the current regulations. CASA is proposing an option to formalise the 3 tier system:

- Simple operations that operate within certain limits will not be required to meet new fatigue management obligations
- Operations that pose a moderate fatigue risk will be able to continue those operations by meeting certain obligations with minimal cost impact
- Complex operations that pose a significant fatigue risk will be required to develop a Fatigue Risk Management System (FRMS) or significantly change their operations in order to comply with prescriptive limits to avoid the need for an FRMS

Approximately 90 businesses have already chosen to develop a FRMS without regulatory compulsion and the feedback from these businesses is that the FRMS produces benefits to the business that outweigh the costs.

In terms of impact, many aircraft operating businesses (approximately 30%) will be unaffected by these changes as they have simple operations that do not impose a significant fatigue risk.

Approximately 526 businesses that conduct certain operations that pose a moderate fatigue risk will be required to meet new obligations to manage that fatigue with minimal cost impact.

Approximately 77 businesses with complex operations posing a significant fatigue risk will have the option of meeting revised prescriptive limits or developing an approved fatigue risk management system. It is CASA's assessment that these businesses, most of whom have a FRMS or have indicated they will be developing one, will comply by developing a FRMS. The cost to the affected businesses is moderated by the fact that a number of the affected businesses already have a FRMS and/or a Safety Management System.

Whilst it is difficult to quantify the likely reduction in the fatigue related accident risk, indicative international evidence suggests that the proposed option will generate safety benefits. Moreover, the businesses that have already developed a FRMS have reported significant operational efficiencies that more than justify the investment in developing a FRMS.

Glossary

AOC	Air Operator's Certificate
Augmented crew	Consists of more than the minimum number of flight crew members to operate the aircraft to allow for inflight crew relief and rest
CAAP	Civil Aviation Advisory Publication
CAO	Civil Aviation Order
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations 1998
FCM	Flight Crew Member (pilots and flight engineers)
FDP	Flight Duty Period
FRMS	Fatigue Risk Management System
HK CAD	Hong Kong Civil Aviation Department
ICAO	International Civil Aviation Organization
NFRM	Notice of Final Rule Making
NPRM	Notice of Proposed Rule Making
OH&S	Occupational Health & Safety
SMS	Safety Management System
SARP	Standards and Recommended Practices of ICAO
SCC	Standards Consultative Committee
Sector	One segment of a flight comprising 1 take-off and 1 landing
SIE	Standard Industry Exemption
UK CAA	United Kingdom Civil Aviation Authority
WOCL	Window of Circadian Low

Problem

Fatigue reduces the ability of pilots to safely conduct flying tasks. Specifically, the effects include:

- slowed reaction times
- reduced vigilance
- reduced mental abilities
- memory problems
- poor communication
- reduced alertness
- poor decision-making
- fixation on a single task
- actually falling asleep while flying

Research has shown that the effects of fatigue on some cognitive functions are similar to the effects of moderate alcohol consumption. On-the-job performance loss for every hour of wakefulness between 10 and 26 hours is equivalent to a .004 per cent rise in blood alcohol concentration. Seventeen to eighteen hours of wakefulness is usually considered to be equivalent to a blood alcohol concentration of .05. A person who has been awake for this length of time is likely to act and perform as if they had a blood alcohol concentration of .05 (ICAO 2011, ATSB 2010).

Science and the current fatigue regulations

The current Australian regulations relating to the fatigue of flight crew have been in place for over 50 years without significant review. A recent review in the light of advancements in the science of fatigue and evidence of accidents and near misses, both within Australia and internationally, has found that there are some areas of the current regulations that are deficient.

The science of fatigue is complex but generally, the research shows an increased fatigue risk when conducting work over 12 continuous hours, combined with extended periods of wakefulness (Goode, 2003; Spencer & Robertson, 1999). The research also shows increased error rates and impaired hazard perception associated with longer duty periods.

Research has identified the importance of considering acclimatisation (human body clock) when determining maximum duty times, which the current regulations do not consider. The research is not clear on the expected rate of acclimatisation for different amounts of time zone change (Klein, et al, 1972; Roach, et al, 2002).

Research has shown that the rate of adaptation, and consequent elimination of jet lag symptoms, is dependent on the number of time zones crossed and the recency of the time zone transition. When less than 4 time zones are crossed the research indicates that for most individuals the rate of adaptation is approximately 1 hour of

time zone change per day in the new time zone for Easterly travel, and 1.5 hours per day for Westerly travel (Samel & Gander, 1991; Klein & Wegmann, 1980).

Research indicates that not being acclimatised to a location impacts negatively on both the propensity for sleep and the quality of sleep obtained. This means that off-duty periods need to be increased to compensate for the reduced quality of sleep obtained and subsequent FDP limits need to be constrained due to the difficulty in identifying clear times of increased and decreased alertness. As an example, it becomes difficult to establish the time of the individual's window of circadian low (WOCL).

CASA has also reviewed the augmented crew limits in part utilising research (Simons & Spencer, 2007) specifically addressing:

- the likely amount of in-flight sleep for a given period of access to in-flight rest facilities;
- the average recovery value of in-flight sleep;
- the impact of different standards of in-flight rest facilities on sleep quality; and
- the impact of being not acclimatised on the quality of in-flight sleep.

One of the concerns was research that indicated flight crew were on average awake for six hours prior to commencement of flight duty periods in the afternoon. This had the potential to result in extended periods since last sleep in suitable sleeping accommodation.

Based on the current scientific evidence the current fatigue regulations are considered deficient because they do not account for a number of factors that the current scientific evidence suggests are important including;

- circadian rhythms,
- the impact of crossing multiple time zones
- differences in the quality of rest at different locations and different times of the day
- number of sectors flown in a flight duty period
- flight duty period start times; and
- late night operations

With the current regulations not taking into account these factors which the current science suggests are important for affecting pilot fatigue, there is the risk that the current regulations will allow pilots to operate under circumstances that are considered unsafe.

Accidents attributed to fatigue

There is evidence that a number of Australian aviation accidents and near misses have fatigue as a contributing factor. The Australian Transport Safety Bureau (ATSB) has identified 12 accidents and 64 near misses over the last 10 years in which fatigue was a contributing factor. There were 2 deaths as a result of these accidents (Unpublished ATSB data). To put this in context, within Australia over the last 10 years there were 251 accidents resulting in 87 fatalities within commercial air transport (this figure excludes aerial work and private operations).

Whilst there have been relatively few fatigue related accidents, the observed rate is likely to understate the true accident risk. Aviation accidents are generally infrequent and as a result it is difficult to construct precise accident risk probabilities based on the low number of observations. In addition, the trends within the aviation industry would suggest that the fatigue related accident risk may increase in the future and that the observed accident risk from the past may not be relevant for assessing future accident risk probabilities. As the airline industry becomes more competitive, businesses are more likely to extend the limits in terms of pilot work periods and to utilise shift work in order to improve productivity. In addition, aircraft are becoming more sophisticated and are capable of flying for longer periods, therefore increasing the demands on pilots.

Internationally the US National Transportation Safety Board (NTSB) found that over the last 15 years fatigue was a contributing factor to 6 accidents resulting in 356 fatalities (NTSB 2011). This evidence is relevant for assessing the Australian accident risk because the current US fatigue regulations are similar to the current Australian fatigue regulations and more broadly the US aviation industry operates in a very similar way as that in Australia.

Options

Australia is a signatory to the Convention on International Civil Aviation committing Australia to implement the ICAO standards. ICAO standards require a country to have prescriptive limits, including for flight crew duty times and flight times. Australia has had prescriptive limits for over 50 years. ICAO standards allow for countries to permit businesses to operate to a Fatigue Risk Management System (FRMS) as an alternative to prescriptive limits. All developed aviation nations including the United States, Canada and European countries have fatigue regulations that are broadly comparable to the current Australian regulations that is, they impose limits on flight crew duty periods and flight times. The US and European regulations will allow for businesses to operate to a FRMS.

Given that Australia is a signatory to the Convention on International Civil Aviation, the only feasible option is to have prescriptive limits for flight crew duty times and flight times with an option for businesses to develop a FRMS.

Option 1: Status Quo

CASA currently regulates the fatigue risk of pilots primarily through flight and duty time limits for flight crew members specified in Civil Aviation Order (CAO) Part 48. The regulations apply to all commercial aircraft operators, including the regular public transport, charter and aerial work operations incorporating approximately 862 businesses. Whilst the regulations apply to Australian businesses operating international flights, the regulations do not apply to international businesses that operate to and within Australia.

The current regulations impose a general obligation on businesses and pilots to ensure that flight crew members do not operate an aircraft if fatigued:

> a flight crew member shall not fly, and an operator shall not require that person to fly if either the flight crew member is suffering from, or, considering the circumstances of the particular flight to be undertaken, is likely to suffer from, fatigue or illness which may affect judgement or performance to the extent that safety may be impaired (CAO 48, Part 1.4).

The current regulations do not impose a direct requirement on businesses to provide fatigue training to flight crew members or to have systems to monitor fatigue, however it is possible to argue that the current general requirement to adequately resource an operation would require operators to consider fatigue.

Businesses currently providing scheduled flights would provide some fatigue training and monitor fatigue risks through their current requirement to have a safety management system and provide human factors and non-technical skills training. There are approximately 30 businesses currently approved to undertake scheduled flights.

The current regulation (CAO Part 48) prescribes operational limits for businesses, however, the current regulations permit operators to be exempt from the operational limits prescribed in CAO Part 48 if the business:

- meets the prescriptive limitations contained in Standard Industry Exemptions (SIEs) which are 'class of operation' specific; or
- develops a safety case-based Fatigue Risk Management System (FRMS).

The current regulations informally create three tiers of businesses;

- Simple operations that fit within the existing CAO 48 requirements that do not require an industry exemption
- More complex operations that do not fit within the CAO 48 requirements and operate to the standard industry exemption. Most businesses operating scheduled flights operate under a standard industry exemption.
- More complex operations that are outside the CAO 48 requirements that choose to develop a Fatigue Risk Management System. There are approximately 90 businesses that currently operate to an approved FRMS.

Duty periods and flight time limit

The primary limitations within the current regulations are the duty periods and flight time limits in the Standard Industry Exemption (SIE) for multi-crew public transport operations. The SIE outlines the maximum hours per flight duty period by start time and sectors (Table 1).

Table 1: Current Flight Duty Period limits (Multi-Crew Public Transport operations)

Local start time	Sectors[1]						
	1&2	3	4	5	6	7 +	
0500 - 0559	13	12	12	11	11	10	maximum hours per flight duty period
0600 - 1259	14	13	12	12	11	10	
1300 - 1459	13	12	12	11	11	10	
1500 - 0459	12	11	11	10	10	9	

1: A segment of a flight comprising 1 take-off and 1 landing.

Option 2: Graduated Requirements

The applicability of this option would be to businesses carrying fare paying passengers, that is regular public transport and charter flights, and to aerial work operators. After reviewing the current fatigue regulations CASA determined that a graduated approach in the new regulatory standards was most appropriate. The first level refers to a business with a very simple operation posing minimal fatigue risk to pilots that would not be subject to any fatigue obligations (Tier 1). Next would be a broader prescriptive regime with business and pilot obligations that apply to more complex operations (Tier 2). The final stage of complexity/maturity is where a business would manage most fatigue risk through a Fatigue Risk Management System (Tier 3).

Tier 1

The first tier outlines the criteria for assessing a simple operation that is not required to meet any fatigue risk management obligations due to its low risk. A business falls into tier 1 if the pilots:

- Operate between 7am and 10pm;
- Have a maximum 9 hour flight duty period;
- Have a minimum of 12 hours off-duty each day; and
- Have 2 days off per week.

This tier is broadly comparable to the current CAO 48 requirements and businesses operating under tier 1 will not be required to meet any additional regulatory obligations. However, the qualifying limits are more restrictive than the requirements applying in the current CAO 48. The main difference is that the current requirements (Option 1) allow a maximum flight time up to 11 hours compared to 7 hours under Option 2.

Tier 2

Businesses that operate outside the basic limits of tier 1 can operate to less restrictive limits by meeting certain obligations to manage fatigue risk. The obligations include: developing procedures to identify the fatigue hazards for the type of operation, developing a system for monitoring pilot feedback of fatigue, making operational changes based on identified pilot fatigue risk, and fatigue training for pilots.

CASA will not be prescriptive in the regulatory requirements for these obligations and operators will be able to develop systems that they believe will be acceptable in meeting the objectives of the obligations. CASA will provide guidance material to assist industry to develop processes to comply. For example, the requirement to provide fatigue training is specified, however, the exact nature of the training such as content, length, or mode of delivery is left to the operator to decide based on CASA guidance material and CASA surveillance.

The level of the obligations will be commensurate with the complexity of the operation, for example, businesses that do not undertake augmented crew operations will not be required to train their pilots for the fatigue issues of augmented crew operations.

The limits of operation are comparable to the limits currently specified in the standard industry exemptions. Based on advancement in the science of fatigue and recent operational experience CASA is proposing to make adjustments to some of the limits contained in the current standard industry exemptions.

Prior sleep opportunity

A new requirement is that each pilot will have a minimum of 8 hours sleep opportunity prior to any duty in which a flight takes place. This sleep opportunity is not the same as “off-duty” which is typically a minimum of 10 hours when away from home base and or 12 hours when at home base. The intent of this new requirement is to provide pilots with the opportunity to be adequately alert prior to flight.

Duty periods and Flight time limit

CASA is proposing to increase the number of time categories and include body clock and time zone considerations. The flight duty period limits are set out in Table 3. Most of the limits remain largely unchanged, however, there is some tightening of the limits and some relaxation of limits based on advanced understanding of sleep and fatigue science.

Table 3: Flight Duty Period and Flight Time limits (Multi-Crew Public Transport)

Acclimatised Time at Start of FDP	Maximum FDP and Flight Time (in brackets) according to sectors rostered to be flown					
	1-2	3	4	5	6	7+
0500 – 0559	11(9)	10(8)	10(8)	9(8)	9(8)	9(8)
0600 – 0659	12(9)	11(9)	11(9)	10(8)	10(8)	9(8)
0700 – 0759	13(9.5)	12(9)	12(9)	11(9)	11(9)	10(8)
0800 – 1059	14(10)	13(9.5)	13(9.5)	12(9)	11(9)	11(9)
1100 – 1359	13(9.5)	12(9)	12(9)	11(9)	11(9)	10(8)
1400 – 1459	12(9)	11(9)	11(9)	10(8)	10(8)	9(8)
1500 – 1559	11(9)	10(8)	10(8)	10(8)	9(8)	9(8)
1600 – 0459	10(8)	9(8)	9(8)	9(8)	9(8)	9(8)

Whilst the flight deck duty limits are removed, other mechanisms such as minimum inflight rest periods and maximum flight time restrictions perform a similar function in limiting continuous time at the controls.

The ability to increase roster limits by split duty will remain largely unchanged.

Off–duty period limits

Most of the off-duty period limits will remain essentially the same, including where a flight duty period exceeds 12 hours the following off-duty period must be a minimum of 12 hours plus 1.5 times the time that the previous duty period exceeded 12 hours.

However, there are some changes to the off-duty limits. Where a duty period does not exceed 12 hours the following off-duty period must be at least 10 hours if not at home base (same as current requirements), but 12 hours if taken at home base, an increase of 2 hours on current requirements. The minimum off-duty period at home base is increased to 12 hours to allow for the predicted increased commute time and social obligations.

Under current regulations where a duty period does not exceed 10 hours, the following off-duty period may be reduced to a minimum of nine hours if the condition is met that the time free of duty includes the period between 2200 to 0600 local time.

The conditions under which the minimum off-duty period may be reduced to nine hours away from home base have been changed. In detail the requirements are:

- the off-duty period undertaken immediately before the flight duty period was at least 12 hour and included a local night; and
- the flight crew member is acclimatised at the commencement of the off-duty period; and
- the off-duty period is undertaken over a local night; and
- the off-duty period is not undertaken at home base; and
- the off-duty period following the next flight duty period is at least 12 hours including a local night.

Where a minimum off-duty period has been calculated to be greater than 14 hours, it can be reduced to 14 hours under certain conditions in order to allow a flight crew member to have a suitable period for sleep recovery and then commence a flight duty period still acclimatised to the last location where they were acclimatised. For example, this provision allows a flight crew member to return to their home base in a relatively acclimatised state before commencing a minimum 36 hour off-duty period. This figure of 14 hours is an increase from the previous limit of 12 hours based on research that indicated the likelihood of poorer sleep quality away from home base after multiple time zone changes.

Delayed reporting time

The current requirements are silent on delayed reporting (that is when the flight is delayed and the crew are required to report for duty at a later time than originally specified) and by being silent effectively mean that the delayed reporting time is the start of the flight duty time.

Under Option 2 the requirements remain the same for a delay between 0 and 4 hours and more than 10 hours, but are more limiting for delays between 4 and 10 hours.

If the delay is more than four hours—the maximum duty period is calculated based on the more limiting of the original reporting time or the delayed reporting time, and the duty period starts counting four hours after the original reporting time.

Requirements not subject to change

Option 2 will leave the current limits unchanged for:

- Standby time
- Cumulative flight time
- Cumulative duty time

Tier 3

Certain businesses required to have an FRMS

Whilst an FRMS would be available to all aviation businesses, it will be a requirement for certain businesses currently conducting certain types of operations. The increased fatigue risk associated with certain types of operations such as ultra-long range operations (generally those with flights in excess of 16 hours) would require the business to develop a Fatigue Risk Management System which will be subject to CASA approval. The standards for FRMS are consistent with ICAO requirements.

Impact

CASA estimates that there are currently 862 businesses operating aircraft that would be potentially affected by the fatigue regulations and would fall into Tier 1, Tier 2 or Tier 3.

Tier 1: Within the Basic Limits: no obligations

CASA estimates that 259 businesses have relatively straightforward operations that would fall within the basic limits of Tier 1.

There is no impact on these businesses as the fatigue management requirements will not change.

Tier 2: Within the Prescriptive Limits: operator obligations

CASA estimates that 526 businesses will have operations that fall within Tier 2. For these businesses the primary impact will be complying with the operator obligations of Tier 2.

Based on consultation with industry it is assumed that businesses that currently have operations outside the Tier 2 limits will operate under Tier 3, rather than modifying their operations to operate within the limits of Tier 2.

Cost of the operator obligations

For businesses operating within Tier 2 there will be the additional cost of meeting the operator obligations, including understanding the fatigue risk of their specific operation, developing a system for pilots to report on their fatigue and making changes to their operations in order to address the known fatigue risks of pilots.

The operator obligations will involve fatigue training, initial and recurrent. Whilst CASA has not specified times required for the training, it is likely that the initial training will require one day to complete and be relatively consistent across all operators. Based on a duration of one day the initial training is estimated to have an upfront cost of $5.3m for the industry (Table 5). The assumption is made that there would be a ratio of one instructor for every 10 pilots undertaking the training.

Table 5: Initial fatigue training costs

	Pilot	Instructor	Total
Daily wage rate[1]	$600	$600	
Cost per pilot	$1,200	$1,200	
Number of pilots	8000	800	
Total industry cost	$4.8m	$0.48m	$5.28m

1: The labour costs are based on the average wage of Air and Marine Transport professionals being $2 148.70 (ABS 2011) plus a 15% on cost

Recurrent training

Recurrent training would be operator specific and depend on the complexity of the operations. It is likely to range from about 2 hours for simple operations to 8 hours for complex operations, such as pilots employed in large airlines. The interval between initial and recurrent training would be variable between 1 and 3 years depending on a training needs analysis. For simple operations the main objective of the training is to provide information to pilots on how to identify and manage their fatigue risk, such as information on the Window of Circadian Low. For complex operations the training may involve training on the fatigue issues facing augmented crew. Recurrent training is estimated to cost industry $3m annually (Table 6).

Table 6: Recurrent fatigue training costs

Recurrent training	Simple operations	Complex operations	Total
Hours of training	2	8	
Cost per pilot	$150	$600	
Number of pilots	4000	4000	
Total industry cost	$0.6m	$2.4m	$3m

Fatigue monitoring

The other obligations would involve the monitoring of fatigue risk. For operators with a Safety Management System (SMS) the requirements would be met within the SMS at no additional cost. However, operators without an SMS would be required to put in place processes to monitor fatigue risk. This would be ongoing process. The businesses would have to think about the fatigue risk created by their operations on flight crew and how to manage that risk. In terms of time this could be in the order of 5 hours for 5 staff every 3 months, with an estimated industry cost of $2.4m annually for the 526 affected businesses.

Table 7: Fatigue monitoring costs

Hours per meeting	3
Number of staff	5
Frequency per year	4
Total cost per business per year	$4,500
Industry cost	$2.4m

CASA costs

CASA will ensure that Tier 2 operators meet the operator obligations under existing CASA surveillance activities and within the same budget. Operators will not be required to seek approval from CASA on how they will meet the operator obligations, rather they will be required to include the obligations in their operator's manual which is approved. CASA currently audits operators against their operator's manual which will continue under Option 2 and within the same CASA surveillance budget. Part of

the ability to undertake the compliance activities within the same budget is an independent but simultaneous movement to risk based surveillance.

Tier 3: Outside prescriptive limits: modify operations or develop a FRMS

CASA estimates that less than 9% (or 77) of the operators will be outside the prescriptive limits and will either be required to modify their operations to fall within the prescriptive limits of Tier 2 or develop a FRMS. From the consultation process it was determined that the main operators affected by the change in the limits would be a subset of the 77 businesses operating mainly scheduled flights.

CASA has undertaken two approaches to cost the impact for these businesses. The first is the cost of complying with the prescriptive limits of Tier 2 without developing a FRMS and the second is the cost of developing and operating to a FRMS under Tier 3.

It is important to note that in terms of the impact there will be no change to current operations if they can be demonstrated to be safe, in which case the cost is the cost of demonstrating that the current operations are safe, which is a relatively minor cost. The cost of meeting more restrictive limits only occurs is if operators cannot demonstrate the safety of their current operations, in which case the cost is the cost of attempting to demonstrate the safety of the operation, plus the cost of altering their operations. In this case there is a safety benefit from ceasing the operation.

Cost of meeting more restrictive limits

CASA has consulted with affected businesses to estimate the cost impact. Affected businesses have developed costing estimates largely on the basis of modifying their current operations to comply with the prescriptive limits. A number of businesses supplied cost estimates for complying, mainly based on being required to employ additional pilots and some based on ceasing particular routes.

Upfront

Several affected businesses argued that the prescriptive limits under Option 2 were more complex than the existing limits, with the incorporation of acclimatisation, increased number of time categories and an increased number of flight duty period times and greater variation in off-duty period limits based on previous flight duty periods.

One business argued that the greater complexity in the application of the limits would require the upgrading of the crew management system at a cost of $150 000. CASA has assumed that this cost would be applied to all of the affected businesses.

Average annual compliance cost

There was a diversity of views on the impact of the revised limits on affected businesses. The affected businesses argued that the changes that made some limits for

flight duty periods and off-duty periods more restrictive would have a significant cost impact. The cost estimates supplied by the affected businesses ranged:

- domestic passenger carrying operators: $1m to $1.8m
- international passenger carrying operators: $1m to $2m
- complex non-passenger carrying operators: $0.4 to $1m

As one specific example, a regional airline submitted to CASA that it would cost $1.3m per year to comply with the revised prescriptive limits published in the Notice of Proposed Rule Making. However, CASA has made changes to the prescriptive limits which should lower the cost of compliance for the regional airline.
Based on the industry estimates for the compliance costs and the number of businesses CASA estimates to be affected, the total upfront cost would be approximately $11.55m and the annual compliance cost $70.5m (Table 8).

Table 8: Prescriptive Limit Compliance Costs $m

	Number of businesses	Upfront cost	Annual compliance cost	Total upfront cost	Total annual cost
Domestic passenger	25	$0.15	$1.30	$3.75	$32.5
International Passenger	12	$0.15	$1.50	$1.80	$18.0
Complex non-passenger	40	$0.15	$0.50	$6.00	$20.0
Total	77			$11.55	$70.5

International competition

An important potential impact of Option 2 is the competitive position of Australian airlines that compete with overseas businesses. If Australia has significantly greater fatigue requirements than competing overseas businesses, Australian airlines could potentially be put at a competitive disadvantage. With many of the operating costs of the aircraft being consistent across countries, imposing greater staff costs through more stringent fatigue management requirements on Australian businesses relative to overseas businesses could have a significant impact.

The competition impact on most international routes to and from Australia that involve distances requiring augmented crew are likely to be minimal because the requirements for augmented crew are relatively consistent across national regulatory authorities. However, on some shorter international routes requiring augmented crew Australia may have different requirements for crew rest facilities that may result in some additional aircraft costs or lost passenger revenue in specific cases.

One business undertaking short international flights argued that the seat requirements for resting pilots whilst being the same as the US and European requirements, was

likely to be more stringent than the Hong Kong requirements. This may result in the Australian business being required to modify a seat at an approximate cost of $10 000 per aircraft. Importantly, the other requirements for rest facilities in terms of screening from other passengers, which could result in lost passenger revenue, are the same between countries.

The potential competition impact is therefore likely to be limited to international routes with a distance below the threshold for an augmented crew, such as between Australia and some Asian countries. However, the potential for international businesses competing on Australian routes obtaining a competitive advantage by operating to more liberal fatigue regulations could be limited through the CASA approval process for international operators.

If the international operators were assessed by CASA as having fatigue management policies/standards below what CASA assessed as safe, those businesses would not be permitted to operate to or from Australia. The operational approval could be limited to routes for which fatigue management was assessed as adequate or a condition of operation be imposed that required an acceptable fatigue management system in order to obtain the international approval. This approval process would effectively level the playing field in terms of fatigue management for competition on the affected international routes.

CASA's assessment is that the fatigue management requirements imposed on foreign businesses competing with Australian businesses are similar to the Australian requirements of Option 2. As a result there would be no significant cost differences as result between Australian and foreign operators and no need for CASA to impose conditions through the international approval process on foreign operators.

Reduced flexibility

The affected businesses also argued that there were factors affecting costs that were not possible to quantify, mainly based on reduced flexibility. Two examples provided on the lack of flexibility was the requirement for 7 days leave per 28 days and minimum off-duty limits applying to regional routes involving the same flight crew flying into a regional port and flying out the next morning.

Other views

Two associations representing the interests of pilots and one university specialising in fatigue and a consulting business argued that the prescriptive limits of Option 2 were not different from the current limits and that the affected businesses would not be required to change their operations:

> the NPRM stated that it was" concluded that the SIEs would form a substantial part of the new regulatory system and this is readily apparent, particularly in Annex B, Appendix B. As articulated in our detailed comments this is a cause of concern because the proposals appear to be virtually the same as the SIEs.

Developing a FRMS

Whilst modifying current operations to meet the revised prescriptive limits is one option for compliance, CASA has presented the case that for most businesses developing a Fatigue Risk Management System (FRMS) will be the lowest cost of compliance. Supporting the assessment that the FRMS option is the least cost method of compliance is the fact that most of the affected businesses already have an FRMS or have indicated an intention to develop one. This includes most of the affected businesses supplying the cost estimates for complying with the prescriptive limits.

There is difficulty in costing the FRMS option because the cost to the operator will depend on the extent of the obligations that they develop in order to continue with certain operations. Developing a FRMS will be no guarantee that the operations will be able to continue. The business must demonstrate that the operations are managed appropriately and do not compromise safety.

There are four basic processes which an operator will need to develop in order to gain approval to implement a FRMS:

- Policy and documentation
- Risk management
- Safety assurance
- Safety promotion

These processes should, if sufficient, enable an operator to demonstrate and maintain the safety of the operation. If the operator cannot demonstrate the safety of the operation, then the impact will be the cost of ceasing the operation or the cost of modifying their operations to make it safe. If this was to occur then safety would be enhanced by ceasing or modifying an unsafe operation.

The affected businesses did not supply the cost estimates of developing and operating to a FRMS. CASA has estimated the indicative costs based on surveying 6 of the 90 businesses that have already developed and operate to a FRMS.

The reported average cost depended on business size:

- Very large business: upfront $250 000 and an annual cost of $100 000
- Large business: upfront $100 000 and an annual cost of $100 000
- Small or Medium business: upfront $70 000 and an annual cost of $100 000

Based on the costs for existing businesses to develop and operate a FRMS and the number of businesses CASA estimates to be affected, the total upfront cost would be approximately $24.8m and with an annual operating cost of $7.7m (Table 9).

Table 9: Cost Estimates for FRMS $m

	Number of businesses	Upfront cost	Annual compliance cost	Total upfront cost	Total annual cost
Domestic passenger	25	$0.4	$0.10	$10.0	$2.5
International Passenger	12	$0.4	$0.10	$4.8	$1.2
Complex non-passenger	40	$0.3	$0.10	$10.0	$4.0
Total	77			$24.8	$7.7

Based on the relative cost assessments of compliance by limiting operations to meet prescriptive limits or developing a FRMS it is clear that the compliance cost is lower for developing a FRMS. An FRMS is estimated to cost a large business approximately $250 000 upfront and $100 000 annually which is significantly less than the reported annual cost of limiting operations to meet the prescriptive limits being within the range of $1m to $1.8m.

Supporting the assessment that the FRMS cost estimate is the most appropriate is that most of the affected businesses already have an FRMS or have indicated an intention to develop one.

The cost to CASA of assessing an FRMS needs to be factored in. Although the precise time estimates will vary according to the level of complexity in the FRMS the average is likely to be around 100 hours of CASA time. When valued at $180 per hour this would result in a CASA assessment cost of approximately $18 000 per FRMS or $1.4m for the 77 businesses within the industry.

Summary of the total costs for Option 2

The costs of implementing Option 2 relative to the status quo (Option 1) is the cost associated with the operator obligations, which is primarily flight crew member training and monitoring of fatigue hazards, for operators within Tier 2 and the costs of implementing and maintaining a Fatigue Risk Management System for Tier 3 operators. There is no cost for Tier 1 operators. Overall the estimated costs for Tier 2 are estimated at $31.4m upfront and ongoing costs of $13.1m per annum (Table 10).

Table 10: Option 2 Total Cost ($m)

	Upfront	*Ongoing*
Tier 2		
Pilot Training	$5.2	$3.0
Monitoring of fatigue hazards		$2.4
Tier 3		
FRMS	$24.8	$7.7
CASA assessment cost	$1.4	
Total	$31.4	$13.1

Safety benefit

The intention of the fatigue regulations under Option 2 is to reduce the risk of a pilot fatigue related accident. Whilst Option 2 will not eliminate the risk of a fatigue caused accident to zero, by incorporating the latest science on fatigue into the working and rest condition of pilots is likely to reduce the risk. The increased education level which will impact all operators and pilots will raise awareness of fatigue and its consequences and is likely to reduce the fatigue related accident risk. The American FAA in analysing a similar proposal estimated that their proposal would reduce the fatigue related accident risk by 40% (FAA 2012, p. 99).

It is important to note that the proposal is based primarily on the potential risks for fatigue related accidents, which includes an analysis of industry trends, including to greater competition, low cost carriers, greater shift work and the greater use of contracting out. Whilst the proposal considers the historical fatigue related accidents, which generally show a relatively low (but still significant) accident rate, the proposal is not directly motivated by the historical accident rate.

Operational efficiencies and other impacts

An important benefit of a FRMS outlined by businesses that have already developed a FRMS without regulatory compulsion was the improved rostering efficiency of staff. The businesses contacted by CASA reported a minimum productivity improvement of 9% from more efficient pilot rostering. The improvements in staff productivity more than compensated the businesses for the cost of developing the FRMS with the average ratio of productivity benefits to FRMS cost being $3 of benefit for $1 of cost.

These businesses also reported other benefits that were more difficult to quantify, including better staff morale towards management and between staff.

Consultation

CASA has developed the options with the assistance of business and union representatives. The organisations and individuals involved in the development and formulation of the options include:

- Aerial Agricultural Association of Australia
- Airborne Law Enforcement Association
- Australian Airline Pilots' Association
- Australian and International Pilots Association
- Australian Business Aviation Association
- Australian Federation of Air Pilots
- Australian Helicopters
- CHC Helicopters
- Cobham Aviation Services
- Flight Training Adelaide
- Heli West
- Hunter Region Helicopter Rescue
- Jetstar Airways
- NSW Police Force Aviation Support Branch
- Royal Flying Doctor Service
- Qantas Airways
- Qantaslink
- Virgin Australia Airlines

Whilst these organisations assisted in the development of the options, through the formation of a working group and the holding of working group meetings, CASA is responsible for the options presented in this Regulation Impact Statement and many of the organisations above oppose parts or all of the options presented. The full working group had 3 meetings, with 1 additional meeting for air transport operators and 2 additional meetings for aerial work operators.

When Option 2 was released for public consultation the major airlines generally opposed the changes to the prescriptive limits, but supported the increased obligations on their employees. A typical view from a passenger carrying business was:

> The values [for flight duty periods] are shorter than currently allowed by existing industrial agreements. A number of the table elements are (2 hrs) more restrictive than current regulations. … [It] will have a moderate restriction and cost impact.

Some businesses claimed that the additional requirements would be unworkable in terms of the rostering of staff.

In terms of other operations that may be affected the Professional Ballooning Association of Australia argued that their operations, because some begin at 4am,

would be classified as late night operations and would restrict pilots to operating 4 days per week, despite the average flight being between 0.5 and 1.5 hours.

CASA considered the possibility of granting an exception to the ballooning sector, but such an exception would be inconsistent with the principles under which the regulations were developed. The principle is that operations that pose a significant fatigue risk given current scientific understanding should demonstrate through a safety assessment that the operations are safe to continue. The ballooning industry may achieve the same outcome, but via a different method. Rather than the balloon industry convincing CASA that their current operations are safe and having this written into an industry exemption, the balloon operators can convince CASA of the safety of their current operations through an FRMS.

The organisations representing pilots argued for more stringent prescriptive limits, such as lower flight duty times. These pilot organisations argued that the requirements under Option 2 did not go far enough, and were essentially no different to the current requirements specified in the industry exemptions.

CASA has outlined the detailed comments made by the pilot organisations in a summary of responses document that includes CASA's response to each comment. A typical response was that:

> The prescribed limits are too liberal and, rather than encouraging movement towards a FRMS, almost preclude the need for any Australian operator to instigate such a scheme.

A consultant specialising in fatigue similarly argued Option 2 did not deviate enough from the current requirements:

> [CASA stated] that it was "concluded that the SIEs would form a substantial part of the new regulatory system and this is readily apparent, particularly in Annex B, Appendix B. As articulated in our detailed comments this is a cause of concern because the proposals appear to be virtually the same as the SIEs.

Overall of the organisations or individuals that responded to the options when released for public consultation approximately 15% supported Option 2 without change, 70% if changes were made to Option 2 and 15% would not find Option 2 acceptable even if changes were made.

Changes made following consultation

Since Option 2 was released for public consultation, CASA has made changes to Option 2 and the level of opposition to the Option 2 has been significantly reduced as a result. The complete CASA response to the comments received during the consultation period, including changes made to Option 2, are summarised in a summary of responses document. Some of the minor changes include to definitions,

additional guidance material, changes to off duty periods at home base and to high sector late night operations.

In terms of changes to requirements, CASA has changed the requirements for allowing a 9 hour off-duty period. The requirement under Option 2 released for public consultation focused on reducing the available flight duty period following the 9 hour off duty period. The revised requirement permits the normal flight duty period following the 9 hour off-duty period, but imposes amended conditions to protect local nights, before, during and after the 9 hour off-duty period. Biomathematical analyses indicate that the duration of a flight duty period, up to the maximum provided for, is not a significant risk when a local night off-duty is provided for either side of the particular flight duty period.

Another requirement addressed in light of comments received is the new requirement for at least 2 consecutive local nights off-duty in a 168 hour period. This requirement exists in the existing CAO 48 and is a common requirement in foreign rule-sets to address cumulative fatigue in the medium term.

Following the formal consultation period and the changes made to Option 2, CASA has undertaken further consultation with the affected stakeholders. It appears that the most significant opposition to Option 2 are from the employee organisations who argue that Option 2 is not based on scientific evidence, which CASA disputes. The feedback from most businesses to CASA is that they are now neutral to the changes, but equally they would not argue in favour of the changes.

Implementation and Review

The new rules are expected to be made by the end of March 2013. However, there will be a 3 year transition phase until 30 April 2016 which is intended to enable operators to transition to the new rules.

Transitional arrangements

Operators not presently regulated under a Standard Industry Exemption (SIE) may not apply for a SIE after the making of the new rules.

For operators presently regulated under a SIE, these exemptions will only apply until 30 April 2016. If a SIE is to expire prior to this date, a renewal will only be given up until this date.

Operators with an approved FRMS to manage flight crew fatigue must ensure that their FRMS is in compliance with the new rules by 30 April 2016. A trial phase for the FRMS will be required, after which the operator may seek final approval.

The monitoring and review of the new rules would be conducted on an ongoing basis during the implementation/transition phase. Thereafter, following the commencement

of the rules, monitoring and review would be conducted on an as required basis under Government guidelines.

Conclusion

CASA has reviewed the current regulations relating to the fatigue of flight crew in the light of advancements in the science of fatigue and evidence of accidents and near misses that have fatigue as a contributing causal factor.

The current regulations of fatigue have essentially created an informal three tier system. CASA is proposing an option to formalise the 3 tier system.

- Simple operations that operate within certain limits will not be required to meet new fatigue management obligations
- Operations that pose a moderate fatigue risk will be able to continue those operations by meeting certain obligations with minimal cost impact
- Complex operations that pose a significant fatigue risk will be required to develop an FRMS or significantly change their operations in order to comply with the prescriptive limits to avoid the need for an FRMS.

In terms of impact, many aircraft operating businesses (approximately 30%) will be unaffected by these changes as they have simple operations that do not impose a fatigue risk (Tier 1).

Approximately 526 businesses that conduct certain operations that pose a moderate fatigue risk will be required to meet new obligations to manage that fatigue with minimal cost impact.

For approximately 77 businesses with complex operations posing a significant fatigue risk will have the option of meeting revised prescriptive limits or developing a fatigue risk management system. It is CASA's assessment that these businesses, most of whom have a FRMS or have indicated they will be developing one, will comply by developing a FRMS. The affected businesses have reported that the annual compliance cost of a FRMS is approximately $100 000 per business.

Whilst it is difficult to quantify the likely reduction in the fatigue related accident risk, indicative international evidence suggests that Option 2 will generate safety benefits. Moreover, the businesses that have already developed a FRMS have reported significant operational efficiencies that more than justify the investment in developing a FRMS.

One interpretation of the changes is that it is changing the onus of proof to demonstrate the safety of certain types of operation. It may be entirely possible for aircraft operators to continue to maintain their same operations. However, it will

require them to demonstrate the safety of those operations which currently fall within the prescriptive limits but which will be outside the limits of Option 2.

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