

[REDACTED]
[REDACTED]

30 June 2016
Reference: F0002824

Dear [REDACTED]

I am writing in respect of your recent request of 24 June 2016, for the release of information held by the Civil Aviation Authority (CAA).

Your request:

'I would like to obtain a copy of –

*“Report of the Committee on Flight Time Limitations, Civil Aviation Authority, 1973”
Otherwise known as the “Bader Report”*

Our response:

Having considered your request in line with the provisions of the Freedom of Information Act 2000 (FOIA), please find attached a copy of the Report of the Committee on Flight Time Limitations 1973.

If you are not satisfied with how we have dealt with your request in the first instance you should approach the CAA in writing at:-

Caroline Chalk
Head of External Information Services
Civil Aviation Authority
Aviation House
Gatwick Airport South
Gatwick
RH6 0YR

caroline.chalk@caa.co.uk

The CAA has a formal internal review process for dealing with appeals or complaints in connection with Freedom of Information requests. The key steps in this process are set in the attachment.

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Wycliffe House
Water Lane
Wilmslow
SK9 5AF
<https://ico.org.uk/concerns/>

If you wish to request further information from the CAA, please use the form on the CAA website at <http://publicapps.caa.co.uk/modalapplication.aspx?appid=24>.

Yours sincerely

A handwritten signature in black ink that reads "Rihanne Stephen". The signature is written in a cursive style with a large, stylized 'R' and 'S'.

Rihanne Stephen
Information Rights Officer

CAA INTERNAL REVIEW & COMPLAINTS PROCEDURE

- The original case to which the appeal or complaint relates is identified and the case file is made available;
- The appeal or complaint is allocated to an Appeal Manager, the appeal is acknowledged and the details of the Appeal Manager are provided to the applicant;
- The Appeal Manager reviews the case to understand the nature of the appeal or complaint, reviews the actions and decisions taken in connection with the original case and takes account of any new information that may have been received. This will typically require contact with those persons involved in the original case and consultation with the CAA Legal Department;
- The Appeal Manager concludes the review and, after consultation with those involved with the case, and with the CAA Legal Department, agrees on the course of action to be taken;
- The Appeal Manager prepares the necessary response and collates any information to be provided to the applicant;
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Civil Aviation Authority



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4 June 1973

THE RIGHT HONOURABLE LORD BOYD-CARPENTER
CHAIRMAN OF THE CIVIL AVIATION AUTHORITY

Dear Chairman,

I am pleased to submit to you the Report of the Committee on Flight Time Limitations, of which I was appointed Chairman when you set up the Committee on 16 November 1972.

To keep the Report as short as possible we have avoided the repetition of the arguments. A proper appreciation of the Report therefore depends on studying the Report as a whole.

The Report is unanimous.

Yours sincerely,

Douglas Bader.

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PART I – INTRODUCTION

1 Preamble

Appointment and Terms of Reference

1.1 The appointment of the Committee was announced by Lord Boyd-Carpenter, Chairman of the Civil Aviation Authority, on 16 November 1972, with the following terms of reference:

“To inquire into the adequacy of present measures taken to prevent such fatigue in the flight crews of public transport aircraft as is likely to endanger the safety of aircraft and to make recommendations”.

Composition of Committee

1.2 Chairman:

Group Captain Douglas Bader, CBE, DSO, DFC, Civil Aviation Authority

Deputy Chairman:

Dr Walter Tye, CBE, Civil Aviation Authority

Members:

Mr John R Sidebotham, Operations Director of a British Airline
Captain Laurie Taylor, OBE, a Senior Airline Captain
Mr Norman A White, Adviser to Hambros Bank Ltd

Secretary:

Mr Michael Varley, Civil Aviation Authority.

Procedure Followed

1.3 Our first meeting was held on 6 December 1972, and we held 41 meetings altogether. A number of organisations and persons were invited by letter to submit details of any evidence they had concerning flight crew fatigue hazarding flight safety, together with comments as to the present method of control by legislation and guidelines, and, where appropriate, any suggestions as to how it should be changed.

1.4 We received written evidence from 110 contributors, and oral evidence was given by 85 witnesses. The organisations contributing included the majority of the holders of Air Operators' Certificates and the associations representing pilots, flight navigators and flight engineers. In addition, a number of individual pilots, aeromedical specialists and other persons engaged in the air transport industry were interviewed. Written evidence received varied in length from a few lines to over 100 pages. A list of those who gave evidence is given in Appendix 1.

2 Scope of Inquiry

2.1 In accordance with our terms of reference we concerned ourselves solely with fatigue, and the measures taken to prevent fatigue, in relation to *safety*. It is, however, abundantly clear that limitations on flight and duty periods have a marked influence on the economy of airline operations and on the attractions or otherwise of the aircrews' professions. For this reason in the negotiation of industrial agreements, fatigue has appeared as a factor on the negotiating table. This has obscured the safety aspect with which we are concerned.

2.2 There were three kinds of evidence available—aeromedical, accidents, and opinion based on experience of operators and aircrews. As will appear later in our report, neither aeromedical nor accident evidence provided a basis for establishing fatigue requirements in quantitative terms. Although we believe that many witnesses sought to give us objective opinions, it was noticeable that on the same set of facts, opinion as to the safety aspects of fatigue often varied according to whether the witness was an aircraft operator or a flight crew member. In forming our own judgment we had to make allowance for this degree of bias. An examination of the rules of other countries showed a wide variety of attempted approaches to the same problem. It is apparent that there is no ideal solution.

2.3 Despite these limitations we believe that from all the evidence we have heard and considered, commonsense deductions can be drawn and improvements made. In particular we believe that our proposals should prevent fatigue and that industrial negotiations need not be based on arguments that the "official" rules are deficient.

PART II – THE NATURE OF THE ISSUES INVOLVED

3 Aeromedical Evidence

3.1 The fact that fatigue has become an issue in industrial bargaining has arisen in our opinion for two separate reasons. First, the alleged inadequacy of the existing regulations and, secondly, because of failure to discriminate between tiredness and fatigue.

Nature of Fatigue and Tiredness

3.2 Tiredness resulting from physical or mental effort is a normal experience. Whilst tiredness may develop into fatigue it differs from it in that a tired person can be quickly aroused to a high level of performance. We have come to consider fatigue as a markedly reduced ability to carry out a task. It is a condition of reduced performance from which there is no certainty that a person can be aroused in an emergency even when considerable stimulus is present. Persons in a state of tiredness or fatigue can be restored to full fitness through adequate rest and sleep.

3.3 We found that a number of witnesses tended to confuse tiredness with fatigue and generally held the opinion that the amount of work should be reduced to a level at which tiredness was the exception. We do not accept this as a valid conclusion.

Assessment of Fatigue

3.4 The need to be able to measure tiredness and fatigue in aircrew has long been recognised. At present it appears that no satisfactory psychological or physiological tests have been devised which will provide positive evidence of the presence of fatigue. Similarly, tests of performance cannot yet be correlated with established standards of fatigue. Consequently we have concluded that the assessment of fatigue can only be undertaken subjectively at this time.

Factors Contributing to Fatigue

3.5 Resistance to tiredness and, eventually, fatigue is at its maximum when a person begins his duties in a fully rested state. It therefore follows that the way in which the pre-flight rest period is utilised and the environment

in which it is taken can affect the onset of tiredness and fatigue in the ensuing duty period.

3.6 We believe that the provisions and use of suitable rest periods are of major importance in combating fatigue and we deal with this subject later.

3.7 During a duty period there are a number of factors which can affect the rate of approach to, and level of, tiredness and eventual fatigue. These factors can be conveniently grouped under four headings as follows:

Work Load: physical and mental, arising from the operation of the aircraft in both normal and abnormal situations. Such conditions may be created by the aircraft itself or by external sources.

Working Environment: the levels of temperature, humidity, oxygen content, vibration, noise, glare and personal comfort which exist on the flight deck of the aircraft.

Physiological Factors: the effects of flight in rough air, restrictions on personal movement, problems of food and liquid intake, and upset circadian rhythms.

Psychological Factors: the effects of boredom, sudden increases in tension, changes of working stress, emotional disturbance and preoccupation.

Sleep Deficit

3.8 A few individuals claimed that as a result of long term exposure to accumulated sleep deficit a deterioration in their mental and physical condition was occurring. In 1971 there were 51 losses of licence on medical grounds among 7500 professional pilot licence holders but no evidence was produced to show that this was a consequence of fatigue.

3.9 At home man sleeps at night and is awake by day. Deprived of his awareness of the alternation of light and darkness, he will lose his normal pattern of sleep/wakefulness, although the ratio between the number of hours of sleep and wakefulness will be maintained. Synchronisation of circadian rhythms and sleep/wakefulness cycles with local time seems to depend on environmental time cues ("zeitgeber").

3.10 It is common for younger people to require about 8 hours sleep daily, whereas the middle-aged may require only about 6½ hours. However, individual requirements vary considerably and it would appear that some of the adult population could have requirements which are 25% greater or less than the average.

3.11 A considerable amount of study has been undertaken into the sleeping patterns of flight crew engaged on long range operations. It would seem that there is a relationship between the subjective assessment of tiredness and the accumulated deficit from the amount of sleep which a person would

normally have taken. These deficits occur even when the periods available for rest are quite generous and in excess of the rest periods specified in Article 52 of the Air Navigation Order 1972 (Appendix 3).¹ We have therefore concluded that an overall increase in the required rest periods is unlikely to prove to be a panacea.

3.12 The prevention of the accumulation of sleep deficit is necessary to avoid the development of fatigue. Neither shortening the duty period nor lengthening the associated rest period would necessarily help. Sleep deficit can only be minimised by careful planning. Crews may find it necessary to take sleep in amounts different from those to which they are normally accustomed. It is clear that some have difficulty in readjusting sleep patterns.

Flight Deck Work Load

3.13 A number of witnesses expressed opinion on the crew work load involved in current air transport operations.

3.14 It was stated that the increased reliability of modern aircraft and power plants, the improved design of flight decks, and the "redundancy" provided in critically important aircraft systems, all tend to reduce the work load involved in operating the aircraft. A contrary view was expressed that the complexity of the latest aircraft, and the critical importance of making the correct human input to "automatic" systems and monitoring the consequent performance of those systems, have together increased the work load on the flight crew.

3.15 Flight crew organisations and individual pilots all stated their belief that the changed operating environment of increased air traffic, and operations conducted in lower weather minima, had made each flight and each hour of flight more tiring than those of only a few years ago.

3.16 It is our opinion that progress in the design and performance of transport aircraft has led to a number of easements in work load and to a considerable improvement of the working environment. On the other hand higher aircraft speed, greater sophistication of systems and changes in the operational environment have brought in their wake, for example, intensified operations, more complex air traffic control procedures and operations to lower weather minima. Overall, the result has been a change of emphasis in

¹ DEPARTMENT OF TRADE AND INDUSTRY. Air navigation. The orders and the regulations as now in operation. London, 1972 (H.M. Stationery Office), Second Edition.

the working life of flight crew. This change of emphasis has influenced our minds in formulating our proposals on duty periods in Part III of this Report.

3.17 The Committee believes that its recommendations providing for a reduction in duty hours for each sector flown, which change the emphasis from flying hours to duty hours, provide the correct degree of accountability for the present level of flight deck work load.

3.18 We believe that whilst it is important to examine individually the factors which can contribute to fatigue and affect flight safety there is presently an even greater need to consider the cycles of work and rest periods so as to achieve maximum preparedness for the next duty and to avoid an accumulation of rest deficit over an extended period of time.

Transmeridian Flight (Time Zone Changes)

3.19 A number of body functions have a given periodicity, the prevailing one of which is a 24-hour cycle. Circadian rhythms, as they are called, have been the subject of extensive research. After flight which traverses time zones a period of adjustment is required to regain circadian rhythms relative to the new location. This can vary with the individual and the number of time zones traversed.

3.20 Complete adjustment to time zone changes may take from one to several days. In the case of persons visiting a place for social or business reasons it is probably essential to adapt circadian rhythms and sleep patterns to the local time as soon as possible.

3.21 The longer a crew stays in a location the greater the tendency to adjust to local time. Crews should make a conscious effort to plan their activities in accordance with the requirements of their forthcoming duty period irrespective of local time.

Other Factors

3.22 As regards the many detailed factors mentioned in para 3.7, we do not consider it practicable to formulate rules to attempt to take them all into account. Such matters as the working environment are subject to airworthiness and customer requirements which maintain reasonable minimum standards. Others, such as the psychological factors, while important, can only be protected against by good planning by the operators and by harmonious relationships between the operators and crews.

Conclusions

3.23 Although there has been much aeromedical research into the problem of flight deck work load and fatigue, it is fragmented and not comprehensive. Nevertheless it has provided a useful insight into many of the issues involved and enabled subjective judgments to be applied with confidence. Therefore we *recommend* that a properly co-ordinated programme of research, suitably supported by field work, be undertaken so that the setting of Flight Time Limitations can in the future be more objectively based. To ensure that this research is properly related to operational needs and its results applied promptly, we recommend later in the report that new regulatory machinery be introduced.

4 Present Measures for the Prevention of Fatigue

International Obligations

4.1 As a signatory to the Convention on International Civil Aviation (Chicago 1944) the United Kingdom has an obligation to comply with the International Standards and Recommended Practices contained in the various Annexes to the Convention. That relevant to Flight Time Limitations is at present contained in Annex 6 Part 1, *Operations of Aircraft*, which states:

“4.2.8.3 An operator shall formulate rules limiting the flight time and flight duty periods of flight crew members. These rules shall also make provision for adequate rest periods and shall be such as to ensure that fatigue, occurring either in a flight or successive flights or accumulated over a period of time due to these and other tasks, does not endanger the safety of a flight. These rules shall be approved by the State of Registry.

Note—This Standard does not preclude a State from establishing regulations specifying the limitations acceptable to it as the State of Registry. Ensuring that such regulations are complied with would then satisfy the requirement that these rules shall be approved by the State of Registry. Guidance on the establishment of limitations is given in Attachment A”.

The Guidance in Annex 6 is of a general nature and does not contain any numerical values for rest and duty periods.

United Kingdom Requirements

4.2 Between 1927 and 1957 the only positive control was exercised by requiring a complete medical examination if 125 hours flying was exceeded in any 30 consecutive days. After 1950 an operator was required to establish his own limitations and rest periods. In 1957 the Air Navigation Order was amended so as to require an operator to set limits on flight time and duty periods within limits fixed by provisions in the Order. In 1966 proposals

were made to reduce the statutory limits, but after consultations it was decided to introduce a comprehensive system of guidance tied to the "Air Operator's Certificate" procedure. The text of the guidance contained in Appendix D to CAP 360, *Air Operators' Certificates. Information on Requirements to be Met by Applicants and Holders*¹ (issued separately as CAP 295), are reproduced in Appendix 3 and a more detailed explanation of the historical background is given in Appendix 2.

4.3 The Air Navigation Order 1972, Article 54, restricts the maximum amount of flying which can be accumulated during any period of 28 consecutive days to 100 hours. This is the only long term limit on work in UK legislation and theoretically in 12 months a pilot could accumulate 1300 flying hours without being in breach of the law. In addition, the maximum length of Flying Duty Periods is limited by the Air Navigation Order and the conditions governing the grant of an Air Operator's Certificate.

The basic limitations on Flying Duty Periods for scheduling purposes are:

Crew	Air Navigation Order	Air Operators' Certificate
	Limit (hours)	Limit (hours)
Single pilot	10	10
Two pilots	15	12
Two pilots and a flight navigator	15	13
More than two pilots	15	15
More than two pilots, and sufficient bunks for in-flight rest	22	18

Note: A Flying Duty Period includes flying time and any associated pre-flight time. It is unlikely that a Flying Duty Period of 12 hours duration would include more than 11 hours flying time.

4.4 We heard much evidence criticising the present method of the control of Flight Time Limitations. We ourselves experienced difficulty in disentangling the interconnected mass of rules, law, directions and guidance contained in three different documents, the Air Navigation Order, CAP 295, and CAP 360.

¹ CIVIL AVIATION AUTHORITY. Air operators' certificates. Information on requirements to be met by applicants and holders. CAP 360. London, 1972 (H.M. Stationery Office).

Regulations in Other States

4.5 The Secretariat of the International Civil Aviation Organisation prepares and publishes periodically in English a collection of the regulations in some 50 States. We examined the 4th Edition (1971) of this publication (ICAO Circular 52—AN/47/4) and noted a considerable variation in the manner in which the regulations are framed, their scope and their applicability. In some cases regulations are developed and issued by a State while in others an operator is permitted to prepare detailed rules, which are submitted to the State for approval.

4.6 Of particular interest is a requirement contained in the Australian Air Navigation Order which gives weight to personal subjective assessments of fatigue:

“ANO Part 48.02. Notwithstanding anything contained in these orders a pilot shall not fly, and an operator shall not require him to fly if either the pilot or operator has any reason to believe that the pilot is suffering from fatigue or, having regard for the circumstances of the particular flight to be undertaken, is likely to suffer from undue fatigue during the flight”.

4.7 A number of States set weekly, monthly, quarterly and annual limits. Examples of limits in relation to a flight crew consisting of two or three members appear in Table 4.7.

Conclusions

4.8 No ideal solution to the various issues involved has been found by any country.

4.9 The pattern of United Kingdom legislation concentrates on flying time and single duty periods. Flying hours are today too crude a measure of flight work load. In our view the duty period is a better measure of work load, but rules based solely on single duty periods cannot provide adequate protection against fatigue.

4.10 We therefore concluded that a new system of rules based on the overall planning of work and rest is required. Preferably such rules should appear in one document which is continuously monitored in the light of experience and results of aeromedical and other research.

Table 4.7

	LIMIT IN FLYING HOURS			
	Weekly	Monthly	Quarterly	Yearly
UNITED STATES International "Flag" Carriers	—	120 (30 days)	300 (in 90 days)	1000
Domestic Air Carriers	30 (in 7 days)	100 (calendar month)	—	1000
AUSTRALIA	30 (in 7 days)	100 (30 days)	—	900
CANADA	—	120 (calendar month)	300	1200
FEDERAL REPUBLIC OF GERMANY (turbo jet)		110	280	1000
FRANCE (jet aircraft over 14 tonne)		75 (average)	180 (2 consecu- tive months)	900
		95 (max-single month)	265 (3 consecu- tive months)	
JAPAN (jet aircraft)	—	80 (calendar month)	220	840
UNITED KINGDOM	—	100 (28 days)	—	—

5 Actual Hours of Duty Performed by Aircrew

Industrial Limits

5.1 The actual flying hours for which flight crew are scheduled are normally considerably less than the maximum permitted by law. In the case of some operators limits are set by industrial agreement, and examples of such limits are:

Table 5.1

Operator	Annual (flying hours)	28 day summer (winter) (flying hours)		Flying <i>Duty</i> Period limits (flying time about 1 hour less)
British Caledonian Airways				
VC10 and B707	700	85	(80)	10½ to 14*
BAC 1-11	570	70	(60)	10½ to 13*
Dan-Air Services				
BAC 1-11	550	75	(60)	12 (normal crew)
Comet 4	650	85	(70)	12 (normal crew)
BOAC	1000	non-comparable "credited" hour system subject to 100 hr/28 day legal limit		9½ to 12
BEA Trident fleet	600	75		12
BEA Airtours	600	80	(60)	12
				*depending on crew

The limits contained in all the industrial agreements brought to our notice are lower than those contained in the regulations. We found little evidence to suggest that these lower limits have been determined primarily on the basis of fatigue and its effect on safety. Indeed in some instances the method of application of lower limits may have had an adverse effect.

Operational Experience—Hours Achieved

5.2 Some basic information has been collected which when taken together with figures given by certain operators has given us a general picture of the flying and duty hours achieved by their pilots.

5.3 At the end of 1972 there were about 2130 pilots employed as aircraft captains by 44 of the operators who hold UK Air Operators' Certificates, who totalled about 910 500 revenue flying hours during 1972. This gives an average of about 425 flying hours per captain per annum. At the same time there were about 2900 pilots employed as "co-pilots", but it is impractical to draw any conclusions as to their average flying hours as with some operators, such as BEA, two are frequently carried in a crew. The figure of 425 flying hours is of course likely to be an underestimate for several reasons—first, during check flights two captains will be flying together; secondly, pilots employed on management and base training duties are included but they will normally fly fewer hours than a "line" pilot. It would seem likely that the average figure for "line" pilots is about 500 flying hours per annum. Hours flown over quarterly periods may vary considerably according to the "peaking" of operations on a seasonal basis.

5.4 During the course of our enquiries some operators provided information on the hours achieved by the pilots flying for them. Some examples are shown in the Table 5.4.

Table 5.4

Operator and category of crew	ANNUAL TOTAL HOURS			
	FLYING		DUTY	
	Average	Highest Individual	Average	Highest Individual
BOAC (1970/1)				
VC10—Captain	579	780	} not available	
B707—Captain	517	792		
VC10—P2	570	800		
B707—P2	534	805		

Table 5.4 *continued*

Operator and category of crew	ANNUAL TOTAL HOURS			
	FLYING		DUTY	
	Average	Highest Individual	Average	Highest Individual
BEA (1971/2)				
Trident 1 and 2—Captain	569	661	1369	1417
BAC 1-11 —Captain	376	481	1263	1505
Viscount —Captain	380	498	1330	1388
Trident 1 and 2—First Officer	545	776	1341	1644
BAC 1-11 —First Officer	385	453	1298	1415
Viscount —First Officer	344	476	1304	1264
BRITISH CALEDONIAN (1971/2)				
VC10 —Captain	517	578	932	1118
B707 —Captain	598	725	1086	1083
VC10 —First Officer	514	617	931	1160
B707 —First Officer	543	736	980	1134
BAC 1-11 (500)—Captain	546	690	1092	1481
BAC 1-11 (500)—First Officer	529	627	1058	1230
BRITANNIA AIRWAYS LTD				
All pilots 1972	600	—	—	—
All pilots 1971	590	—	—	—
BRITISH MIDLAND AIRWAYS LTD (1972)				
Viscount Pilots	616	—	—	—
BAC 1-11 Pilots	432	—	—	—
B707 Pilots	567	—	—	—
MONARCH AIRLINES LTD (1972)				
Boeing 720—Captain	578	—	—	—
Britannia —Captain	745	—	—	—
Boeing 720—First Officer	606	—	—	—
Britannia —First Officer	616	—	—	—

All pilots, including those employed on management duties, are included in the above data; this has the effect of slightly lowering the overall average when compared with that achieved by "line" pilots.

5.5 Although no precise statistics were provided by smaller operators it would appear from evidence given that in some cases average annual flying time may reach 800 hours. No evidence was given that 1000 hours was ever reached.

Evidence on Limits

5.6 Generally speaking, operators favoured either the retention of the present limits or their extension, whereas flight crew members and their associations called for reductions in the maximum length of the Flying Duty Period depending on the time of commencement and the number of sectors flown. Medical opinion tended to discount the importance of the duration of the duty period and to place more emphasis on the overall planning of work and rest.

5.7 Among the reasons advanced for a reduction in the Flying Duty Period the most predominant one was that a number of crews had subjectively assessed themselves as fatigued. In support of this, the British Air Line Pilots' Association submitted to the Committee some 150 letters which had been received over a number of years from pilots concerning alleged cases of fatigue.

5.8 We do not doubt the evidence submitted by many pilots that during and at the end of operations they have felt very tired. But we doubt whether they are correct in concluding that this was solely the result of the length of the duty period concerned. We were impressed by the amount of documented medical opinion which indicated that fatigue is more likely to result from badly planned sequences of work and rest rather than from the actual duration of duty.

Conclusions

5.9 Industrial agreements have undoubtedly led to the introduction of lower limits on flying and duty hours. The outcome of these agreements has been a tendency to concentrate flying and duty hours within a minimum number of days in order to achieve longer uninterrupted periods off duty. This practice has in our view increased rather than reduced the possibility of fatigue. These conclusions lead us to believe that the control of a matter which bears so directly on flight safety should not be part of the industrial bargaining process. It should be controlled by the regulatory authority imposing a concept of duty cycles relating duty, rest and leisure.

6 Aircraft Accidents

6.1 Our attention was drawn to accidents in which it was alleged there was a possibility that fatigue may have been a contributory factor. Some of these accidents occurred many years ago and we consider that they have little or no relevance to present day operations. On the other hand, several witnesses have commented that they have no knowledge of any accident in which it had been shown that fatigue was the causal factor.

6.2 We did not accept the argument that fatigue should be assumed to be a factor, unless proved otherwise, in every case where the duty period was a long one or the flight was at night.

Accident Statistics

6.3 The operating statistics and accident data for all public transport services of UK operators 1967-71 are given in Table 6.3.

Table 6.3

Year	Revenue Hours Flown	Stage Flights Flown	Notifiable Accidents		Suggested as Due to Fatigue by Certain Witnesses (See Note 2)
			Total	Fatal	
1967	688 800	426 200	18	4	1 (fatal)
1968	680 500	424 600	8	3	1 (non-fatal)
1969	716 900	455 600	8	nil	1 (fatal: not UK registered)
					2 (non-fatal)
1970	781 400	474 600	11	1	Nil
1971	865 500	504 800	7	1	Nil
1972	910 600	526 300	9	1	Nil

Notes: (1) Excluded from this table are accidents involving only a third party and accidents to aircraft for which no operating statistics are available, e.g. air taxi operations and foreign operated aircraft.

1967 1 air taxi (non-fatal)

1968 1 third party; 1 air taxi (non-fatal); 1 foreign operated aircraft

1969 1 air taxi (fatal)

1970 1 third party; 1 air taxi (non-fatal)

1971 2 third party; 6 air taxi (non-fatal)

1972 1 third party; 2 air taxi.

- (2) In addition to the accidents listed, 1 fatal accident in 1967 and 1 fatal accident in 1970 were classed as "non-assessable". A possibility of fatigue was suggested by a witness to this Committee.
- (3) Statistical information on hours and stage flights flown, and numbers of notifiable and fatal accidents is taken from CAP 361, *Accidents to Aircraft on the British Register/1971*.¹

Accident Reports

6.4 We found that, in general, accident reports contained either insufficient or no information on the period of duty at the time of the accident, the duty and rest on preceding days, and how the latter period was spent. It was suggested to us that as long as the applicable national regulations on Flight Time Limitations have been complied with the authority concerned with the investigation has usually assumed that fatigue could not have occurred. We commend authorities responsible for accident investigation to comply with the advice contained in the ICAO "Manual of Aircraft Accident Investigation" (Doc 6920-AN/855/4) para III-3-2-1:

"The following information should be obtained in respect of each crew member: . . .

- (d) medical history (recent illness or interruption of flight activity, last medical examination, investigation of fatigue factor including an assessment of duty time and rest time within the month preceding the accident and particularly within the last week and last 48 hours)".

From inquiries we have made it would appear that some authorities may decide not to give this information in the report when *they are satisfied* that fatigue has no bearing on the accident. We understand that the Accident Investigation Branch of the Department of Trade and Industry always make an investigation in the manner suggested by the ICAO Manual, but that when it is concluded that the information is quite irrelevant to the cause of the accident it may not be included in the published report.

Conclusion

6.5 On the evidence we received we were unable to decide whether fatigue had caused any accident to a United Kingdom registered aircraft in recent years. The absence of vital information in many accident reports prevented us from making deductions based on accident information.

¹ CIVIL AVIATION AUTHORITY. Accidents to aircraft on the British register/1971. A survey including statistics of airmiss incidents involving civil aircraft in United Kingdom airspace. CAP 361. London, 1972 (H.M. Stationery Office).

PART III – RECOMMENDED FRAMEWORK FOR NEW REGULATIONS

7 Rationale for Recommendations

7.1 Based on aeromedical evidence and other evidence given us by operators and aircrew we have concluded that the concept of a “duty cycle” is the most appropriate framework for defining measures designed to prevent fatigue. This concept is akin to the normal manner of covering a like situation in other occupations and professions in industry and business. Our prime objective in adopting the concept of a duty cycle is to ensure that aircrew are rested at the beginning of each duty period. This requires proper attention to the overall planning of duty, rest and time off within each duty cycle and between consecutive duty cycles, and recognition of the interdependence of the operator and the aircrew in achieving the objective.

7.2 A duty cycle encompasses both duty and off-duty periods.

Duty Period

7.3 This is the period commencing when a crew member reports for duty whether ground or flying, and ending at such time as the crew member is released from all duties, as defined in Article 48 of the Air Navigation Order 1972. We interpret duty period to include:

- Flying Duty Period, as defined below
- Positioning at the behest of the operator
- Ground training
- Ground duties
- Standby (qualified by paras 8.14 – 8.17).

Flying Duty Period

7.4 Our definition of the Flying Duty Period includes pre-flight preparation, actual flight time, and the immediate post-flight activity required by the operator before the crew is released from duty. In the case of a split duty period the intervening rest period is included in the Flying Duty Period. This differs from current practice in that it includes post-flight activity prior to release from duty.

Off-Duty Periods

7.5 We cannot agree that everything other than duty periods should be defined as *rest* periods as is presently the case in Article 48 of the Air Naviga-

tion Order 1972. We have made a clear distinction between rest periods and time-off in the duty cycle. Our interpretations of the terms rest period and time-off are:

Rest period—This is the period intended to ensure that a crew is adequately rested *before* a flight.

Time-off —This is time available for leisure and relaxation, and includes annual vacation and other free time.

7.6 The period immediately prior to a Flying Duty Period must be used for rest whether it occurs in a rest period or in the latter part of a period of time-off.

The Duty Cycle

7.7 Of other occupations it may fairly be stated that a normal working pattern comprises eight hours of duty on five consecutive days a week followed by two days free from all duty. Civil air transport operations do not permit the attainment of this pattern. Therefore aircraft operators have to construct duty cycles within the constraints provided by four separate but interrelated measures:

- Controls relating to individual duty periods
- Controls relating to individual rest periods
- Controls on cumulative duty hours within a duty cycle
- Controls on length of duty cycles and related to time-off.

These are detailed in sections 8, 9, 10 and 11.

Scheduling Practice

7.8 There are some aspects of crew scheduling which are less desirable than others. These include the scheduling of an alternate day/night pattern of work, or after a crew has become adapted to a particular local time translating that crew by "positioning", to another place where the time difference is likely to cause a serious disruption of their sleep/work pattern. Consecutive duty cycles should be constructed so as to avoid to the maximum extent possible these and other less desirable practices. We have made a great effort to construct a realistic scheduling framework, and operators will be expected to arrange their schedules within the spirit of our recommendations as well as following the letter.

7.9 Schedules must be realistic if flights are to be concluded within the scheduled Flying Duty Period limits. Therefore scheduled Flying Duty

Periods should not be exceeded by more than 30 minutes on 25% of occasions during the period of validity of a particular schedule, e.g. seasonally or annually.

Summary

7.10 The rationale on which our recommendations are based differs from that formerly used by placing greater emphasis on the overall planning of duty, rest and time-off. This necessitates operators accepting constraints such as cumulative duty hours, tightening the controls on the length of individual Flying Duty Periods and planning of duty cycles. Similarly, crews will be required to accept the responsibility for reporting for duty in a properly rested state.

8 Limitations on Single Duty Periods

8.1 There are a number of interrelated factors which should determine the permissible lengths of single duty periods. In this section we shall consider flight duty periods for crews consisting of two pilots and other crew members if so required by the certificate of airworthiness. Other crew complements and other factors affecting limits on duty periods are for convenience dealt with in section 12.

Maximum Permissible Duty Period

8.2 We examined records of the occasions on which operators have reported exceeding the current statutory Flying Duty Period limits of 11 hours (one pilot) and 16 hours (two or more pilots). This occurred 114 times during 1972, an overall average of once in every 7800 aircraft flying hours. We understand that this aspect of operations is under constant surveillance by the Flight Operations Inspectorate and should any operator incur a high incidence of such reports he is subject to a careful investigation. We noted in particular that one operator had incurred nine reports which gave an average of one in every 685 flying hours. Corrective action was taken against this operator. We consider that the incidence of the statutory limits being exceeded is comparatively rare. We have not been given any evidence to show that when they have, there was any hazard to flight safety.

8.3 Having regard to the above conclusion and that reached in section 5, we *recommend* that the maximum scheduled Flying Duty Period in the most favourable circumstances should not exceed 14 hours. The commander's discretion to exceed the maximum scheduled Flying Duty Period should continue to be available as defined in para 8.11.

Reduction in Flying Duty Periods for Work Commencing at Base

8.4 Medical evidence suggests that each landing and take-off results in peaks of work load on the aircraft captain and to a lesser degree on the co-pilot. It appears, therefore, that the more sectors flown the greater the work load during a duty period. We do not consider that medical evidence justified establishing a complex relationship between allowable duty periods and numbers of sectors. We believe that a simple rule would be appropriate in which the increment of fatigue for a take-off and landing equals three-quarters of an hour of normal flight. We also believe that the effort involved in pre-flight preparation or in post-flight activities cannot be disregarded.

8.5 A normal pattern of life is for a person to sleep for eight hours and be awake for 16 hours. We therefore consider that the local time of commencement of a Flying Duty Period is significant when it begins at base owing to the constraints of the home environment. The most favourable time to commence duty is in the morning since it should be easy to obtain proper rest beforehand. When a Flying Duty Period starts later in the day it is possible that a crew member will have been awake in excess of 16 hours when it finishes. Alertness may be affected when a duty period impinges on the normal hours of sleep. We therefore consider that the maximum scheduled Flying Duty Period of 14 hours should only be permitted to commence between 0800 and 1300 local time, and that periods commencing at other times should be curtailed.

8.6 Finally we consider that when the Flying Duty Period permitted by the above considerations is only nine hours, no further reduction in Flying Duty Period for additional sectors is necessary.

8.7 We therefore *recommend* that Table 8.7, which is based on the foregoing conclusions, should be mandatory for scheduling purposes:

Table 8.7

FLYING DUTY PERIOD COMMENCING AT "BASE"¹

Local time of start of Flying Duty Period	Maximum length of Flying Duty Period which may be scheduled out of Base ¹							
	Number of sectors							8 or more
	1	2	3	4	5	6	7	
0801—1300	14	13½	12½	11¾	11	10½	9½	9
1301—1800	13	12½	11½	10¾	10	9½	9	9
1801—2200	12	11½	10½	9¾	9	9	9	9
2201—0600	11	10½	9½	9	9	9	9	9
0601—0800	12½	11¾	11	10½	9½	9	9	9

¹ Base includes an airfield within 80 km of the Base airfield from which the crew normally operate.

Reduction in Flying Duty Periods for Work away from Base

8.8 We do not consider that a variation in the maximum scheduled Flying Duty Period based on the local time of departure is justified when the stopover is of a short duration and the crew member has not adjusted to local time. If however a pre-flight rest period is of unfavourable duration, that is between 18 and 30 hours, then the maximum scheduled Flying Duty Period permitted should be reduced. We *recommend* Table 8.8 to cover these circumstances:

Table 8.8

**FLYING DUTY PERIOD COMMENCING AWAY FROM "BASE"
AS PROVIDED IN PARAGRAPH 8.8**

Preceding rest period	Maximum Flying Duty Period which may be scheduled						
	Number of sectors						7 or more
	1	2	3	4	5	6	
Up to 18 hours, or more than 30 hours but not including three or more local nights	13	12½	11½	10¾	10	9½	9
Between 18 and 30 hours	12	11½	10½	9¾	9	9	9

8.9 When three or more consecutive nights free of duty and on the same local time have been provided, whether or not duties are performed during the daytime, a crew member tends to become adjusted to local time. Under these circumstances the maximum permitted scheduled Flying Duty Period shall be controlled by the associated conditions as set out in Tables 8.10.1 and 8.10.2. These tables apply whether or not duties have been performed during the period which contains the three or more "local nights". A "local night" is a period of eight hours falling between 2200 and 0800 local time.

8.10 We *recommend* that Tables 8.10.1 and 8.10.2 should apply in the circumstances described in para 8.9:

Table 8.10.1**FLYING DUTY PERIOD COMMENCING BETWEEN 0801-1300**

Preceding rest period	Maximum Flying Duty Period which may be scheduled							
	Number of sectors							
	1	2	3	4	5	6	7	8 or more
Up to 18 or more than 30 hours	14	13 $\frac{1}{4}$	12 $\frac{1}{2}$	11 $\frac{3}{4}$	11	10 $\frac{1}{4}$	9 $\frac{1}{2}$	9
Between 18 and 30 hours	13	12 $\frac{1}{4}$	11 $\frac{1}{2}$	10 $\frac{3}{4}$	10	9 $\frac{1}{4}$	9	9

Table 8.10.2**FLYING DUTY PERIOD COMMENCING BETWEEN 1301-0800**

Preceding rest period	Maximum Flying Duty Period which may be scheduled						
	Number of sectors						
	1	2	3	4	5	6	7 or more
Up to 18 or more than 30 hours	13	12½	11½	10¾	10	9¾	9
Between 18 and 30 hours	12	11½	10½	9¾	9	9	9

Particular Cases (Air Navigation Order 1972, Article 50(6))

8.11 We consider that it remains necessary to retain provision for the commander of an aircraft to extend a Flying Duty Period beyond the maximum which may be scheduled, provided circumstances warrant such action. In all cases where this is done we *recommend* that the commander shall report the circumstances to the operator. When the actual Flying Duty Period exceeds 16 hours, or by three hours the periods which may be permitted in accordance with the tables given in paras 8.7, 8.8, and 8.10, then both the aircraft commander and the operator shall be required to submit a report to the Authority within 30 days.

Positioning/Dead Heading of Aircrew

8.12 We have encountered differing uses of the terms “positioning” and “dead heading”. In one case the terms are synonymous, in another the term dead heading is used to describe a specific type of positioning where crews travel as passengers on company or other aircraft subsequent to completion of a Flying Duty Period and when less than normal minimum rest has been taken. We shall use the single term positioning to cover the practice of transferring crew as passengers to or from a place of duty.

8.13 We have identified three basic sequences incorporating positioning and we *recommend* that:

- (i) When positioning immediately precedes a Flying Duty Period the total time spent on duty is subject to the limitations placed upon a single Flying Duty Period. The total time spent on duty should be included in the cumulative totals of duty hours.
- (ii) When positioning immediately follows a Flying Duty Period only the time of the Flying Duty Period is subject to the limitations placed upon a single Flying Duty Period (paras 8.7, 8.8 and 8.11). The total time spent on duty should be included in the cumulative totals of duty time.
- (iii) When positioning is separated from a Flying Duty Period by rest periods, half of the time spent on positioning should be included in the cumulative totals of duty time.

Standby Duties

8.14 Standby duty is defined as being any period of time when the operator places restraints upon the crew members' use of what would otherwise be time off duty. Various names have been used by operators and crews to describe the many forms of this duty – standby, duty crew, available, etc. In some cases the duty is undertaken at places (which may be aerodromes) where adequate rest facilities are not available.

8.15 It would appear to us that on long standby periods crew members may be unable to plan adequate pre-flight sleep. At the end of such a period there is a possibility of their being called on duty near the expiration of a long period of wakefulness. This problem can be minimised by reducing the length of standby, the following duty period, or both. We *recommend* that operators be required to devise standby rules such that the length of standby should not exceed 12 hours and the combined sum of standby time and

following duty time should not exceed 20 hours. We recognise that reduction in the length of standby may well result in crews being required to standby on more occasions than at present, but we consider this is preferable, in the interests of fatigue avoidance, to their going on duty near the end of a long period of wakefulness.

8.16 We *recommend* that time spent on standby be subject to the controls set out in Table 8.17. The controls vary according to whether adequate rest facilities are available, and whether the standby results in a crew member being called for positioning or to carry out a Flying Duty Period.

8.17 Periods of standby duty, flying duty, or both, will be deemed to be continuous unless a minimum period of 12 hours' duration separates them. In no circumstances will the period of standby exceed 12 hours.

Split Duty

8.18 We accept the concept of split duty periods as presently allowed for in CAP 360, and *recommend* that when a Flying Duty Period consists of two or more sectors separated by a period of rest, which is less than 12 hours, then the period may be extended beyond that permitted in accordance with the tables given in paras 8.7, 8.8 and 8.10 by the amounts indicated as follows:

Not less than four consecutive hours rest	: plus two hours
Not less than six consecutive hours rest	: plus three hours
Not less than eight consecutive hours rest	: plus four hours
Not less than 10 consecutive hours rest	: plus five hours

When the rest period is not more than six consecutive hours, the facilities will be considered adequate providing that a quiet and comfortable room is available not open to the public, but if it is more than six consecutive hours then a bed shall be provided.

Extension on Length of Flying Duty Period by In-flight Relief

8.19 A number of operators have stated that there are aircraft in existence or being designed, which have the capability of operating a single sector in excess of 12½ hours flying time. This might exceed the proposed scheduling limitations of a 14-hour Flying Duty Period. To perform such operations safely necessitates each individual crew member obtaining rest during flight. This requires the carriage of additional qualified crew members and rest facilities. In discussions a significant number of individual pilots considered that it was difficult for the commander of an aircraft to obtain adequate in-flight relief from duty. None equated in-flight rest with that taken on the ground. We consider that with the safeguard given in para 8.2 an extension of Flying Duty Periods is permissible over both single and multi-sector operations.

Table 8.17

Duty	Maximum Duration	Accountability for cumulative controls where:	
		Adequate rest facilities are available	No adequate rest facilities are available
Standby	12 hours (all cases)	$\frac{\text{Standby hours}}{2}$	Standby hours
Standby + Flying Duty Period	20 hours	$\frac{\text{Standby hours} + \text{Flying Duty Period hours}}{2}$	Standby hours + Flying Duty Period hours
Standby + positioning	No limits	$\frac{\text{Standby hours} + \text{Positioning hours}}{2}$	Standby hours + Positioning hours <u>2</u>

For the purpose of this table adequate rest facilities are defined as:

- (i) Crew members places of residence
- (ii) Quiet private accommodation with beds, at any location.

Art 48(3)(c)(i) of the Air Navigation Order 1972 requires that periods of rest at an aerodrome be counted as duty. We consider this constraint should not apply to rest taken in private accommodation, as described above, in an airport hotel.

8.20 The current requirements for the use of a relief pilot are contained in CAP 360, Chapter 2, Para 4.8, (see Appendix 3A) and are:

“that he should hold a ‘Part 1 pilot in command’ rating on the type of aircraft to be flown and either:

(a) be currently qualified without restriction as a commander, or

(b) be currently qualified without restriction as a co-pilot *and* have at least 100 hours’ experience on the type of aircraft to be operated.”

We consider the latter of these qualifications does not provide an adequate standard for any in-flight relief for the aircraft commander. We therefore *recommend* that any crew member carried to provide in-flight relief for the purpose of extending a duty period shall hold equal qualification to those required for the crew member he relieves.

8.21 We find no justification for the present CAP 360 provision which allows an extension of the Flying Duty Period for all crew members when a flight navigator is a required member of the flight crew. The evidence given us indicates that his presence provides little in-flight relief to other crew members from their allocated duties.

8.22 We *recommend* that the commander of aircraft and his designated in-flight relief shall both sign all the required pre-flight documents. We *recommend* that the in-flight handing over of duty to a relief crew member shall be recorded in an appropriate log.

8.23 We *recommend* when in-flight relief is provided there must be available for the crew member who is resting a comfortable seat or bunk, separated and screened from the flight deck and passengers. We *recommend* that when bunks are provided the scheduled Flying Duty Period may be extended to 18 hours, but with seats the maximum should be 15 hours. The scheduled Flying Duty Period may be extended beyond that permitted in accordance with the tables given in paras 8.7, 8.8 and 8.10 by the amounts indicated as follows:

Not less than four consecutive hours rest : plus one hour

Not less than six consecutive hours rest : plus two hours

Not less than eight consecutive hours rest : plus three hours

Not less than 10 consecutive hours rest : plus four hours

Extended Flying Duty Period operations should be subject to vigilant surveillance by the Flight Operations Inspectorate.

Notification of Duty

8.24 Operators of scheduled services generally appear to plan their duty rosters sufficiently in advance so as to provide an opportunity for crew members to plan both social life and pre-duty rest satisfactorily. However, due to cancellations, delays and aircraft unserviceability, all of which are inherent in the industry, it is frequently necessary to amend rosters at fairly short notice. We consider it is impractical to demand an overriding minimum period of notification. However, we see no reason why individual operators should not establish minimum periods of notification of duty for flight crews, other than those on standby. In the case of some non-scheduled operators flight crew appear to be called for duty as required. We *recommend* that in these cases the flight crew members should be allocated, well in advance, time off duty during which they will not be called.

Flight Engineers and Flight Navigators

8.25 Longer hours of duty are presently permitted in respect of Flight Engineers and Flight Navigators. It would appear to us from the evidence submitted that no distinction between members of flight crew is justified. We therefore *recommend* that the same requirements apply to all flight crew.

9 Purpose and Length of Pre-flight Rest

Responsibilities of Operator

9.1 It is the responsibility of the aircraft operator to notify a Flying Duty Period so that adequate pre-flight rest can be obtained by the crew. Away from base the aircraft operator must provide both the opportunity and facilities for the crew to obtain adequate pre-flight rest. It is the responsibility of operators to ensure that rest accommodation is satisfactory particularly in respect of noise, temperature, light and ventilation.

9.2 We also *recommend* that operators should be obliged to provide facilities for those crew members who have difficulty in achieving pre-duty sleep to discuss their problems with an aeromedical specialist.

Responsibilities of a Crew Member

9.3 It is the responsibility of the crew members to make optimum use of the opportunities and facilities and plan the rest periods properly. It would appear to us that some crew members fail to make the best use of their rest periods in order to prevent cumulative sleep deficit. The required rest periods

associated with Flying Duty Periods are provided solely in the interests of safety.

9.4 We *recommend* that the Authority provide detailed guidance to crew members on the planning of sleep during rest periods.

Responsibilities of the Aircraft Commander

9.5 We note that Article 30, Air Navigation Order 1972, describing the pre-flight actions by the aircraft commander, makes no reference to responsibility for ensuring the fitness of the crew, although commanders may well have assumed such responsibilities in practice. We also note that the Australian legislation, quoted in para 4.6, places a responsibility on each individual pilot not to fly if he has reason to believe that he is likely to suffer from undue fatigue during the flight. We *recommend* that similar provisions applicable to all flight crew members be included in the Air Navigation Order.

Pre-flight Rest Periods

9.6 Article 52 of the Air Navigation Order provides tables of minimum rest periods depending on the duration of the preceding duty period. We heard evidence which suggested that a minimum period of 10 hours was seldom satisfactory, particularly if it occurred at base when the element of time spent travelling to and from home could significantly reduce the time available for sleep. We were also advised that rest periods in excess of 18 hours when taken en route did in some circumstances defeat their object.

We therefore *recommend* that Table 9.6 should apply in all circumstances:

Table 9.6

MINIMUM REST REQUIRED

Length of duty period immediately preceding						Minimum length of sufficient rest period			
Not exceeding 12 hours .. .. .						..	..	..	12 hours
Exceeding 12 but not exceeding 13 hours						..	..	..	13 hours
..	13	..	..	..	14	..	..	..	14 ..
..	14	..	..	..	15	..	..	..	15 ..
..	15	..	..	..	16	..	..	..	16 ..
..	16	..	..	..	17	..	..	..	17 ..
..	17					..	..	..	18 ..

Note: The objective of this table is to provide opportunity for an uninterrupted period of 8 hours horizontal rest.

9.7 Many of the long haul schedules we examined provided rest periods which were well in excess of the present legal minima. Yet because they were close to being multiples of 24 hours these were in fact less than ideal from the point of view of getting sleep immediately before the commencement of the following Flying Duty Period. However, the commercial dictates of scheduled operations frequently result in departure and arrival times which are separated by slightly more than 24 or 48 hours. We consider this to be undesirable but unavoidable. The best use of a 24-hour rest period requires careful planning by the crew members concerned and we consider that both the Authority and operators should provide them with advice where necessary.

10 Acceptable Cumulative Duty and Flying Hours

10.1 We believe that the adverse effect of sleep deficit can be contained by limiting the hours of duty that can be accumulated.

Weekly Limits

10.2 We therefore *recommend*, in respect of all types of operation, that the maximum duty hours which may be scheduled within any seven consecutive days be limited to 50.

Monthly Limits

10.3 Some witnesses suggested that the existing 28 days (monthly) limit on flying hours be reduced from 100 to about 80. However, aeromedical evidence indicated that occasional peaking to 100 hours a month was not in itself a cause of cumulative fatigue. We therefore *recommend* that the present limit is retained.

10.4 We consider that the 28 days (monthly) duty hours of flight crew should be related to that normal in other occupations. We therefore *recommend* that the cumulative amount of duty should be limited to 160 hours within any 28 consecutive days, and that for this purpose duty time shall be counted in the manner proposed in Sections 7 and 8.

Quarterly Limits

10.5 We agreed that the imposition of limits on weekly and monthly duty hours, supported by an annual limit on flying hours, renders a quarterly limit unnecessary.

Annual Limits

10.6 In view of the fact that excessive annual flying hours do not occur in United Kingdom civil aviation, we found it impossible to obtain evidence to show the level at which safety might be jeopardised. Established limits have either been arbitrarily selected or based on industrial negotiation. The typical annual duty time of people engaged in business and industry is 1680 hours. Data provided in evidence disclosed that the ratio of duty time to flying time varied between 1.5:1 and 3.4:1 according to the type of operation.

10.7 On the basis of these figures, which are unrelated to flight safety, we *recommend* an annual limit of 900 flying hours in any consecutive 12 calendar months. Flying hours have been selected because they have to be recorded in a crew member's personal flying log book.

11 Duty Cycles and Time Off Duty

Short "Weekly" Break

11.1 There is a long-established precedent based on social considerations and habit for a break from work once a week. Apart from social considerations there is probably a physiological advantage to be gained from a short "weekly" break. At present a "weekly" break is required not by the Air Navigation Order but by para 3.5 of CAP 360, Appendix D, which states:

"The aim should be to schedule crews so that they have a clear break of at least 36 hours, including two local nights, at least once in any seven day period. Exceptionally, this period may be extended to ten days to meet special circumstances."

11.2 We *recommend* that the normal duty cycle should not extend beyond seven days (168 hours) and that a regular short break be provided within the period for the purpose of rest and time off. The interval between the end of one short break and the beginning of the next should not normally exceed 136 hours. In order to provide flexibility the duty cycle may exceptionally be extended to 240 hours (10 days) with the interval between short breaks not exceeding 208 hours. In no case may more than 50 duty hours be scheduled in any duty cycle.

11.3 For the purpose of the above requirement we *recommend* that a short break should be deemed to be sufficient if it extends over a period of at least 32 hours, and includes two periods of eight hours falling between 2200 and 0800 hours local time.

Short Breaks away from "Base"

11.4 Operations which necessitate short breaks being taken away from normal "Base" require special attention. Whilst we found support from aircrew for a weekly break, it was pointed out to us by certain operators and aeromedical specialists that such requirements inevitably extend the crew's time away from "Base". Furthermore the cumulative effect of sleep disruption and time zone changes may be reduced by completing a pattern of duty cycles as quickly as possible. We do not consider the evidence is sufficient to eliminate or reduce short break periods away from "Base". We consider a short break is an essential element of the duty cycle. When crew schedules can be so arranged this short break may coincide with the days off at "Base" required by para 11.5.

Time Off Duty at "Base"

11.5 Aeromedical and other opinion emphasised the importance of the home environment in the avoidance of cumulative stress leading to fatigue. We *recommend* an average of eight days (192 hours) off at "Base" within every 28-day period, with not less than six days (144 hours) off within any particular 28-day period. We *recommend* that time off duty including three consecutive nights be provided within any 14 consecutive days. However, when the time away from "Base" exceeds 11 days, then time off duty, which includes three consecutive nights, shall be provided on return to "Base". A local night is a period of eight hours falling between 2200 and 0800 local time.

Additional Employment

11.6 We received evidence that some flight crew undertake demanding activities additional to their primary employment with an aircraft operator. These include politics, local government, community work, business unrelated to flying, private flying, instructional flying, and in some cases flying as flight crew on air charter operations.

11.7 Reasons given for flight crew involvement in such activities included the fact that some have longer uninterrupted periods of time off duty than most members of the community. Therefore such interests tend to counteract boredom arising through inactivity. An opposing view held that such interests may lead to preoccupation, worry and lack of sleep leading to the onset of fatigue and that this should therefore be discouraged or even forbidden.

11.8 It is our view that reasonable involvement in activities other than flying is acceptable and could indeed be beneficial. In stating this we emphasize it is a *crew member's absolute responsibility* to ensure that such activities

do not in any way contribute to the possibility of fatigue occurring during flying duties. In this respect flight crew differ from other members of the community and must apply the highest possible standards of self-discipline.

11.9 Where flight crew undertake flying additional to that performed on behalf of their primary employer it should be with that employer's foreknowledge and approval. We heard evidence that this is not always the case. In this context we *recommend* that a legal obligation be placed on a flight crew member to notify any operator who employs his services of all flying he undertakes either privately or for other operators.

11.10 We have noted that Article 22 of the Air Navigation Order 1972 requires the particulars of all flights made as a member of flight crew to be recorded in a personal flying log book. Evidence showed that this law is frequently infringed by default and that the log books concerned are seldom checked, inspected or certified as correct. This state of affairs is lamentable since the log book is the only place where a crew member's total flying time is required to be recorded. We *recommend* that the Authority correct this deficiency.

12 Special Considerations Applying to Certain Types of Operation

12.1 The recommendations elsewhere in this Report specifically relate to public transport aircraft with crews consisting of two pilots and other crew members if so required by the certificate of airworthiness. Whilst we consider the basic rationale and many of the recommendations should be applied to other aircraft and crew configurations, in some instances other factors predominate and require special considerations.

12.2 Unless modified by the recommendations made in this Section those contained elsewhere should be deemed to apply to all aircraft types and crew configurations.

Single Pilot Operations

12.3 Article 18 of the Air Navigation Order 1972 requires the carriage of two pilots on public transport flights in aircraft having a maximum total weight authorised of 5700 kg or more, and when specified in the certificate of airworthiness. Other aircraft may operate with only one pilot. Single pilot operations are frequently conducted over relatively short sectors and without instrument approach and landing facilities at the terminal airfields. In these

circumstances the pilot work load will be of a different nature and often quite high, therefore the hours of duty should be less than those for a two-pilot crew. We *recommend* that the following table of duty should apply to these operations:

Table 12.3

Time of start of duty	Maximum Flying Duty Period which may be scheduled (hours)				
	No of sectors				
	1 and 2	3 and 4	5 and 6	7 and 8	9 or more
0801-1300	10	9½	9	8½	8
1301-1800	9	8½	8	8	8
1801-0600	8	8	8	8	8
0601-0800	9	8½	8	8	8

Operations by Aircraft under 2300 kg Weight

12.4 Some witnesses expressed concern about the conduct of operations by public transport aircraft under 2300 kg maximum take-off weight. The operators of such aircraft are not required to hold an Air Operators' Certificate and are consequently not subject to surveillance by the Flight Operations Inspectorate. It was alleged that although the provisions of the Air Navigation Order relating to fatigue are applicable to *all* operations for the purpose of public transport compliance was inadequately enforced. We *recommend* stricter control of these operations by the Authority.

Executive Aviation and Aerial Work

12.5 The terms of reference restricted our inquiry to "the flight crews of public transport aircraft". However, we received some evidence which involved other types of operation. Concern was expressed that the crews of executive and aerial work aircraft were not subject to Flight Time Limitations. We heard no evidence to show that the operators of such aircraft were carrying out fatiguing operations. Nevertheless we consider that fatigue in the crews of such aircraft is a potential hazard and that consequently their flying duties should be subjected to controls similar to those applicable to public transport.

Helicopter Operations

12.6 These operations do not normally involve long distance flights with time zone changes. They normally consist of a number of relatively short

flights during which multi sectors may be carried out without stopping the rotor. They involve high pilot work load. We consider that flying helicopters can be more fatiguing than flying aeroplanes.

12.7 We *recommend* the following scheduling limitations should apply to public transport helicopter operations:

(a) **Flying Duty Periods**

Table 12.7

Type of operation				Maximum length of Flying Duty Period which may be scheduled (hours)			
(i) Single pilot							
	day	..	..	..	..	..	10
	night*	..	..	..	..	..	8
(ii) Two or more pilots							
	day	..	..	..	..	..	12
	night*	..	..	..	..	..	10

* An operation any part of which is within the period of night as defined in the Air Navigation Order.

(b) **Flying Hours**

Within any one Flying Duty Period
a maximum of:

- (i) 7 hours flying time for single pilot operations
- (ii) 9 hours flying time for two or more pilot operations.

Sector Limits

12.8 It may be necessary at some time in the future to limit the number of sectors which may be flown on helicopter operations within a single Flying Duty Period. We are of the opinion that it would be premature to recommend the introduction of such a limitation at this time. We *recommend* that this matter should be kept under review by the Authority.

PART IV – PROPOSED REGULATORY SYSTEM

13 Format of Rules and Legislation

13.1 The present rules for Flight Time Limitations are divided between the Air Navigation Order 1972 and material contained in Appendix D to CAP 360, *Air Operators' Certificate. Information on Requirements to be Met by Applicants and Holders* (also issued separately as CAP 295, *Flight Time Limitations*). CAP 360 is published by the Authority and includes important provisions which must be met by an applicant seeking an Air Operators' Certificate. It also includes guidance material.

13.2 We consider it important that any written requirements for Flight Time Limitations should have as uniform an effect as possible in achieving the objective of fatigue prevention. It is clear that the several factors which determine the periods of work and rest vary considerably with the nature of the operation. The written requirements, therefore, must either be detailed and elaborate, or in basic form with reasonable freedom to apply them with commonsense. We believe the latter to be a practicable solution for the future.

13.3 We consider that the present system is not suited to this purpose. The inclusion of detailed numerical limitations in the Air Navigation Order does not permit sufficient flexibility in application. Further, we believe that a matter as technically complex, and in need of progressive review, as Flight Time Limitations does not lend itself to the processes involved in formulating legislation.

13.4 Furthermore we are not convinced of the need to provide rules in the form of legislation, the infringement of which renders either the individual or the operator liable to criminal proceedings. We consider that a better system of control is for the Authority to publish rules as conditions which an operator must meet. It is for the Authority to satisfy itself that the operator is taking adequate steps to prevent fatigue.

13.5 We consider that enforcement can be adequately achieved through the Air Operators' Certificate in the case of operators of public transport aircraft of over 2300 kg (approx 5000 lb). Operations not conducted under the provisions of an Air Operators' Certificate should receive close supervision from the Authority.

13.6 We therefore *recommend* that:

- (a) the Air Navigation Order 1972 be amended so as to require that the

Flight Time Limitations established by an operator shall be approved by the Authority

- (b) the Authority issues information on the "Requirements" to be met by air operators and flight crew members for the avoidance of fatigue in flight crew. We commend as a short title "Flight Time Limitation Requirements".
- (c) Articles 51 and 52 should be deleted from the Air Navigation Order 1972.

14 Interpretation and Development of "Flight Time Limitation Requirements"

14.1 We recognised that the proposed "Flight Time Limitation Requirements" would need to be interpreted in relation to the particular circumstances of the operation under consideration. The task of considering the operator's proposed system of control in relation to the "Requirements" will rest with the Flight Operations' Inspectorate. In our view they will need guidance in the task of interpretation.

14.2 An aeromedical specialist, an operator and a crew organisation proposed the setting up of a Board to deal with the various issues which arise in connection with Flight Time Limitations. The concepts put forward as to its constitution, role and function differed widely.

14.3 Our view is that the task of the Inspectorate would be facilitated if a suitable Board were to be appointed to which issues of difficulty could be referred. We recognised that the proposed Requirements, though they now seem appropriate, will need to be kept under review. A standing body capable of making such a review is preferable to the appointment of a special committee from time to time. If such a Board is to create confidence it will need to be representative of those who can make real contributions to its work—the operators, aircrew, aeromedical specialists and flight safety personnel.

14.4 A further advantage of such a Board would be to bring aeromedical personnel into close contact with current problems. It would provide a valuable feed-back to the longer term development of aeromedical science. The concept of such a Board as part of the regulatory system is not new. The Airworthiness Requirements Board and its predecessor the Air Registration Board, in relation to the broader field of airworthiness, have shown that

in a complex and sometimes contentious field of regulations, a suitable specialised Board has much to offer.

14.5 We therefore *recommend* that the Authority appoints an advisory Flight Time Limitations Board, with membership as follows:

- (i) three or four members appointed directly by the Authority, who shall include a chairman and an independent aeromedical specialist and
- (ii) two members from airline operators and two experienced practising airline captains. Both these categories of members will be selected by the Authority from nominations made by appropriate organisations.

14.6 We *recommend* that the Authority should co-opt additional members to the Board for specific meetings where their special expertise could be valuable. They could include specialist flight or cabin crew, experienced and still active in their occupations. Such persons should be selected by the Authority in a similar manner to that used for the pilot and operator members.

14.7 We consider the duties of the Board should be two-fold. First it should advise the Authority in respect of the Flight Time Limitations Requirements and associated legislation. Secondly it should act as a reference body to advise the Flight Operations Inspectorate on any significant or contentious application of the Requirements in particular cases. We would expect the Board to request particular matters to be remitted to it. Equally its advice would be given at the request of the Flight Operations Inspectorate, or the request of an operator directly concerned, or an Association representing flight crew interests. Under no circumstances should the Board be concerned with arbitration in industrial disputes. Its advice will be concerned solely with flight safety.

PART V – CONCLUSION

15 Summary of Main Recommendations

Our main recommendations are summarised as follows:

- (1) The Air Navigation Order should be amended so as to require that the Flight Time Limitations established by an operator be *approved* by the Authority (para 13.6 a).
- (2) The Authority should issue “Requirements”, which are to be met by operators and flight crew, for the avoidance of fatigue (para 13.6 b).
- (3) Articles 51 and 52 should be deleted from the Air Navigation Order 1972 (para 13.6 c).
- (4) An advisory “Flight Time Limitations Board” should be established to which issues of difficulty could be referred (para 14.5).
- (5) For a crew consisting of two pilots, and other crew members if so required by the certificate of airworthiness, the maximum scheduled Flying Duty Period in the most favourable circumstances should not exceed 14 hours (para 8.3).
- (6) The maximum length of Flying Duty Period which may be scheduled from Base should depend on the number of sectors and the time of starting (para 8.7).
- (7) The maximum length of Flying Duty Period which may be scheduled away from Base should depend upon the number of sectors and the preceding rest period (paras 8.8 and 8.10).
- (8) Positioning (dead heading) should count as either duty or part of a Flying Duty Period depending on the circumstances (para 8.13).
- (9) Standby should count as either duty or part of a Flying Duty Period depending on the circumstances (para 8.16 and 17).
- (10) The length of standby should not exceed 12 hours (para 8.15).

- (11) The extension of a Flying Duty Period by the provision of in-flight relief crew should be restricted (para 8.23).
- (12) A new table (para 9.6) of "minimum rest required" is proposed. The minimum rest period should be 12 hours, and a rest period longer than 18 hours should not be required (para 9.6).
- (13) The Air Navigation Order should be amended to require that a flight crew member should not fly, and an operator should not require him to fly if the crew member is suffering from fatigue (para 9.5).
- (14) The maximum *duty hours* which may be scheduled within any seven consecutive days should be limited to 50 (para 10.2).
- (15) The maximum *duty hours* which may be accumulated within 28 consecutive days should be limited to 160 (para 10.4).
- (16) There should be a limit of 900 flying hours within any 12 consecutive calendar months (para 10.7).
- (17) There should be a short break, of at least 32 hours and including two local nights, once in any seven days (para 11.2 and 11.3).
- (18) A flight crew member should have an average of eight days (196 hours) time off duty at base within every 28-day period (para 11.5).
- (19) A legal obligation should be placed on flight crew members to notify any operator who employs his services of all flying he undertakes privately or for other operators (para 11.9).
- (20) The Authority should ensure that flight crew complete their personal flying log books as required by law (para 11.10).
- (21) For single pilot operations the maximum Flying Duty Period which may be scheduled should depend on the number of sectors and time of starting, but should not exceed 10 hours (para 12.3).
- (22) Stricter control should be applied to public transport operations by aircraft under 2300 kg maximum take-off weight (para 12.4).
- (23) Special limits on Flying Duty Periods are proposed for helicopter operations (para 12.7).

16 Acknowledgements

16.1 We are indebted to the many persons and organisations, listed in Appendix 1, who presented evidence to us. We were impressed by the trouble taken in submitting proposals and the presentation of detailed arguments.

16.2 Throughout our inquiry we have been well served by our Secretary, Mr Varley. His expert advice has been of great help to us.

DOUGLAS BADER, Chairman

WALTER TYE, Deputy Chairman

JOHN R SIDEBOTHAM

LAURIE TAYLOR

NORMAN A WHITE

MICHAEL VARLEY, Secretary

June 1973

APPENDIX 1

LIST OF WITNESSES

During the course of the Inquiry we received written evidence varying in length from a few lines to over 100 pages, from a wide section of interested parties. In many cases this was supplemented by oral evidence. We wish to thank:

Air Freight Ltd
Air London Air Taxis Ltd
Air Service Training Ltd
Air Taxi Operators Association Ltd
 Capt D J Antrobus
 Capt E F Thurston
Alidair Ltd
Capt A M Allenby
Capt J Arnot
Capt R E Atkins
Aurigny Air Services Ltd
Capt M J Austin
Mr A F Bance
Beecham-Imperial Aviation Ltd
Capt W H Benton
Dr K Bergin
Bristow Helicopters Ltd
 Capt A Gordon
Britannia Airways Ltd
 Capt D H Davison
 Capt R McDougall
British Air Ferries Ltd
British Air Line Pilots Association
 Capt H A Hopkins
 Mr N J Jackson
 Capt E S Linstead
 Mr O Malik
 Capt J L Richardson
 Mr A W Wright

British Airways Group

British Airways Helicopters Ltd

British European Airways Corporation

Capt I A L Slight

Mr A H Bridger

BEA Air Tours Ltd

Capt W Brennan

Capt P J McKeown

British Overseas Airways Corporation

Capt J Andrews

Mr D T Dresch

Mr M R Mitchell

Capt T Nisbet

Capt D F Redrup

Capt F W Walton

Cambrian Airways Ltd

Northeast Airlines Ltd

Capt R E Johnson

British Airways Joint Medical Service

Dr Graham Taylor

British Caledonian Airways Ltd

Capt S Calder

Dr P Chapman

Capt T Evans

Capt P Mackenzie

Mr A Pugh

British Helicopter Advisory Board

Capt E Brown, RN

British Island Airways Ltd

Capt S G Allen

Mr L B Elwin

Capt J F Johnson

British Midland Airways Ltd

Mr M D Bishop

Capt J E Blackman

Capt W Brown.

Brymon Aviation Ltd

Business Aircraft Users Association Ltd

Mr R R Stephenson

Mr J Ward

Prof A Charlesby

Civil Aviation Authority

Dr G Bennett

Mr G C Chouffot

Mr D P Davies

Mr R E Dominy

Capt J C Forshaw

Capt G B Gurr

Capt E J Hengle

Dr J S Howitt

Mr P Kenworthy

Capt R Kohn

Mr J R Neill

Mr A M Raffael

Capt R G K Rice

Capt W F Williams

Capt D C Cole

Capt P R Cole

Prof R T W L Conroy

Court Line Aviation Ltd

Capt G L Tong

Cyprus Airways Ltd

Dan-Air Services Ltd

Capt R E Atkins

Mr M J Diamond

Donaldson International Airways Ltd

Eagle Flying Services Ltd

Eastern Seaboard Ltd

Capt M T Fitzpatrick-Nash

Gibraltar Airways Ltd

Capt A Gibson

Prof J D Gillett

Capt J L Gregory

Guild of Air Pilots and Air Navigators

Mr J F Allen

Capt K R Blevins

Capt E J Davies

Capt R Gillman

Mr W E B Griffiths

Capt H G Hazelden

Mr P Martin

Mr W Rossiter

Mr P Wilson

Capt I Hannay

Haywards Aviation Ltd

Capt A G Henderson

Capt A J Holderness

Humber Airways Ltd

Capt R C Hurcombe

International Aviation Services (UK) Ltd

Intra Airways Ltd

Invicta International Airlines Ltd

IPECO Europe Ltd

Island Air Charter Ltd

Capt B O Prowse

Mr M D Jeffery

Capt R L Jones

Capt A H Kerr

Capt M F Laing

Laker Airways Ltd

Mr F Laker

Capt R Landells

Capt D Leah

Lincs Aerial Spraying Company

Loganair Ltd
 McAlpine Aviation Ltd
 Capt J McIlwham
 Merchant Navy and Airline Officers' Association
 Mr A R Begg
 Mr R Chadwick
 Mr O Withers
 Monarch Airlines Ltd
 Capt A J Burridge
 Mr H S Wyatt
 Mr M H Murray
 Northair Aviation Ltd
 Mr J K Oxspring
 Mr G M Paddon
 Peters' Aviation Ltd
 Capt R E Phillips
 Professional Pilots Association
 Capt J R Jeffrey
 Capt M A Reveler
 Capt J Proctor
 RAF Institute of Aviation Medicine
 Wing Commander A N Nicholson
 Rank Organisation
 Capt J M P Ree
 Capt D A Regan
 Mr J E Rolfe
 Dr H P Ruffell Smith
 Capt G W Rydon
 Capt I B Scott
 Shell Aircraft Ltd
 Mr G Rees
 ShoreLink Ltd
 Dr A Sibbald

Capt S K Sickelmore

Capt J G Simpson

Capt R B Speirs

Capt G A Stone

Mr B P Swift

Mr N Tebbit, MP

Mr R H Tice

Mrs R H Tice

Mr N E Tomlin

Tradewinds Airways Ltd

Capt E J Foster

Mr C Jones

Transmeridian Air Cargo Ltd

Capt K Keegan

Capt B Patrick

Capt F Tricklebank

Capt J R Turner

Westward Airways (Lands End) Ltd

Mr J P Williams

Dr D G Wilson

Capt D Wittick

World Plan Executive Council

APPENDIX 2

NOTES ON THE HISTORICAL BACKGROUND TO THE CONTROL OF FLIGHT TIME LIMITATIONS

1 Between 1927 and 1950 control was exercised by requiring a complete medical examination if 125 flying hours was exceeded in any 30 consecutive days. In April 1950 in keeping with international obligations under Annex 6 to the Convention on International Civil Aviation, Chicago (1944), an Article was introduced into the Air Navigation Order requiring operators to establish limitations on flight times such as to ensure the safety of aircraft was not endangered by crew fatigue.

2 In January 1954 a report (CAP 119, 1954) was published of a Court of Investigation into the disappearance on 2 February 1953 of the York aircraft G-AHFA. Although the cause of the accident was not ascertained, it was recommended that: "the whole subject of crew fatigue shall receive study at an impressive level, It is for consideration whether a Departmental Committee should be set up to investigate this important subject". Subsequently the Minister of Civil Aviation invited Air Chief Marshal Sir Frederick Bowhill to chair a working party and make recommendations.

3 On 13 March 1954 a BOAC Constellation aircraft G-ALAM crashed on landing at Kallang Airport, Singapore. In the report of this accident, issued in September 1954 by the Colony of Singapore, it was stated in paragraph 100(9) (f) that: "The Captain's error cannot be attributed to fatigue of which he was aware. The possibility of the more dangerous type of fatigue i.e. insidious fatigue cannot be excluded."

4 In March 1955 draft proposals based on the "Bowhill" Working Party were circulated to interested parties by the Ministry of Civil Aviation. After many meetings and considerable exchange of correspondence the Air Navigation Order was amended in May 1957 so as to require operators to establish their own limits on flight time and duty periods within amounts fixed by provisions in the Order. In addition, the maximum amount of flying by the crew of public transport aircraft was limited to 125 hours in any 30 consecutive days. These requirements took account *inter alia* of the views put forward by operators, aeromedical specialists and airline pilots.

5 In January 1964 the maximum amount of flying permitted was reduced to 115 hours in any 28 consecutive days, and an operator was required to plan rosters one hour shorter than the maximum period of duty allowed by the Air Navigation Order.

6 In August 1966 following meetings with the British Airline Pilots' Association and discussions with the Department's aeromedical specialists, the Director of Flight Safety in the Civil Aviation Department of the Board of Trade circulated proposals to reduce the maximum length of flying duty periods permitted, require a weekly break including two nights rest, and establish monthly, quarterly and annual limits on flying hours. However, as a result of consultation, the Department decided the proposals were too rigid and failed in their purpose of having an operator specify limits taking into account all the facets of his own particular operation. It was decided that what was really needed was comprehensive guidance to help operators discharge their responsibility under the Air Navigation Order, and not reductions in statutory limits.

7 In January 1968 the Air Navigation Order was amended to reduce the maximum amount of flying permitted in 28 days from 115 hours to 100 hours. Guidance material was issued separately as CAP 295 and as an appendix to *Air Operators' Certificates. Information on Requirements to be Met by Applicant and Holders* (now known as CAP 360, see Appendix 3). Operators were advised in a circular letter that their limits would be expected to take fully into account all the matter included in the guidance material. Thereafter, the operator and crews' observance of the limits would be subject to surveillance by the Department's Flight Operations Inspectorate. The main point of substance in the guidance material was that the single flying duty period for a multi-pilot crew, which includes both time in the air and on the ground, should be planned around a period which did not exceed 12 hours.

8 In July 1971, following on the work of an internal review group, the Director of Flight Safety (Department of Trade and Industry) circulated proposed changes to the "guidelines". As a result of difficulties in reconciling the conflicting comments which resulted from this consultation no action was taken to implement these proposals, and it was decided to refer the problem to a committee of inquiry.

APPENDIX 3A

EXTRACT FROM CHAPTER 2 OF CAP 360 *AIR OPERATORS' CERTIFICATES. INFORMATION ON REQUIREMENTS TO BE MET BY APPLICANTS AND HOLDERS.*

4 Limits on Flight Times and Duty Periods

4.1 There are detailed statutory requirements in this connection and operators should be familiar with the relevant provisions of the Air Navigation Order.

4.2 Subject to the overriding provisions of the Order, it is the responsibility of the operator to establish maximum flying duty periods and minimum rest periods appropriate to the nature of his flight operations. Comprehensive guidance and instructions should be included in the manual for the benefit of crews and those members of the operating staff who are concerned with rostering and scheduling. It will normally be necessary to issue one set of instructions for crews and a separate, more detailed, set for other operating staff.

4.3 Factors to be taken into account in producing these instructions and the nature of the limitations to be specified are indicated in Appendix D. This Appendix, which is also available as a separate publication (CAP 295 *Flight Time Limitations: The avoidance of excessive fatigue in aircrews*, HMSO, 1968), has been produced after consultation with the Authority's aeromedical advisers and compliance with its provisions is an essential requirement for holders of an Air Operator's Certificate. It is recognised, however, that certain operations may present special features warranting some slight easement of the limitations detailed in Appendix D, and the Authority is prepared to consider individual cases on their merits. Any concession agreed upon in this way would normally be in relation to particular schedules and duty periods and it would not be permissible for them to be reflected in the operator's general instructions on flight, duty and rest periods. Requests for such concessions should be made to the Chief Inspector of Flight Operations in writing, giving full details of all the relevant factors.

4.4 The extent to which an aircraft commander is authorised in abnormal circumstances to exceed the operator's limitations on flying duty periods should be clearly defined in the manual. Instructions on this point should be as clear and concise as possible, so that commanders can readily determine the extent of their discretionary powers. The Authority will not normally be

able to agree to instructions that authorise commanders to extend a flying duty period:

- (a) to more than 125 per cent of the total than would otherwise have been permissible under the provisions of Appendix D, or
- (b) by more than three hours,

whichever gives the lower figure. The extent of a commander's authority to reduce rest periods should be limited to 20 per cent of the minimum permissible figure ascertainable from the Air Navigation Order *and* Appendix D, provided that no rest period may be reduced below 10 hours. Aircraft commanders should be forbidden to curtail a rest period immediately following a flying duty period that was extended by virtue of the commander's discretion.

4.5 As long as the statutory requirements relating to the exercise of discretion are complied with, a commander may be authorised to start or continue a flying duty period knowing that it cannot be completed within the operator's normal limitations. If, for example, the operator's normal limit in a particular case were 12 hours and the crew were scheduled for an 11½ hours duty involving three sectors, the commander need not be precluded from starting the first flight solely because departure was delayed for 50 minutes while runway visual range improved to the take-off minimum. Similarly, a commander need not be precluded from operating the final sector solely because he had run an hour late on the first two.

4.6 Commanders should be instructed to file a report each time they exercise their discretion. If the *statutory* limitations are exceeded, the report should be forwarded by the operator to the Flight Operations Inspectorate within 21 days of the occurrence. In other cases the report should be retained by the operator for a period of six months; Inspectors will wish to examine such reports from time to time, and operators will be required to take suitable corrective action if commanders' discretion is exercised too freely or without good reason.

4.7 To ensure compliance with paragraph 3.4 of Appendix D instructions to rostering and scheduling staff should include the names of the airports where the adjustment will apply. Airports at which advantage may be taken of the provisions of paragraph 4.3.5(c) of Appendix D should also be specified.

4.8 If an additional pilot is provided in order to take advantage of the provisions of paragraph 4.3.5(b) of the Appendix, he should hold a "Part 1 pilot in command" rating on the type of aircraft to be flown and either:

- (a) be currently qualified without restriction as a commander, or
- (b) be currently qualified without restriction as a co-pilot *and* have at least 100 hours' experience on the type of aircraft to be operated.

4.9 If the conditions of the certificate of airworthiness require the carriage of the holder of a flight engineer's licence, advantage should be taken of the provisions of paragraph 4.3.5(b) of the Appendix only if two such persons are carried.

4.10 The instructions issued to crews in accordance with paragraph 3.10 of Appendix D should include clear guidance on abstention from alcoholic drinks for a suitable period prior to flight. The minimum acceptable period will be eight hours. Crews must also be advised of the precautions to be taken if they are undergoing medication. Information Circulars issued from time to time on this subject will form a useful basis for instructions in manuals. Operators encountering any special difficulty in framing their instructions may call on the Authority's Medical Branch for advice.

4.11 Responsibility within an operator's organisation for issuing instructions and making decisions on questions of flight, duty and rest periods, and for processing discretion reports, should be clearly defined and assigned to a member of the executive staff. The name of the person concerned, or the title of the office that he holds, should be included in the operations manual.

APPENDIX 3B

EXTRACT FROM CHAPTER 4 OF CAP 360 *AIR OPERATORS' CERTIFICATE. INFORMATION ON REQUIREMENTS TO BE MET BY APPLICANTS AND HOLDERS*

16 Duty and Rest Period Records

16.1 To comply with the relevant provisions of the Air Navigation Order, records must be kept of the duty and rest periods of all flying staff. It may not be essential, however, to maintain a *separate* record of the duty and rest periods of each member of the flying staff. If a voyage report or flight operations return gives this information it will be acceptable if the operator can readily produce, in addition, a list of all the flights upon which a particular individual has been employed over a given period.

16.2 Unless the utilisation of crews is consistently low, and there is clearly no risk that the statutory flight time limitations will be exceeded, suitable cumulative records (eg a "28 day accumulator") should be kept.

16.3 A flying duty period may be considered to have ended at "engines off", but the subsequent rest period will start only when the individual is actually "off duty".

16.4 Time spent on any duty connected with employment by the operator should be recorded if it is performed within a period of 72 hours immediately preceding a flying duty period.

16.5 It is a legal requirement that a commander exercising the discretion conferred upon him by the Air Navigation Order to exceed the statutory limitations shall submit a report in writing to the operator, who in turn is required to make a report to the Civil Aviation Authority. Operators are asked to use the form of report shown at Appendix C. The report should be forwarded to the Flight Operations Inspectorate within 21 days of the occurrence. A similar report should be made if a commander exercises the discretion conferred upon him in respect of the operator's established limits, but in this case the report should be retained by the operator.

APPENDIX 3C

APPENDIX D TO CAP 360 AIR OPERATORS' CERTIFICATE. INFORMATION ON REQUIREMENTS TO BE MET BY APPLICANTS AND HOLDERS

Prevention of Excessive Fatigue in Aircrews

1 FOREWORD

1.1 Article 50 of the Air Navigation Order is designed to ensure that no flight crew member to whom the Article applies is subjected to excessive fatigue. It requires the aircraft operator, after taking into account the particular circumstances of his operations, to include in his operations manuals or comparable documents details of his limitations on flight times and flying duty periods, and of the minimum rest periods he has established.

1.2 It is the purpose of this publication to provide guidance material to assist operators in establishing the principles which should determine the limits and minimum rest periods to be set. It will be reviewed periodically in the light of experience and of advances in aeromedical knowledge on the subject of fatigue.

1.3 The Articles of the Air Navigation Order mentioned in this Appendix refer to the ANO 1972.

2 WORK/REST CYCLES

2.1 Introduction

2.1.1 Man is normally accustomed to a 24-hour cycle corresponding to the 16 hours or so during which he is awake, working and getting tired, and the 8 hours or so during which he is asleep and by which he becomes once again refreshed.

2.1.2 Whilst undue stress or over-activity, whether mental or physical, during the waking period of such a cycle will lead to sensations of fatigue, so also will extensions of waking period significantly beyond the average 16 hours, or inadequate sleep before the waking/working period begins.

2.1.3 For crew members, obliged by the nature of their job to keep irregular hours of work, difficulties inevitably arise in following the normal sleeping/waking pattern, but with careful planning it should be possible to ensure that adequate rest is obtained. The following paragraphs outline a number of factors which should be taken into account both by those who plan rosters and by crew members themselves, so that any sleep debts incurred in the course of flying duties are kept to the minimum.

2.2 The Physical Environment

2.2.1 Conditions conducive to sleep include darkness, environmental comfort (temperature particularly) and quiet. When trying to sleep outside the sleeping time of the local community quietness may be the most difficult of these conditions to achieve, and considerable importance should be attached to this factor when selecting accommodation for flight crews during stopovers away from base. Not only the position of the hotel, but also the position of the rooms in the hotel, should be carefully chosen.

2.2.2 Where duty schedules make it necessary for crew members to sleep at home during the daytime, operators should bear in mind that, during short rest periods, it may be difficult for them to obtain adequate rest because of disturbing influences over which they may have only marginal control—children, for example.

2.3 Pre-flight Sleep

Flying duty periods which fall within the usual 7 a.m./11 p.m. waking period and which can be preceded by the usual 11 p.m./7 a.m. sleeping period do not normally present any sleep debt problems. However, flight crews conditioned to such a pattern and then rostered for a duty period starting at, say 6 p.m. and finishing in the early hours of the morning, would clearly experience excessive tiredness before the end of the duty period if they awoke from an 8-hour sleep at 7 a.m. the previous morning and did not rest again before going on duty. Under such circumstances, the aim of crew members should be to adjust their sleep pattern so that some rest can be taken during the afternoon shortly before going on duty. Whilst the aim may be obvious, its achievement can be realised only by careful individual planning. Scheduling for night-flying duties should therefore include consideration of the facilities and time available for pre-flight sleep.

2.4 Pre-flight Activities

The permissible length of flying duty periods is based on the assumption that crew members start their duty in a reasonable state of fitness. Where crews are operating from their home base, travelling from home to the departure airfield can become an important factor if long distances are involved. Under these circumstances crew members should consider making arrangements for accommodation nearer to their base for the few hours before flight. Operators should consider the question of travelling times at stopovers away from base—see 3.4.

2.5 Time Zone Changes

2.5.1 Human beings are conditioned to an innate 24-hour bodily rhythm normally dependent on local time at the place of residence. Adaptation to changes of local time following Eastwards or Westwards air travel takes place only slowly, several days being required for complete adaptation to changes of more than a few hours. Disturbances of body functions occur, particularly during the first 24 hours of adaptation, but by far the most important effect of time-zone changes is the difficulty of sleeping normally. Some rearrangement of the normal sleeping/waking cycle is necessary to fit in with both a crew member's "body time" and the local time, until adaptation has occurred.

2.5.2 Long-haul operators should ensure that their crews are properly briefed on the physiological effects of time zone changes so that they can adjust their sleeping patterns accordingly, and should bear this factor in mind when scheduling rest periods between flights.

3 REST PERIODS BETWEEN FLIGHTS—FLIGHT CREW AND CABIN STAFF

3.1 Tables A and B of Article 52 to the Air Navigation Order set out the minimum rest periods to be taken by flight crews, according to the length of the preceding duty period, before they can be rostered for further duties.

3.2 Operators should aim to give cabin staff the same amount of rest as flight crew under Tables A and B. Because of the nature of their duties, it is reasonable that they can undertake slightly longer flying duty periods than the flight crew members with whom they are associated. If necessary therefore, the figures in the second columns of each of Tables A and B may be increased by 2 hours in respect of cabin staff.

3.3 Paragraphs 3.4 to 3.9 should be particularly borne in mind when applying the provisions of Tables A and B, which it should be noted are the minimum considered appropriate, particularly for the shorter rest periods.

3.4 Where travelling times between the airport and sleeping accommodation whilst away from the home base exceed 1 hour each way, rest periods up to and including 12 hours should be increased by the amount of excess.

3.5 The aim should be to schedule crews so that they have a clear break of at least 36 hours, including 2 local nights, at least once in any 7 day period. Exceptionally, this period may be extended to 10 days to meet special circumstances.

3.6 Crew members should not be scheduled for more than two successive night flying duty periods (i.e. periods extending through 3 a.m. local time at the place where the duty ends) unless they have had a rest period of at least 24 hours prior to the first of the two relevant periods to allow them to adjust their sleeping pattern in preparation for the series.

3.7 In the event of their being a time zone change of 4 or more hours between the place of departure and the place where the duty ends, the subsequent rest period should not be less than 12 hours.

3.8 Where a flying duty period extends through 3 a.m. local time at the place where it ends, the subsequent rest period should be not less than 12 hours.

3.9 Operators should take into account the local time of arrival and next departure and the facilities available for meals and sleeping in determining the minimum sufficient rest period.

3.10 Operators should issue instructions to their crews that they should so conduct themselves as to obtain the necessary benefit from mandatory rest periods between flights.

4 FLYING DUTY PERIODS—FLIGHT CREW

4.1.1 Article 51 of the Air Navigation Order sets limits in the duration of flying duty periods according to the crew composition.

4.1.2 It is not possible in the present state of aeromedical knowledge to make specific allowances in the flying duty period for all the factors which are known to affect fatigue. In some instances allowances have been made to relate to rest periods rather than duty periods where this has been considered more appropriate.

4.1.3 For a number of established factors, specific allowances are quoted in 4.2 and 4.3 below.

4.2 Single Pilot Crews

4.2.1 In the case of single pilot crews flying duty periods are limited by Articles 50 and 51 to a maximum duration of 10 hours for scheduling purposes, with a statutory limit of 11 hours. Provision is made for each of these figures to be increased by 2 hours where a continuous break of at least 5 hours is taken, during which the pilot is free of all duties.

4.2.2 Although the legislation allows the 10 hours' scheduled limit to be extended by giving credit for a break in the flying duty period, the limit of 10 hours would itself be regarded as excessive if a number of unfavourable or "minus" factors were present. The allowances listed in 4.2.3 and 4.2.4 should, where appropriate, be applied to the figure of 10 hours to arrive at the maximum, appropriate to a particular set of circumstances.

4.2.3 Sector allowances:—

- | | | |
|--|---|---------------|
| 5 or 6 sectors (except for helicopters) | — | MINUS 1 HOUR |
| 7 or more sectors (except for helicopters) | — | MINUS 2 HOURS |

4.2.4 Off-duty period between flights:—

Where the pilot has been on the ground free of all duties and with adequate rest facilities for a period of not less than 5 continuous hours—PLUS 2 HOURS. Rest facilities will normally be considered adequate if a quiet and comfortable room or rooms are available, not open to the general public, though it is desirable that a bed should be available during night hours.

4.3 Crews with Two or More Pilots—No Bunks Available

4.3.1 In the case of crews with two or more pilots, but where no bunks are provided for use by the crew, flying duty periods are limited by Articles 50 and 51 to a maximum of 15 hours for scheduling purposes with an absolute limit of 16 hours.

4.3.2 A flying duty period of 15 hours should be regarded as acceptable only when compensatory or "plus" factors are present. Where they are not, 12 hours should be the maximum for scheduling purposes, though this figure would be considered excessive if a number of unfavourable or "minus" factors were present.

4.3.3 The allowances listed in 4.3.4 and 4.3.5 should, therefore, be applied to a figure of 12 hours in the case of the multi-pilot crew to arrive at the maximum—within the mandatory scheduling limit of 15 hours—applicable to any particular set of circumstances.

4.3.4 Sector allowances:—

- | | | |
|--|---|---------------|
| 5 or 6 sectors (except for helicopters) | — | MINUS 1 HOUR |
| 7 or more sectors (except for helicopters) | — | MINUS 2 HOURS |

4.3.5 Allowances for relief crew members, off-duty periods and the Carriage of a Flight Navigator:—

PLUS allowances may be given as follows where a flight crew member can be relieved for part of the flight, or is required to be working for only part of the flying duty period, or where the overall workload is spread by the services of a Flight Navigator:—

- (a) For all flight crew members where the crew includes a Flight Navigator in addition to those members required under Article 18(2) and 18(3) of the Air Navigation Order—PLUS 1 HOUR.
- (b) Where the flight crew contains members additional to those required under 18(2) and 18(3) of the Air Navigation Order or where the Flight Navigator required under Article 18(4) is required for part of the flight only, the allowance for each crew member will be—PLUS an amount equal to the time for which the crew member may be relieved from all duties in the air.
- (c) Allowances may be given as follows where crew members have been on the ground free of any duties and with adequate rest facilities for periods of

Not less than 4 consecutive hours — PLUS 1 HOUR

Not less than 6 consecutive hours — PLUS 2 HOURS

Not less than 8 consecutive hours — PLUS 3 HOURS

Rest facilities will normally be considered adequate if a quiet and comfortable room or rooms are available, not open to the general public, though it is desirable that a bed should be available during night hours.

4.4 Aircraft Fitted with Crew Bunks

4.4.1 Article 51 of the Air Navigation Order enables flight crew members to be scheduled for periods of up to 22 hours if sufficient bunks are available. Consideration of the environmental conditions associated with the use of bunks leads to the conclusion that excessive fatigue may occur over such prolonged duty periods. Pending investigations into the efficacy of aircraft bunks as places of rest, flight crews should not be scheduled for flying duty periods exceeding 18 hours.

4.5 Conditions Producing Abnormal Stress

The permissible length of flying duty periods takes into account the combinations of adverse factors likely to be encountered in most types of public transport operations. Where, however, a particular type of operation is likely to produce abnormal stress on crew members, operators should make special allowance for this.

5 FLYING DUTY PERIODS—CABIN STAFF

5.1 Because of the nature of these duties it is reasonable that cabin staff can undertake somewhat longer flying duty periods than the flight crews with whom they are associated, but the scheduled maximum should not normally exceed 14 hours.

5.2 If adequate rest facilities—a passenger-type seat for example—are provided, this period may be extended by an amount equal to the time for which a cabin crew member is relieved of all duties, within an overall scheduled maximum of 20 hours.

5.3 For off-schedule operations the maximum flying duty period for cabin staff should not exceed 22 hours. Where 14 hours flying duty is exceeded during off-schedule operations, rest facilities should be provided, including a suitable seat on the aircraft.

6 AIRCRAFT COMMANDER'S DISCRETION

6.1 Nothing in this appendix should be construed as limiting in any way discretion conferred on the aircraft commander under Article 50 of the Air Navigation Order.