UK OFFSHORE PUBLIC TRANSPORT HELICOPTER SAFETY RECORD (1976 – 2002)

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EXECUTIVE SUMMARY

This report was commissioned by the Health and Safety Executive (HSE) with the support of the Civil Aviation Authority (CAA), to produce a safety record of UKCS offshore helicopter operations and to make comparisons with various other modes of transport.

UKCS offshore helicopter operations data covering 27 years (1976 to 2002) are available for analysis and comparison, and have been grouped into three 9-year inclusive periods as follows: 1976 to 1984, 1985 to 1993, and 1994 to 2002. It should be noted, however, that the data sets used to obtain accident rates for offshore helicopter operations are relatively small, hence caution is required when interpreting the results.

From 1976 up to year-end 2002, just over 48 million passengers were transported to and from offshore installations on the UKCS. Over 6 million sectors were flown taking about 2.7 million flying hours. During this time 7 fatal accidents claimed the lives of 88 offshore workers and flight crew. As a measure of current UKCS activity, some 160,000 sectors were flown in 2002 transporting over 1.5 million passengers offshore and sector flight times averaged just over 30 minutes.

During the first 18 years (1976 to 1993) 6 fatal accidents were recorded (3 in each 9-year period of review). During the last 9 years 1994 to 2002 there was one fatal accident and this occurred in July 2002. Catastrophic component failure was the primary cause of 4 accidents and the other 3 were attributed to human factors.

42 non-fatal reportable accidents were recorded during the first 18 years of UKCS offshore helicopter operations, 20 in the period 1976 to 1984 and 22 in the period 1985 to 1993. Between 1994 and 2002 there were 8 non-fatal reportable accidents and, taking into account the corresponding rates for the three periods (see Table 3.17), this represents a significant reduction on the previous two periods.

Data for World–Wide and All North Sea offshore helicopter operations is available from the International Oil & Gas Producers Association (OGP), but is limited to the period 1995 - 2002. Table 1 overleaf compares the global fatal and non-fatal accident rates with UKCS helicopter operations during this period with both fatal and non-fatal accident rates based on 100,000 flying hours / sectors (flight stages) flown. For the period 1995 to 2002, the UKCS recorded one fatal accident whereas 3 fatal accidents were recorded for All North Sea operations and 40 Worldwide. The UKCS fatal accident rate (flying hours) compares favourably with the figure for Worldwide operations and is lower than the rate for All North Sea. For the same period, non-fatal reportable accident rates for flying hours for the UKCS are lower than, but similar to All North Sea and Worldwide operations. The non-fatal reportable accident rates for sectors show the UKCS to be better than All North Sea and virtually the same as Worldwide operations.

REGION	PERIOD	FATAL ACCIDENT RATES (Flying Hrs.)	NON-FATAL ACCIDENT RATES (Flying Hrs.)	FATAL ACCIDENT RATES (Sectors)	NON-FATAL ACCIDENT RATES (Sectors)
All North Sea	1995 - 2002	0.23	1.32	Not available	0.95
Worldwide	1995 - 2002	0.57	1.45	Not available	0.47
UKCS	1995 - 2002	0.14	1.10	0.06	0.50

Table 1 Comparison of UKCS Accident Rates with OGP Worldwide Average Fatal and Reportable Accident Rates 1995 to 2002

Comparing offshore helicopter operations with other forms of transport used in the UK (e.g. car, train, pedal cycle) provides a useful comparison with everyday experience. The latest available data from the DETR (1992 to 2001) indicates that the safety record of offshore helicopter travel compares favourably with other forms of commonly used land-based passenger transport apart from rail, and is very similar to travel by car. See Table 2 below.

TRANSPORT MODE	1992 - 2001 AVERAGE
Offshore Helicopter	4.33
Air	0.01
Rail	0.4
Car	3
Two Wheeled Motor Vehicle	106
Pedal Cycle	42
Pedestrian	58

Table 2 Comparison of Average Passenger Fatality Rates per Billion Passenger Kilometres by Transport Mode 1992 to 2001

Overall it can be claimed that, in recent years, UKCS offshore helicopter operations have achieved a good safety record. This is demonstrated by recording zero fatalities for the 9-year period from 1993 to 2001. However, the fatal S76 accident that occurred in 2002 clearly demonstrates there is no room for complacency. Additionally, non-fatal reportable accidents continue to occur on the UKCS with serious injury occasionally being inflicted. This situation highlights the need for the UK Oil & Gas industry to continue to vigorously pursue safety initiatives (current and future) and research projects to further reduce risks. Appendix 1 of this report describes safety enhancements that have been introduced to UKCS helicopter operations resulting from several initiatives and research projects, and future enhancements that are expected to result from ongoing work.

1. INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The HSE and the CAA are responsible for regulating UK offshore health and safety and aviation safety respectively. The actual achievement of aviation safety is the responsibility of all those on whom the law places a duty of care and these include, but are not limited to, helicopter operators, flight crews, installation operators and offshore workers with helicopter / helideck duties.

Helicopter transport is primarily the CAA's area of regulatory responsibility whereas Installations are the responsibility of HSE. However, in practice, both regulators share a common and practical interest for many aspects of offshore helicopter safety performance and are therefore jointly seeking continuous improvement. HSE / CAA Leaflet IND (G) 219L sets out in more detail how offshore helicopter travel is regulated and the responsibilities and arrangements in place to ensure the safety of offshore helicopter operations.

The HSE and CAA regularly consult on offshore helicopter safety and both regulators agree that offshore helicopter risk is a topic that needs continuous scrutiny. HSE and CAA are concerned, however, that the long held perception of the workforce that offshore helicopter operations are a "high risk mode of transport" does not match the statistical evidence**.** This apparent misconception led to the initiation of this project to gain a better insight into offshore helicopter risk, including available safety performance data and the criteria used to measure it.

The purpose of this study is to provide an accurate historical safety record for UK offshore public transport helicopters over the period 1976 to 2002, and to compare fatal and non-fatal accident numbers and rates with other UK and worldwide aviation data and other forms of transport. It is hoped that this will provide a good foundation for risk assessments of UKCS helicopter activities, and give good indicators of the overall performance and potential risks.

1.2 BACKGROUND

Offshore public transport helicopter flight statistics and reportable accident data are available for a period covering the 27 years of UKCS operations from 1976 to 2002.

From 1976 up to year-end 2002, more than 48.25 million passengers have been transported to and from offshore Installations on the UKCS. Over 6 million sectors were flown taking about 2.75 million flying hours. As a measure of current UKCS activity, some 160,000 sectors were flown in 2002 transporting over 1.5 million passengers offshore, and sector flight times averaged just over 30 minutes.

Between 1976 and 2002 seven fatal accidents claimed the lives of 88 offshore workers and flight crew whilst travelling in offshore helicopters. Catastrophic component failure was the primary cause of 4 accidents and the other 3 were attributed to human factors. There have also been two HLO fatalities on helidecks. Occasionally, reportable (non-fatal) accidents have also occurred, just as they do in other aviation sectors. These have included lightning strikes, major airframe damage, loss of engine power, tail rotor damage and loss of flight control. In most of these cases only the helicopter has been damaged but, infrequently, these incidents have resulted in injury to personnel.

In the last decade, a large number of safety enhancements have been introduced to UKCS helicopter operations and they are described in Appendix 1 of this report. These enhancements have resulted from a number of initiatives and research projects.

2. DATA SOURCES AND ANALYSIS

2.1 DATA SOURCES

The main data source and references used for developing the UK offshore helicopter safety record are:

- CAA SS&A UK Offshore Helicopters Annual Flight Statistics for the Period 1976 – 2002.

This data source includes flight hours, sectors flown, passengers carried, fatal and reportable accidents, crew and passenger fatalities, etc.

Later in the report the following information sources have been referenced for comparative purposes:

- International Association of Oil & Gas Producers (OGP) – Safety Performance of Helicopter Operations in the Oil & Gas industry 1995 to 2002. (Note: 2002 figures were obtained in draft form).

- Department for Transport, Local Government and the Regions – Transport Statistics Great Britain 2002 (published October 2003). 'Extract' Section 1.6 – Passenger casualty rates by mode 1992 – 2001.

- CHC Scotia - Base Statistics for the period 2001 to 2002 (passengers carried and miles flown).

- Bristow Helicopters Limited - Base Statistics 1998 to 2002 (passengers carried and kilometres flown).

2.2 ANALYSIS

Using the available data, an analysis has been undertaken to establish the safety record for UKCS offshore oil & gas helicopter passenger transport operations.

To allow this report to focus specifically on the passenger transport safety record the following occurrences have been excluded: helideck crew fatalities that have occurred on the helideck; offshore SAR flight fatal and non-fatal reportable accidents; flight crew fatalities that have happened during offshore positioning flights. In the analysis, rates for fatal and non-fatal reportable accidents have been confined only to those occurrences that relate specifically to helicopters carrying the offshore oil & gas workforce as passengers (such offshore oil & gas helicopter operations are defined by the Air Navigation Order as being non-scheduled public transport).

It is recommended that helideck crew fatalities and the non-fatal reportable accidents excluded in this report should be included in risk assessments (e.g. QRA), if establishing “Individual Risk” for activities relating to offshore Installations. Excluded offshore helicopter fatal accidents are listed in Tables 2.1and 2.2 below.

YEAR	OCCURRENCE	OUTCOME
1981	Bell 212 (G-BDIL) crashed into the sea in poor visibility during a mission to winch a casualty from a ship.	6 fatalities (all on board)
1982	Bell 212 (G-BJJR) crashed into the sea on approach to an oil rig to embark passengers (positioning flight).	2 Flight Crew fatalities
1992	Helideck accident on MS Mayo.	HLO fatality.
1992	Helideck accident on Viking ‘B’ platform.	HLO fatality.

Table 2.1 Helideck Crew Fatalities and Flight Crew Fatalities that Occurred During Offshore Positioning and SAR Flights

YEAR	OCCURRENCE	OUTCOME
1983	Sikorsky S61 crashed into the sea off the Scilly Isles	20 fatalities

Table 2.2 Excluded non-oil & gas industry offshore helicopter fatal accidents

3. UK OFFSHORE PUBLIC TRANSPORT HELICOPTER SAFETY RECORD

3.1 INTRODUCTION

This section deals with helicopter types, historical flight statistics and fatal and non-fatal reportable accidents that have occurred during UKCS offshore helicopter passenger transport flights. All data used in this section has been obtained from the CAA SS&A UK Offshore Helicopters Annual Flight Statistics for the Period 1976 – 2002.

Where accident rates are shown in this section of the report, a base of 100,000 has been used for flying hours and sectors flown (flight stages). This is the figure generally used by the oil and gas industry and the CAA.

3.2 HELICOPTER TYPES

During the period 1976 to 2002 the helicopter types engaged in offshore service on the UKCS are shown in Table 3.1 below.

TYPE	WEIGHT CLASS	INTRODUCED	WITHDRAWN
Bell 212	Medium	Pre 1975	2000
Bell 214 ST	Heavy	1982	Still in Service
Boeing BV234 (Chinook)	Extra Heavy	1980	1989
Eurocopter B105	Light	1977	2001
Eurocopter AS330 (Puma)	Medium	1977	1985
Eurocopter AS332 (Super Puma)	Heavy	1982	Still in Service
Eurocopter AS365 (Dauphin)	Medium	1979	Still in Service
Sikorsky S58	Medium	Pre 1975	1980
Sikorsky S61	Heavy	Pre 1975	Still in Service
Sikorsky S76	Medium	1980	Still in Service
Westland 30	Medium	1982	1991
Westland Wessex 60	Medium	1975	1981

Table 3.1 Helicopter Types Used in UKCS Offshore Support

From this table it can be seen that most of the earlier helicopter types have been withdrawn from UKCS offshore flight operations and replaced by more modern aircraft.

It should also be noted that some of the helicopter types currently in North Sea service, namely the AS332 (Super Puma), AS365 (Dauphin) and S76, have been significantly modified since they first entered service. Later variants of the AS332, AS365 and S76 have modifications that introduced improved technologies and systems and, as a result, exhibit improved performance and safety features.

Offshore helicopter types are categorised into the following Maximum Take-off Weight Authorised (MTWA) groups.

Extra Heavy Twin >20000 Kg MTWA (e.g. Chinook)

Heavy Twin >5700 Kg MTWA (e.g. S61 and Super Puma)

Medium Twin 2730 to 5700 Kg MTWA (e.g. Dauphin and S76)

Light Twin < 2730 Kg MTWA (e.g. Bo 105)

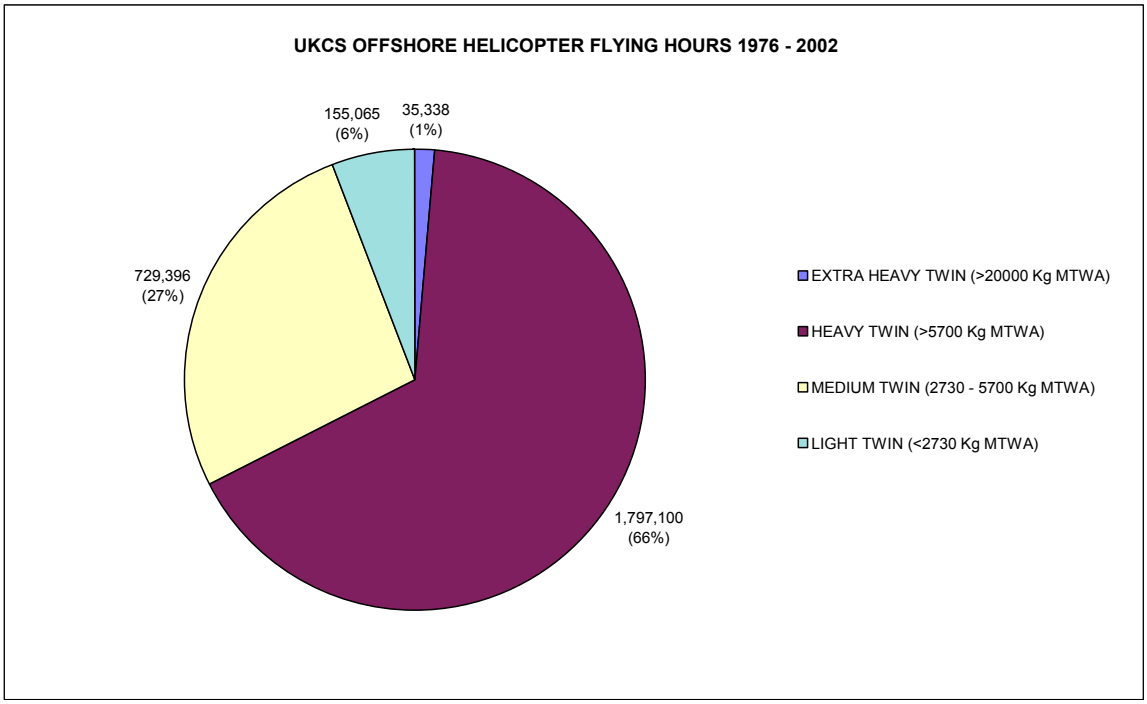
Since 2001, only Heavy and Medium Twin engine helicopters have been used on the UKCS.

It is important here to make a distinction between Heavy and Medium Twin helicopter operations. As a rule it can be said that Heavy Twins (e.g. S61, AS332 and Bell 214) operate mainly out of Aberdeen and generally fly sectors (flight stages) with long flight times. Medium Twins (e.g. S76 and AS365) fly mainly out of regional heliports (e.g. Blackpool, North Denes, Norwich and Humberside) and these aircraft record a high number of sectors (flight stages) with relatively short flight times.

3.3 HISTORICAL ACCIDENTS AND FLIGHT STATISTICS

The pie charts in Figure 3.2 provide a breakdown of UKCS offshore helicopter operations flying hours and sector (flight stage) activity by MTWA groups for the period 1976 to 2002.

Table 3.3 summarises all the UKCS offshore public transport fatal accidents referenced in this report.



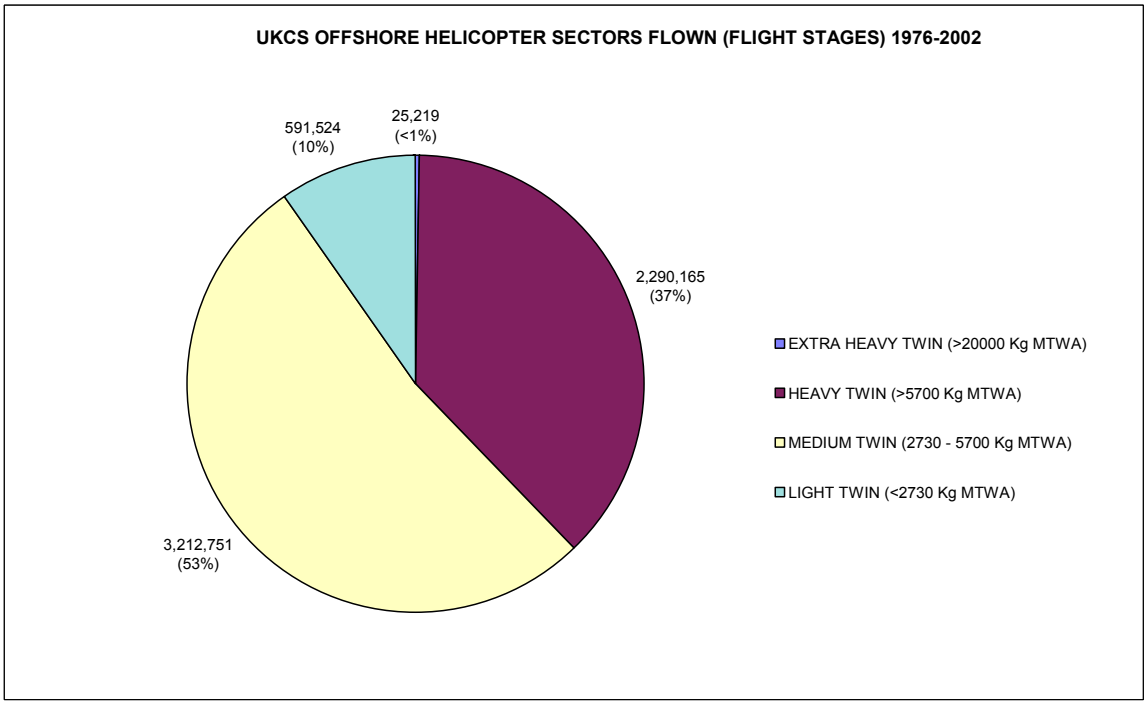


Figure 3.2 UKCS Offshore Helicopter Flight Statistics (1976 – 2002)

YEAR	AIRCRAFT TYPE	FATAL	INJURED	INCIDENT LOCATION	CAUSED BY	PRIMARY CAUSE
1976	Sikorsky S 58 ET	1	0	Forties Field	Tail Rotor detached as A/C approached to land on helideck. Forced landing carried out onto installation but A/C fell off helideck onto a Barge 140 ft below. A/C destroyed by impact and subsequent fire.	Tail Rotor/Gearbox Failure
1981	Bell 212	1	0	Near Dunlin	During a daytime VMC flight, pilot encountered an area of reduced visibility and decided to return. As A/C entered turn at 200 ft control was lost. The A/C pitched 20deg nose up, climbed to 300 ft and lost all airspeed. A/C then rapidly yawed right and descended into sea.	Human Factors
1981	Westland Wessex Mk 60	13	0	Off Bacton	Power to main rotor gearbox lost. A/C went out of control and crashed into the sea.	Total System Failure
1986	Boeing BV 234 LR	45	0	1.5 miles off Sumburgh	The A/C crashed in the sea 1.5 miles off Sumburgh and sank. A gear in the forward MRGB had failed through fatigue, causing the rotors to desynchronise and collide.	Main Rotor/Gearbox Failure
1990	Sikorsky S 61 N	6	0	Brent Spar Helideck	While manoeuvring to land on the Brent Spar helideck the tail rotor struck a crane. The aircraft descended onto the helideck and fell into the sea where it sank rapidly.	Human Factors
1992	Eurocopter AS 332 L / L1	11	1	Near Cormorant 'A'	A/C taking pax from platform to flotel 200m away. Access Bridge had been lifted due to adverse weather. A/C departed and then turned downwind with insufficient airspeed and descended rapidly into the sea and sank.	Human Factors
2002	Sikorsky S 76	11	0	Leman Field	Rotor Blade failure during approach to platform. Aircraft went out of control and crashed into the sea.	Main Rotor Blade Failure

Table 3.3 UK Offshore Helicopter Fatal Accidents 1976 – 2002

3.4 OCCUPANT FATAL ACCIDENT RATE AND NON-FATAL REPORTABLE ACCIDENT RATE

Fatal and non-fatal reportable accident rates recorded for the MTWA groups for the period 1976 to 2002 are compared in Table 3.4 below. All offshore helicopter types that have been used on the UKCS are included and the rates are based on 100,000 flying hours and sectors (flight stages) flown.

	Per 100,000 Flying Hours		**Per 100,000 Sectors (Flight Stages)**	
HELICOPTER MTWA GROUP	**Occupant Fatal Accident Rate**	**Non-Fatal Reportable Accident Rate**	**Occupant Fatal Accident Rate**	**Non-Fatal Reportable Accident Rate**
Extra Heavy Twin (> 20000 Kg MTWA)	127.34	5.66	178.44	7.93
Heavy Twin (> 5700 Kg MTWA)	0.95	1.89	0.74	1.48
Medium Twin (<5700 Kg MTWA)	3.29	1.51	0.75	0.34
Light Twin (< 2730 Kg MTWA)	0.00	1.93	0.00	0.51
All UK Offshore Helicopters	3.24	1.84	1.44	0.82
Adjusted for Current Helicopter Types in Use	1.24	1.73	0.65	0.90

Table 3.4 Fatal and Non-Fatal Reportable Accident Rates by Helicopter MTWA Groups 1976 – 2002

With 45 fatalities, the Extra Heavy Twin (Chinook) accident in 1986 dominates the overall fatal accident rate statistics for both flying hours and sectors flown. Since 1989 this aircraft type has not flown offshore in the UK and it accounts for only a very small proportion (1%) of the total flying hours between 1976 and 2002.

By comparison, other weight classes have better records particularly the Light Twins with no fatalities recorded. However, it should be borne in mind that Light Twins only account for a small number (6%) of the total flying hours between 1976 and 2002.

The safety performance of Heavy and Medium Twins is similar in terms of the fatal accident rate for sectors flown (flight stages). This performance contrasts with fatal accident rate for flying hours where Medium Twins are just under three and a half times higher than Heavy Twins. The higher ratio of sectors to flying hours of almost 3.5:1 accumulated by Medium Twins would appear to

account for this significant difference and suggests that accidents are more closely correlated to sectors than flying hours.

When comparing non-fatal accident rates for sectors flown (flight stages) by weight class, Medium and Light Twins have a better record than Heavy Twins.

3.5 UK OFFSHORE HELICOPTER SAFETY RECORD

3.5.1 Introduction

This section analyses the UKCS Offshore Safety Record for the 27 years of UK offshore helicopter operations from 1976 to 2002 inclusive.

For comparative purposes the data have been broken down into the three 9-year periods of 1976 to 1984, 1985 to 1993 and 1994 to 2002. For each period the flight statistics, fatal and non-fatal accidents and their causes are given along with key indicators showing where major offshore helicopter flight safety initiatives have been introduced. All helicopter types are included and an interpretation of the available information is set out in the following sections for consideration.

3.5.2 The Years 1976 to 1984

Table 3.5 below shows the flight statistics for this period.

Flight Hours		Sectors		Passengers Carried	
Total	**Yearly Average**	**Total**	**Yearly Average**	**Total**	**Yearly Average**
893,281	99,253	1,844,033	204,892	13,219,722	1,468,858

Table 3.5 UKCS Offshore Helicopter Flight Statistics 1976 – 1984

It can be seen from the above table that an average of just over 200,000 sectors (flight stages) was flown and a little under 1.5 million passengers were carried each year.

Table 3.6 below shows the occupant fatal and non-fatal reportable accident rates for the period 1976 to 1984.

Per 100,000 Flying Hours		Per 100,000 Sectors (Flight Stages)	
Occupant Fatal Accident Rate	**Non-Fatal Reportable Accident Rate**	**Occupant Fatal Accident Rate**	**Non-Fatal Reportable Accident Rate**
1.68	2.24	0.81	1.08

Table 3.6 Fatal and Non-Fatal Reportable Accident Rates 1976 – 1984

Fatal Accident Rates recorded were 1.68 and 0.81 per 100,000 flying hours and sectors flown (flight stages) respectively. During this period there were 3 fatal accidents that accounted for the lives of 13 offshore workers and 2 flight crew (see Figure 3.7 below).

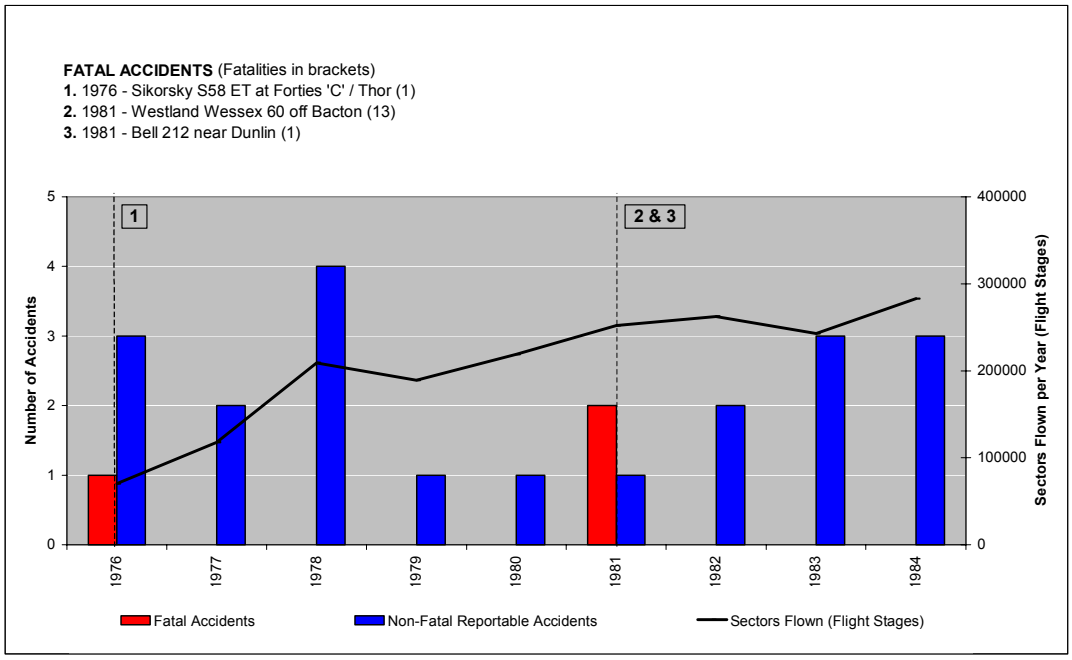


Figure 3.7 UKCS Offshore Helicopter Safety Record 1976 - 1984

There were also 20 non-fatal reportable accidents giving Reportable Accident Rates of 2.24 and 1.08 per 100,000 flying hours and sectors flown (flight stages) respectively. The causes of non-fatal reportable accidents during this period are listed in Table 3.8 below. A total of 8 human factor events accounted for the largest proportion of the accidents during the period.

	Primary Cause	1976 - 1984
People / Machine	Component / System - Failure / Defect	3
	Human Factors	8
	Loss of Control	4
	Defective Maintenance	3
External Influences	Weather	0
	Helideck Turbulence / Exhaust Plumes	1
	Excess Vessel Motions	0
	Other Causes	1

Table 3.8 Causes of UK Offshore Helicopter Non-Fatal Reportable Accidents 1976 – 1984

3.5.3 The Years 1985 to 1993

Table 3.9 below shows the flight statistics for this period.

Flight Hours		Sectors		Passengers Carried	
Total	Yearly Average	Total	Yearly Average	Total	Yearly Average
1,003,482	111,498	2,462,758	273,369	18,005,519	2,000,557

Table 3.9 UKCS Offshore Helicopter Flight Statistics 1985 – 1993

From the table it can be seen that an average of just under 275,000 sectors (flight stages) were flown and a little over 2 million passengers were carried each year.

Table 3.10 below shows the occupant fatal and non-fatal reportable accident rates for the period.

Per 100,000 Flying Hours		Per 100,000 Sectors (Flight Stages)	
Occupant Fatal Accident Rate	Non-Fatal Reportable Accident Rate	Occupant Fatal Accident Rate	Non-Fatal Reportable Accident Rate
6.18	2.19	2.52	0.89

Table 3.10 Fatal and Non-Fatal Reportable Accident Rates 1985 – 1993

Fatal Accident Rates recorded were 6.18 and 2.52 per 100,000 flying hours and sectors flown (flight stages) respectively. During this period there were 3 fatal accidents that accounted for the lives of 57 offshore workers and 5 flight crew bringing the total over 18 years to 77 (see Figure 3.11).

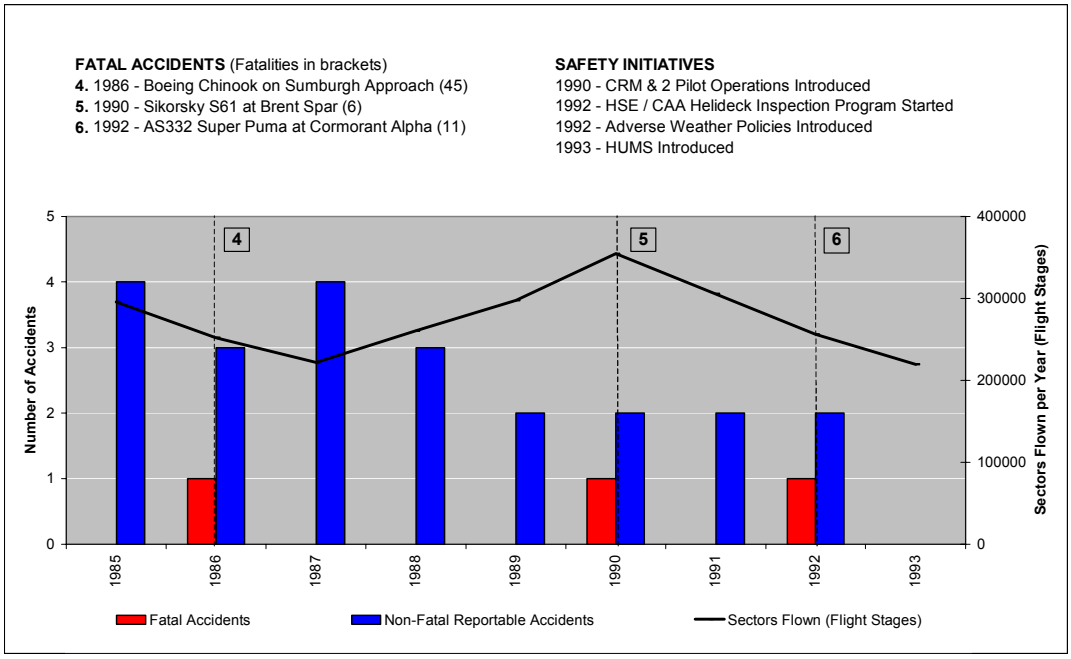


Figure 3.11 UKCS Offshore Helicopter Safety Record 1985 - 1993

There were also 22 non-fatal reportable accidents bringing the total to 42, and giving Reportable Accident Rates of 2.19 and 0.89 per 100,000 flying hours and sectors flown (flight stages) respectively. The causes of non-fatal reportable accidents during this period are listed in Table 3.12 below. A total of 12 component or system failures / defects accounted for the largest proportion of accidents during the period.

In Figure 3.11 above it can be seen that several significant safety initiatives were introduced during this period; these are discussed in more detail in Appendix 1.

	Primary Cause	1985 - 1993
People / Machine	Component / System - Failure / Defect	12
	Human Factors	2
	Loss of Control	0
	Defective Maintenance	1
External Influences	Weather	0
	Helideck Turbulence / Exhaust Plumes	1
	Excess Vessel Motions	2
	Other Causes	4

Table 3.12 Causes of UK Offshore Helicopter Non-Fatal Reportable Accidents 1985 – 1993

3.5.4 The Years 1994 to 2002

Table 3.13 below shows the flight statistics for this period.

Flight Hours		Sectors		Passengers Carried	
Total	Yearly Average	Total	Yearly Average	Total	Yearly Average
820,136	91,126	1,812,868	201,429	16,874,909*	1,525,867*

* From 1994, EC regulations required only the reporting of flight and sector activity, therefore the figures for passengers carried are estimates.

Table 3.13 UKCS Offshore Helicopter Flight Statistics 1994 – 2002

It can be seen from the above table that on average a little over 200,000 sectors (flight stages) were flown with over 1.5 million passengers carried each year.

Table 3.14 below shows the occupant fatal and non-fatal reportable accident rates for this period.

Per 100,000 Flying Hours		Per 100,000 Sectors (Flight Stages)	
Occupant Fatal Accident Rate	**Non-Fatal Reportable Accident Rate**	**Occupant Fatal Accident Rate**	**Non-Fatal Reportable Accident Rate**
1.34	0.98	0.61	0.44

Table 3.14 Fatal and Non-Fatal Reportable Accident Rates 1994 – 2002

Fatal Accident Rates recorded were 1.34 and 0.61 per 100,000 flying hours and sectors flown (flight stages) respectively. During this period there was one fatal accident that accounted for the lives of 9 offshore workers and 2 flight crew bringing the total over 27 years to 88 (see Figure 3.15).

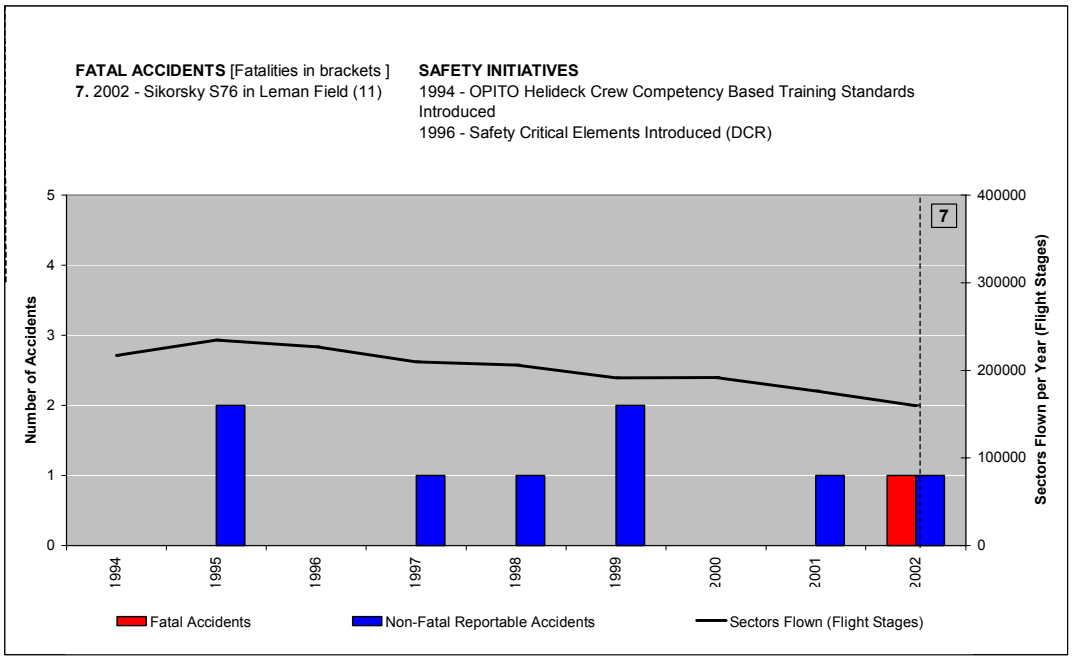


Figure 3.15 UKCS Offshore Helicopter Safety Record 1994 - 2002

There were also 8 non-fatal reportable accidents bringing the total to 50 and giving non-fatal Reportable Accident Rates of 0.98 and 0.44 per 100,000 flying hours and sectors flown (flight stages) respectively. The causes of non-fatal reportable accidents during this period are listed in Table 3.16 below. A total of 5 occurrences were caused by external factors with 3 lightning strikes and a helideck affected by hot gas plumes from adjacent Installation turbine exhausts accounting for the largest proportion of accidents during the period.

In Figure 3.14 above it can be seen that significant safety initiatives were introduced during this period and these are discussed in more detail in Appendix 1.

	Primary Cause	1994 - 2002
People / Machine	Component / System - Failure / Defect	2
	Human Factors	1
	Loss of Control	0
	Defective Maintenance	0
External Influences	Weather	3
	Helideck Turbulence / Exhaust Plumes	1
	Excess Vessel Motions	1
	Other Causes	0

Table 3.16 Causes of UK Offshore Helicopter Non-Fatal Reportable Accidents 1994 – 2002

3.6 ASSESSMENT OF UK OFFSHORE HELICOPTER SAFETY RECORD 1976 -2002

The overall and yearly average flying hours, sectors flown and passengers carried for the past 27 years are given in Table 3.17 below.

Flight Hours		Sectors		Passengers Carried	
Total	**Yearly Average**	**Total**	**Yearly Average**	**Total**	**Yearly Average**
2,716,899	100,625	6,119,659	226,654	48,100,150*	1,781,487*

* From 1994, EC regulations required only the reporting of flight and sector activity, therefore the values for passengers carried are estimates.

Table 3.17 UKCS Offshore Helicopter Flight Statistics 1976 - 2002

From the above table it can be seen that, from 1976 up to year-end 2002, just over 48 million passengers were transported to and from offshore installations on the UKCS. Over 6 million sectors were flown taking about 2.7 million flying hours. Between 1976 and 2002 seven fatal accidents claimed the lives of 88 offshore workers and flight crew whilst travelling in offshore helicopters.

During the period 1976 - 1984 UKCS helicopter activity increased year on year in response to the developing needs of the oil & gas industry. Toward the end of this period more modern helicopters were introduced to replace some of the older types that had been involved in fatal accidents in earlier years. Ironically, 1985 – 1993 was the period when the highest number of occupant

fatalities and reportable accidents were recorded on the UKCS but this was also the period when helicopter activity on the North Sea was at its greatest.

During the period 1994 to mid-2002 there were no fatalities on the UKCS. As a result, year on year improvement in overall safety performance is evident from 1993 up to July 2002 when a Sikorsky S76 fatal accident occurred in the Leman Field as a result of catastrophic main rotor blade failure.

	Per 100,000 Flying Hours		Per 100,000 Sectors (Flight Stages)	
Period	**Occupant Fatal Accident Rate**	**Non-Fatal Reportable Accident Rate**	**Occupant Fatal Accident Rate**	**Non-Fatal Reportable Accident Rate**
1976 - 1984	1.68	2.24	0.81	1.08
1985 - 1993	6.18	2.19	2.52	0.89
1994 - 2002	1.34	0.98	0.61	0.44
1976 - 2002	3.24	1.84	1.44	0.82

Table 3.18 Fatal and Non-Fatal Reportable Accident Rates 1976 – 2002

Table 3.18 above shows that for the first period 1976 -1984 and the third period 1994 to 2002 fatal accident rates are remarkably similar at 1.68 and 1.34 for flying hours and 0.81 and 0.61 for sectors flown respectively. This suggests there has been little change in safety performance between the early years of UK North Sea flying activity and the recent past. However, during the second period 1985 - 1993 there was a marked drop in safety performance with corresponding increases in the fatal accident rates to 6.18 and 2.52 (flying hours and sectors flown respectively). The overall fatal accident rates for the past 27 years (for all helicopters) are also given in this table.

Non-fatal reportable accident rates for flying hours and sectors flown (flight stages) in the first (1976 - 1984) and second (1985 - 1993) periods are similar, but are more than halved in the third period (1994 - 2002). The reduction in the number of occurrences is approximately 64%. A review of the non-fatal reportable accidents and their causes over the last 27 years provides good evidence of improvement since 1994.

Table 3.19 overleaf compares the two elements of people / machine and external influences; and significant reductions are noted in the people / machine reportable accidents since 1994 whereas external factors, after an initial increase from the first to second reporting period, have remained fairly constant.

	Primary Cause	76 - 84	85 - 93	94 - 02	76 - 02
People / Machine	Component / System - Failure / Defect	3	12	2	17
	Human Factors	8	2	1	11
	Loss of Control	4	0	0	4
	Defective Maintenance	3	1	0	4
Total		18	15	3	36
External Influences	Weather	0	0	3	3
	Helideck Turbulence / Exhaust Plumes	1	1	1	3
	Excess Vessel Motions	0	2	1	3
	Other Causes	1	4	0	5
Total		2	7	5	14
All Causes		20	22	8	50

Table 3.19 Breakdown of Causes of UK Offshore Helicopter Reportable Accidents 1976 – 2002

4. COMPARISON WITH OTHER ACTIVITIES

4.1 INTRODUCTION

In an effort to put the passenger risk associated with offshore helicopter transport into a more meaningful context, the safety records of various forms of travel have been collated and compared. It should be noted that helicopter travel offshore is, in many respects, a unique operation because flights are to remote installations and vessels, and much of the flight takes place over water. Also, passengers are equipped with survival suits and other aids for their journey and undergo survival training. Comparing activities that differ in environment and nature can be difficult and it is therefore worth noting that:

- Fixed wing airline aeroplane operations are not truly comparable with public transport helicopter operations because there are distinct differences between the operating regimes for fixed wing and rotary wing aircraft. Helicopters conduct operations that fixed wing aircraft cannot.

- Comparing offshore helicopter activities directly with onshore public transport helicopter activities can be misleading because the types of operation, types and size of helicopter (and hence level of equipment fit), operating environment and passenger exposure are quite different.

- Achieving accurate and meaningful comparisons between UK offshore helicopter operations and similar activities around the world is not always straightforward. This is due in part to the incompleteness of overseas data, the variable operating environments encountered (e.g. harsh vs. benign weather - UK operations are conducted in a harsh weather environment), and differences in reporting criteria.

- Unlike most other forms of transport, the size of the database for offshore helicopter passenger transport operations is very small in statistical terms. This means that apparent patterns in the data could be the result of random chance rather than any systematic cause. In addition, a single accident involving an offshore helicopter will have a proportionally more marked effect on the statistics than will a single accident involving a transport type having a larger database.

The information in the following sections is included to assist readers reach their own conclusions.

4.2 COMPARING UKCS WITH WORLD-WIDE OFFSHORE HELICOPTER OPERATIONS

Some comparisons between UKCS and worldwide offshore helicopter operations safety performance can be made using data available from the International Association of Oil & Gas Producers (OGP).

The data available from OGP covers an 8-year period from 1995 to 2002. OGP's Aviation Sub-Committee has been collecting worldwide oil industry helicopter data since 1994, but advise in their reports that there are countries for which the accumulated operational data is incomplete, particularly in earlier years. OGP reporting is based on 100,000 flying hours and sectors (flight stages) and deals with occupant fatalities, which includes passengers and crew.

In this section it should be noted that Worldwide and All North Sea data is extracted directly from tables in OGP reports, whereas the UKCS data used for comparison is derived from the same sources used in Section 3. In OGP reports, figures quoted for Worldwide cover all global activities including All North Sea, which in turn includes UKCS activities.

Table 4.1 overleaf gives the annual statistical data for fatal and reportable accident rates per 100,000 flying hours and sectors for UKCS, All North Sea and Worldwide offshore operations from 1995 to 2002.

	UKCS			ALL NORTH SEA			WORLDWIDE		
Year	Fatal Acc. Rate per 100,000 Flt Hrs	Accident Rate per 100,000 Flt Hrs	Accident Rate per 100,000 Sectors	Fatal Acc. Rate per 100,000 Flt Hrs	Accident Rate per 100,000 Flt Hrs	Accident Rate per 100,000 Sectors	Fatal Acc. Rate per 100,000 Flt Hrs	Accident Rate per 100,000 Flt Hrs	Accident Rate per 100,000 Sectors
1995	0.00	1.96	0.85	0.00	1.65	0.85	0.82	1.36	0.41
1996	0.00	0.00	0.00	0.00	1.26	1.20	0.85	1.82	0.59
1997	0.00	0.99	0.48	1.19	1.78	1.08	0.53	1.16	0.35
1998	0.00	1.03	0.49	0.00	0.61	0.39	0.58	1.07	0.36
1999	0.00	2.43	1.04	0.00	1.37	1.74	0.60	2.05	0.61
2000	0.00	0.00	0.00	0.00	0.68	0.41	0.78	1.79	0.60
2001	0.00	1.22	0.57	0.00	1.23	0.82	0.11	1.19	0.40
2002	1.23	1.23	0.63	0.65	1.96	1.09	0.32	1.16	0.41
Average	0.14	1.10	0.50	0.23	1.32	0.95	0.57	1.45	0.47

Table 4.1 OGP Worldwide Offshore Helicopter Fatal and Reportable Accident Rates 1995 to 2002

REGION	PERIOD	FATAL ACCIDENT RATES (Flying Hrs.)	NON-FATAL ACCIDENT RATES (Flying Hrs.)	FATAL ACCIDENT RATES (Sectors)	NON-FATAL ACCIDENT RATES (Sectors)
All North Sea	1995 - 2002	0.23	1.32	Not available	0.95
Worldwide	1995 - 2002	0.57	1.45	Not available	0.47
UKCS	1995 - 2002	0.14	1.10	0.06	0.50

Table 4.2 Comparison of UKCS Accident Rates with OGP Worldwide Average Fatal and Reportable Accident Rates 1995 to 2002

Table 4.2 above summarises the averaged data for each region for the 8-year period 1995 - 2002. For the period 1995 to 2002, the UKCS recorded one fatal accident whereas 3 fatal accidents were recorded for all North Sea operations and 40 Worldwide The UKCS fatal accident rate (flying hours) compares favourably with the All North Sea and Worldwide rates.

The 1995 to 2002 non-fatal reportable accident rates for flying hours for the UKCS are lower than the All North Sea and Worldwide operations, but are quite similar. The non-fatal accident rate value for Worldwide sectors flown is very slightly less than the UKCS, but both are only half the rate for the All North Sea category.

4.3 OTHER TRANSPORT MODES

The Transport Statistics Great Britain 2002, 27th Edition, published in October 2002 by the Department for Transport, Local Government and the Regions (DETR) provides data on yearly passenger casualty rates by mode, for the period 1991 up to 2001. The rates published are based on one billion (10^9) passenger kilometres.

For the period 1992 to 2001, annual comparisons with DETR statistics (fatality rates) are set out in Table 4.3 overleaf along with values calculated for UKCS offshore helicopter operations. The data given for air travel relate to passenger casualties in accidents involving UK registered airline aircraft in UK and foreign airspace. Comparing offshore helicopter operations with other forms of transport used in the UK helps to set it in the more meaningful context of everyday experience.

Table 4.4 overleaf gives a summary of the 1992 to 2001 averages which indicate that, with the exception of rail, the safety record of offshore helicopter travel is much better than most forms of land-based passenger transport and quite similar to that for travel by car.

2002 has not been included in the comparison because DETR data for 2002 is not available at this time. In addition, since 1994 when new EC reporting requirements were introduced, base data are no longer collected for deriving offshore helicopter "passenger kilometres" values (also referred to as seat-km). Therefore it will not be possible to accurately calculate a value for offshore helicopters for 2002 (which includes the S76 fatal accident) and thus make reasonable comparisons with other transport modes.

Transport Mode	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Offshore Helicopter	43.3*	0	0	0	0	0	0	0	0	0
Air	0.07	0	0	0.05	0	0	0	0	0	0
Rail	0.4	0.4	0.4	0.2	0.4	0.5	0.4	0.9	0.4	0.1
Car	4	3	3	3	3	3	3	3	3	3
Two Wheeled Motor Vehicle	97	106	110	110	108	119	112	113	123	112
Pedal Cycle	43	46	43	52	50	45	40	42	31	33
Pedestrian	75	70	62	57	56	58	50	50	49	48

* The North Cormorant fatal accident occurred offshore in 1992.

Note: From 1994, EC regulations no longer require data on kilometres flown, passengers carried and passenger kilometres for offshore helicopters to be reported to the CAA.

Table 4.3 Comparison of Passenger Fatality Rates per Billion Passenger Kilometres by Transport Mode (DETR Statistics for the Period 1992 to 2001)

Transport Mode	1992 - 2001 Average
Offshore Helicopter	4.33
Air	0.01
Rail	0.4
Car	3
Two Wheeled Motor Vehicle	106
Pedal Cycle	42
Pedestrian	58

Table 4.4 Comparison of Average Passenger Fatality Rates per Billion Passenger Kilometres by Transport Mode 1992 to 2001

5. CONCLUSIONS

From 1976 up to year-end 2002, just over 48 million passengers have been transported to and from offshore installations on the UKCS and over 6 million sectors have been flown taking about 2.7 million flying hours. Between 1976 and 2002 seven fatal accidents claimed the lives of 88 offshore workers and flight crew whilst travelling aboard offshore helicopters.

During the period 1976 - 1984 UKCS helicopter activity increased year on year in response to the developing needs of the oil & gas industry. Toward the end of this period more modern helicopters types were introduced to replace some of the older types that had been involved in fatal accidents in earlier years. Ironically, 1985 to 1993 was the period when the highest number of occupant fatalities and reportable accidents were recorded on the UKCS, but this was also the period when helicopter activity on the North Sea was at its greatest.

Fatal accident rates of 1.34 and 0.61 (flying hours and sectors flown respectively) recorded for the period 1994 to 2002 remain well below those recorded for the second period 1985 to 1993, but are similar to the first period 1976 to 1984. For the 10 years following the North Cormorant accident in 1992, no fatalities were recorded for UKCS offshore helicopter passenger transport operations until July 2002 when the S76 fatal accident occurred in the Leman Field, the result of catastrophic main rotor blade failure.

Non-fatal reportable accidents continue to occur on the UKCS, occasionally with serious injury being inflicted. However, it is recognised that the number of non-fatal reportable accidents has significantly reduced in recent years. A good measure of the level of improvement during the period 1994 to 2002 is the significant reduction in the rates of occurrences (both in terms of flying hours and sectors) from the previous two periods. This appears to be largely due to the reduction in the number of technical failures since 1993. It is probable that part of this improvement can, at least in part, be attributed to the introduction of Health Usage and Monitoring Systems (HUMS) on UK offshore helicopters from 1992. It should be noted, however, that the July 2002 fatal S76 accident was caused by a catastrophic component failure that would not have been identified by HUMS; detecting such failure modes is beyond current system capability.

Direct comparisons of UKCS safety performance with Worldwide and All North Sea offshore helicopter operations are limited to the 8 year period 1995 to 2002, and during which the UKCS fatal accident safety record compares favourably with the other regions. The non-fatal reportable accident rates for flying hours for the UKCS are less than, but similar to, the All North Sea and Worldwide regions. Also, the non-fatal reportable accident rate for sectors is half that for the All North Sea operations and very close to that for Worldwide operations.

While the limitations of the exercise are recognised, in an effort to put the passenger risk associated with offshore helicopter transport into a more meaningful context, the safety records of various other forms of travel have been collated and compared. The data readily available covering the period 1992 to 2001 indicates that the averaged fatality rate per billion passenger kilometres for UK offshore helicopter transport is of a similar order to that of travel by car. NB: The

2002 fatal S76 accident offshore has not been included in the comparison because DETR data for 2002 was not available at the time of compilation.

This study and its analysis demonstrate that, overall, UKCS offshore helicopter operations have achieved a good safety record over the reporting period when compared with similar operations globally and with most other forms of UK land-based passenger transport. This is most clearly demonstrated by offshore passenger transport helicopters recording zero fatalities for 9 years from 1993 to 2001. However, the fatal S76 accident that occurred in July 2002 serves to remind the industry that there is no room for complacency.

Additionally, non-fatal reportable accidents continue to occur on the UKCS, occasionally with serious injuries being sustained as in the case of the Super Puma AS332 accident on the West Navion helideck, in 2001. This situation highlights the need for the UK Oil & Gas industry to continue to vigorously pursue current and future safety initiatives and research projects to further reduce risks. A summary of safety initiatives is shown in Appendix 1.

6. ABBREVIATIONS AND DEFINITIONS

A/C	Aircraft
BHAB	British Helicopter Advisory Board
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CRM	Crew Resource Management
DCR	Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996
deg	degree
Flight Hours	The time recorded from the moment a helicopter first moves under its own power to take-off until the moment it comes to rest after landing.
ft.	feet
HSE	Health and Safety Executive
HOMP	Helicopter Operations Monitoring Programme
HUMS	Health and Usage Monitoring System
Flight Stage	The activity of one take-off and landing (see Sector)
MRGB	Main Rotor Gearbox
MTWA	Maximum Take-off Weight Authorised
Occupants	For the purposes of this report all souls on board are included (e.g. passengers and flight crew)
OGP	International Oil & Gas Producers Association
OPITO (Cogent)	Offshore Petroleum Industry Training Organisation
pax	Passengers
Reportable Accident	An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all persons have disembarked, including an aircraft sustaining damage or structural failure which adversely affects the structural strength, performance or flight characteristics of the aircraft and which would normally require major repair or replacement of the affected components.
SAR	Search and Rescue
Sector	The activity of one take-off and landing (the same as a flight stage).
SS&A	Strategic Safety and Analysis (CAA)
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
VMC	Visual Meteorological Conditions

APPENDIX 1 SAFETY IMPROVEMENTS AND INITIATIVES

The following safety initiatives and improvements have been funded and fully supported by industry and the regulators and include. They are not listed in any order of priority or importance.

- Regular reviews and periodic updating of CAP 437, Offshore helicopter landing areas - guidance on standards:
  This key document is founded on the ICAO international standards and recommended practices, and provides the basic requirements applied to offshore helidecks by the regulators and helicopter operators to ensure they are fit for purpose.

- Health and Usage Monitoring Systems (HUMS):
  HUMS was introduced on the UKCS in the early 1990's to reduce catastrophic component failures by providing information on operating limit exceedences and early detection of defects. It has been highly successful and is now mandated by CAA for all UKCS Offshore helicopters. It should be noted that in respect of the recent fatal S76 accident, which was caused by a catastrophic component failure (main rotor blade), the latent defect would not have been identified by HUMS because detecting such failure modes is beyond current system capability.

- Improved standard of helidecks and equipment:
  In the early 1990's a series of helideck surveys conducted by CAA on behalf of HSE identified many helideck and equipment deficiencies and non-compliances with regulations and codes of practice. The outcome from these surveys led to introduction of the BHAB Helideck Inspection regime to provide for routine helideck examinations and acceptance for flight operations by the helicopter operators.

- Improved helideck operating standards:
  In response to helideck operating deficiencies, highlighted during the HSE / CAA offshore helideck operations inspection programme, Guidelines for the Management of Offshore Helideck Operations were developed by Industry and other stakeholders and were first published by UKOOA in 1993. They are regularly reviewed and were last updated in 2003.

- Offshore flights restricted in poor weather conditions:
  As a result of the findings of a fatal accident near Cormorant Alpha in 1992, industry introduced operating policies to improve the management of helicopter operations in adverse weather conditions.

- More competent helideck crews:

The training and competence of helideck crews was challenged in the early 1990's leading to industry and other stakeholders developing competence based training requirements.

- Greater focus on safe helidecks and helicopter operations:
  An offshore helideck is a collection of systems, some of which are safety critical. Duty Holders have to identify such safety critical systems and have them independently verified as required by The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996 (SI 1996/913). HSE Safety Notice 4/99 - Offshore Helideck Design and Operability was issued in September 1999 drawing attention to these requirements.

- The introduction of Crew Resource Management (CRM):
  Helicopter operators, in conjunction with the CAA, have developed and introduced systems to improve crew resource management. CRM training provides crews with skills for more efficient flight management. Progressively, since the late 1980's, multi-crewing and the use of all instrument rated pilots was introduced for UK offshore flights.

Some of the above initiatives have been part of the extensive research into improving offshore helicopter flight safety that has been ongoing since the Helicopter Airworthiness Review Panel (HARP) Report was published by the CAA in 1984 (CAP 491) and, subsequently, the Review of Helicopter Offshore Safety and Survival (RHOSS) Report which was published in 1995 (CAP 641). Other research projects that have already contributed to improving offshore helicopter flight safety and those initiatives currently active, include:

- Helideck motions on floating platforms and vessels:
  Since 1992 a significant amount of research has been carried out into the effects of the motion of helidecks on floating platforms and vessels on helicopters. The new motion severity index (MSI) that has been developed will better establish whether a helicopter can safely remain on a moving helideck. Establishment of MSI-based helicopter operating limits is nearing completion.

- Environmental hazards around offshore platforms:
  According to pilot opinion (CAA Paper 97009 refers) turbulence represents the greatest safety hazard and largest source of flight deck workload for crews landing on offshore helidecks. A research project, funded jointly by the HSE and CAA and reported in CAA Paper 99004, investigated the nature and extent of environmental hazards around offshore helidecks, installations and vessels. Follow-on work to establish better aerodynamic criteria for validating helideck design is nearing completion.

- Helideck lighting:
  On approach to an offshore helideck, the surrounding light pollution can hinder helideck location. Furthermore, existing helideck lighting systems can present a source of glare for helicopter pilots and often do not provide adequate visual cues for landing. Trials of

a new helideck lighting system designed to address these issues have been successful and the new scheme is being introduced into the international standards and into service. The report on the first set of trials, performed at the NAM K14 platform, has been published in CAA Paper 2004/01.

- Helicopter emergency flotation:
  This project is directed at practical improvements in the crashworthiness of flotation equipment to enhance post water impact survivability, and to provide a fall-back side floating attitude in the event of capsize following a ditching. Hydrodynamic model tests of potential systems have been carried out and are reported in CAA Paper 97010. Escape trials from a side floating 'helicopter' have been successfully performed using a helicopter underwater escape trainer (HUET) and are reported in CAA Paper 2001/10.

- Preparation of comprehensive Offshore Helideck Design Guidelines:
  Offshore helideck design guidelines have been developed in response to one of the recommendations in CAA paper 99004 (see above) which identified that some offshore helideck and Installation operations can create problems that potentially affect flight safety. Problems may be caused by helideck layout and equipment deficiencies, structure-induced turbulence, hot gas plumes generated by turbines and flares, or the effects of wave-induced motions on helidecks on floating structures and vessels. These aspects often result in operating limits being imposed by helicopter operators. The Guidelines are scheduled for publication in early 2004.

- Helicopter Operations Monitoring Programme (HOMP):
  Independent and continuous monitoring of flight operations allows helicopter operators to identify and address operational weaknesses (e.g. shortfalls in training or procedures), and obtain better information on operational difficulties caused by environmental factors such as weather and thereby minimise risks. HOMP trials were started in 2000 and were so successful that, in 2002, the industry committed to full-scale implementation. The original in-service trials of HOMP are reported in CAA Paper 2002/02.