

AIRCRAFT ACCIDENT REPORT 3/94

Air Accidents Investigation Branch

Department of Transport

**Report on the incident to
Boeing 737-2Y5A, 9H-ABA
at London Gatwick Airport
on 20 October 1993**

This investigation was carried out in accordance with
The Air Navigation (Investigation of Air Accidents) Regulations 1989

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**Department of Transport
Air Accidents Investigation Branch
Defence Research Agency
Farnborough
Hampshire GU14 6TD**

12 May 1994

*The Right Honourable John MacGregor
Secretary of State for Transport*

Sir,

I have the honour to submit the report by Mr R StJ Whidborne, an Inspector of Air Accidents, on the circumstances of the incident involving Air Malta Boeing 737-2Y5A, 9H-ABA at London Gatwick Airport on 20 October 1993.

I have the honour to be
Sir
Your obedient servant

K P R Smart
Chief Inspector of Air Accidents

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GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

AAIB	-	Air Accidents Investigation Branch
AAR	-	Aircraft Accident Report
AIP	-	Aeronautical Information Publication
AIS	-	Aeronautical Information Service
ANO	-	Air Navigation Order
ASI	-	Airspeed Indicator
ATC	-	Air Traffic Control
ATIS	-	Automatic terminal Information Service
CAA	-	Civil Aviation Authority
CAP	-	Civil Aviation Publication
CCF	-	Coordinated Control Function
CVR	-	Cockpit Voice Recorder
DRA	-	Defence Research Agency
FDR	-	Flight Data Recorder
IAM	-	Institute of Aviation Medicine
ICAO	-	International Civil Aviation Organisation
LATCC	-	London Air Traffic Control Centre
MATS	-	Manual of Air Traffic Services
mb	-	millibars
MHz	-	Mega Hertz
NATS	-	National Air Traffic Services
nm	-	nautical miles
NOTAM	-	Notice to Airmen
OM	-	Operations Manual
PAPI	-	Precision Approach Path Indicator
QNH	-	Corrected mean sea level pressure
SRA	-	Surveillance Approach Radar
UTC	-	Co-ordinated Universal Time
VHF	-	Very High Frequency
VMC	-	Visual Meteorological Conditions

Air Accidents Investigation Branch

Aircraft Accident Report No: 3/94

(EW/C93/10/4)

Registered owner and operator: Air Malta Company Limited

Aircraft Type and Model: Boeing 737-2Y5A

Nationality and Registration: Maltese 9H-ABA

Place of accident: London Gatwick Airport

Date and Time: 20 October 1993 at 2016 hrs

All times in this report are UTC

Synopsis

The incident was notified to the Air Accidents Investigation Branch (AAIB) at 2105 hrs on 20 October 1993 and an investigation began the next day. The AAIB team comprised Mr R StJ Whidborne (Investigator in Charge), Mr A W Skinner (Operations) and Mr T G Wild (Flight Recorders). Mr J Chappelow, Principal Psychologist of the RAF Institute of Aviation Medicine advised the investigation on human factor aspects.

The incident occurred when a Boeing 737-2Y5A aircraft landed on Taxiway 2 at London Gatwick Airport after making a Surveillance Radar Approach (SRA) at night to land on Runway 26R. Taxiway 2 was unoccupied at the time. The aircraft was subsequently taxied to the parking area where the passengers and crew disembarked via the normal channels.

The report concludes that the incident occurred as a result of the following factors:

- (i) Runway 26R was clearly visible throughout the approach but the pilots looked for and selected a pattern of lights to the right of it because they assumed erroneously that 26R was in fact 26L and they knew that the designated runway had to be to the right of this.
- (ii) The flight crew had not briefed themselves on the lighting they were expecting to see on Runway 26R once the change of runway had been confirmed.

- (iii) The crews' misinterpretation of the visual cues was facilitated by:
- a. The similarity between the night time view of Runways 26L and 26R with associated taxiways to the right which are marked with green centreline lighting.
 - b. The use of Runway 26R sometimes as a runway with edge lighting and sometimes as a taxiway with centreline lighting.
 - c. The green centreline lights of Taxiway 2 were set at a brilliance of 30% until the aircraft was about 2 miles from touchdown when they were reset to 10%. Whilst the lights were at the brighter intensity the chance of mistaking Taxiway 2 for the runway was considerably increased and the mistake was possible at an earlier stage in the approach.

The report contains three safety recommendations.

1 Factual Information

1.1 History of the flight

The Boeing 737-2Y5A aircraft, 9H-ABA, using the radiotelephony call sign 'Air Malta 144', departed Malta International Airport at 1658 hrs on 20 October 1993 on an international scheduled public transport passenger flight to London Gatwick Airport. Six crew members and 95 passengers were on board. The first officer was the handling pilot.

The cruise was uneventful and Air Malta 144 first contacted the London Air Traffic Control Centre (LATCC) Lydd Sector controller at 1940 hrs when descent clearance was issued. At this time the London Gatwick Automatic Terminal Information Service (ATIS) was broadcasting information 'ECHO' that reported that the active runway at London/Gatwick was 26L, and added the advice that operations were due to be changed to Runway 26R at 2000 hrs. (Full details of relevant ATIS broadcasts are included in paragraph 1.9.2. of this report.) Air Malta 144 acknowledged receipt of information 'ECHO' and the flight crew have stated that at this stage in the descent they expected and had briefed for, a standard arrival and an Instrument Landing System (ILS) approach for landing on London Gatwick Runway 26L.

The aircraft's descent proceeded normally and ATC was transferred to Combined Control Function (CCF) Biggin and then to Gatwick Approach when, at 1954 hrs, the controller informed Air Malta 144 that the London Gatwick runway was being changed from 26L to 26R. The aircraft was instructed to take up the Eastwood holding pattern at Flight Level (FL) 80 and expect radar vectoring for an SRA to 26R. At this time the London Gatwick ATIS had been changed to reflect the change of runway and the broadcast also routinely ended with a standard advice on the approach and runway lighting. This advice was: 'RUNWAY IN USE 26R, WITH WHITE APPROACH AND EDGE LIGHTS - RUNWAY 26R SPECIAL PROCEDURES IN OPERATION'. Although Air Malta 144 was informed of the runway change no advice was passed concerning the change of ATIS. The aircraft was required to hold at Eastwood for 10 minutes. During this time the pilots acknowledge that, although the runway had been changed, they did not specifically re-brief themselves on the lighting they could expect to see during their approach and landing.

At 2004 hrs the Gatwick Approach controller instructed Air Malta 144 to re-commence descent to FL70 and route inbound to Mayfield. This would have required the aircraft to fly a magnetic track of 312° from Eastwood to Mayfield. At this time both the runways were closed while necessary safety checks were being completed before Runway 26R could be declared operational. Because of

problems in switching some of the stop bars associated with the terminal area taxiways, there was a further short delay and it became necessary for the Gatwick Approach controller to extend the approach path of Air Malta 144 and, at 2006 hrs, he therefore instructed the aircraft to turn onto a radar heading of 290°. At 2008 hrs Runway 26R was declared open. The centreline lights of Taxiway 2 had been set to 30 % brilliance, to assist ground movements, and at 2014:43 hrs they were reduced to 10% (see paragraph 1.10.2). Once the runway was open, the approach controller instructed Air Malta 144 to turn right onto a heading of 010° and descend to 4,000 feet. At this point the aircraft was approximately 20 nm from touchdown and control was transferred to the director on the appropriate Gatwick Radar Frequency.

The Gatwick Radar director advised Air Malta 144 that he would provide an SRA terminating at 2 miles from touchdown and he requested the pilots to advise him when they had the runway in sight. The aircraft was also requested to maintain an approach speed of 160 kt until it was at a range of 4 miles on final approach. Descent and heading instructions followed. Radar recordings and an analysis of the aircraft's Flight Data Recorder and Cockpit Voice Recorder (FDR & CVR) show that Air Malta 144 turned onto the final approach track at a range of approximately 8 nm from touchdown and thereafter was flown close to the correct approach path and at the requested airspeed. At 2014 hrs the radar director advised Air Malta 144 that the aircraft was 4 nm from touchdown and the crew should check that the wheels were down and the flight was clear to land. Air Malta 144 acknowledged the landing clearance and reported that the field was in sight. Shortly after this transmission the CVR shows that the first officer had doubts concerning the precise location of the runway and asked, "IS IT THIS ONE OR THE ONE ON THE RIGHT?" The commander replied, "ITS THE ONE ON THE RIGHT, THE ONE WITH THE GREEN LIGHTS". At 2015 hrs the radar director informed Air Malta 144 that the range was 2 nm from touchdown and instructed the aircraft to transfer radio communication to Gatwick Tower. On initial contact the Gatwick air controller confirmed landing clearance and Air Malta 144 landed at 2016 hrs. The landing appeared normal to the flight crew and the aircraft was decelerated normally. Shortly afterwards the air controller informed Air Malta 144 that the aircraft had landed to the right of the runway and on Taxiway 2. The aircraft subsequently taxied to the terminal where the passengers and crew disembarked through the normal channels.

1.2 Injuries to persons

None.

1.3 Damage to aircraft

None.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 Commander: Male, aged 46 years

Aircraft ratings: B727, A300, B747, B737

Medical certificate: Class 1, renewed 26 May 1993 valid until 15 December 1993

Instrument rating: Valid until 14 June 1994

Last proficiency check: 11 June 1993

Last line check: 22 June 1993

Flying experience

Total:	13,180 hours
Total on type:	2,408 hours
Total in last 24 hours:	Nil
Total in previous 90 days:	110 hours

Licence: Malta Airline Transport Pilot's Licence

Rest period before duty on day of incident flight: 62 hours

During the four months before the incident the commander had operated the B737 aircraft on Gatwick sectors at night on eight occasions. He had never before landed at night on Gatwick Runways 26R or 08L.

1.5.2 First Officer: Male, aged 26 years

Licence: Malta Commercial Pilot's Licence

Aircraft ratings: C212, B737

Medical certificate:	Class 1, renewed 9 February 1993 valid until 8 February 1994	
Instrument rating:	Valid until 30 April 1994	
Last proficiency check:	2 June 1993	
Last line check:	16 August 1993	
Flying experience	Total:	3,100 hours
	Total on type:	2,000 hours
	Total last 90 days:	185 hours
	Total last 24 hours:	Nil

Rest period before duty on day of incident flight: 60 hours

Since qualifying on B737 aircraft the first officer had operated Gatwick sectors on 50 occasions of which 10 were at night. He had never before landed on Runway 26R or 08L either by day or night.

1.6 Aircraft information

Type:	Boeing 737-2Y5A
Constructor's No	23038
Date of construction:	March 1983
Certificate of Registration:	Malta Certificate No 24, issued 11 March 1983
Certificate of Airworthiness:	Malta Certificate No 45/1, valid from 12 March 1993 to 11 March 1994
Maintenance:	Certificate of Maintenance Review valid from 14 July 1993 to 13 November 1993
Total airframe hours:	40,574 (as at 20 October 1993)
Engines:	2 Pratt & Whitney JT8D-15A turbofan engines

1.7 Meteorological information

The actual weather observation recorded at London Gatwick Airport at 2015 hrs on 20 October 1993 was: Surface wind 250°/08 kt, visibility 9 km, cloud 6 oktas at 4,000 feet, QNH 1022 mb. Meteorological conditions were not a factor in the circumstances of the incident.

1.8 Aids to navigation

The following extract is included in the United Kingdom Aeronautical Information Publication (UK AIP) for LONDON/Gatwick, page 2-23-2 dated 5 August 1993 and was valid at the time of the incident:

'26 (i) Use of Runway 08L/26R

(iii) Nav aids

(a) When Runway 08L/26R is in use the only navigational aids available are:

(1) Surveillance Radar

(2) DME

(3) GY and GE NDBs'

At the time of the incident all navigation aids were serviceable and the crew of Air Malta 144 was offered and accepted an SRA to Runway 26R.

1.9 Communications

1.9.1 Air Traffic Control

Air Malta 144 established communications with the Lydd sector of LATCC at 1940 hrs on VHF frequency 127.1 MHz, followed by CCF-Biggin (128.4 MHz), Gatwick Approach (126.825 MHz), Gatwick Radar (119.6 MHz), Gatwick Tower (124.22 MHz), and Gatwick Ground Movement Control (121.8 MHz). Two-way communication was good on all frequencies and transcripts were obtained after the incident.

1.9.2 Gatwick Automatic Terminal Information Service (ATIS)

Guidelines for the contents of ATIS information is contained in ICAO Document 9426 (ATS Planning Document). Details of the information which is to be included in Arrival ATIS broadcasts for UK airfields is included in the Manual of

Air Traffic Services (MATS)¹, Part 1, Section 3, Chapter 1, paragraphs 9 and 11. When it is planned to use the northern runway at Gatwick, there is a requirement for additional information to be included in the ATIS broadcast and this is included in Gatwick MATS Part 2, Section 2, Chapter 1, paragraph 5 (a) (ii) and (a) (v) which state:

'(a) (ii) Whenever possible, one hour before the planned opening time of 26R/08L, the ATC Watch Manager is to ensure that the following message is included in the ATIS broadcast:

'BE ADVISED, RUNWAY (26R OR 08L) OPERATIONS ARE PLANNED TO COMMENCE AT HOURS.'

(a) (v) When Runway 26R/08L has been handed over for operational use the ATC Watch Manager is to ensure that the following message is included in the ATIS broadcast:

'RUNWAY IN USE (26R OR 08L) WITH WHITE APPROACH AND EDGE LIGHTS. RUNWAY (26R OR 08L) SPECIAL PROCEDURES IN OPERATION.'

The messages broadcast by the Gatwick ATIS on 20 October 1993 were as follows:

'GATWICK INFORMATION ECHO ONE NINE ONE FIVE HOURS - WEATHER SURFACE WIND TWO FIVE FIVE DEGREES MAGNETIC ZERO EIGHT KNOTS - NINE KILOMETRES- NIL WEATHER BROKEN CLOUD AT FOUR THOUSAND FEET - AIR TEMPERATURE PLUS EIGHT DEW POINT PLUS FOUR - QNH ONE ZERO TWO TWO MILLIBARS PRESSURE QFE ONE ZERO ONE FIVE MILLIBARS - RUNWAY IN USE TWO SIX LEFT - BE ADVISED THAT NORTHERN RUNWAY OPERATIONS RUNWAY TWO SIX RIGHT ARE PLANNED TO COMMENCE AT TWENTY HUNDRED HOURS.'

'GATWICK INFORMATION FOXTROT ONE NINE FOUR FIVE HOURS - WEATHER SURFACE WIND TWO SIX FIVE DEGREES MAGNETIC ZERO NINE KNOTS - VISIBILITY NINE KILOMETRES - NIL WEATHER BROKEN CLOUD FOUR THOUSAND FEET - AIR TEMPERATURE PLUS EIGHT DEW POINT PLUS FOUR - QNH ONE ZERO TWO TWO MILLIBARS PRESSURE QFE ONE ZERO ONE FIVE MILLIBARS - RUNWAY IN USE TWO SIX RIGHT WITH WHITE APPROACH AND EDGE LIGHTS - RUNWAY TWO SIX RIGHT SPECIAL PROCEDURES IN OPERATION.'

1 MATS Part 1 contains instructions that are applicable to all air traffic control units. Part 2 contains instructions that are applicable to individual units such as an airport.

1.10 Aerodrome information

London Gatwick Airport is a licensed aerodrome operated and administrated by Gatwick Airport Limited (GAL), with ATC services operated by the National Air Traffic Services (NATS) of the CAA.

1.10.1 Runway and taxiway details

London Gatwick Airport has a main runway designated 26L/08R. Parallel to it and displaced to the north by 200 metres is another runway designated 26R/08L. The displacement between these runways is such that they are not permitted to be in use for takeoffs and landings at the same time. Runway 26R/08L is only used when the main runway (26L/08R) is temporarily non-operational by reason of an accident/incident, a structural defect, or when planned maintenance is being undertaken. Runway 26R/08L is a non-instrument runway that is only available when promulgated by GAL. Whenever the main runway is in use the northern runway is utilised as a taxiway.

Taxiway 2 measures 2,875 metres from the Lima holding point at its western end, to the junction with Taxiway 6 at the eastern end. This taxiway is parallel to and displaced 90 metres to the north of Runway 26R/08L and is 300 metres longer. A plan of the eastern end of the airport is shown at Appendix A.

1.10.2 Airport lighting - Runway 26R and taxiways

The approach and runway lighting for Runway 26R is described in the UK AIP for London Gatwick on page AGA 2-23-5, section 35 dated 13 May 1993 and valid at the time of the incident. The approach lighting comprises a 420 metre high intensity centreline with one cross-bar and two flashing white strobes of variable brilliance sited on either side of the centreline 400 metres before the threshold. The threshold lighting consists of high intensity green lights with high intensity green wing bars.

The runway is normally lit by high intensity flush bi-directional edge lighting that has a low intensity omni-component and a line of transverse red lights at the runway end. Precision Approach Path Indicator lights (PAPIs) are situated on the left side of Runway 26R. The runway lights are selected on at all times when Runway 26R is in use and its approach lights are on whenever the runway is available for landings. It is not possible for the approach lights of either runway to be illuminated at the same time.

Under normal conditions, when Runway 26L is in use, the northern Runway 26R is used as a taxiway. In these circumstances taxi guidance on

Runway 26R is provided by a single straight line of bi-directional green centreline lighting. Taxiway 2 is similarly lit with a single straight line of bi-directional centreline green lights. A red stop bar is sited across the complete width of Taxiway 2 immediately opposite Stand 142 (see Appendix A).

The status of the airfield lighting is electronically recorded and examination of the record for the duration of the approach and landing by Air Malta 144 showed that at 2003 hrs the brilliance of Taxiway 2 centreline lights was set to 30% (30 candelas (cd) output). At 2014:43 hrs, the brilliance of the centreline lights was reduced from 30% to 10% (20 cd output). Aerodrome lighting is described in Chapter 6 of Civil Aviation Publication (CAP) 168 - Licensing of Aerodromes. Paragraph 9.2 describes typical intensity settings and refers to Table 6.3 which lists a setting of 10% for Taxiway centreline Scale L1 in darkness with visibility over 5 km and cloudbase 700 feet or more. Table 6.3 is intended as a guide because 'the final choice of intensity setting must rest with the pilot'. The setting of 10% was appropriate to the existing meteorological conditions at the time of the incident.

The UK AIP AGA 2-23-2 gives details about London Gatwick Airport. Paragraph 26 (g) has the following warning:

'(i) In low visibility at night the apron and car park's floodlighting may be seen before approach lights on 26L and 26R approaches.'

1.10.3 Approach and runway lighting - Runway 26L

The approach lighting to Runway 26L comprises a 915 metre high intensity centreline with five cross-bars and supplementary lighting in the inner 300 metres. Two flashing white strobe lights, of variable brilliance and visible in the approach sector only, are sited either side of the centreline 400 metres before the threshold. The threshold lighting consists of high intensity green lights with wing bars.

The runway lighting comprises high intensity flush bi-directional edge lights which show red for the first 393 metres from runway end up to the displaced landing threshold. There is high intensity colour coded centreline lighting at 15 metre spacing and high intensity touchdown zone lighting is installed together with red runway end lights and red stopway lighting for 74 metres beyond runway end lights.

This lighting meets all the requirements for Category III operations.

1.10.4 Aeronautical Information Service (AIS) Bulletins

Whenever planned maintenance to London Gatwick Runway 26L/08R is due to take place the dates and times are published in Notices to Airmen (NOTAMS) which are transmitted by the NATS Aeronautical Information Service in advance of the work commencing. NOTAM No A1311/93 advised the planned closure of London Gatwick Runway 26L/08R from 2000 hrs to 0500 hrs on 18 to 21 October 1993 inclusive and advised operators to note that Runway 26R/08L is a visual runway and that distances may, in some instances, restrict aircraft operating weights. This NOTAM was issued on 27 August 1993.

Closure of Runway 26L for maintenance work occurs infrequently and Runway 26R is used for little more than two weeks per annum.

1.11 Flight recorders

1.11.1 Cockpit Voice Recorder

The CVR was a Fairchild A100, which had a 30 minute duration using an endless loop of tape. The audio information was recorded on four tracks as follows:-

- TRACK 1 - Observer's (3rd crew member) 'live' microphone and headset
- TRACK 2 - First officer's 'live' microphone and headset
- TRACK 3 - Commander's 'live' microphone and headset
- TRACK 4 - Cockpit area microphone

The early stages of the approach had been overwritten while electrical power remained on after landing. The recording began when the aircraft was 12 nm from touchdown and continued until it was parked and electrical power was removed. During the recording it is apparent that the crew did not listen to ATIS 'FOXTROT' although throughout this time it could be heard on the observer's (3rd crew member) track.

The CVR recording contained four exchanges concerning identification of the runway. The first happened shortly before 8 nm on the approach:

FIRST OFFICER: GOT THE RUNWAY.

There was no response to this comment from the commander. The second exchange occurred shortly after 8 nm on the approach.

FIRST OFFICER: SO ARE THEY BOTH LIT UP OR WHAT?

COMMANDER: EH?

FIRST OFFICER: BECAUSE I CAN SEE ONE RUNWAY.

COMMANDER: YEAH, I CAN JUST SEE THE ONE; THAT'S THE ONE THAT WE'RE LANDING ON. OH NO, IT'S THE ONE ON THE RIGHT, NOT THE ONE ON THE LEFT.

FIRST OFFICER: WELL, HE'S GOT TO TURN US FURTHER IN THEN, FURTHER TO THE LEFT, EH?

The third exchange occurred 2.5 nm from touchdown:

COMMANDER: SO 26 RIGHT IS THE ONE WITH THE GREEN LIGHTS, EH?

FIRST OFFICER: YEAH.

COMMANDER: THEY'VE JUST SWITCHED IT OFF NOW.²

The fourth exchange was initiated by the first officer 30 seconds later.

FIRST OFFICER: IS IT THIS ONE OR THIS ONE?

COMMANDER: THE ONE WITH THE GREEN LIGHTS.

FIRST OFFICER: JUST THE CENTRELINE LIGHTS.

COMMANDER: THE CENTRELINE, YEAH.

1.11.2 Flight Data Recorder

The FDR was a Fairchild F800 recording five aircraft parameters, a selection of these, altitude (referenced to 1,013 mb), IAS and magnetic heading are shown in the plot at Appendix B. Also shown are selected comments from the CVR and indications of the distances to touchdown calculated from radar data. The touchdown point was determined from the vertical acceleration data recorded by the FDR.

At the start of the plot the aircraft was at a steady altitude of 1,750 feet and was turning onto a heading of 270° following an instruction from ATC. At time 10 seconds the first officer reported that he had sight of the runway. The first exchange between the crew, querying identification of the runway, followed 20 seconds later. At 80 seconds the aircraft started its descent and 10 seconds later began to turn left in response to an ATC instruction to turn onto a heading of 265°. During the next 30 seconds the heading decreased to 266° and then from

² Neither crew member can recall the circumstances of this remark. However, the record of airfield lighting selections shows that shortly before this remark was made the centreline lighting of Taxiway 2 was reduced to 10% brilliance.

120 seconds to 180 seconds varied between 265° and 268°. A plot of radar data during this time indicated that the aircraft was drifting north of the extended runway centreline. At 164 seconds the second exchange querying the runway identification occurred. At 185 seconds, 2 nm before touchdown and at an altitude of 700 feet, the aircraft turned left onto a heading of 260° to 261° maintained for 10 seconds before the heading increased slightly at 200 seconds to between 262° and 263° during the last mile before touchdown. The third exchange between the crew querying the runway identification started at 200 seconds. The aircraft touched down at 236 seconds with an IAS of 140 kt.

1.12 Wreckage and impact information

Not applicable.

1.13 Medical and pathological information

Not applicable.

1.14 Fire

Not applicable.

1.15 Survival aspects

Not applicable.

1.16 Tests and research

None.

1.17 Additional information

1.17.1 Previous incident

On 12 April 1988 a similar incident occurred at Gatwick when a BAC 1-11 aircraft was landed at night on Taxiway 2 when the flight crew mistakenly believed it to be Runway 08L. The circumstances of the incident were investigated by AAIB and published in the Aircraft Accident Report (AAR) No 2/89. The report identified the following causal factors :

'The commander's misinterpretation of the visual clues was facilitated by:

- a. The similar visual appearance at night of Runway 08R with a green centreline to its left on the taxiway (Runway 08L); and Runway 08L with a green taxiway to its left on Taxiway 2.
- b. The use of Runway 08L both as a runway with edge lighting and as a taxiway with centreline lighting.
- c. The red LIMA stop bar on Taxiway 2, implying a threshold, and enabling the impression to be formed of Taxiway 2 as a poorly lit runway to the left of the apparent main runway.
- d. The failure of the crew to brief themselves on the lighting they were expecting to see on the approach to Runway 08L.'

1.17.2 Previous safety recommendation and CAA response

The causal factors identified in the report resulted in the promulgation of nine safety recommendations, one of which referred exclusively to the airfield lighting and recommended the following:

'4.3 A review of the airfield lighting at Gatwick Airport should be made and should consider all aspects of operations on all runways, in particular:

- a) The modification of the red stop bar at the LIMA holding point to make it uni-directional to the east.
- b) The provision of a reduced minimum lighting intensity for the green centreline lights of Taxiway 2 and Runway 08L/26R, to a level considerably below the minimum setting of 30% which existed at the time of the incident.
- c) The modification of the green centreline lighting of Taxiway 2 to make it uni-directional and switchable for the direction in use.
- d) The modification of the green centreline lighting of Runway 08L/26R (when it is in use as a taxiway) to make it uni-directional and switchable for the direction in use.
- e) The provision of sequenced strobe centreline lighting to identify the active runway.'

The CAA response to this recommendation was published in the Follow-up Action on Accident Reports (FACTAR) No F7/89 dated 4 May 1989 and stated:

'The authority accepts this recommendation in its capacity as the Licensing Authority for UK airfields. The lighting at Gatwick has been reviewed in association with Gatwick Airport Limited. On each of the particular aspects raised by AAIB the Authority's response is as follows:

- a) The need for modification is agreed. Appropriate changes were implemented by Gatwick Airport Limited on 5 August 1988.

b) The need for modification is agreed. Appropriate changes were implemented by Gatwick Airport Limited on 5 January 1989.

c & d) The Authority does not consider that these modifications are necessary in addition to those already implemented as a result of a & b above. The authority believes that it is important to maintain international standardisation as far as possible and also to minimise system complexity. The recommended modifications would result in a system that was completely non standard internationally and would require an extremely complex switching procedure.

e) The Authority does not accept sequential strobe centreline lights at UK airports. Trials at RAE Bedford into their use as a precision approach lighting system identified a number of unsatisfactory visual sensations in low visibility. Pilots reported sensations of vertigo and a small number reported feelings of nausea resulting from the impression gained that the environment appeared to pulse. The Authority believes that the existing REILS (Runway End Identification Lights) provide adequate runway identification for a properly briefed flight deck crew.'

1.17.3 International Standards and Recommended Practices - aerodrome lighting

Annex 14 to the Chicago Convention on International Civil Aviation contains the International Standards and Recommended Practices for Aerodrome Design and Operations. Included in this document are Standards and Recommended Practices for the installation and operation of aerodrome lighting. The Standard set for taxiway centreline lights is detailed in ICAO Annex 14, Volume I Chapter 5³, paragraph 3.16.3 which states:

'Taxiway centreline lights on a taxiway other than an exit taxiway shall be fixed lights showing green with beam dimensions such that the light is visible only from aeroplanes on or in the vicinity of the taxiway'.

Where Contracting States' national regulations are different from the standards and practices recommended in ICAO Annexes, those States may notify a difference. The United Kingdom has notified (initially in 1987) the following difference to Annex 14, Volume I Chapter 5, paragraph 3.16.3:-

'In the United Kingdom, omni-directional taxiway centreline lights are also used'.

³ At the time of the incident ICAO Annex 14 Volume 1 First Edition - July 1990 was current. The same Standard had been promulgated in the Eighth Edition of March 1983 as had the difference, filed by UK, regarding the use of omni-directional taxiway centreline lights.

1.17.4 Confidential Human Factors Incident Reporting System

In 1983 a Confidential Human Factors Incident Reporting Programme (CHIRP), was established in the UK. This established a valuable avenue for the confidential reporting of Human Factors Incidents to an independent organisation, the RAF Institute of Aviation Medicine. Analysis of the data received has enabled the Institute to establish a database to assist in the detection of any trends that may be hazardous to flight safety.

Since the incident in April 1988 when a BAC 1-11 was landed on Taxiway 2 in mistake for Runway 08L, CHIRP has received a small number of reports from pilots who have experienced some confusion caused by the complex arrangements of lights which are a necessary feature of any major international airport. One report in particular, submitted by an ATC controller in August 1988⁴, describes how the controller, using an SRA, positioned an aircraft onto the final approach of Runway 26R at 2 miles. When asked by the pilot if the runway was to the right of the two white strobe lights, he was able to direct him to the correct runway which in fact lay between the strobe lights.

1.17.5 ICAO Accident/Incident data

In accordance with Annex 13 to the Convention on International Civil Aviation, member States provide ICAO with information on all aircraft accidents that involve aircraft of a maximum certificated take-off weight of over 2,250 kg. ICAO also gathers information on aircraft incidents considered important for safety and accident prevention. This information is stored in a data bank and statistics are available to member states.

Details of all accidents/incidents involving aircraft landing on or taking off from a wrong runway or taxiway were requested. The ICAO database records that, since 1982, 65 such occurrences have been reported. Whilst most of these accidents/incidents do not show direct similarities with the circumstances associated with the Gatwick incidents, there are some noted exceptions. Zurich Airport has two runways (14 and 16) with thresholds approximately 700 metres apart. In May 1986 there were two accidents involving public transport aircraft at Zurich when pilots' mis-identification of the landing runway were contributory factors.

1.17.6 Approach Monitoring Aid

The CAA (NATS) is currently carrying out a programme of research and development of an approach monitoring aid using existing airfield radar systems

⁴ This predates the changes made to the lighting which is described in paragraph 1.17.2.

that will alert controllers when an aircraft on approach is not lined up with the operational runway. A software programme monitors a series of radar returns from approaching aircraft and triggers an alert to the controller when a return shows an aircraft to be outside an operationally defined approach sector. Development of the aid will consider the type and degree of assistance or instruction that a controller might pass to an aircraft at a very late stage of an approach. The human factors aspect of the most suitable display to be provided for the controller will also be examined. Initial trials are considered to be promising and suggest that the installation of such a system at Gatwick might contribute towards safer operations on the northern runway.

1.18 New investigating techniques

None.

2 Analysis

2.1 General

The incident occurred when the aircraft made a landing on Taxiway 2 because the flight crew mistakenly believed it to be Runway 26R. Although both pilots readily acknowledge that it was their own error, such errors are not unique at Gatwick. In April 1988 a similar incident occurred when a BAC 1-11 was landed in the opposite direction on Taxiway 2 because the flight crew mistakenly believed it to be Runway 08L. The similarities between the two incidents are marked. The BAC 1-11 crews were experienced and familiar with operating at Gatwick, although neither pilot had landed before on Runway 08L. The crews in this incident were well experienced and familiar with operating at Gatwick both by day and night but neither pilot had ever landed on Runway 26R or 08L. In both incidents the flight crews were aware that the northern runway was active at the time but nevertheless convinced themselves that Taxiway 2, with its standard green taxiway centreline lighting was the northern runway and landed on it.

In the first incident Taxiway 2 was occupied by a Boeing 737 which was taxiing towards the take-off point but, most fortunately, both aircraft came to a halt before a ground collision ensued. In this incident Taxiway 2 was fortunately unoccupied. The potential for this kind of mistake resulting in a collision between two aircraft on the ground causes serious concern. This analysis examines why such a fundamental error by the flight crew of Air Malta 144 could have been possible. It also examines the reasons why the AAIB recommendation made in the report on the earlier incident in April 1988⁵, which were intended to prevent a recurrence, were not successful in preventing this incident.

2.2 The approach and landing

When the pilots of Air Malta 144 first received the Gatwick ATIS information 'ECHO' they would have been aware that Runway 26L with its ILS was then in use and that the weather was fine with no low cloud and the reported visibility of 9 km should present no problems during the approach and landing. ATIS 'ECHO' also included the information that a change to Runway 26R was planned to start at 2000 hrs. At 1954 hrs, when Air Malta 144 reached Eastwood, the Gatwick Approach controller instructed the aircraft to take up the holding pattern. The crew was also informed of the change to Runway 26R and told to expect an SRA. Although the aircraft remained in the holding pattern for a further 10 minutes, the pilots acknowledge that they did not take this opportunity to brief themselves on the runway lighting. In this case it is understandable that both pilots probably considered that they were sufficiently familiar with the airfield and therefore a

⁵ AAR 2/89 and FACTAR No F7/89.

further briefing was not carried out. Had the pilots studied the airfield lighting information in detail whilst the aircraft was holding at Eastwood, they should have been better able to differentiate between Runway 26R and Taxiway 2 during the final stages of the approach.

The aircraft's approach path, although typical of an arrival at London Gatwick Airport culminating in a SRA for landing on Runway 26R, was not familiar to the pilots neither of whom had previously landed on this particular runway. The delay whilst the aircraft was held at Eastwood and subsequent radar vectors to extend the approach path may well have frustrated a natural desire to achieve an expeditious arrival, but it was a situation with which the pilots were undoubtedly familiar. The request from ATC to maintain a speed of 160 kt until 4 miles on the final approach was not unusual at a busy international airport and the pilots were well used to complying with such requests. Overall the evidence suggests that the crews were not under pressure and the approach was not rushed. Certainly the evidence from the CVR, which commences at 12 miles on the final approach⁶, shows that the pilots were not under stress and were carrying out their duties according to the company's operating procedures.

The approach continued normally and it was not until the aircraft was about 7 miles from touchdown that there is the first evidence of doubt. At this point the first officer declared himself uncertain whether they were approaching the correct runway. His doubts appear to have been resolved by the commander's assertion "...THAT'S THE ONE THAT WERE LANDING ON. OH NO, ITS THE ONE ON THE RIGHT, NOT THE ONE ON THE LEFT". Thereafter it is not altogether surprising that the aircraft was landed on Taxiway 2, and that the pilots were unaware that they had mistaken the taxiway for Runway 26R until so informed by ATC.

After landing the pilots discussed the approach and landing and wondered how they had been able to mistake the taxiway for Runway 26R. It is clear that 26R was clearly visible throughout the approach but the pilots looked for and selected a pattern of lights to the right of it because they assumed that 26R was in fact 26L and they knew that the designated runway had to be on the right of this. In their discussion the pilots comment on the confusion of the overall lighting pattern, including a great many contractor's vehicles. They also rationalised what had appeared to them as unusual, one of them thinking "I THOUGHT THAT'S HOW THEY DO IT HERE". The first officer also commented that he could see the runway (26R) but thought that "...THEY HAD LIT UP 26L AS WELL".

⁶ Since the 30 minute CVR tape was allowed to run on after landing and during the disembarkation of passengers, the first recorded intelligence recovered was at the time when the aircraft was 12 miles from touchdown.

2.3 Airfield layout

It is not unusual for a runway to have a parallel taxiway. Pilots of aircraft landing on such a runway at night would normally expect to see the lights of both the runway and the taxiway at the same time and have no difficulty in differentiating between the two. Nevertheless the ICAO database records that there have been a number of incidents worldwide where an aircraft has mistakenly landed on or, more commonly, taken off from an adjacent taxiway.

There are also many major airfields worldwide with parallel runways, spaced sufficiently far apart to allow simultaneous operation. At these airfields the considerable separation of the runways, together with the availability of runway approach and landing aids such as ILS, make the probability of confusion less likely. Again the ICAO database records that incidents have occurred at such airfields where an aircraft has been landed on the wrong runway.

The airfield layout at London Gatwick is unusual in having Runway 26L, Runway 26R and Taxiway 2 all running parallel to each other within a width of 290 metres. There must inevitably be an increased risk of confusion in such circumstances, particularly because the middle of the three strips is used both as a taxiway and as a runway. There have now been two incidents when aircraft have landed on Taxiway 2 in mistake for the northern runway, and CHIRP reports indicate that pilots can find it difficult to identify the runway amongst the many other lights which are part of a major airport. It is apparent that the closeness of the two runways at London Gatwick merits special attention and it is therefore important that the airfield lighting should aid identification of the active runway and minimise any ambiguity. Furthermore, the importance of pilots self-briefing on the specific characteristics of the relevant approach and runway cannot be over emphasised.

2.4 Airfield lighting

The evidence concerning difficulties experienced in runway identification at Gatwick have not been confined to Runway 26R and instances have occurred during both day and night flights. Following the incident in April 1988 when a BAC 1-11 was landed on Taxiway 2 which was mistaken for Runway 08L, the AAIB Aircraft Accident Report 2/89 recommended that a review of the airport lighting should be made and should consider all aspects of operations on all runways. Such a review was carried out and resulted in some modifications to the lighting on Taxiway 2. This second incident shows that a further review of the airfield lighting is necessary.

The background lighting to the airport adjacent to the thresholds of Runway 26L and 26R includes the well lit South Terminal and its associated piers, aircraft parking areas and the large public car park. The problems that this can cause are recognised and are included as a warning in the UK AIP AGA 2-23-2 (26g). There is another problem of runway identification when Runway 26R is in use at night. Once the northern runway has been activated the main runway is released to the contractors carrying out the necessary repair work. This can involve a great many vehicles on the runway, all of which may be illuminated by side and head lights plus yellow flashing lights. In order to aid identification, both Runways 26L/08R and 26R/08L had two flashing white strobe lights sited either side of their centrelines 400 metres prior to their thresholds. The main runway lighting meets all the requirements for Category III operations⁷. When this runway has been in use at night there have been no reports of pilots mistakenly making an approach to the northern runway which under these circumstances would have been lit as a taxiway. It is questionable whether the strobe lights on the main runway serve any useful purpose and one way of countering possible ambiguity would be to remove these lights so that only the northern runway had strobe lighting. If this information was also included in the arrival ATIS broadcast the chances of mistaken identification would be further reduced.

The investigation examined the reasons given by the CAA for not implementing some of the AAIB recommendations made following the April 1988 incident. In particular, if the green centreline lighting of Taxiway 2 had been made uni-directional and switchable it should have made a recurrence of the incident virtually impossible. The CAA was particularly concerned not to introduce any lighting or procedure that was not in accordance with ICAO Standards. The difference which had been filed in 1987 against Annex 14 Chapter 5 paragraph 3.16.3 simply registered the fact that the UK has accepted the continued use of omni-directional taxiway centreline lights while the changeover to bi-directional fittings takes place in accordance with aerodrome planned replacement programmes. At the time of the 1988 incident London Gatwick Airport was operating to Category III limits, but the taxiway centreline lighting consisted of Category I 'modified' lighting units. The practical effect of this was that the taxiway fittings were omni-directional with lamps upgraded from 20 cd to 100 cd but with only two brilliancy settings, 100% and 30%. Following the 1988 incident these units were replaced in 1989 with 200 cd ICAO Standard bi-directional narrow beam light units with three brilliancies, 100%, 30% and 10%. The main point about the new fittings was that at the 10% brilliancy on a good clear night the output of the new fittings would be 20 cd as opposed to 30 cd and would be controlled in a narrow 7° wide beam along the taxiway centreline and not spread all around as was the situation in 1988. Therefore the CAA did not consider that modifications to the green centreline lighting of Taxiway 2 and

⁷ These limits refer to Instrument Landing System minima, Category III being the lowest.

Runway 08L/26R to make them uni-directional and switchable for the direction in use were necessary in addition to modifications already implemented as a result of AAIB Recommendation 4.3 a) and b); (see paragraph 1.17.2).

The incident that is the subject of this report shows that because the taxiway lights were still visible (even at minimum brilliance) it was possible for the same mistake to be made. Throughout the initial stage of the final approach, up to about 2.5 miles from touchdown, the lights were set at 30% instead of the typical value of 10%. It is believed that this setting had been chosen to assist an aircraft manoeuvring on the ground. No request from the Air Malta crew had been made about lighting intensity settings. The design and operation of taxiway lighting is primarily for the benefit of aircraft on the ground; it should be of little significance to an aircraft approaching to land. However, in the case of parallel taxiways and runways it is clear that the lighting of the former should not affect operations on the latter. Investigation of this incident has revealed a lack of procedures to ensure the co-ordinated management of all the airfield lighting at London Gatwick so that undue prominence of a particular feature, such as the taxiway, is not inadvertently displayed.

At 30% intensity the centreline lights of Taxiway 2 were undoubtedly more prominent than if they had been at a setting of 10% (by a factor of 50% in terms of light output). This meant that it was possible for the pilots erroneously to select Taxiway 2 as the runway when they were some 8 miles from touchdown. If the taxiway lights had been set to 10% intensity the same mistake could have been made but at a point much closer to touchdown. This would have reduced the risk but not necessarily eliminated it. In the event, even when the taxiway lights were reduced to a setting of 10%, when the aircraft was 2.5 miles from touchdown, and when, presumably it prompted the commander to remark "THEY'VE JUST SWITCHED IT OFF NOW", it did nothing to alter the crew's landing intentions. Therefore the fact that they were visible at all contributed to the crew's persistent error as is evident from the remarks on the CVR. AAIB Recommendation 4.3 (c) & (d), made following the April 1988 incident, was for the taxiway lights to be made uni-directional and switchable for the direction in use, thus ensuring that they would be invisible to landing aircraft. Thus reliance on intensity settings which are described as 'typical' and which may be varied for other operational reasons, including at the request of pilots, did not provide a complete response to the recommendations made after the 1988 incident. It was therefore recommended to the CAA on 19 November 1993 that the lighting of runways and taxiways at London Gatwick Airport should be re-examined with particular reference to the elimination of any possible confusion for pilots identifying Runway 26R/08L and Taxiway 2. Recommended modifications include:

- a) Rendering the green centreline lighting of Taxiway 2 invisible to pilots on approach to Runway 26R/08L.
- b) The removal of the white strobe lights sited either side of Runway 26L/08R, which were originally installed to assist in the identification of this runway when 26R/08L was commissioned, leaving the strobe lights at the thresholds of 26R/08L in order to facilitate its positive identification. [Recommendation 93-66]

It is also recommended that a further review of the lighting at London Gatwick Airport should consider in particular:

- a) The modification of the green centreline lighting of Taxiway 2 to make it uni-directional and switchable for the direction in use.
- b) The development of systematic procedures to manage the choice lighting selections.
- c) Shielding, where possible, of all extraneous lighting so as to cause minimum confusion to approaching aircraft. [Recommendation 94-6]

The investigation reconsidered the question of sequential strobe centreline or approach lighting. The former had been recommended as a result of the April 1988 incident (AAR 2/89). The reservations expressed then by RAE Bedford were noted but it is also noted that sequenced strobe approach lighting is being installed at London Heathrow Airport for Runway 23 at the request of operators who have identified a need for clearer runway identification amongst confusing background lighting. Despite some special circumstances giving rise to the installation at London Heathrow, operational experience of such a system may indicate its relevance to some other UK airports.

2.5 Human Factors

The Principal Psychologist of the RAF Institute of Aviation Medicine has made the following analysis of the relevant parts of the CVR combined with a study of the airfield lighting at London Gatwick:

'On the basis of an examination of the cockpit voice recording and video recordings of the relevant lighting patterns, the following comments seem appropriate. The atmosphere on the flight deck seems relaxed and friendly. The commander appears comfortably in charge, but the first officer has no difficulty in voicing questions. Three exchanges took place concerning identification of the runway. The first happened just after 8 nm on the approach:

FIRST OFFICER: SO ARE THEY BOTH LIT UP OR WHAT?

COMMANDER: EH?

FIRST OFFICER: BECAUSE I CAN SEE ONE RUNWAY.

COMMANDER: YEAH, I CAN JUST SEE THE ONE; THAT'S THE ONE THAT WE'RE LANDING ON. OH NO, IT'S THE ONE ON THE RIGHT, NOT THE ONE ON THE LEFT.

FIRST OFFICER: WELL, HE'S GOT TO TURN US FURTHER IN THEN, FURTHER TO THE LEFT, EH?

This exchange suggests:

- a. Runway 26R was plainly visible, but there were sufficient irrelevant lights in the field of view to make the first officer consider that he might have failed to discriminate another runway.
- b. The captain was expecting to land on a taxiway, and this caused him to revise his initial impression and select the northern taxiway as the desired runway.
- c. Both pilots expected more than one surface to be lit.

The problem is, therefore, a cognitive rather than perceptual one. This essential, initial error could have been avoided by making the taxiway lights invisible from the approach, or by providing surface guidance to assist in identification of the correct surface.

The second exchange occurred just 2.5 nm from touchdown:

COMMANDER: SO 26 RIGHT IS THE ONE WITH THE GREEN LIGHTS, EH?

FIRST OFFICER: YEAH.

CAPTAIN: THEY'VE JUST SWITCHED IT OFF NOW.

This suggests that some doubt remained in the commander's mind, and he sought confirmation from the first officer. (Although the commander was much more experienced than the first officer, he had less experience of landing at Gatwick at night.) The first officer, however, was probably somewhat preoccupied with handling the aircraft and, possibly, had accepted the initial, erroneous identification on the commander's authority. His simple confirmatory response provoked a somewhat enigmatic comment from the commander which could be an indication that the commander's doubts were prompted by the lack of edge lights and other runway lights on the taxiway.

The third exchange was initiated by the first officer some 30 seconds later. The commander's question may have re-activated his own lingering doubts, or proximity to touchdown may have prompted closer scrutiny:

FIRST OFFICER: IS IT THIS ONE OR THIS ONE?

COMMANDER: THE ONE WITH THE GREEN LIGHTS.

FIRST OFFICER: JUST THE CENTRELINE LIGHTS.

COMMANDER: THE CENTRELINE, YEAH.

This exchange confirms that the commander's choice was based on his expectation that they would land on a taxiway. If he had any remaining doubts at this stage, they were probably over-ridden by the need to give the handling pilot unequivocal guidance at a critical stage of flight.

There were two ways in which this incident could have been avoided:-

First, the pilots could have taken advantage of the spare time in the holding pattern to acquaint themselves with the situation they were about to confront using charts or by talking to ATC. Whatever justice there is in this suggestion, it cannot be regarded as a generally valid means of avoiding such incidents. It would be better to provide positive guidance from ATC or the ATIS as a matter of routine. There was, of course some guidance on the relevant ATIS in this case. The flight crew's apparent failure to attend it suggests that using ATC as the information source might be more attentive.

Second, the lighting visible to aircraft on the approach could have been adjusted to restrict the number of alternatives visible. If the taxiway lighting had not been visible, the crew could not have chosen that option.'

2.6 Pilot briefing

As part of their arrival procedures flight crews listen to and copy a recorded ATIS broadcast and inform the appropriate controlling authority that they have received it. Each message is consecutively coded using a single letter of the phonetic alphabet. In this case 'FOXTROT' was current at the time of landing. Details of the aerodrome actual weather conditions are contained in an ATIS broadcast but pilots may well already be aware of their destination weather conditions having listened to VOLMET broadcasts during the flight. The recorded ATIS message repeats itself until it is updated and it is therefore possible to select the frequency in the middle of a broadcast and, having verified essential information such as surface wind, temperature and altimeter pressure settings and the current code letter, the complete recording may not in every case be listened to. Therefore careful thought needs to be given to the information that is included and in

particular its sequence in the message. Since the code letter is one important element and since it occurs at the beginning of every message it may be sensible to include other important information close to it. It is therefore recommended that the CAA should revise the content of the Gatwick ATIS broadcast in the light of the guidelines contained in ICAO Document 9426 (ATS Planning Document). Any advice concerning runway lighting and other identifying features when Runway 26R/08L is in use should be at the beginning of the broadcast rather than the end. [Recommendation 93-67]

Information that the Gatwick northern runway will be in use at programmed times is notified by NOTAM. This information is confirmed and updated by the Gatwick ATIS broadcast. Prior to departing from Malta the crew had received a copy of NOTAM A1311/93 which promulgated the planned times for the runway change. They therefore had information that Runway 26L was likely to be closed from 2000 hrs. With a scheduled arrival time of 2015 hrs at Gatwick the crew would have been well advised to plan for landing on Runway 26R. Use of this runway is infrequent and neither crew member had landed on it before at night. It would therefore have been prudent to have considered the differences between the more usual approach to Runway 26L, with an ILS and familiar lighting and the less usual features of Runway 26R with an SRA and slightly different lighting. The crew have stated that they did not do this either before departure or during the flight.

However, this omission would not have occurred to them when they first obtained arrival information by listened to ATIS 'ECHO' which indicated a landing runway of 26L. ATC advised them that, despite the imminent change of runway, there was still a chance of them landing on Runway 26L but eventually instructed them to hold at Eastwood whilst the runway change was effected at the airport. At this stage there was a clear need to reconsider their approach briefing in the light of the changed circumstances but the crew acknowledge that this opportunity was missed

2.7 Approach Monitoring Aid

The research and development that is currently being conducted by CAA (NATS) of an approach monitoring aid that would enable controllers to be alerted when an aircraft was outside an operationally defined approach sector shows promise. The installation of such an aid at Gatwick might well contribute in the future towards safer operations on the northern runway. The initiative for such a system is welcomed and, if successfully developed, it could make a positive contribution to the safety of an aircraft which becomes, for whatever reason, displaced from the correct approach path.

3 Conclusions

(a) Findings

- (i) Both pilots were properly licensed and qualified to conduct the flight. They were adequately rested and medically fit.
- (ii) The aircraft had current Certificates of Airworthiness, Registration and Maintenance.
- (iii) The aircraft and its systems were fully serviceable before the incident.
- (iv) Before departure the pilots had NOTAM information that a runway change at Gatwick was planned for 2000 hrs, some 15 minutes before their scheduled arrival time but because they were ahead of schedule they were initially told to expect to land on Runway 26L.
- (v) Prior to descent the pilots had briefed for an ILS approach and landing on Runway 26L. After the change to Runway 26R the pilots did not brief themselves on the approach or runway lighting.
- (vi) If the pilots had studied the airfield lighting information in detail whilst the aircraft was holding at Eastwood, they should have been better able to differentiate between Runway 26R and Taxiway 2 during the final stages of the approach.
- (vii) After Runway 26R had been declared serviceable the green centreline lights were increased in brilliance to 30% (to assist ground manoeuvring) before being reset to 10% when the aircraft was about 2 miles from touchdown. Whilst the lights were at a brighter intensity the chance of mistaking Taxiway 2 for the runway was considerably increased and the mistake could be made earlier in the approach.
- (viii) At approximately 4 nm from touchdown the flight crew discussed and resolved their doubts concerning the identification of the runway so that thereafter they were both convinced that they were landing on the correct one.
- (ix) Runway 26R was clearly visible throughout the approach but the pilots looked for and selected a pattern of lights to the right of it because they assumed that 26R was in fact 26L and they knew that the designated runway had to be on the right of this.

- (x) The abundance of extraneous lighting that is unavoidably visible to pilots on the approach to London Gatwick's westerly runways contributed to the confusion in the pilots' minds.
- (xi) Neither pilot was aware that they had landed on Taxiway 2 in mistake for Runway 26R until so informed by ATC which indicates that they had resolved any doubts they had to their own satisfaction.
- (xii) Following a previous incident in April 1988 and in response to AAIB Recommendations, the CAA reviewed the lighting at Gatwick in association with GAL and certain modifications were implemented in January 1989.
- (xiii) The CAA did not consider that modifications to the green centreline lighting of Taxiway 2 and Runway 08L/26R to make them uni-directional and switchable for the direction in use were necessary in addition to modifications already implemented as a result of AAIB Recommendation 4.3 a) and b). It was also considered undesirable to adopt a system which was non-standard internationally and with complex switching arrangements.
- (xiv) There were no procedures to ensure that the minimum brilliancy setting of 10% for the centreline lighting of Taxiway 2 was maintained throughout the period that an aircraft was on the approach to Runway 26R. Such procedures were essential if the reasons for not adopting uni-directional and switchable lights were to be valid.

(b) Causes

The incident occurred as a result of the following factors:

- (i) Runway 26R was clearly visible throughout the approach but the pilots looked for and selected a pattern of lights to the right of it because they assumed erroneously that 26R was in fact 26L and they knew that the designated runway had to be to the right of this.
- (ii) The flight crew had not briefed themselves on the lighting they were expecting to see on Runway 26R once the change of runway had been confirmed.
- (iii) The crews' misinterpretation of the visual cues was facilitated by:
 - a. The similarity between the night time view of Runways 26L and 26R with associated taxiways to the right which are marked with green centreline lighting.

- b. The use of Runway 26R sometimes as a runway with edge lighting and sometimes as a taxiway with centreline lighting.
- c. The green centreline lights of Taxiway 2 were set at a brilliance of 30% until the aircraft was about 2 miles from touchdown when they were reset to 10%. Whilst the lights were at the brighter intensity the chance of mistaking Taxiway 2 for the runway was considerably increased and the mistake was possible at an earlier stage in the approach.

4 Safety Recommendations

The following safety recommendation was made to the CAA on 19 November 1993:

93-66 The lighting of runways and taxiways at London Gatwick Airport should be re-examined with particular reference to the elimination of any possible confusion for pilots identifying Runway 26R/08L and Taxiway 2A. Recommended modifications include:

- a) Rendering the green centreline lighting of Taxiway 2 invisible to pilots on approach to Runway 26R/08L.
- b) The removal of the white strobe lights sited either side of Runway 26L/08R, which were originally installed to assist in the identification of this runway when 26R/08L was commissioned, leaving the strobe lights at the thresholds of 26R/08L in order to facilitate its positive identification.

The following safety recommendations are made:

93-67 The CAA should revise the content of the Gatwick ATIS broadcast in the light of the guidelines contained in ICAO Document 9426 (ATS Planning Document). Any advice concerning runway lighting and other identifying features when Runway 26R/08L is in use should be at the beginning of the broadcast rather than the end.

94-6 A further review of the lighting at Gatwick Airport should consider in particular:

- a) The modification of the green centreline lighting of Taxiway 2 to make it uni-directional and switchable for the direction in use.
- b) The development of systematic procedures to manage the choice lighting selections.
- c) Shielding, where possible, of all extraneous lighting so as to cause minimum confusion to approaching aircraft.

R StJ Whidborne
Inspector of Air Accidents

April 1994