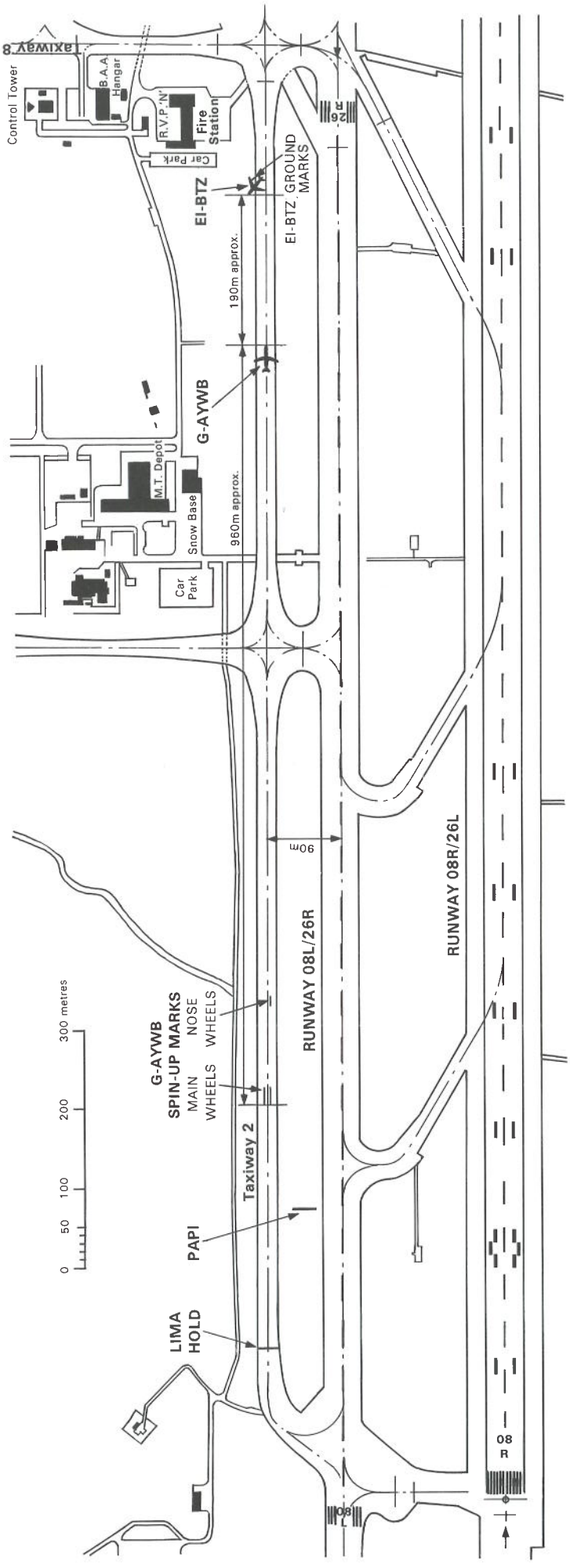

GROUND MARKS AND FINAL POSITIONS OF G-AYWB AND EI-BTZ AT GATWICK AIRPORT, 12 APRIL 1988

EXTRACT FROM UK AERONAUTICAL INFORMATION PUBLICATION
LONDON/Gatwick

Visual Ground Aids

32 **Taxiing guidance system:** Green centre-line lighting with selective switching on all taxiway routes except the maintenance taxiway. Reflective edge markers. Blue edge lighting on maintenance taxiway. Lead-off green taxiway centre-line lights beyond Rwy 08R end lights. Rapid exit taxiways (green) from Rwy 26L at 1 356 m and 1 798 m from displaced landing threshold. Rapid exit taxiways (green) from Rwy 08R at 1 375 m and 1 914 m from threshold. The eastern holding area has a dual parallel taxiway layout designated ALPHA NORTH and ALPHA SOUTH. ALPHA NORTH is the primary route. Aircraft Stands: Apron floodlighting. All stands are designed for nose-in parking and have yellow centre-line markings. Nose-docking is by AGNIS for azimuth guidance, stopping information is by side marker board (SMB) or parallax aircraft parking aid (PAPA). The relevant stopping device being indicated at the AGNIS position. All other stands without SMB or PAPA are marked with yellow STOP arrows to indicate the stopping position. Colour-coded centre-line lights are installed permanently on CAT 3 exit taxiways from RWY 26L/08R at ALPHA NORTH, CHARLIE, DELTA and ECHO holds.

33 **Visual aids to location:**

34 **Indicators and ground signalling devices:** Wind direction indicator.

35 **Lighting Aids**

Runway/ Run	Lead-in/Approach lights	Threshold lights	Runway lights	Angle of App. lights
a	b	c	d	e
08R	914 m HI coded centre-line with five cross bars. Supplementary lighting, inner 300 m. 3 307 m RAL Fl. Red (29).	HI Green with HI Green W bars.	HI Flush bi-directional edge (46 m gauge), first 393 m from runway end showing red to displaced landing threshold. HI colour coded centre-line lighting (30 m spacing). HI TDZ 914 m. Runway end lights red. Red stopway lighting for 74 m beyond runway end lights.	†PAPI 3° 430 m MEHT 68 ft
26L	915 m HI coded centre-line with five cross bars. Supplementary lighting, inner 300 m.		HI Flush bi-directional edge (46 m gauge), first 267 m from runway end showing red to displaced landing threshold. HI colour coded centre-line lights (30 m spacing). HI TDZ 914 m. Runway end lights red. Red stopway lighting for 61 m beyond runway end lights.	†PAPI 3° 440 m MEHT 69 ft
08L	420 m HI centre-line with one crossbar.	HI Green with W bars	HI Flush bi-directional with LI omni-component. Runway end lights red.	†PAPI 3° 450 m MEHT 65 ft
26R	420 m HI centre-line with one crossbar. Two flashing white strobe lights, one either side of centre-line, of variable brilliancy and visible in the approach sector only.			†PAPI 3° 425 m MEHT 68 ft

†During any runway change, pilots are warned that PAPI indicators are advisory only within the first 15 minutes of alteration and should be used with caution.

APPENDIX 3

PHOTOGRAPHS OF GATWICK RUNWAY 08L AND TAXIWAY 2 LIGHTING

HUMAN FACTORS REPORT

This report is based on interviews with members of the AAIB, and the members of the crew of G-AYWB. It deals with the human factors issues raised by this incident, and does so in two sections, dealing firstly with the problems of airfield lighting and terminology, and then with the situation on the flight deck of WB.

Runway Factors

Runway 08L at Gatwick - the emergency runway - is also a taxiway when 08R is in use; 08R and 08L cannot be used at the same time. When 08L is configured as a runway it is marked by edge, threshold, and approach lighting, but not by centreline lighting, and appears very similar to the main runway. When it is in use as a taxiway, it is also marked by green centreline lighting - as is taxiway 2. When Gatwick is viewed from the west, at night, with the main runway in use, the dominant visual impression is of an obvious runway with taxiways to its left. Similarly, when 08L is in use, the dominant visual impression is of an obvious runway with a taxiway to its left.

The similarity between these two visual scenes is striking, and it is quite understandable that one who is familiar with Gatwick, and who knows that the emergency runway is the taxiway to the left of the main runway, could land on taxiway 2 when 08L is in operation. There can be little doubt that it is the duality of function of 08L (as both a taxiway and runway), combined with the striking visual similarity of operations with 08L and 08R that enabled this incident to occur.

There are, however, some unfortunate visual properties of taxiway 2. The first is that the centreline lighting is both bright and bi-directional making it unnecessarily conspicuous when viewed from the air. The second is that the centreline lighting on this taxiway is in the form of a terminated perfect straight line. The lights do not curve round to join the runway, and no subsidiary taxiways can be seen so the centreline lighting on this taxiway gives a clear indication of a straight, terminated surface (ie a runway). More important, and probably crucially important in the present context, is the set of red lights, the stop bar, at the western end of this taxiway. This red bar not only provides a definite end (ie a threshold) to the centreline lights, but it also confers width to the surface. If a photograph of the approach is viewed with this stop bar obliterated, all similarity between taxiway 2 and a runway disappears. The capacity for a stimulus containing only partial information about a familiar object to elicit a percept or mental model of the complete object was well known to the Gestalt school of

psychologists, and the way in which the centreline lights and stop bar of taxiway 2 are able to provide length, width, and orientational information on the implied rectangular surface is a good example of this. It is emphasised that the presence of the red stop bar normal to the centreline lights is seen as crucial in this incident.

The last point of lighting ambiguity concerns the location of the 08L PAPI. This runway has only one PAPI, situated to its left. Clearly, this would normally be entirely adequate, but it is unfortunate that this location also enables the PAPI to be interpreted as an approach aid sited to the right of taxiway 2. Thus, if a pilot had already misidentified taxiway 2 as 08L, he would be likely to be reassured by the existence of an apparently appropriate PAPI, and would, furthermore, be able to use the PAPI indications as an aid to his approach to this taxiway. It could even be argued that the apparent provision of this PAPI for taxiway 2 added to the set of cues which enabled the commander to regard it as a runway in the first instance. Such a mistake would be less likely if PAPIs were provided on each side of 08L, since their symmetry would indicate more clearly to which set of lights they belonged.

The terminology used to refer to 08L is also unsatisfactory. It is often referred to as the emergency runway, and this could imply a standard of lighting rather worse than that which prevails, perhaps a standard of lighting similar to that provided by taxiway 2. Even referring to this runway as 08L could be misleading since it is never used at the same time as 08R - Gatwick being, operationally, a single runway field. During daylight operations this will cause no difficulty since both runways will be visible, and it will be obvious which is the right and which is the left. At night - at least, on the night in question - 08R was not illuminated; it will be fairly unusual for a pilot to land on a runway designated L without being able to see any sign of the parallel 'R' runway. The designators R and L clearly imply a visible relationship between two runways, but the genuine relationship could not be observed on the evening of the accident. In fact, on this evening, two sets of lights were visible - those of 08L and taxiway 2 - and it was logically consistent for the crew to perceive the dominant lights as those of the main runway, and the poorer, but perfectly visible, lights to the left of it as those of the emergency runway.

The Flight Deck

Although the lighting at Gatwick performed an important role in the aetiology of this incident, it must be borne in mind that many crews have landed on 08L, at night, apparently satisfactorily. In fact, a number of CHIRP reports reveal that other pilots have had doubts about the visual scene presented by the emergency runway, but they have resolved these successfully. The question is therefore

raised of whether the members of this crew possessed any special characteristics that led them to succumb to a situation that others had managed to avoid.

The crew members of WB are both happy to report that the day's flying that they were about to complete by landing at Gatwick had been uneventful, and even enjoyable. Both pilots were fully aware of the runway layout, they knew that they were to land on 08L, and they had discussed this earlier in the day before they had even departed from Gatwick. Neither of them had ever landed on 08L and so they did not know what the visual scene during the approach would look like; they had no doubt or anxiety about this, however.

The first event in the chain which led to landing on the taxiway was a remark from the first officer to the commander. There is no CVR trace of this remark, but commander and first officer agree that it was something like "You are going for the emergency runway, aren't you?" The first officer made this remark because he could see clearly the lights of Gatwick and was a little concerned that the dominant set of lights visible to him (those of 08L) seemed to be of a much higher standard than he was expecting for the "emergency runway". At this point his doubt was that it might be the main runway that was being viewed, and it occurred to him that the lighting may not have been changed from 08R to 08L. He believed, from a previous experience, that it could take some time to switch the runway lighting and felt that since their arrival was only some twenty minutes after the nominal time for change, it was possible that 08R was still lit. Although he had never landed on 08L, he had taken off on this runway, and had a recollection of a lower standard of lighting than appeared evident to him on the evening of the incident.

These doubts had not crystallized into a clear cut mental model for the first officer, and it was almost certainly in an attempt to provoke some discussion of the situation, and from the discussion to gain a clear model with which he was happy, that he made his remark, "You are going for the emergency runway, aren't you?"

The commander's reply to this remark was fairly emphatic, and something like "Yes, of course I am.", but he is now completely candid in admitting that this reply was not an accurate reflection of his thoughts. Although he had been entirely happy with everything about the approach, the first officer's question caused him instantly to change his mind, and leap to the conclusion that he was in fact lined up not with 08L, but with the main runway, 08R, and that 08L was the seductive strip of green lights to the left. From his familiarity with Gatwick, he knew that the emergency runway was normally lit by just such a strip of centreline green lights. The first officer was understandably reassured by the commander's confident assertion that he was fully in control and was aware of

what he was doing, and so continued with some head down checks. While he was doing so, the commander manoeuvred the aircraft to the left, and lined up with taxiway 2, which he now confidently believed to be the emergency runway.

As the commander had hoped, the first officer had not noticed the aircraft slide to the left, and, when he looked up, the first officer was consequently surprised to see that the aircraft was lined up with the taxiway. It could be argued that since he was now very unsure whether they were about to land where they should, he ought immediately to have called for an overshoot as the obviously safe course of action. He was almost certainly prevented from doing so by a combination of factors. He was not certain himself that they were actually heading for the wrong strip, and research has shown that most pilots need to be very confident that they are right before they will correct a colleague. The nature of the relationship on the flight deck of WB would have made such an intervention even less likely; an individual being assessed will wish to be very sure of himself before appearing to question the competence of his assessor.

The commander is a confident and perhaps slightly assertive individual, and this contrasts markedly with the first officer's personality. Although both of them served in the RAF, the first officer operated in the more considered atmosphere of the transport force, whereas the commander flew Lightnings, and he has the decisive personality which such critical single seat aircraft both demand and develop. This is evidenced by his "Of course I am" response, and it was clearly important to him not to make a mistake or demonstrate any form of incompetence to his subordinate. Even though the crew members were, no doubt, relaxed and friendly toward one another, the commander's confidence would doubtless have been apparent to the first officer, and made him wish to be especially sure of himself before calling for the dramatic action of an overshoot. The third factor making for difficulty here was the status relationship between the two, in that the commander was acting in his training capacity and checking the competence of the first officer as a captain. The first officer must be forgiven in such circumstances for not wishing to call for an overshoot that might have proved unnecessary simply because he had failed accurately to appreciate the situation.

By the time the first officer was sure that it was not the intended runway on which they were about to land, it was too late for overshoot action to be initiated. Even after touch-down the commander was completely satisfied that everything was normal, and it was only on hearing the air traffic controller's concern that he realised what he had done.

Summary

Two sets of factors enabled this accident. The first concerns the runway and taxiway lighting at Gatwick. The visual similarity of operations on runways 08L and 08R, the dual use of one paved surface as a runway with edge lighting and as a taxiway with centreline lighting, the invisibility of 08R when 08L is in operation, and the stop bar and lack of curved extension to the runway at the end of taxiway 2 all conspire to increase the uncertainty and ambiguity of the visual information provided at Gatwick when 08L is in operation.

The second set of factors concerns the flight crew. The properties of these crew members which made it possible for them to land on taxiway 2 were their familiarity with Gatwick (specifically, their knowledge that 08L could be lit with centreline lights), and their relative personalities, roles, and status; the more dominant and decisive individual was in command and in control, with the more contemplative and less assertive individual in a position of both subordination and evaluation.

Although no specific treatment of the crew of WB is likely to influence the already low probability of their repeating this incident, the events described should be used as an example to other crews of the importance of maintaining good co-ordination on the flight deck. Every effort should be made to promote LOFT and other forms of crew co-ordination, or flight deck management, training.

Roger Green
Head of Flight Skills Section
RAF Institute of Aviation Medicine
IAM/4003/6
30 June 1988

APPENDIX 5

CHIRP REPORTS

First Report (June 1988)

I was operating as pilot and Captain of a B737 returning to GATWICK at 0030Z. Having read notams apropos 08L ops. (for some weeks previously as well) my co-pilot and I discussed, then briefed for a 2NM SRA to 08L. SRA approaches are a rarity in my job, so I flew it in my mind a couple of times, before we started descent from just west of the Belgian coast. I could see LGW, across the cockpit, whilst at about 4000 ft and about 6NM South. The greatest visual impact (apart from the terminal lights) was the flashing of a "million" yellow beacons, and sundry flood lights on the airfield. No other lights, neither runway nor taxiway, caught my attention. I remarked to the co-pilot that things looked busy down there. I was therefore fully notamed; briefed; and had seen the work in progress. Descent continued to 2000 ft QNH and we were controlled onto a heading of around 085° some "eight miles" from the field - mentally geared for the SRA. The controller said "call visual". Sure enough, there were the lights of two runways, and being relieved of having to fly an SRA, we called visual. The jet was settled in the approach configuration - slightly nose high but the lights were clearly visible. There was a set of very bright MAIN runway lights and to the left, a set of not so bright (and easier on the eye) runway lights. Which set do I go for? I verbalised my thoughts and almost immediately answered my own question, when I could just make out the flashing beacons (yellow) of the work in progress next to the right hand set of lights. I suppose the range to touchdown was about six and a half to five and a half NM. The co-pilot agreed that we were going to go for the right hand set, but did so in such a manner as to make me think that he had been unsure and was glad that our answers coincided. I requested ATC to dim the runway lights (which would also have confirmed the runway to us) as they were far too bright. They said that they were already at a minimum. At approximately 2NM I noticed some strobe lights somewhere in front of the runway and thought "fat lot of good they are except for annoyance". I was getting irritated by the brightness of the lights, as they were robbing me of my depth/height perception. The landing was a positive one but the game wasn't over - where's the end of the runway? The lights continued into more lights, hundreds of green ones in fact. Never mind the noise - I used the standard reverse thrust - until the runway end loomed up out of the other lights.

So there you go! My co-pilot and I talked about the whole deal, afterwards. Neither of us could pin anything down as to why we both had doubts as to which runway to land on. We looked out of the crewroom window (in Concord House) and couldn't figure out why a centre line light taxiway could be attractive enough for us to consider it as another runway - but we did. There was a chance of my landing on that taxiway that night.

My analysis in this:- With the main runway "out", and confirmed as such by so many clues, I was not expecting a choice. My mental picture anticipated only one runway. Some would say there was only one runway - but at 8NM for myself and my co-pilot there were two; 08L must be the "left" of the two!?! Therefore the urge was to go left.

Second Report (June 1988)

Returning to Gatwick. Cleared localiser only approach to O8R. Wx 4/8 1400 ft good visibility but hazy. First sighted the threshold at around 900 feet so concentrated on achieving and maintaining a visual glidepath. Suddenly at 600 feet ground visibility improved and I realised that it was the emergency runway that I was concentrating on - instead of O8R. Quickly jinked to the right and landed O8R.

How could I make such an error? Well the ILS is localiser only and being offset, at 900 feet the approach path is as close to 08L as 08R. The crosswind was from the North so our lookout favoured the left of the centreline. There were no approach lights on 08 Right - or strobes and the VASIS don't stand out in haze. Finally with the work in progress on 08R the newly surfaced emergency runway presents a much more presentable "picture" of how a runway should look.

Third Report (March 1988)

Earlier this year, on returning from a long night flight, we were radar vectored for visual 26R, as anticipated. I was handling and this was my first "standby runway" landing for over a year. Viz was good and we went visual from 3000 ft - the lights were clear from 10 nms. I remarked to the Captain on the brightness of the lights - was it 26R? To satisfy my doubt he queried with the tower who altered the light intensity to identify the runway. On passing 1500 ft it was obvious from knowledge of airport layout (esp position of terminal) that we were correctly lined up. No one criticized me for doubting!

Fourth Report (June/July 1988)

I have lost count of the number of times I have witnessed aircraft over the last couple of months nearly, or actually line up on taxiway 2 instead of 26R due non-switchable "greens" routing to both from Holding Points "Q" and "S". (MORs submitted on the subject some time ago, by myself and several colleagues, have not even had the courtesy of an acknowledgement). I believe the removal of some "greens" from the curves is deemed to have solved the problem So instead of curved simultaneous routings onto taxiway 2 and 26R, we now have ninety

degree simultaneous routings onto both - and the mistakes persist. One night in the murk, particularly without GMR, somebody will miss this and an aircraft will obliviously "roll" on taxiway 2.

I understand that it is generally accepted that accidents/incidents invariably occur as a result of a combination of factors. All the above combined tonight and some are in evidence on an average night. How many additional factors unknown to me are happening at the same time on each incoming/outgoing flight deck?!?

Printed from CRC Produced by Department.
Printed in the United Kingdom for Her Majesty's Stationery Office
Dd 291342, 4/89, C6, 38938