SERIOUS INCIDENT

Aircraft Type and Registration:	Gulfstream 550, HZ-A6	
No & Type of Engines:	2 Rolls-Royce BR710C4-11 turbofan engines	
Year of Manufacture:	2004	
Date & Time (UTC):	10 December 2013 at 0325 hrs	
Location:	Stansted Airport, Essex	
Type of Flight:	Commercial Air Transport	
Persons on Board:	Crew - 4	Passengers - 3
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Underside of left wing and left landing gear door	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	53	
Commander's Flying Experience:	8,685 hours (of which 1,311 were on type) Last 90 days - 70 hours Last 28 days - 0 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft was carrying out a charter flight from Riyadh in Saudi Arabia to London Stansted Airport. It was radar vectored for a CAT I, ILS DME approach to Runway 22 at Stansted with the autopilot (AP) and autothrust (AT) engaged. Conditions at the time were below the CAT I approach minima. With the aircraft fully established on the approach, the AP and AT were disengaged at 1,600 ft aal and the aircraft was hand flown by the commander for the remainder of the approach and landing. The localiser was maintained, but the aircraft flew above the glidepath before descending through it. For reasons that could not be established, go-around mode was selected, which would have inhibited the EGPWS glideslope warnings. In the final stages of the approach the aircraft was well below the glideslope, causing it to strike the Runway 22 ILS localiser monitor aerial and the Runway 04 localiser aerial array, before touching down short of the Runway 22 threshold.

The accident occurred as a result of the pilot continuing to land from a destabilised approach, rather than performing a go-around.

History of the flight

The flight crew reported for duty at 1730 hrs and carried out the normal flight planning, which included reviewing the weather. The TAF for Stansted covering the aircraft's ETA gave a 40% probability of fog between 0300 hrs and 1000 hrs, with a surface visibility of 500 m and cloud overcast at 100 ft. The weather at Manchester Airport, the selected alternate, was forecast to be 10 km visibility with cloud FEW at 3,500 ft for the same period.

The commander was the pilot flying (PF) and the co-pilot was the pilot monitoring (PM). There was one deferred defect, concerning the commander's audio control panel which had the mask/boom selector button stuck in the mask position, but with the hand-held microphone available to the commander, this defect was accepted.

The aircraft departed at 2001 hrs and, following an uneventful flight, commenced a descent for a CAT I[1] approach into Stansted. The Stansted ATIS was recorded as:

> Information Bravo, Runway 22 at time 0220 hrs, wind 160º at 04 kt, Runway 22, Runway Visual Range (RVR) 250 m in fog with broken cloud at 100 ft, temperature 2ºC with a dew point 1ºC and a QNH of 1030 hPa.

This was updated at 0250 hrs with Information Charlie, which was essentially the same but with the RVR increased to 300 m and the temperature and dew point both 1ºC. The crew reported that they carried out the normal and missed approach briefings for the ILS DME approach for Runway 22 at Stansted Airport, with the alternate as Manchester Airport.

The aircraft was radar vectored for the ILS to Runway 22 and cleared by ATC for the approach. The landing weight was 63,000 lbs, with a V_{REF} of 126 kt IAS to which 5 kt had to be added, giving a V_{APP} of 131 kt. The localiser and glideslope upper modes of the autopilot were armed and the autothrust was engaged. The localiser was intercepted at 10.84 nm and the glideslope at 8.41 nm from the runway threshold.

The aircraft successfully captured the localiser and descended with the glideslope. The crew changed to the Tower radio frequency, established radio contact at 6 nm, and were issued with the following landing clearance: "HZA6 THE SURFACE WIND 170 5 KNOTS YOU'RE CLEARED TO LAND RVR 325, 400 300". This was acknowledged by the co-pilot transmitting: "CLEARED TO LAND HZA6". At 5 nm and a height of 1,625 ft, the flaps were commanded to fully down. The speed was 181 kt IAS, which is above the flap limiting speed of 170 kt IAS and an overspeed audio warning was generated. The flap travel was stopped at 20º and, shortly thereafter, the autopilot was disengaged. The flaps were reselected to the fully down (landing) position at 4.3 nm.

At 4 nm the autopilot was re-engaged but shortly thereafter, at a height of 1,212 ft, the autopilot was disengaged and at 3.6 nm and a height of 1,388 ft and 165 kt, the autothrust was disengaged. The aircraft was significantly above the glideslope at this point, prompting ATC to advise the crew: "HZA6 INDICATING SLIGHTLY HIGH ON THE GLIDEPATH CONFIRM CORRECTING", to which the co-pilot responded: "YES WE ARE CORRECTING". At 3 nm, the autopilot was again engaged, but almost immediately disengaged and the commander hand flew the aircraft in a descent towards the glideslope.

The pilots reported that, throughout the approach, they both had the approach and runway lights in sight, but did not see the PAPIs. At 1.7 nm, for reasons that could not be established, the autopilot mode, autothrust and vertical mode all changed to

Footnote

[1] For a CAT I approach the RVR must not be less than 550 m.

go-around[2], but the commander continued to fly the aircraft towards the runway. Continuing the approach from that point was carried out by visual reference to the approach and runway lighting.

At 1.0 nm the aircraft was at a height of 237 ft, 120 ft below the glideslope and it continued to descend to 30 ft at 0.3 nm, 130 ft below the glideslope. At a height of 11 ft and just under 0.2 nm from the runway threshold, the lower part of the fuselage and landing gear struck the Runway 22 ILS localiser monitor aerial and the Runway 04 localiser aerial array. The aircraft continued in the flare at a height of 3 ft at 0.1 nm from the threshold, before touching down at 108 kt on the concrete surface of the runway undershoot area, 55 ft below the glideslope and 109 ft short of the runway threshold.

During the final approach there were no EGPWS warnings, apart from the normal radio altimeter height 'callouts' and 'APPROACHING MINIMUMS' alert, which were heard on the CVR. The passengers and crew were unaware of the impact with the aerials and it was not until the aircraft was taxied to the parking area and the after flight inspection was carried out that the damage was seen.

Regulatory requirements

The aerodrome operating minima requirements for foreign aircraft being operated in the United Kingdom are set out in Article 108 of the United Kingdom Air Navigation Order (UK ANO) 2010 as follows:

> *'**Article 108 - Public transport aircraft registered elsewhere than in the United Kingdom-aerodrome operating minima***
>
> *(1) This article applies to public transport aircraft registered elsewhere than in the United Kingdom.*
>
> *(2) An aircraft to which this article applies must not fly in or over the United Kingdom unless the operator has made available to the flight crew aerodrome operating minima which comply with paragraph (3) for every aerodrome at which it is intended to land or take off and every alternate aerodrome.*
>
> *(3) The aerodrome operating minima provided in accordance with paragraph (2) must be no less restrictive than either:*
>
> *(a) minima calculated in accordance with the notified method for calculating aerodrome operating minima; or*
>
> *(b) minima which comply with the law of the country in which the aircraft is registered,*
>
> *Whichever are the more restrictive.*

Footnote

[2] Selecting the go-around mode changes the Primary Flight Display (PFD) from an ILS presentation to the horizontal and vertical go-around presentation. ILS guidance is no longer provided and the EGPWS Mode 5 'GLIDESLOPE' warning is no longer available.

An aircraft must not:

conduct a Category II, Category IIIA or Category IIIB approach and landing; or
take off when the relevant runway visual range is less than 150 metres,

otherwise than under and in accordance with the terms of an approval to do so granted in accordance with the law of the country in which it is registered.

An aircraft must not take off from or land at an aerodrome in the United Kingdom in contravention of the specified aerodrome operating minima.

Without prejudice to paragraphs (4) and (5), when making a descent to an aerodrome an aircraft must not descend from a height of 1000 feet or more above the aerodrome to a height of less than 1000 feet above the aerodrome if the relevant runway visual range at the aerodrome is at the time less than the specified minimum for landing.

Without prejudice to paragraph (4) and (5), when making a descent to an aerodrome an aircraft must not:

continue an approach to landing at an aerodrome by flying below the relevant specified decision height; or descend below the relevant specified minimum descent height, unless, in either case, the specified visual reference for landing is established and maintained from such height.

(8) In this article 'specified' means specified by the operator in the aerodrome operating minima made available to the flight crew under paragraph (2).'

Aerodrome information

London Stansted Airport (EGSS) has a single runway orientated 04/22, 3,049 m long and 46 m wide. The runway in use at the time of the accident was Runway 22, which has a threshold elevation of 348 ft. It is equipped with approach lighting, runway, threshold and stop end lighting, and PAPIs set to an angle of 3.0º.

The runway is equipped with an ILS capable of CAT I, II and III operations for suitably equipped and authorised aircraft. The ILS is frequency paired with the DME on 110.5 MHz. The runway and approach lighting and radio navigation aids were fully serviceable throughout the approach. The Final Approach Track was 224º with a magnetic variation of 1.3º W.

The crew were carrying out a CAT I, QNH approach for which the minima are: Decision Altitude 548 ft and a minimum Runway Visual Range (RVR) of 550 m.

A copy of the Jeppesen approach chart used by the crew is shown at Figure 1.

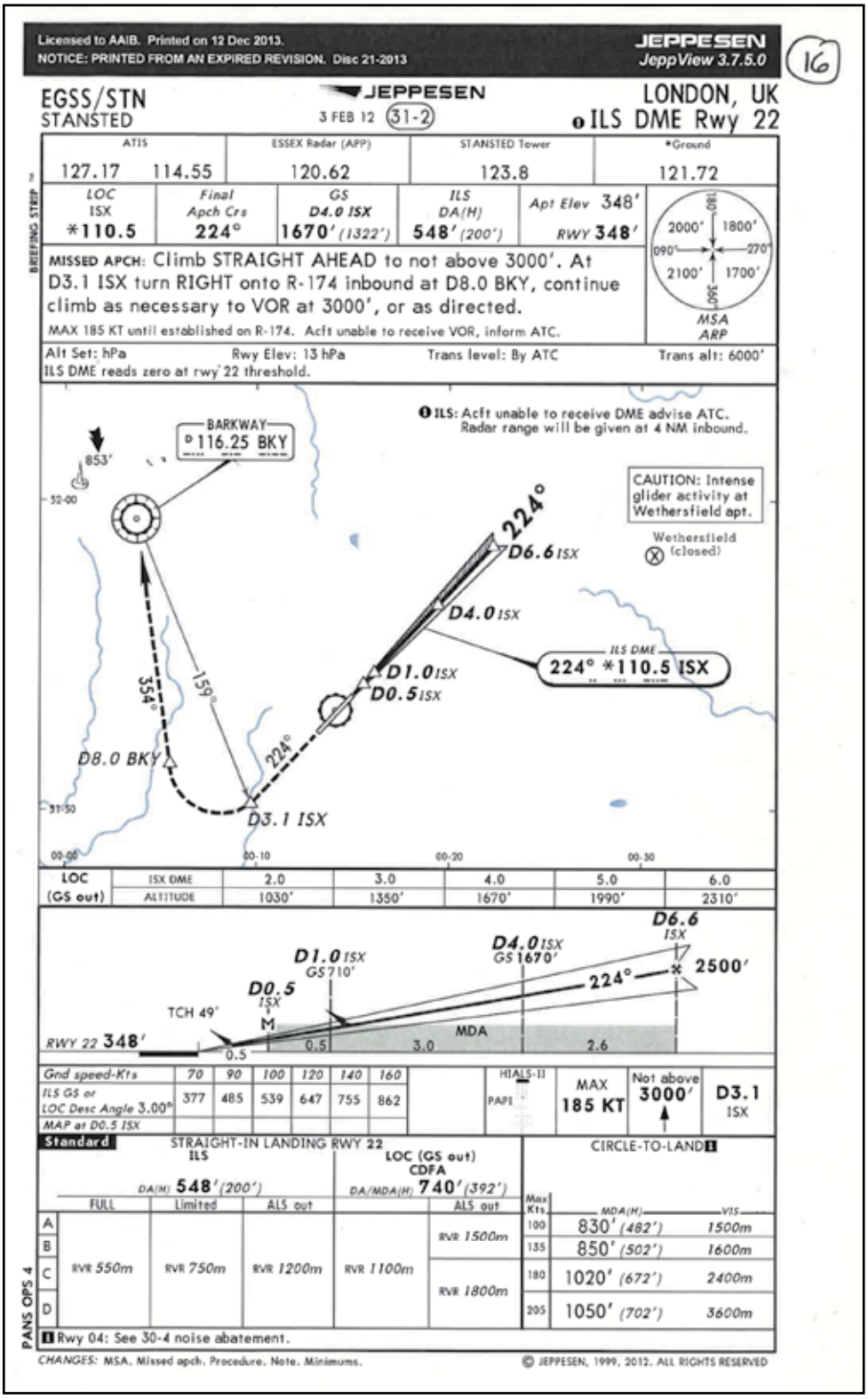

Figure 1

London Stansted Runway 22 ILS DME approach chart

Meteorology

The general situation for the night of the accident was a high pressure system centred over Europe which created light southerly winds and relatively high humidity over the United Kingdom. This created a risk for deterioration in visibilities and low cloud which eventually occurred. At Stansted the visibility dropped quickly through the evening to less than 1,000 m before 2200 hrs, then going into fog for the remainder of the night.

The Stansted (EGSS) and Manchester (EGCC) Terminal Aerodrome Forecasts (TAF) provided to the crew in their briefing pack were as follows:

EGSS 0912/1018 24010KT 9999 FEW014 SCT025 PROB30 0912/0913 4000 BR BKN004 BECMG 0916/0919 18006KT 6000 TEMPO 0919/1010 3000 BR PROB40 1003/1010 0500 FG OVC001 BECMG 1010/1012 9999

EGCC 0912/1018 20007KT 9999 FEW035

The Stansted METARs covering the landing time of 0325 hrs were:

100320Z EGSS 100320Z 18005KT 0400 R22/0325 MIFG SCT001 01/00 Q1030
100350Z EGSS 100350Z 16005KT 0400 R22/0275 FG OVC001 01/00 Q1030

The commander of an aircraft which landed at 0319 hrs, six minutes ahead of HZ-A6, provided the following description of the conditions during his approach, which was conducted as a CAT III Autoland:

> *'We were flying a Boeing 737-300 engaged on a CAT 3a approach onto RWY 22 at STN, the TDZ RVR was being given as 350 m in Fog. Our approach was uneventful and the required visual reference was easily achieved by our decision height of 50 ft Radio followed by a normal autoland and exit from the runway. All ILS transmissions, runway and approach lighting were functioning normally.'*

As the pilot was concentrating on elements of the approach/runway lights, he was not aware of the PAPIs. He also stated that:

> *'The flying conditions were very clear above about 100 ft and runway and approach lights were clearly individually visible apart from a section of runway about 200 metres long approximately one third of the length of the runway from the 22 runway end that obscured the lighting from individual lights to merely a glow. Although the fog bank was entered at around 100 ft determination of approach and runway lighting was not difficult.'*

The crew of HZ-A6 also reported that they could clearly see the approach and runway lighting throughout the approach.

Company General Operations Manual

The operator had set out in the company General Operations Manual (GOM) the requirements for conducting Terminal Instrument Procedures. Of relevance to the accident, the Company Policy and Procedures set out at paragraph 18.40.8 stated:

> *'Approaches to airports where the weather is reported below published landing minimums are not authorized'*

The Article 108 requirement stipulated in the UK ANO and set out below was not included here or in any other part of the operator's GOM:

> *'Without prejudice to paragraphs (4) and (5), when making a descent to an aerodrome an aircraft must not descend from a height of 1000 feet or more above the aerodrome to a height of less than 1000 feet above the aerodrome if the relevant runway visual range at the aerodrome is at the time less than the specified minimum for landing.'*

The operator had also set out the maximum deviation parameters during the approach phase in order to ensure a stabilized approach. These were:

> *'1.1.3 Approach Phase*
>
> *The maximum deviation parameters are:*
>
> - *One dot deviation from glide slope.*
> - *½ dot deviation from localiser.*
> - *½ dot deviation from course (non-precision).*
> - *5 deviations from NDB course.*
> - *100 ft above or 50 ft below MDA. Prior to runway in sight, any deviation below MDA requires an immediate correction.*
> - *Plus 10 kts, minus 0 knots deviation from target speed.*
> - *Descent rate exceeds 1,000 fpm on final approach*
>
> *Below 500 feet (VMC) and 1,000 feet (IMC), it is policy to execute a go around if the aircraft exceeds any of the maximum deviation parameters during this phase.'*

The operator also included comprehensive procedures for approach monitoring and the duties and responsibilities for the Pilot Flying (PF) and the Pilot Monitoring (PM).

The approach window was also defined with its associated requirements as follows:

> *'1.120. Approach Window*
>
> *In order to facilitate a stabilized approach, an approach window is established as a point 500 ft above the runway elevation (VMC), 1000 ft above the runway elevation (IMC), on centreline and glide slope. At this point the aircraft must be configured to land, unless an abnormal procedure requires otherwise, and must not exceed the parameters listed in Paragraph 18.116., Flight Deviation Parameters.'*

Aircraft information

At the time of the accident the aircraft had achieved 1,888 flight cycles and 3,961 flying hours. The most recent significant maintenance inspection was a '24 Month Check', which was conducted in Switzerland and completed on 3 October 2013 when the flights/hours figures were 1,831 and 3,779 respectively. Since then, maintenance activity consisted of daily and weekly inspections. The only defect recorded in the Technical Log was that the Captain's microphone switch had become stuck in the 'mask' position, as noted earlier. This item had been deferred in accordance with the aircraft Minimum Equipment List (MEL).

Accident site details

Examination of the airfield on the approach side of Runway 22 threshold revealed that the aircraft had successively struck the Runway 22 ILS localiser monitor aerial and the Runway 04 localiser aerial array. These structures were located only 5 to 6 m apart and the damage can be seen in Figure 2.

Figure 2

View of damaged monitor aerial and ILS localiser array

The monitor aerial consisted of a tower approximately 5.5 m high, which was constructed from lightweight fibreglass material and supported a coaxial aerial cable. The 4.2 m high ILS array comprised a series of 24 stanchions, each carrying 14 horizontally-orientated dipoles, which consisted of aluminium alloy tubes covered with orange plastic sheathing. The stanchions were arranged equidistant from each other, 12 either side of the runway centreline.

It was apparent that the aircraft had broken off the top of the monitor tower before striking the dipoles on stanchions 13 and 15, which placed the aircraft slightly right of the runway centreline. The latter impact had dislodged eight of the dipoles, which were scattered over the grass towards the runway.

Some tyre marks were observed on an 85 m paved extension that preceded the 'piano key' marks at the start of the runway. These indicated that touchdown had been made right landing gear first, left of the runway centreline and approximately 40 m from the start of the paved extension. This was approximately 520 m from the start of the touchdown zone.

ILS unserviceability

ATC recorded the aircraft landing at 0325 hrs UTC and at 0328 hrs were advised that Runway 22 ILS had suffered a 'technical fault'. An engineer was despatched to investigate and the ILS was downgraded from CAT III to CAT I; the Airfield Operations Duty Manager issued a NOTAM to that effect at 0345 hrs.

Despite the damage to the localiser aerials, the Runway 04 ILS remained serviceable at CAT III, although it was taken out of service at 0745 hrs prior to the commencement of repairs.

Examination of the aircraft

It was apparent that the aircraft's left landing gear had struck the monitor aerial and the localiser array, with the left wing underside ahead of the gear showing evidence of scratches and orange paint transfer. Most of the scratches were superficial, although there was a significant gash approximately 300 mm in length and 5 mm deep. However, the skin had remained intact, with no fuel seepage. The leading edge was unmarked.

The left landing gear door had sustained a significant impact on its leading edge; the appearance and dimensions of the damaged area suggested this had been made by one or more of the dipoles. The geometry of the main landing gear is such that it is probable that the tyres also made contact with the ILS equipment, although they bore no obvious marks. It was noted that a hydraulic brake line, located close to the bottom of the leg, between the wheels, had sustained some distortion during the impact, although there were no leaks.

After the on-site examination, the aircraft was cleared for the short flight to the aircraft manufacturer's UK facility at Luton Airport, where temporary repairs were effected. The aircraft was then flown to the manufacturer's main base in Savannah, Georgia, USA, for annual inspection and permanent repairs in October 2014.

Recorded data

Fault history database (FHDB)

The aircraft was equipped with the Honeywell Primus Epic Modular Avionic system, which is used across a number of aircraft types. Its function is to integrate the systems and sub-systems that supply the aircraft with navigation, communication, autoflight, indicating, recording and maintenance capabilities.

In the subject aircraft the system consisted of three Modular Avionic Unit (MAU) cabinets, each containing processors, and functional modules, which included input/output modules that provided interfaces with the various aircraft systems. There was also a terrain awareness warning system (TAWS), which comprised two Enhanced Ground Proximity

Warning modules (EGPWM). A Central Maintenance Computer (CMC) Module provided the integrated maintenance and aircraft condition monitoring function. Its purpose was to collect active faults from member systems, and compile a Fault History Database (FHDB). The latter was downloaded and found to contain information for every flight from when the aircraft was returned to service after the 24-month maintenance check.

Analysis of the FHDB revealed that on every approach, a series of *'Voice Activity Fail'* messages was generated, which were associated with EGPWS Warning Modules 1 and 2. However, there were no audio alerts and no messages displayed on the Crew Alerting System (CAS). The aircraft and avionic manufacturers were asked to provide assistance in understanding these messages with a view to determining whether they represented a malfunction of the EGPWS system.

The system is designed such that, under normal power-up conditions, EGPWS Module 1 would have priority over Module 2. Module 2 would gain priority in the event of a fault with Module 1. Although only one module has priority, both modules monitor the same input conditions and would simultaneously execute the same functions. Thus a genuine EGPWS failure on every flight would require the extremely improbable scenario of a defect occurring within each warning module as well as both input/output modules.

In the event of an alert needing to be issued, the EGPWM issues a voice request; this is processed by an audio driver within an audio control panel, which is another system component. The lack of a response to such a request results in a *'Voice Activity Fail'* message. However, the manufacturer stated that, by design, the '*Voice Activity Fail*' functionality cannot inhibit any EGPWS modes. The CVR indicated that the altitude call-outs were being generated as normal during the final approach to the runway on the accident flight.

During the subsequent flight to Luton a Mode 5 (ie 'Glideslope') warning was generated during the approach. Analysis of the associated DFDR data indicated that this was genuine. In addition, although the EGPWM issued the voice requests for the glideslope alerts and altitude call-outs, *'Voice Activity Fail'* messages were also logged. The reason for this was not established. However, Honeywell, after reviewing all the available data, stated that there were no systemic issues and that the TAWS system had otherwise performed as designed.

After the aircraft had returned to the manufacturer's facility in the USA, the software was successfully reloaded into the EGPWS Modules. It was considered that this operation could not have been achieved if there had been a hardware problem.

The aircraft returned to service following repairs and the manufacturer subsequently conducted further downloads of the FHDB. This revealed that the *'Voice Activity Fail'* problem had persisted. It is thought that there may be a common interface fault, possibly on an input/output module, that could result in both EGPWMs falsely reporting a problem. Consequently, a number of MAU modules were removed from the aircraft for further testing.

FDR/CVR information

The flight data recorder (FDR) and cockpit voice recorder (CVR) were removed from the aircraft, downloaded and the recordings analysed by the AAIB.

Figure 3 shows the salient parameters recorded on the FDR during the approach and touchdown. The figure starts with the aircraft about 12 nm from Runway 22 on a westerly heading at 3,750 ft amsl, 179 kt IAS (V_{APP} + 48), Flaps 20, with a descent rate of just over 1,150 ft/min. Autopilot and autothrust were also engaged, with 'heading hold' and 'vertical speed' flight director modes selected.

The aircraft then turned left and levelled off at 3,000 ft amsl (2,500 ft agl), intercepting the localiser at about 11 nm, and the glideslope at about 8.5 nm. As the aircraft descended through 1,600 ft agl on the glideslope, with 181 kt IAS, Flaps 40 was briefly selected before returning back to Flaps 20. The airspeed then reduced to about 165 kt and Flaps 40 was reselected; however, the aircraft was now above the glideslope where it remained (mostly between 1 and 2 dots deviation) until about 300 ft agl and 1 nm from the runway, just as the airspeed slowed to 131 kt (V_{APP}).

The aircraft continued to decelerate and then descended below the glideslope, reaching 4 dots deviation as the aircraft collided with the localiser antenna at 19 ft agl. The airspeed at this point was 115 kt. Main landing gear touchdown occurred seven seconds later.

Automatic radio altimeter height call outs were given at 1,000, 400, 300, 200, 100, 50, 40, 30, 20 and 10 feet. Some of these, together with autopilot (AP), autothrust (AT) and flight director (FD) vertical and lateral use during the approach and descent, are summarised in the following table:

Distance to Runway 22 (nm)	Radio Height (feet agl)	IAS (kt)	UTC	Event
4.99	1612	178	03:22:56	AP disengaged
4.10	1387	167	03:23:14	AP briefly engaged
3.58	1388	165	03:23:25	AT disengaged
3.07	1234	161	03:23:39	AP briefly engaged
2.43	1000	167	03:23:52	'1000'
1.79	690	152	03:24:11	FD-vert: *Glideslope* to *GoAround* FD-lat: *AppLOC* to *HdgHold*
1.66	647	150	03:24:13	FD-lat: *HdgHold* to *Lnav(FMS)*
1.02	300	129	03:24:31	'300'
0.90	179	130	03:24:40	'APPROACHING MINIMUMS'
0.64	141	128	03:24:45	'MINIMUMS'
0.26	20	116	03:24:56	'20'
0.25	19	115	03:24:57	Collision with localiser
0.13	10	112	03:24:59	'10'
0	3	108	03:25:04	Mainwheel touchdown
0	0	103	03:25:06	Nosewheel touchdown

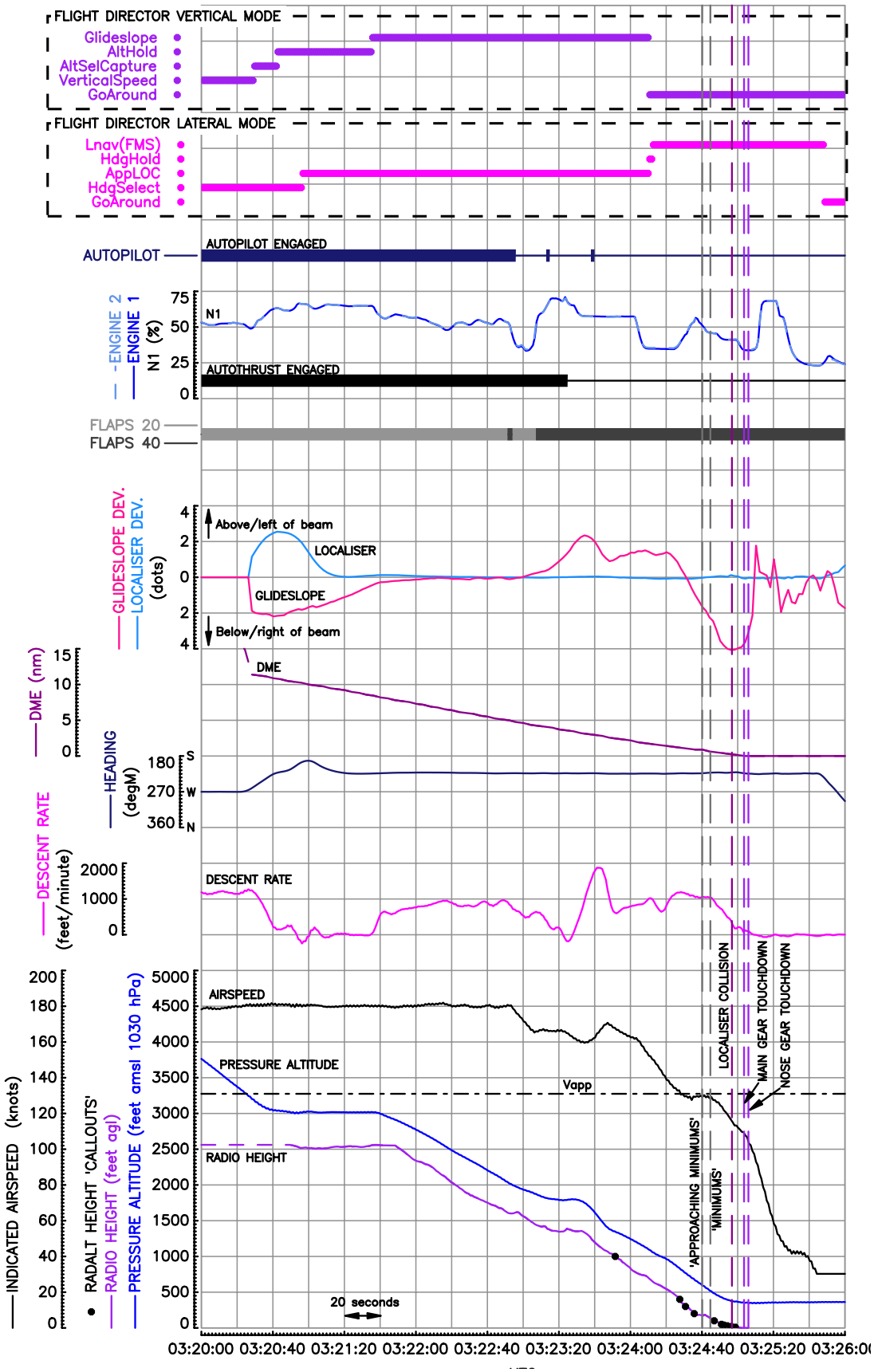

Figure 3

Salient recorded flight data for approach and landing at Stansted

Analysis

The aircraft struck the ILS aerials and touched down more than 500 m short of the touchdown zone as a result of descending below the glideslope. There were no EGPWS warnings, which initially posed questions as to the serviceability of the TAWS system. Although some messages in the FHDB could not be explained, it was concluded that the system had functioned correctly up to the point where the go-around mode was selected, which would have inhibited the glideslope alerts. This was reinforced by the genuine Mode 5 alert that was issued by the system during the subsequent flight from Stansted to Luton.

The crew were properly licensed and qualified to conduct the flight. In their pre-flight briefing and planning they had identified the possibility of fog at Stansted and had nominated Manchester as a suitable diversion. The transit flight to Stansted was uneventful and the commander's unserviceable radio selector panel was not relevant to the accident.

The RVRs in the ATIS reports and those passed to the crew with their landing clearance were below the CAT I minimum RVR of 550 m. The approach should not have been commenced as the UK ANO requirements did not allow the crew to descend below 1,000 ft aal in these conditions and the company GOM procedures did not permit an approach to be made in such conditions.

During the descent towards Stansted Airport, the crew reported that prior to descent they had briefed the arrival and missed approach should it be necessary. The autopilot captured the localiser and the glideslope for Runway 22, but the selection of full flap, above the flap limiting speed, appears to be the start of a chain of events which destabilised the approach.

The disengagement of the autopilot and autothrust led to the aircraft levelling and rising above the glidepath, which was notified to the crew by ATC. Whilst correcting the flightpath to regain the glideslope, two attempts were made to re-engage the autopilot, but these were unsuccessful so the commander continued to hand fly the aircraft. The reason for the unsuccessful re-engagements was not determined. The aircraft flew above the glideslope where it remained (mostly between 1 and 2 dots deviation) until about 300 ft agl and 1 nm from the runway, just as the airspeed slowed to 131 kt (V_{APP}). At a height of 691 ft the go-around mode was selected, but the commander continued visually towards the runway, passing through the glidepath at about 300 ft at 1.0 nm. The reason for the change to go-around mode could not be determined, but it was significant in that glideslope deviation alerts would no longer have been provided. The aircraft continued to decelerate and then descended below the glideslope, reaching 4 dots deviation as the aircraft collided with the localiser antenna at 19 ft agl.

The glidepath deviations were outside the stabilised approach criteria and when combined with the reducing airspeed below V_{APP}, a go-around should have been flown.

Although the approach and runway lights were visible to the pilots, the PAPIs were not and therefore the approach path angle was a matter of judgement. Apart from the normal advisory callouts, the EGPWS did not alert the crew to the deteriorating situation as the aircraft began to undershoot the runway because the go-around mode had been selected.

The radio altimeter height ‘callouts’, combined with the visual perspective of the runway lights, provided the cues to flare the aircraft.

The fact that the pilots could see the runway and approach lighting caused them to believe that, as long as they remained visual with these landing references, they would comply with their company procedures and thus could continue their approach.

Conclusion

The accident occurred as a result of the approach becoming destabilised and the pilots attempting to regain the correct glidepath at a late stage, rather than performing a go-around. Descending below the glidepath at such a late stage caused the aircraft to collide with the ILS aerials.

The RVR was below the 550 m minima required for the crew to commence a CAT I approach.