

x 159 occupants concentrated in the most forward passenger compartment the CG position would have been 21,5% MAC. (App C pp 41 - 42).

The quantity of aviation turbine fuel in the aircraft at the time of the impact was calculated as approximately 24 370 kg (App C p39).

Of the 43 225 kg of cargo and baggage carried in the aircraft, 14 588 kg of cargo was loaded on 6 pallets in the main deck cargo compartment. This cargo consisted mainly of electrical components and parts, electronic components and parts, hardware, paper articles, textiles, medicines and sports equipment. Some articles from the main deck cargo which were recovered showed evidence of fire damage. None of the observed cargo from the lower holds had any signs of fire or heat.

#### 1.7 METEOROLOGICAL INFORMATION (App D PP 1- 3)

Very little information on the actual weather conditions at the accident site is available. From the actual conditions at Mauritius and Rodriquez together with the 03:00 satellite picture, the following weather conditions were estimated:

Upper wind FL 140 : 160/5-8 kt

Visibility : 10 km or more

Cloud : Scattered cumulus and stratocumulus at 5000 ft

No medium level cloud at FL 140.

The night was dark. The moon had set at 20:16 on 27 November 1987.  
(App D p4)

## INSTRUMENTS TO NAVIGATION

The aeroplane was equipped with the following navigational aids and associated displays:

- 3 inertial navigation systems (INS)
- 2 weather and mapping radars with 300 nm range.
- 2 radio magnetic indicators (RMI)
- 1 standby compass
- 2 automatic direction finders (ADF)
- 3 very high frequency omni range (VOR) units
- 3 distance measuring units (DME)
- 3 instrument landing systems (ILS)

Plaisance Airport was equipped with the following terminal navigational aids:

- 2 VOR stations
- 2 DME stations
- 2 NDB stations

The ground stations were serviceable (App D p5)

## 1.9 COMMUNICATIONS

The aeroplane was equipped with 2 high frequency (HF) and 3 very high frequency (VHF) transmitter-receiver radio sets. Interphone and passenger address systems were also provided.

The take-off and departure communications with Taipei departure control were normal in all respects (App A pp 6 - 7).

Some 34 minutes after departure from Taipei, SA 295 called Hong Kong Radar at 14:56:04 and obtained direct clearance from ELATO to ISBAN. Normal position reporting was made over ELATO at 15:03:25; SUNEK at 15:53:52; ADMARK at 16:09:54 and SUKAR at 16:34:47 (App A pp 8 -

12). At 15:55:18 a routine report was made to the operator's base station at Jan Smuts (ZUR). The crew was asked to report again at 18:00 as the selective calling system (SELCAL) was unserviceable. The communication with ZUR ended at 15:56:55. The ZUR tape recording ran until about 16:34 (App A p17). As the follow-on tape was apparently later inadvertently re-used, there is no further communication between SA 295 and ZUR on record. The ZUR operator confirmed that there was no other communication. (App E pp1 - 17). The ZUR log shows that at 04:48 on 28 November flight MK 057 had asked the ZUR radio officer when he last had contact with flight SA 295 and was informed "1600 UTC on 27." (App E p28). From 16:49:41 to 21:43:00 position reports were made to Bangkok, Colombo and Cocos. (App A pp 12 - 16). The first HF call to Mauritius on 3476 KHz was made at about 21:46:00 when the crew reported the time at the Mauritius FIR boundary as 21:43:00. At about 22:30 a report of crossing longitude 070 ° East was made (App A p 16). At 23:13:27 a position report of 065 ° East at FL 350 was made to Mauritius (App A p19). From 15:41:06 until 23:14:00 all position reporting was by means of high frequency transmissions. At 23:48:51 the pilot called Mauritius approach control. The following communication was transcribed from the Plaisance control tower tape recording (App A pp 30 - 33). Free translations of Afrikaans phrases are in brackets. Whilst most of the words were clearly recorded and could be easily transcribed, some unintentional transmissions from SA 295 could not be clearly identified as to what was being said.

**KEY**

**295: PILOT-IN-COMMAND OF FLIGHT SA 295**

**MRU : MAURITIUS APPROACH CONTROL**

<b>TIME</b>	<b>SPEAKER</b>	<b>RECORDED INFORMATION</b>
23:48:51	295	Eh, Mauritius, Mauritius, Springbok Two Niner Five
23:49:00	MRU	Springbok Two Nine Five, eh, Mauritius, eh, good morning, eh, go ahead

16/.....

23:49:07 295 Eh, good morning, we have, eh, a smoke, ehp, eh, problem and we're doing emergency descent to level one five, eh, one four zero

23:49:18 MRU Confirm you wish to descend to flight level one four zero

23:49:20 295 Ya, we have already commenced, eh, due to a smoke problem in the aeroplane

23:49:25 MRU Eh, roger, you are clear to descend immediately to flight level one four zero

23:49:30 295 Roger, we will appreciate if you can alert, eh, fire, ehp, ehp, eh, eh

23:49:40 MRU Do you wish to, eh, do you request a full emergency?

23:49:48 295 Okay Joe, kan jy ... vir ons (Okay Joe can you ... for us)

23:49:51 MRU Springbok Two Nine Five, Plaisance

23:49:54 295 Sorry, go ahead

23:49:56 MRU Do you, eh, request a full emergency please a full emergency?

23:50:00 295 Affirmative, that's Charlie Charlie

23:50:02 MRU Roger, I declare a full emergency, roger

23:50:04 295 Thank you

23:50:40 MRU Springbok Two Nine Five, Plaisance

23:50:44 295 Eh, go ahead

23:50:46 MRU Request your actual position please and your DME distance

23:50:51 295 Eh, we haven't got the DME yet

23:50:55 MRU Eh, roger and your actual position please.

23:51:00 295 Eh, say again

23:51:02 MRU Your actual position

23:51:08 295 Now we've lost a lot of electrics, we haven't got anything on the on the aircraft now

23:51:12 MRU Eh, roger, I declare a full emergency immediately

23:51:15 295 Affirmative

23:51:18 MRU Roger

23:52:19 MRU Eh, Springbok Two Nine Five, do you have an Echo  
Tango Alfa Plaisance please

23:52:30 MRU Springbok Two Nine Five, Plaisance

23:52:32 295 Ya, Plaisance

23:52:33 MRU Do you have an Echo Tango Alfa Plaisance please?

23:52:36 295 Ya, eh, zero zero, eh eh eh three zero

23:52:40 MRU Roger, zero zero three zero, thank you

23:52:50 295 Hey Joe, shut down the oxygen left

23:52:52 MRU Sorry say again please

00:01:34 295 Unintelligible transmission

00:01:36 295 Unintelligible transmission

00:01:45 295 Unintelligible transmission

00:01:57 295 Unintelligible transmission

00:02:10 295 Unintelligible transmission

00:02:14 295 Unintelligible transmission

00:02:25 295 Carrier wave only

00:02:38 295 Eh Plaisance, Springbok Two Nine Five, do (did)  
you copy

00:02:41 MRU Eh negative, Two Nine Five, say again please, say  
again

00:02:43 295 We're now sixty five miles

00:02:45 MRU Confirm sixty five miles

00:02:47 295 Ya, affirmative Charlie Charlie

00:02:50 MRU Eh, Roger, Springbok eh Two Nine Five, eh re  
you're recleared flight level five zero. Recleared  
flight level five zero

00:02:58 295 Roger, five zero

00:03:00 MRU And, Springbok Two Nine Five copy actual weather  
Plaisance Copy actual weather Plaisance. The wind  
one one zero degrees zero five knots. The visibility  
above one zero kilometres. And we have a precipita-  
tion in sight to the north. Clouds, five octas one six  
zero zero, one octa five thousand feet. Temperature  
is twenty two, two two. And the QNH one zero one  
eight hectopascals, one zero one eight over

00:03:28	295	Roger, one zero one eight
00:03:31	MRU	Affirmative, eh and both runways available if you wish
00:03:43	MRU	And two nine five, I request pilots intention
00:03:46	295	Eh we'd like to track in eh, on eh one three
00:03:51	MRU	Confirm runway one four
00:03:54	295	Charlie Charlie
00:03:56	MRU	Affirmative and you're cleared, eh direct to Foxtrot Foxtrot. You report approaching five zero
00:04:02	295	Kay
00:08:00	MRU	Two Nine Five, Plaisance
00:08:11	MRU	Springbok Two Nine Five, Plaisance
00:08:35	MRU	Springbok Two Nine Five Plaisance

(NO ANSWER)

A NTSB human performance expert commented as follows on the pilot's last VHF communication with the approach controller:

"The air traffic recording is generally of very good audio quality. After screening it, I had a definite impression that there were changes in the stress level of the speaker (who was identified to me as the captain) over the course of the tape. From 23:48:51 to 23:49:30) the speaker sounds relatively calm, speaking slowly and courteously (although the seriousness of his communication is clear from its content). At 23:49:30 he fails to complete the sentence, and there is a definite impression that someone or something in the cockpit is distracting him due to the growing emergency. From this point until the end he definitely sounds more agitated, is definitely more distracted, and appears to be talking more quickly. Several of the transmissions, for example from 00:01:34 to 00:02:14, appear to have the high levels of fundamental frequency, speaking rate, and amplitude which are generally characteristic of great psychological stress (the statement at 00:01:45 seems so high it is close to screaming). It should be noted, however, that these statements appear to be inadvertent transmissions meant for the on-board crew and that the speaker may be yelling partly to be heard

through his oxygen mask and above the background noise in the cockpit. In the final section, from 00:02:38 to the end, the speaker appears to be more composed and responsive than he was in the preceding section. It seems possible that he has calmed down somewhat and feels that the emergency is more under control at this point than it was at earlier points. These comments are based on simply reviewing the tape and do not reflect scientific measurement for psychological stress". (App A pp 34 - 35).

#### 1.10 AERODROME INFORMATION

The emergency services at Plaisance Airport conformed to category 8 standards as laid down in ICAO's Annex 14 (App D p4). All navigational, landing and communication aids were functioning normally. At 00:25 everything was ready to receive the aircraft in distress and everybody was on alert (App J p2). The aerodrome was not equipped with radar and only runway 14 was equipped with an instrument landing system.

#### 1.11 FLIGHT RECORDERS

The following recorders were fitted :

- (1) Penny and Giles quick access recorder (QAR) type D50761 for logging flight data. The QAR was mounted in the main equipment bay just forward of the lower cargo hold at station 460
- (2) Lockheed model 209F digital flight data recorder (DFDR) Part no. 10077 A500 - 803 fitted with a Dukane N15F210B underwater locator beacon. The DFDR was mounted on top of a stowage facility in the left hand rear side of the main deck cargo compartment at station 2320.
- (3) Collins type 642 C-1 cockpit voice recorder (CVR) Part No. 522 - 4057 -002 fitted with a Dukane N15F210B underwater

locator beacon. The CVR was mounted next to the DFDR and was the only recorder found and recovered from the sea bed.

After the CVR was found it was handled with great care and all possible precautions were taken to ensure that the recorded information would be retained. To prevent the formation of air bubbles on the tape and hence a deposit of seawater chemicals, the transfer from the lifting tackle to the transport container was performed under the water. Once on board the ship the seawater was replaced with de-ionised water whilst ensuring non-entry of air into the recorder unit. Ice made from de-ionised water was progressively added to maintain the temperature within the range of 4 to 12° C. The CVR, in the transport container, was then flown to the operator's suitably equipped laboratory for removal of the tape. All metal tools used for this process were de-magnetised. The tape was removed with the unit submerged in de-ionised water and cleaned in such water by winding it from one reel to another after which it was dried in a vacuum chamber with periodic nitrogen purging. After drying the tape was hand carried to a NTSB laboratory in Washington DC for copying and analysis.

Examination of the recorder revealed impact damage to the outer casing. It had been exposed to heat as evidenced by blistering of the paint. The insulation of electrical wiring found attached to the mounting rack plug was scorched. The solder of some electrical wire joints had melted indicating that the unit had been exposed to heat. The melting point of the solder is between 180 and 190°C. The interior of the unit was covered with an oily soot, ingress of which was probably through an aperture in the front cover. The plastic blanking plug of this aperture had melted. The signal and control wiring was routed along the top left hand side of the main deck cargo compartment in raceway G and was next to