)S TO NAVIGATION

ıe aeroplane was equipped with the following navigational aids and ssociated 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

TIME	SPEAKER	RECORDED INFORMATION
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

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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

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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	Unintelligble transmission
00:01:57	295	Unintelligble transmission
00:02:10	295	Unintelligble transmission
00:02:14	295	Unintelligble 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 precipitation 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

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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 form 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 onboard 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

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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 progressivley 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

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the DFDR wiring. The power supply cable was routed along the top right hand side in raceway H. (App F pp 1 - 4).

The CVR locator beacon was examined by the manufacturer who concluded that the unit had been subjected to external heat in excess of 190° C. This temperature caused the solder around the water switch spring to reflow and hold the switch in the compressed position. This high temperature also damaged the potting compound around the transducer, the transducer itself, and it reflowed solder in the module causing it to short. The electronics module was also found to be internally shorted across the battery connection. (App F pp 5 - 8).

The CVR was powered directly from the essential 115V AC bus and was wired to record from the audio selector panels of the pilot, co-pilot, flight engineer and from the cockpit area microphone. The CVR was not wired for *"**hot mic**" recording but all verbal communications from the abovementioned crew members via oxygen masks, hand held and boom microphones would have been recorded.

***"HOT MIC" recording means that the microphones are connected to a recorder in a manner that ensures the recording of all cockpit sound regardless of audio control panel selections.**

Although the tape was not damaged at all, much of the information which was recorded on the area microphone channel, was unintelligible. Only the last 1 minute and 14 seconds of the 30 minute recording cycle was reasonably clear. However, sufficient data was recovered to determine that the cockpit conversation prior to the sounding of the smoke warning bell had been on general topics only. Joe referred to in the following transcription was the senior flight

engineer. Free translations of Afrikaans phrases are in brackets.

TIME IN MINS. AND SECS. FROM BEGIN= NING OF TAPE	ORIGIN	CONVERSATION/REMARKS
28:31	Fire alarm bell (Stopped almost immediately)	
28:35	Intercom Chime	
28:36	Joe	What's going on now?
28:37	?	Huh?
28:40	Joe	Cargo?
28:42	Joe	It came on now afterwards
28:45		Strong click sound
28:45	?	And where is that?
28:46		Click sound
28:48	Joe (?)	Just to the right
28:49	?	Say again (?)
28:52	Joe	Main deck cargo
28:57	Joe	Then the other one came on as well, I've got two
29:01	Joe	Shall I (get/push) the (bottle/button) over there
29:02	?	Ja (Yes)
29:05	Capt	Lees vir ons die checklist daar hoor (Read the checklist there for us hear) (Double click sound)
29:08	?	Die buik (?) se lig is af (?) (The belly's (?) light is off)
29:09	?	Huh (Two click sounds)
29:11	?	Checklist main deck cargo light
29:12	Capt	Ja (Yes)

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		(Sounds of movement can be heard with clicks and clunks)
29:33	Capt	Fok dis die feit dat altwee aangekom het - dit steur mens (Fuck it is the fact that both came on - it distrubs one)
29:36	Intercom chime (While captain is speaking)	
29:38	?	Aag shit
29:40	!!!	(800 Hz TEST TONE signal commences)
29:41	Capt	Wat de donner gaan nou aan? (What the thunder is going on now?) This is said in a surprised tone of voice.
29:44		Sudden loud sound
29:46		Large and rapid changes in amplitude of test tone starts
29:51		End of test signal, very irregular near end
29:52		End of recording. There is about 1 second of old recording on this side of the tape

The 800 Hz test tone is introduced on all four CVR channels. After about 6 seconds rapid changes in amplitude commence. After another 5 seconds the signal ends.

The tape ran for exactly 29 minutes and 52 seconds after its beginning. It was noted that neither the last HF communication with MRU at 23:13:27 nor the first VHF communication with MRU approach control at 23:48:51 was recorded on the CVR.