CHAPTER 3.2 - DIRECT CAUSES OF THE ACCIDENT

In analysing the direct causes of the accident, the Commission reached the following conclusions:

32.1 - Due to ambiguities in communication between the crew and Control, the crew were late in modifying their approach strategy. They then let themselves be guided by the Controller, relaxing their attention particularly with regard to the way in which they plotted the aircraft's position. Also, they did not adequately anticipate preparation of the aircraft's configuration for landing.

32.2 - In this context, and due to the fact that radar guidance carried out by the Controller did not bring the aircraft to a position which allowed the acting pilot to align the aircraft on the approach track before ANDLO, the crew was faced with a sudden intensive workload to enable them to make the necessary lateral adjustments, prepare the aircraft's configuration and put it into descent.

32.3 - The pivotal event in the sequence leading to the accident was therefore putting the aircraft into descent mode at the correct distance specified by the procedure, but at an abnormally high rate of 3,300 ft/mn instead of approximately 800 ft/mn, and the fact that this abnormal rate was not corrected by the crew.

32.4 - The reason for the occurrence of this unusually high rate of descent could not be established by the Investigation with any degree of certainty. Among all the hypotheses it explored, the Commission retained the following, as they appeared to be the ones which called more particularly for wider consideration and preventive measures:

32.41 - the (quite probable) hypotheses of a misunderstanding involving vertical mode (resulting either from an omission to change the trajectory reference, or from poor execution of the command to change it) or of an error in displaying the consigned value (mechanical digital display of the numeric value given out during the briefing).

32.42 - the (very improbable) hypothesis of a malfunction of the FCU (fault in the push-button used for changing mode or corruption of the consigned value, displayed by the pilot on the FCU before it is captured by the Autopilot computer).

32.5 - In all of these hypotheses retained by the Commission, the accident was made possible by the crew's lack of perception of the resulting discrepancy in the vertical trajectory, as evidenced primarily by a

particularly obvious rate of vertical speed which was four times higher than the reference value, an abnormal pitch-down attitude, and an increase in speed over the flight path.

32.6 - The Commission attributes this lack of perception by the crew to the following factors, which are arranged in no particular order of importance:

32.61 - below average crew interaction, characterised by a distinct lack of mutual checks and monitoring of the results of actions delegated to automatic equipment. This lack manifested itself especially in terms of disregard for a large proportion of the call-outs specified by the Operations Manual and the absence of height/distance checks laid down for the execution of a VOR DME approach;

32.62 - an atmosphere among the crew characterised by minimum levels of communication;

32.63 - the ergonomics of presenting control parameters for the vertical flight path, appropriate for normal situations, but not possessing a warning capability sufficient for a crew in a situation where there is a display error;

32.64 - belated modification of the approach strategy, induced by ambiguities in communication between the crew and Control;

32.65 - slackening of the crew's attention during the radar guidance phase, followed by a sudden intensive workload which led them to pay disproportionate attention to horizontal navigation and the setting of the aircraft's configuration, and to hand over vertical navigation completely to the automatic equipment of the aircraft;

32.66 - the fact that during the alignment phase on to the approach track, the two crew members focussed their attention on horizontal navigation and failed to monitor the vertical flight path being flown in automatic mode;

32.67 - the absence of a GPWS together with an appropriate usage protocol, which deprived the crew of one final warning opportunity concerning the serious irregularity of the situation.

32.68 - in other respects, and notwithstanding the hypothesis of FCU malfunction, the Commission considers that the ergonomic design of Autopilot command sequencing in the vertical plane could have had a part to play in the origin of the accident scenario. In fact, this design appeared to the Commission, particularly in cases involving sudden and

significant workload, to be axiomatic in increasing the probability of certain utilization errors.