(Stamped: Ministry of Transport and Communications – Directorate General of Air Transport)

ACCIDENT OF THE BOEING 757-200 AIRCRAFT

OPERATED BY EMPRESA DE TRANSPORTE AÉREO DEL PERÚ S.A.

AEROPERÚ

PROPERTY OF THE CINTRA COMPANY WITH ITS HEAD OFFICE IN MEXICO CITY
BASE OF OPERATIONS
LIMA, PERU

DATE: 2 OCTOBER 1996

PLACE:

LIMA, PERU

LOCATION:

OFF THE COAST OF LIMA DEPARTMENT

POSITION:

48 DME MILES TO THE NORTH-WEST OF THE LIMA VOR

TIME OF IMPACT

06:11:30 UTC, EQUIVALENT TO 01:11:30 LOCAL TIME

PRODUCED BY THE ACCIDENT INVESTIGATION BOARD

MINISTRY OF TRANSPORT, COMMUNICATIONS, HOUSING AND CONSTRUCTION

DIRECTORATE GENERAL OF AIR TRANSPORT

(Seven sets of initials)

INTRODUCTION

The present report is a technical document which details the events, evidence, analysis, conclusions and recommendations of the ACCIDENT INVESTIGATION BOARD OF THE DIRECTORATE GENERAL OF AIR TRANSPORT, in relation to the circumstances surrounding the accident of the AEROPERÚ BOEING 757-200 with US registration N52AW, which is the subject of this investigation, with its causes and recommendations.

The character of the investigation is exclusively technical. It has not addressed the declaration or limitation of personal or financial rights and responsibilities.

The investigation has been carried out using all the available information. Its sole aim is the prevention of similar accidents.

The results of the investigation do not condition or prejudge those of any punitive action which may be taken in relation to it on the basis of the legal provisions in force.

ACCIDENT INVESTIGATION BOARD

DIRECTORATE GENERAL OF AIR TRANSPORT

(Seven sets of initials)

CONTENTS

(Seven sets of initials)

(Seven sets of initials)

ACCIDENT OF THE AEROPERÚ BOEING 757 AIRCRAFT WITH REGISTRATION N52AW

1.- CREW

Pilot-in-command:	ERIC SCHREIBER
Co-pilot:	DAVID FERNÁNDEZ
Auxiliary crew members:	MARÍA ANGELA CASABO
	CAROLINA LÓPEZ
	GEMA BRUZZONE
	ROXANA MINO
	ANA CONTRERAS
	NANCY FERNÁNDEZ
	SILVIA BARRETO

2.- AVIATION EQUIPMENT

Name of operator:	AEROPERÚ
Manufacturer:	BOEING
Aircraft type:	BOEING 757-200
Serial number:	25489
Registration:	N52AW
Nationality:	USA

3.- LOCATION, DATE AND TIME

Location:	LIMA DEPARTMENT, PERU, OFF CHANCAY
Coordinates:	11° 44' S, 77° 53' W
Date:	2 October 1996
Approximate time:	06:11 Zulu time

(Seven sets of initials)

ACCIDENT INVESTIGATION BOARD

- **CHAIRMAN**
  DIRECTOR GENERAL OF AIR TRANSPORT
  Ricardo La Puente Robles [sgd]

- **MEMBERS**

  DIRECTOR OF AIR TRAFFIC
  Arturo Nuñez Sarda [sgd]

  DIRECTOR OF THE LEGAL ADVISORY SERVICE
  Fabricio Medrano [sgd]

  DGTA INSPECTOR – HEAD OF AERONAUTICAL EQUIPMENT
  Gabriel Delgado [sgd]

  DGTA INSPECTOR
  Guido Fernández Lañas [sgd]

  DGTA INSPECTOR
  Luis Ballinas Granados [sgd]

  DGTA INSPECTOR
  Sergio Altamirano Vidal [sgd]

(Seven sets of initials)

I.- INFORMATION REGARDING THE EVENTS

1.- SUMMARY OF THE FLIGHT

At 05:42 UTC on 2 October 1996 the BOEING 757 AIRCRAFT WITH REGISTRATION N52AW, operated by the airline AEROPERÚ, took off from Jorge Chávez International Airport in Lima, Peru, to perform scheduled flight 603 to Santiago de Chile, with the following crew on board.

Pilot-in-command:	ERIC SCHREIBER LADRÓN DE GUEVARA
Co-pilot:	DAVID FERNÁNDEZ REVOREDO
Auxiliary crew members:	MARÍA ANGELA CASABO
	CAROLINA LÓPEZ
	GEMA BRUZZONE
	ROXANA MINO
	ANA CONTRERAS
	NANCY FERNÁNDEZ
	SILVIA BARRETO

When they took off and reached speed V2 + 10, the crew noticed that the altimeters were not responding and that something irregular was occurring. They therefore decided to notify the control tower in Lima to declare an emergency, consulted Lima for confirmation of their altitude by radar, and requested assistance to return via radar vectors. After 29 minutes of flight, while returning to Lima airport and with the crew attempting to control the aircraft, it impacted with the sea 48 nautical miles from the airport, with the total loss of the aircraft and all of its occupants – 9 crew members and 61 passengers (70 people on board).

(Seven sets of initials)

2- INJURIES TO THE CREW

Pilot-in-command:	ERIC SCHREIBER LADRÓN DE GUEVARA Dead
Co-pilot:	DAVID FERNÁNDEZ REVOREDO Dead
Auxiliary crew members:	MARÍA ANGELA CASABO
	CAROLINA LÓPEZ
	GEMA BRUZZONE
	ROXANA MINO
	ANA CONTRERAS
	NANCY FERNÁNDEZ
	SILVIA BARRETO Dead

3.- **INJURIES TO THE PASSENGERS**: ALL 61 DEAD

The passenger list is in ANNEX I.

4.- **DAMAGE TO THE AIRCRAFT**: Total loss

5.- **INFORMATION REGARDING THE CREW**

A- **PILOT-IN-COMMAND**

A.1) PERSONAL DATA

NAME:	ERIC SCHREIBER LADRÓN DE GUEVARA
NATIONALITY:	PERUVIAN
DATE OF BIRTH:	23.5.38
LICENCE:	Airline Transport No 386
TYPE OF LICENCE:	AIRLINE TRANSPORT
COUNTRY OF ISSUE OF LICENCE:	PERU
MEDICAL CERTIFICATE:	VALID until February 1997
TOTAL FLIGHT HOURS:	21,955.52

A.2) PROFESSIONAL EXPERIENCE

a) In accordance with the air operations file presented by AeroPerú, the pilot-in-command had the following experience:

(Seven sets of initials)

Total flight hours:	**21,955.18**
In the Boeing 757:	1,520.52
Total hours flown in the previous 90 days:	223.38
Total hours flown in the previous 30 days:	70.59
Total hours flown in the previous 7 days:	17.41

b) He had received a proficiency check as a Boeing 757 pilot at the installations of Canadian Airlines in Vancouver on 26 July 1996.

c) In the check he is described as a 757 airline pilot with a total time of 11 hours and 10 minutes on the Lima-Miami-Lima route.

A.3) MEDICAL ASPECTS

a) His medical fitness certificate was valid until February 1997.

b) In accordance with the statements taken on the day of the accident from those who had contact with the pilot-in-command, ERIC SCHREIBER LADRÓN DE GUEVARA, he showed no sign of any particular medical condition impeding or limiting his capacity as a pilot.

A.4) EMOTIONAL ASPECTS

a) In accordance with the statements taken on the day of the accident from those who had contact with the pilot-in-command, ERIC SCHREIBER LADRÓN DE GUEVARA (doctor's report made 48 hours before the flight).

b) During the flight, as is clear from the transcription of the voice recorder, it can be observed that he is confused in his reactions, given the insistent mechanical sound of the alarms, and he falters in his commands. Confusion can be detected when he fails to heed the GPWS alarms, which he interprets as fictitious, paying more attention

(Seven sets of initials)

to the erroneous altimeter indication corroborated by the radar controller. Mental confusion.

B.- CO-PILOT

B.1) PERSONAL DATA

NAME:	DAVID FERNÁNDEZ REVOREDO
NATIONALITY:	PERUVIAN
DATE OF BIRTH:	29.7.54
LICENCE:	COMMERCIAL
TYPE OF LICENCE:	COMMERCIAL PILOT
COUNTRY OF ISSUE OF LICENCE:	PERU
PERUVIAN LICENCE NUMBER:	COM. 860
MEDICAL CERTIFICATE:	VALID UNTIL JANUARY 1997
TOTAL FLIGHT HOURS:	7,954.21

B.2) PROFESSIONAL EXPERIENCE

a) In accordance with the air operations file presented by AeroPerú, the co-pilot had the following experience:

Total flight hours:	7,954.21
In the Boeing 757:	719.44
Total hours flown in the previous 90 days:	194.19
Total hours flown in the previous 30 days:	60.39
Total hours flown in the previous 7 days:	19.42

b) The co-pilot's simulator retraining was valid until July 1997.

B.3) MEDICAL ASPECTS

a) In accordance with his file, his medical fitness certificate was valid until January 1997.

(Seven sets of initials)

b) In accordance with the statements taken on the day of the accident from those who had contact with the co-pilot, DAVID FERNÁNDEZ REVOREDO, he showed no sign of any particular medical condition impeding or limiting his capacity as a co-pilot.

B.4) EMOTIONAL ASPECTS

a) In accordance with the statements taken on the day of the accident from those who had contact with the co-pilot, DAVID FERNÁNDEZ REVOREDO, he showed no sign of any particular psychological condition impeding or limiting his capacity as a co-pilot.

b) In the CVR recording, one can observe his confusion in his assessment of the alarms, to the same degree as the pilot-in-command.

6) STATEMENTS REGARDING THE ACCIDENT

a) CONTROLLERS
b) OPERATIONAL STAFF
c) MAINTENANCE STAFF
d) FAMILY MEMBERS

See Annex J.

7.- AIRWORTHINESS REPORT

7.A.- GENERAL DATA

MAKE:	BOEING
MODEL:	757-200
SERIAL NUMBER:	25489
REGISTRATION:	N52AW
DATE OF MANUFACTURE:	November 1992
CERTIFICATE OF REGISTRATION:	FAA AC Form 8050-34 (4.5.95)
AIRWORTHINESS CERTIFICATE:	FAA Form 8100-2 (4.5.95)

(Seven sets of initials)

DATE OF LAST INSPECTION:	C, C2, May 1996 AEROMÉXICO	
TOTAL FLIGHT HOURS:	10,654:15	hours
TOTAL NUMBER OF LANDINGS:	2,673	cycles
HOURS WITH AEROPERÚ:	8,291:08	hours
CYCLES WITH AEROPERÚ:	1,860	cycles
MONTHLY AVERAGE:	450	hours
AVERAGE MONTHLY CYCLES:	100	cycles

7.B.- ENGINES

MAKE:	PRATT & WHITNEY
MODEL:	2037
SERIAL NUMBER:	No 1 – 726705 No 2 – 716406
No OF HOURS:	No 1 – 10,654 No 2 – 6,447
No OF CYCLES:	No 1 – 2,673 No 2 – 2,250

7.C.- MAINTENANCE

1) On 26 May 1996 this aircraft entered the AEROMÉXICO installations for the following work to be carried out:
   a) C check
   b) C-2 check
   c) Compliance with service bulletins
   d) Special engineering orders

2) The work was carried out from 26 May to 15 June 1996 in the installations of AEROMÉXICO in Mexico City, an FAA-authorised workshop.

8.- <u>PERFORMANCE</u>

The performance tables for Boeing 757 aircraft equipped with PW-2037 engines indicate the following:

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1) To take off from an airport at 35 m ASL with a take-off weight of 83,036 kg, the minimum runway length required is 1,800 m (the runway at Jorge Chávez International Airport is 3,500 m long).

[Translator's note: at this point p. 11 of the original document is missing.]

e.3) Result of field tests:
The jet A-1 fuel samples supplied for analysis on 2 October 1996 complied with the established specifications.

10.- TRANSPORT OF PERSONS AND CARGO

Since this was a scheduled flight, the Boeing 757 aircraft was carrying 61 passengers and 7 auxiliary crew members plus 2 pilots, making a total of 70 people on board.

11.- CALCULATION OF TAKE-OFF WEIGHT

The take-off weight was calculated taking account of all the available information relating to the Boeing 757, as follows:

Empty weight	57,655 kg
Payload	7,581 kg
Fuel	17,800 kg
TOTAL WEIGHT	83,036 kg

12.- CENTRE OF GRAVITY

In accordance with the weight and balance calculation carried out, the centre of gravity was within the established limits.

13.- FLIGHT PLAN AND DETAILED DESCRIPTION OF THE ACCIDENT

(Seven sets of initials)

a) On 1 October 1996, the flight dispatcher of the Boeing 757 aircraft with registration N52AW presented a flight plan comprising the performance of a scheduled flight 603 from Lima to Santiago de Chile.

b) The flight plan requested the standard route in accordance with Jeppessen navigation charts and instrument departure Arpon 1 (authorisation). Lima air traffic control authorised PLI 603 to Santiago as follows: climb and maintain FL 370 from runway 15 with noise abatement; instrument ARPON 1; restriction: maintain initial FL 290 and request higher en route; 5603 for radar test.

c) The control tower at Jorge Chávez Airport coordinated with Lima ATC and obtained the corresponding prior authorisations.

d) In order to perform the flight, the aircraft took off at 05:42 UTC on 2 October 1996 and, when it reached velocity V2 plus 10 kt, according to the transcription of the cockpit voice recorder (CVR) tape containing the internal cockpit communications, the crew stated that there were problems with the altimeter indications. Then, at 05:45, they declared an emergency on tower frequency 118.1 (see attached CVR transcription).

e) At 05:46 the crew of PLI 603 asked to be vectored by radar, following which they were told to change frequency to 119.7 for radar advice and assistance in returning to Jorge Chávez Airport, which has ILS and VOR instrument descents, both with DME indications, in case of adverse weather conditions.

f) Approach control gave the indications corresponding to the vectors needed for an ILS approach to runway 15 at Jorge Chávez.
When the crew made contact at 05:47, they asked to be told their speed, saying that they were having problems with the controls.

g) At 05:49 the crew of PLI 603 stated that they were maintaining heading 205, flying out to sea and maintaining FL 120.

h) At 05:50 approach control suggested heading 350 with a view to the flight's continuing towards the localiser.

(Seven sets of initials)

i) At 05:53 approach control informed the crew that they were on heading 330, parallel to the localiser, and about to pass to the west of the Lima VOR.

j) At 05:54 the crew of PLI 603 requested vectors. Approach control suggested heading 360, giving them alternative instructions for completing the ILS procedure in case of a communications failure.

k) At 05:55 the crew of PLI 603 requested assistance with altitudes and speed until they could be guided to the localiser, because they were having trouble reading their instruments.

l) At 05:57 the crew of PLI 603 informed air traffic control that they had cut the engines and were still accelerating.

m) At 05:59 the crew were frequently informed by the approach controller of their ground speed.

n) At 06:00 the crew of PLI 603 informed air traffic control that their speed remained high and asked to be rescued, requesting the support of another aircraft.

o) At 06:02 AeroPerú Operations asked the pilot of PLI 603 through the controller whether his two computer systems were out of use.

The co-pilot stated that none of his instruments were working (altimeters, airspeed indicators and vertical speed indicators).
He said that he had an overspeed alarm and had cut his engines, but was not slowing down.

p) At 06:03 approach control informed the crew of PLI 603 that an aircraft would be ready in 15 minutes to take off and assist them. The crew of PLI 603 stated that they had a terrain alarm.

q) At 06:04 the crew of PLI 603 continued to inform ATC that they had a terrain alarm and that the computers had gone haywire. The approach controller informed them that on the basis of what he could see on the radar screen, they were at FL 105

(Seven sets of initials)

and were making a turn to the west 40 miles away. The crew asked whether they were flying over the sea, because they had a terrain alarm.

r) At 06:05 the crew of PLI 603 informed ATC that their indicated speed was 370 kt, and asked whether they were slowing down. The controller informed them that their ground speed was 220 kt.

s) At 06:06 the approach controller informed the crew that he could see PLI 603 on his screen 50 NM from Lima on heading 270 at FL 100. The crew requested information regarding the aircraft which was to depart in support of them.

t) At 6.08 the crew of PLI 603 informed ATC that they would try and intercept the ILS in order to land. They asked for an indication of their speed, since they had no airspeed indicator on board.

u) At 06:09 PLI 603 received a suggested heading from approach control. The crew said that this heading appeared satisfactory, that they had no airspeed indicator and that they were flying at an altitude of 9,700 ft. Approach confirmed the altitude, and said that PLI 603 had a ground speed of 240 kt and was 51 NM from Lima.

v) At 06:10 the crew of PLI 603 requested altitude information. Approach control informed them that on the basis of the information on the radar screen they were flying at 9,700 ft, and asked them what the altitude indication on board the aircraft was, and whether or not they had any visual reference with regard to the terrain. The crew replied that they had a "Too low – terrain" indication.

w) At 06:11 approach control called flight 603. The reply was an unintelligible noise (first impact with the water). The controller told the crew to climb if they were receiving a "pull up" indication. An unintelligible sound was heard (last impact with the sea). All communication was lost after this point, as was the radar screen echo.

14.- EMERGENCIES LINKED TO CFIT ACCIDENTS OR INCIDENTS

a) The term "CFIT accident" means the impact of a controlled flight against obstacles, the ground or water without the crew's noticing in time to prevent it.

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b) The US National Transportation Safety Board (NTSB) made its first recommendation requesting an alarm system for the prevention of unintentional collisions with the ground or obstacles following a non-fatal accident involving a DC-9 which crashed into a group of antennas while about to land in Gulfport, Mississippi, in 1971.

c) In view of subsequent similar accidents which were fatal, the FAA made it mandatory for a ground proximity warning system (GPWS) to be installed and used on large, heavy transport aircraft.

d) GPWS is a mechanism which alerts the crew via an audible warning sound when the aircraft is unintentionally approaching the ground.

e) Since GPWS was applied, the incidence of this type of accident has fallen considerably, because crews have followed the indications of the alert alarms (during this flight, the GPWS alarms were ignored).

f) The statistics show that the seven most common errors in CFIT accidents are:

f.1) **COMMUNICATIONS** – incorrect readback, failure to hear or understand properly without requesting repetition, **failure to give correct information**. Example: failure to repeat a frequency change (from 118.1 to 119.7), **provision of incorrect information to aircraft**. **Erroneous information from the controller because of incorrect information received from the aircraft's instruments**.

f.2) **NAVIGATION** – erroneous selection of a navigation frequency in order to arrive at a selected point, e.g. selection of an incorrect radial or heading, mistakes or erroneous interpretation in the reading of navigation charts. Example: use of DME instead of fixed bearings of published radials for intersections.

f.3) **PROCEDURES** – non-compliance with standard call-outs or making of inappropriate and/or inaccurate call-outs; failure to follow check-list indications; failure to carry out briefings; failure to comply with the procedures indicated in check-lists; failure to consult documents containing information

(Seven sets of initials)

critical to operations **(flight with special charts in case of incorrect speed information)**; and, specifically in this example, the crew did not follow the immediate action procedure in response to the "Too low – terrain" alarm.

f.4) **SITUATION AWARENESS** – failure to realise what is happening; causing the aircraft to fly with erroneous parameters. Example: **DESCENT BELOW 2,000 FEET AS MEASURED BY THE RADIO ALTIMETER BEFORE BEING ESTABLISHED ON THE LOCALISER** and failure to note the correct bearing indicated on the ADIs on the lower right-hand side.

f.5) **OPERATION OF SYSTEMS** – inappropriate operation of engines, systems, brakes and fuels; **incorrect reading of instruments or interpretation**; selection of erroneous data in the power system or airspeed indicator; suppression or deactivation of alarms. Example: deactivation of GPWS, **FAILURE TO OBSERVE THE RADIO ALTIMETER INDICATION**.

f.6) **TACTICAL DECISIONS** – wrongly taken decisions; **FAILURE TO PAY ATTENTION TO ALARM WARNINGS SUGGESTING AN ACTION OR REVISION OF SUCH AN ACTION OR IMMEDIATE IMPLEMENTATION OF A PROCEDURE**.

f.7) **STANDARD CALL-OUTS** – **lack of an appropriate indication, causing incorrect action or unreviewed procedures**.

These data were obtained from the Flight Safety Foundation's document on CFIT accidents.

15.- INFORMATION REGARDING AEROPERÚ

This company is legally constituted and for approximately 23 years has been operating with passenger aircraft of varying performance at international level. It has on its staff pilots-in-command, co-pilots and flight engineers with extensive experience.

(Seven sets of initials)

a.- EXPERIENCE OF USING THE BOEING 757 AIRCRAFT

a.1) AeroPerú had been operating with this type of aircraft for two years before the accident.

a.2) Boeing 757 operations were carried out by a fleet of two aircraft with a crew comprising one pilot-in-command and one co-pilot.

16.- INFORMATION REGARDING THE AEROPERÚ MAINTENANCE SERVICE

a.- EXPERIENCE OF AIRCRAFT REPAIR

The company has been carrying out repairs of its aircraft for approximately 23 years. It carries out major and minor repairs of its commercial aircraft, holding an operational licence as an FAA-approved station.

b.- EXPERIENCE OF BOEING 757 AIRCRAFT REPAIR

b.1) This type of aircraft is repaired in the Aeroméxico hangars in Mexico City, where major and minor inspections are carried out.

b.2) Aeroméxico is authorised by Boeing to carry out major and minor maintenance of the structure of Boeing 757 aircraft belonging to commercial airlines.

b.3) Until the accident, there had been no accidents or incidents involving flights of AeroPerú's Boeing 757 aircraft at the various airports at which it operates.

17.- METEOROLOGICAL INFORMATION

a.- According to the Operations Department of Jorge Chávez Airport, the meteorological conditions in the area of the accident were as follows (06:00 UTC):

(Seven sets of initials)

a.1) The sky was covered by cloud at an altitude of 270 m with the tops at approximately 950 m.

a.2) It had not rained all day and the landing runway was dry.

a.3) The ambient temperature at the time of the accident was approximately 15°C.

a.4) The relative humidity was 79%.

a.5) It has been established that at the approximate time of the accident the wind direction at Jorge Chávez Airport was 240° and the wind speed was 6 km/h.

a.6) The horizontal visibility was 6 km.

b.- According to the control tower at Jorge Chávez International Airport, the aircraft was observed to level out abruptly after take-off at an altitude of approximately 100 m.

b.1) This coincided with the moment at which the aircraft reached V2 + 10, the crew's statement in the VCR transcription that the altimeters were stuck, and, at the same time, the wind-shear alarm indication, three consecutive times, which appears in the data recording, providing evidence of the failures in the altimeters and airspeed indicators.

b.2) The controller observed that the aircraft continued in level flight, and lost sight of it at the end of the runway, where it continued its climb and entered the stratus layer.

b.3) It can be ascertained from the VCR transcription that David Fernández Revoredo was flying the aircraft at take-off and simultaneously carrying out the radio communications.

b.4) Approximately three minutes after take-off, the crew of PLI 603 called the tower, informing it that they were having problems with their instruments,

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especially with the altimeters and airspeed indicators, and declaring an emergency.

b.5) The sequence is detailed in the communications with the control tower and departure control (radar), and is supplemented by the communications in the VCR transcription containing the internal communications between the pilots during the almost 30 minutes of flight in their attempts to control the emergency.

18.- NAVIGATION AIDS

a.- Jorge Chávez has 3 (three) instrument approach systems:

a.1) VOR descent RWY 15
a.2) NDB descent RWY 15
a.3) ILS descent RWY 15

b.- On the day of the accident, the radar surveillance system was operational at Jorge Chávez Airport (it was being tested).

c.- The Boeing 757 aircraft with registration N52AW had the following navigation and instrument descent equipment:

1) ILS equipment
2) VOR-DME equipment
3) ADF equipment
4) FMS/CDU
5) IRS
6) AFDS
7) Autopilot
8) Autoland
9) EFIS

(Seven sets of initials)

d.- On the day of the accident, the navigation and instrument descent equipment of the Boeing 757 aircraft N52AW was in operational condition and had no delayed maintenance reports.

e.- The procedures for an instrument descent at Jorge Chávez Airport in all modes were properly installed on the aircraft's computers, and the database had been updated with the most recent valid technical data.

19.- COMMUNICATIONS

a.- Communications between the control tower at Jorge Chávez and the Boeing 757 aircraft were carried out, only for the take-off clearance and until the aircraft's crew declared an emergency, on frequency 118.1. Subsequently, the aircraft was transferred to departure control on 119.7 (departure control, with the support of the radar which was being tested).

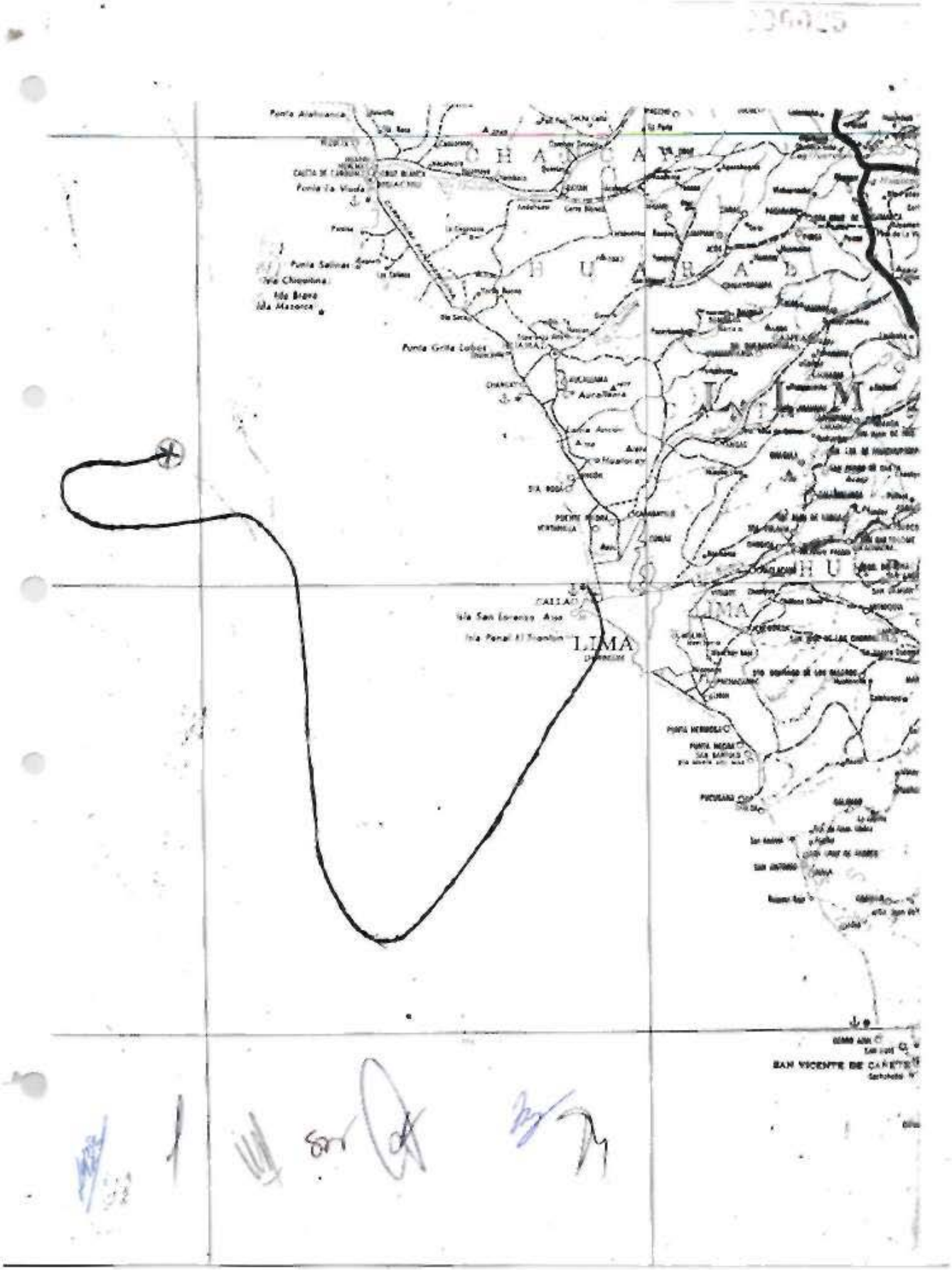
b.- The communications are provided in detail in the communications annex, as is the full transcription of the CVR recording, with precise times and in chronological order.

20.- LOCATION AND TIME OF THE ACCIDENT

a.- 48 NM from the Lima VOR on radial 288°

b.- Geographical coordinates: latitude 11° 49' S,
longitude 77° 51' W

(Seven sets of initials)



(Seven sets of initials)

c.- Time: 06:11:38 UTC

21.- FLIGHT RECORDERS

a.- Boeing 757 aircraft are equipped with a system for recording flight parameter indications, and a voice recorder for radio communications with ground controllers and internal communications between crew members. These two pieces of equipment were located in conjunction with a special team with the cooperation of the US Navy and the National Transportation Safety Board, and were recovered from the sea floor by the robot of the Oceaneering Rescue Team company. They were sent to Washington with part of the investigation team for extraction, cleaning, preparation, reading, digitisation and preliminary interpretation. The two tapes were in very good condition, although the cases containing them were significantly damaged by the impact. The recorders worked adequately on the day of the accident, allowing the parameters of the aircraft before and during the flight, up to the point of final impact, to be assessed.

b.- Through the parameter indication recorder, the following can be established:

b.1) The first indication that there is an anomaly occurs between approximately 200 and 300 ft at a speed of V2 + 10. The pilots state that the altimeters are stuck, and at the same time the wind-shear alarm is heard three times, indicating that there are also speed problems. This confirms the statement of the tower controller, who observed the aircraft almost levelling out and climbing very gradually, a fact which is confirmed by the flight data recorder.

b.2) Having confirmed that they have serious problems with the readings based on interpretation of the altimeters and airspeed indicators, the crew declare an emergency to the tower at 00:44:32. Prior to this, at 00:43:35, they have a wind-shear alarm.

b.3) At 00:45:56 they call departure control on 119.7, but because of the problems which they are having they do not call again until 00:53:40, when they "request vectors from now on".

(Seven sets of initials)

b.4) From 00:43:31 the crew start to receive rudder ratio and mach speed trim warnings, which are repeated throughout the flight, distracting their attention and adding to the problem of multiple alarms and warnings which saturate and bewilder them, creating confusion and chaos which they do not manage to control, neglecting the flight and not paying attention to those alarms which are genuine.

b.5) At 00:54:06, Lima approach control clears them as follows:

> CORRECT, IN CASE OF A LOSS OF
> COMMUNICATIONS, CROSSING RADIAL 315,
> TURN RIGHT TO INTERCEPT THE
> LOCALISER AND COMPLETE THE ILS,
> ALTITUDE TO WHICH YOU CAN DESCEND IS
> 4,000 FT.

b.6) Before the clearance at 00:54:01, Lima asks the crew if they are receiving the VOR, and they reply "affirm".

b.7) At 00:55:07, the AeroPerú crew state that "You're going to have to help us with altitudes and speed if that's possible."

b.8) From this moment until the end, the overspeed and "too low – terrain" alarms start to be activated.

b.9) The stick shaker (indicating low speed or a warning that a stall is imminent) starts again at 00:58:25.

b.10) The overspeed alarm is activated again at 00:59:08 and does not stop sounding until the end.

b.11) The stall alarm is activated again at 00:59:27, 00:59:35, 00:59:41 and 00:59:46.

b.12) At 00:59:37 the co-pilot states "we are flying… loss of…"

(Seven sets of initials)

b.13) The following is an extract from the transcription of the CVR recording of the internal cockpit communications:

0100:19 {20:02}
CAM-2 YES, BECAUSE RIGHT NOW WE'RE STALLING.

0100:21 {20:04}
APR ATTENTION. WE HAVE A 707 WHICH IS GOING TO DEPART FOR PUDAHUEL. IT'S BEING APPROVED.

0100:22 {20 05}
CAM-1 WE'RE NOT STALLING. IT'S FICTITIOUS, IT'S FICTITIOUS.

0100:25 {20:08}
CAM-2 NO, IF WE'VE GOT STICK SHAKER, HOW CAN WE NOT BE STALLING?

0100:27 {20:10}
CAM-1 SHAKER… BUT IT'S… ER… WITH SPEED BRAKE AND EVERYTHING… WE'RE MAINTAINING 9,500 FEET… WHY IS IT GIVING US THE SAME READING?... I DON'T UNDERSTAND… THE POWER, HOW MUCH POWER HAVE WE GOT?

b.14) The "too low – terrain" alarm sounds at 01:02:44 for 45 consecutive seconds, 22 times, with no positive corrective action. The aircraft is climbing very gently.

b.15) At 01:03:31 the wind-shear alarm is activated three times.

b.16) At 01:04:32 the co-pilot says "Let's go up, let's see, let's go up." At 01:04:39 he repeats "Let's go up a bit to see."

The GPWS "sink rate" alarm is activated four consecutive times, as the aircraft loses approximately 700 ft of altitude, recovering and climbing to 4,000 ft as detected by the radio altimeter.

b.17) They reach 4,000 ft 00:26:10 into the flight and maintain this level for one minute. At 00:27:10 they start a measured and continuous descent until they strike the water.

b.18) 00:30:01 into the flight, equivalent to **01:11:20**, the aircraft strikes the sea at a speed of 250 kt, with a left bank of 5° and 1.5 G.

(Seven sets of initials)

b.19) From 01:10:17 the "too low – terrain" alarm is activated, sounding again 22 consecutive times with no reaction from the crew, who believe the altimeter indication of 9,700 ft and take no action in response to a genuine alarm from the GPWS (ground proximity warning system).

b.20) After the first impact the aircraft climbs again and flies for another 17 seconds. The co-pilot's voice is heard saying the words, "We are hitting the water." The pilot-in-command replies "Take her up," and the co-pilot replies "I've got her, I've got her."

b.21) At 01:11:35 the pilot-in-command says his last words, "We're going to turn over."

b.22) At **01:11:38** (06:11:38 UTC) the final impact takes place, with the plane having climbed to an altitude of 300 ft, from where it plummets at a speed greater than 250 kt and strikes the sea with a left bank of 70° approximately at 470 km/h, with a pitch of -5° (i.e. with the nose down) and a magnetic heading of 80°.

c.- The Boeing 757 aircraft with registration N52AW was equipped with a system for the automatic recording of internal and/or external communications, the CVR. The data from these elements, once brought together and correlated with the FDR data, have helped to give us an overview of everything which happened during the flight, in order to make a detailed analysis and thus come to conclusions regarding the probable causes of the accident.

22.- INFORMATION REGARDING DAMAGE TO THE AIRCRAFT

As a consequence of the aviation accident on 2 October 1996, the Boeing 757 aircraft with serial number 25489 and US licence N52AW was totally destroyed when it struck the sea 48 NM from Lima airport to the north-west of its take-off runway, off the town of Chancay.

23.- MEDICAL INFORMATION FOLLOWING THE ACCIDENT

(Seven sets of initials)

The crew and passengers who were on board the aircraft at the time of the accident ceased to exist owing to the violence of the impact.

24.- TESTS AND INVESTIGATIONS

a) Functional test of navigation equipment, alarms and warnings

On 8 October, in conjunction with staff from Boeing, the FAA, the NTSB, the DGTA, AeroPerú and the Investigation Board, an inspection was carried out of the twin of the aircraft involved in the accident, testing all of the alarm, caution and alert systems, and the various messages on the EICAS (engine indicating and crew alerting system) screens. All of the systems worked satisfactorily. The systems and position of the on-board flight recorders were checked. These were behind the passenger cabin, and it was verified that they were in order and operational. The inertial reference systems (IRSs) were verified and the control display units (CDUs) were programmed, with the data from flight 603 being entered. The screens of the EFISs (electronic flight instrument systems) and flight data were verified.

Radar: the operability, sweep and test position were verified.

b) Functional test of the ground proximity warning system

GPWS: the test was carried out and it was verified that the audible alarms and their warning lights were operational. The seven operational modes were tested.

RADIO ALTIMETER: this was observed to be operating correctly and its alarm light was seen to be functioning at the preselected altitude in test mode.

ALTIMETERS: these were cross-compared with the same altimeter setting and also in the QFE (atmospheric pressure at aerodrome elevation) position. It read correctly in accordance with the aircraft's position above sea level.

c) Verification of isogonic variation

(Seven sets of initials)

The charts were checked to determine the magnetic variation and it was found that for 1996 a variation of 2° EAST must be taken into consideration.

d) Investigation of magnetic deviation between instruments

RMI: its bearing was compared with the magnetic compass, and no difference was found in the readings.

PDI: its bearing corresponded with the reading of the RMI, which it is correlated with or slaved to.

MAGNETIC COMPASS: this was compared with the readings of the instruments described above. There was no difference in its readings or in its precision and accuracy (its deviation card was up to date and correctly installed).

25.- RECONSTRUCTION FLIGHT

No reconstruction flight has been planned because duplication of the failures which occurred during the flight would be very risky. The reconstruction will be carried out using a specific flight simulator.

26.- SEQUENCE OF EVENTS

a.- PRELIMINARY ACTIVITIES

a.1) The aircraft was parked in the maintenance installations, where two of the blades of one of the turbines were changed owing to avian ingestion. The hydraulic pump of the right-hand turbine was also changed. The maintenance service handed over the Boeing 757 aircraft with registration N52AW, after finishing the work specified.

Pilot-in-command: ERIC SCHREIBER LADRÓN DE GUEVARA

Co-pilot: DAVID FERNÁNDEZ REVOREDO

(Seven sets of initials)

b.- EVENTS AND ACTION TAKEN AFTER THE ACCIDENT

b.1) After a few minutes, when the Boeing 757 failed to report its situation, radar control called it repeatedly with no response. The Navy, Air Force, Fire Brigade, etc., were all immediately alerted. All of this can be found in the annex setting out the rescue coordination action and all of the staff cooperating in that action.

(Seven sets of initials)

II. ANALYSIS

1.- STAFF

a.- From the facts and evidence obtained with regard to the pilot-in-command, Mr Eric Schreiber, of Peruvian nationality, holder of Air Transport Licence No 386 and FAA Licence No 2324714, the following can be established:

a.1) He was operational, having carried out air operations continuously over the previous 90, 30 and 7 days. AeroPerú had also complied with a cycle of proficiency and airline pilot checks.

a.2) He was familiar with the descent.

a.3) His file and medical certificate were in order, and he had no medical problems on the day of the accident (see medical annex).

a.4) He hesitated in the taking of decisions, owing to the stress which he was under as a result of the psychological pressure of the moment and the excessive number of alarms which, rather than helping, contributed to the confusion and chaos, unleashing the events which the crew were unable to control. In the end, they did not know what to pay attention to, and basically neglected the flight because of their concern with how to disconnect the alarms and, trying to find an adequate solution to the avalanche of problems which was accumulating, they did not pay attention to the recurrent repetitive GPWS alarms, and, because of their inadequate situational awareness, they did not take immediate action in response to the "too low – terrain" alarm.

a.5) In reading the CVR transcription it can be noted that the flight crew are confused and uncertain, and that they do not resolve the situation, which gradually worsens as no plan is used to establish a sequence for the assignation of tasks during the emergency, e.g. I'll fly the aircraft and you review the emergency, inform me of any system activation or change of configuration so that we can agree and take action in a coordinated way (CRM).

(Seven sets of initials)

a.6) In addition to the work overload and the seriousness of the problem, there are moments which show the crew's desperation at the feeling of powerlessness as they are unable to reach an adequate solution to control the aircraft. Over and over again they refer to the rudder ratio and mach speed trim, and they repeatedly read the same check-list, which does no more than give operational advice. They know about the problem but do not identify it in order to really rule out the veracity of the erroneous speed and altitude indications in order to decide on and seek an alternative source of information, which in fact they never lose: the ADIs of both the pilot-in-command and the co-pilot show the ground speed (**GS**), a piece of data which is independent of the air data computers (**ADCs**) and is obtained from the inertial reference system (**IRS**) navigation equipment, and also altitude indications from another independent source, the radio altimeters (**RAs**), which indicate altitude above the ground or obstacles and are coupled to the GPWS (ground proximity warning system). These two systems activate a visual signal on both pilots' instruments, giving them their speed and altitude, which is precisely the essential and principal problem of this flight.

a.7) The radio altimeter is activated on the instrument panel at 2,500 ft, and the ground proximity alarms are activated at 2,450 ft in their seven modes in accordance with the various flight parameters and the aircraft's configuration.

a.8) No clear decision is taken at any point because the problem is not identified, with doubts remaining which cause uncertainties which simultaneously confuse and bewilder the crew, and cause a tunnel vision effect which means that they forget what is basic and essential, i.e. the speed and altitude, and compliance with the GPWS ground proximity alarms (the ground speed is always shown on both pilots' ADIs because the radio altimeter is activated at 2,500 ft).

a.9) The crew are over-saturated with erroneous information, such as the overspeed alarm, which sounds constantly for the last 12 minutes of the flight, and with correct information such as the stick shaker, sink rate alarm and "too low – terrain" alarm, which sound repeatedly and insistently. Confused by the saturation of sounds with different tones and intensities,

(Seven sets of initials)

they pay no attention, thinking that the alarms are fictitious, as stated by Mr Schreiber, the pilot-in-command.

a.10) No paradigm or procedure is followed in the identification of the problem, no adequate solution is proposed, no alternatives are sought in order to choose the best solution, and no action whatsoever is taken to resolve the problem. No new alternatives are sought in view of the fact that the problem does not resolve itself.
Lack of coordination by the crew (CRM).

It can be determined on the basis of the above that ERIC SCHREIBER, the pilot-in-command, had extensive professional experience and the necessary medical conditions, but on this flight in particular he encountered a series of factors which formed the sequence of a chain of actions of various types which unfolded sequentially until the moment of the accident, as follows:

1) He did not realise during the pre-flight inspection that there were lengths of tape covering the static ports, which was the probable cause of the start of the principal problem. He did not find or propose solutions and choose the best one in order to take the corresponding corrective action, or follow the standard operating procedure (SOP), which in this case was a very unusual and exceptional thing, difficult to solve, but there were various resources which were not used because of the saturation of problems and alarms, causing confusion in both pilots and preventing good cockpit coordination to solve the problems. Statements by maintenance staff indicate that the pre-flight inspection was carried out by the pilot-in-command, Eric Schreiber, and not, as is usual, by the co-pilot.

2) Mr Schreiber had doubts about how to react in conditions which required an immediate response to genuine alarms, which he did not obey because of the confusion caused by the overspeed alarms and erroneous altimeter indication.

3) The crew neglected the aircraft's flight and failed to maintain altitude using the radio altimeter, the only reliable element remaining to them in order to be

(Seven sets of initials)

certain of the separation between the aircraft and the terrain (sea). It was the radio altimeter which activated the ground proximity alarms, following which the crew did not follow the procedure or take evasive action in response to the GPWS "too low – terrain" alarm.

4) In the same way, when the stick shaker stall indicator started, the pilot-in-command stated that it was fictitious.

5) All of these errors of interpretation were caused by a lack of credibility, since the speed and altitude problems had not been clearly identified so that the unreliable data could be discarded and the correct information used.

b.- From the facts and evidence obtained with regard to the co-pilot, Mr **DAVID FERNÁNDEZ REVOREDO**, with Commercial Pilot Licence No 860 and FAA Licence No 2474712, of Peruvian nationality, the following can be established:

b.1) As the holder of a valid commercial pilot's licence, No 860, he was qualified to perform any function as a commercial pilot in a Boeing 757 aircraft.

b.2) He had extensive professional experience as an aircraft pilot and was qualified as a co-pilot on the Boeing 757.

b.3) He was operational and had carried out air operations continuously over the previous 90, 30 and 7 days. AeroPerú had also complied with a cycle of proficiency and line checks.

b.4) His file and medical certificate were in order, and he had no medical problems on the day of the accident.

b.5) The VCR transcription shows that Mr David Fernández was in control of the aircraft at take-off and also maintained radio communications, which is not the recommended procedure.

(Seven sets of initials)

b.6) After declaring the emergency, the co-pilot handed over control to the pilot-in-command and made suggestions which were ignored at that moment. The lack of coordination can be observed to be setting in.

b.7) When they consulted the control centre to ascertain their altitude and verify that it was the same as that indicated by the altimeter, they paid more attention to this indication, which was erratic, and not to the radio altimeter, which was the only reliable indication, although they had not yet realised the magnitude of the problem and had not carried out an analysis of the use of the radio altimeter as a solution.

b.8) Subsequently, 23 minutes into the flight, DAVID FERNÁNDEZ warned the pilot of the stall alarm, with the pilot-in-command, Mr SCHREIBER, stating that this was a fictitious indication. Mr Fernández also alerted the pilot-in-command to climb when the ground proximity alarm was activated for the first time. The pilot-in-command obeyed, climbing cautiously to an altitude of 4,000 ft above sea level (indication from the FDR parameters) and continued flying at this altitude for one minute, after which the crew started a continuous descent of 1,482 feet per minute until they struck the surface of the sea.

It can be determined from the above that the co-pilot, DAVID FERNÁNDEZ REVOREDO had extensive professional experience and the necessary medical conditions, but on this flight in particular his performance and cooperation with the pilot-in-command were initially good and deteriorated gradually as a result of the over-saturation of unreliable information which prevented him from cooperating in the operation of the flight, and his performance was affected as he was ignored by the pilot-in-command.

2.- AIRCRAFT

In accordance with the analysis of the documentation regarding the Boeing 757 aircraft with registration N52AW, which was operated at the time of the accident by AeroPerú, the following can be established:

(Seven sets of initials)

It can be determined that on the basis of the maintenance log, timetable and calendar, and the quality control of the work completed during the programme of structural checks, the Boeing 757 aircraft with registration N52AW was in an optimal condition to carry out the flight.

A) INFORMATION REGARDING THE AIRCRAFT

A.1.- GENERAL DATA

MAKE:	BOEING	
MODEL:	757-200	
SERIAL NUMBER:	25489	
REGISTRATION:	N52AW	
DATE OF MANUFACTURE:	November 1992	
CERTIFICATE OF REGISTRATION:	FAA AC Form 8050-34 (4.5.95)	
AIRWORTHINESS CERTIFICATE:	FAA Form 8100-2 (4.5.95)	
DATE OF LAST INSPECTION:	C, C2, May 1996 AEROMÉXICO	
TOTAL FLIGHT HOURS:	10,654:15	hours
TOTAL NUMBER OF LANDINGS:	2,673	
HOURS WITH AEROPERÚ:	8,291:08	hours
CYCLES WITH AEROPERÚ:	1,860	cycles
MONTHLY AVERAGE:	450	hours
AVERAGE MONTHLY CYCLES:	100	cycles

A.2.- ENGINES

MAKE:	PRATT & WHITNEY
MODEL:	2037
SERIAL NUMBER:	No 1 – 726705 No 2 – 716406
No OF HOURS:	No 1 – 10,654 No 2 – 6,447
No OF CYCLES:	No 1 – 2,673 No 2 – 2,250

3.- PERFORMANCE

(Seven sets of initials)

The performance tables for Boeing 757 aircraft equipped with PW-2037 engines state that they can operate safely to perform a scheduled flight from Lima to Santiago de Chile and its alternate airport with enough time in reserve to fly for approximately 5 h 30 m, since this aircraft took off from Lima with 17,800 kg of fuel, more than enough for the three hours' flying required for the planned flight.

[Translator's note: p. 32 is repeated in the original.]

4.- FUEL

It has been determined that the fuel used by the Boeing 757 aircraft with registration N52AW on 2 October 1996 was in optimal condition to be used by aircraft. The quantity of fuel at take-off exceeded what was required for the flight in question.

5.- TRANSPORT OF PERSONS AND CARGO

Since this was a scheduled passenger flight, the Boeing 757 had 70 people on board including the crew, and commercial cargo.

6.- TAKE-OFF WEIGHT

The analysis of the available information shows that the take-off weight of the Boeing 757 aircraft with registration N52AW on 2 October 1996 for scheduled flight PLI 603 was 83,036 kg, which is well below the maximum permitted.

7.- CENTRE OF GRAVITY

In accordance with the weight and balance calculation carried out, the centre of gravity was within the established limits.

8.- FLIGHT PLAN

(Seven sets of initials)

In accordance with the analysis of the available information it is established that on 2 October 1996 AeroPerú's Operations Control Centre presented a flight plan consisting in performance of the scheduled flight between the city of Lima and Santiago de Chile (flight 603).

a) This was a flight controlled by Lima ATC (departure control), and exceptionally that day radar evaluation was taking place, by way of an equipment test.

b) The control tower at Jorge Chávez transferred the flight to departure control on frequency 119.7 after the crew of flight 603 declared an emergency following take-off. Departure control monitored the flight and provided radar vectors at the crew's request.

c) After the emergency was declared, the aircraft flew for approximately 26 minutes and crashed into the sea.

The following can be determined on the basis of the above:

i) The control tower at Jorge Chávez carried out coordination and communication with Lima ATC in accordance with the established rules for a scheduled flight.

ii) Lima departure control on frequency 119.7 worked with the radar surveillance system, which was being tested, and gave all possible technical support in accordance with the requests of the crew of flight 603.

iii) The crew of the Boeing 757 aircraft with registration N52AW did everything possible to remedy the problems which arose, but since this was an exceptional case they had neither the technical nor the psychological preparation to resolve the contingency because this type of emergency is not covered in either the manufacturer's manuals or those of AeroPerú. The procedures of other airlines, however, do cover this situation and have a table for flying under conditions such as these.

9.- CFIT ACCIDENTS

It can be determined on the basis of the above that the accident of the Boeing 757 aircraft with registration N52AW must be considered as falling into the CFIT category, since it took place as the result of an impact with the sea because a ground proximity alarm was ignored and the mandatory procedure for these cases, which is clearly explained in the flight manuals, was not followed.

The following is a point-by-point analysis and correlation with the primary errors of a CFIT accident.

a) Lack of planning: this is related to **COMMUNICATION** errors and problems of understanding within a crew or operational team.

b) There were errors related to **PROCEDURES**, since the crew ignored the preventive alarm warnings which require an immediate action or procedure for their resolution.

c) The crew did not follow the instructions of the procedure which **requires an immediate climb** when a GPWS alarm is heard, and they took no notice of the panel light warning of occurrences.

d) The GPWS warnings were ignored, which was an error of **PROCEDURE** and **SYSTEM OPERATION**.

e) The flight was erratic owing to the following accumulation of primary errors: **SITUATION AWARENESS**, **NAVIGATION**, **STANDARD CALL-OUTS**; **PROCEDURES AND TACTICAL DECISIONS**. This was because the crew were trying to switch off the alarms, make lists and review systems which could not be put right or overridden for the continuation and completion of a safe flight.

In accordance with the analysis of the information regarding CFIT accidents, the following can be established:

a) The term "CFIT accident" means the impact of a controlled flight against obstacles, the ground or water without the crew's noticing in time to prevent it.

b) The Boeing 757 aircraft with registration N52AW had GPWS installed.

(Seven sets of initials)

c) The FAA has made it mandatory to install and use GPWS on large, heavy transport aircraft, which has reduced the incidence of this type of accident.

10.- AEROPERÚ

In accordance with the analysis of the available information, this company has extensive experience of operating different types of passenger aircraft at national and international level. It has a fleet of eight aircraft: two Boeing 757s, three Boeing 727/100s and three Boeing 727/200s; it also has on its staff pilots-in-command, co-pilots and flight engineers with extensive experience.

11.- AEROPERÚ MAINTENANCE SERVICE

This service carries out repairs on the types of aircraft owned by the company. It is authorised to carry out minor repair work and has approved programmes.

12.- METEOROLOGY

In accordance with the analysis of the available meteorological information, it is established that on 2 October 1996 at 06:00 UTC the atmospheric conditions were as follows:

Wind 240° at 6 km/h, visibility 6 km, sky covered with cloud at 270 m, temperature 15°, dew point 13°, altimeter 1015 hPa.

a) To enter the Jorge Chávez traffic, an ILS approach was necessary and the meteorological conditions were not adverse.

b) It can be determined from the above that the meteorological conditions were good when the Boeing 757 aircraft with registration N52AW made its landing approach.

13.- COMMUNICATIONS

(Seven sets of initials)

In accordance with the analysis of the available information regarding communications it can be established that the communications between the control tower at Jorge Chávez and the Boeing 757 aircraft with registration N52AW were carried out with sufficient clarity; no unusual interference was noticed in them.

14.- ACCIDENT LOCATION AND SURROUNDING AREA

In accordance with the analysis of the information regarding the accident location, the following can be established:

The accident took place at sea off the coast of Lima Department, 48 NM from Jorge Chávez Airport on radial 288 of the Lima VOR at 06:11:38 UTC.

15.- FLIGHT RECORDERS

In accordance with the analysis of the information obtained via the flight recorders, the following has been determined:

a.- Via the analysis of the flight profile, the ground track and the performance maintained, it can be determined that on the day of the accident the Boeing 757 aircraft with registration N52AW flew with a trajectory which was initially southerly, with a magnetic heading of 190°, for 50 NM, after which the crew asked to be vectored via radar. Lima vectored them with an initial magnetic heading of 350°, then 330° and lastly 360°. After this they heard the ground proximity warning, turned onto heading 270 and returned to heading 070 when they were cleared for an ILS approach and descent to 4,000 ft. The FDR graphics, showing the route followed from take-off to impact, are in Annex E.

b.- The cockpit voice recorder (CVR) was operational, and a full transcription of the recording is in Annex D.

16.- DAMAGE TO THE AIRCRAFT

(Seven sets of initials)

In accordance with the analysis of the damage suffered by the Boeing 757 aircraft with registration N52AW as a consequence of the accident on 2 October 1996, the following can be established:

a.- The aircraft was totally destroyed at the moment of impact with the sea, and was divided into pieces.

b.- A large part of the aircraft is on the ocean floor and is very difficult to recover owing to the depth of the sea at this location, but a section of the left-hand side of the fuselage was recovered, on which the three static ports can be seen to be covered by adhesive tape (masking tape), which is the principal and most important factor and evidence for the probable cause of the accident (see the annex containing photographs).

17.- MEDICAL INFORMATION FOLLOWING THE ACCIDENT

Report of the forensic medical expert (see Annex E)

18.- TESTS AND INVESTIGATIONS

In accordance with the tests and investigations carried out by the investigating member in conjunction with the pilot member, the following was determined:

a) Functional test of navigation equipment, alarms and warnings.

On 8 October the Board, together with staff from Boeing, the FAA, the NTSB, the DGTA and AeroPerú, carried out an inspection of the twin of the aircraft involved in the accident, testing all of the alarm, caution and alert systems, and the various messages on the EICAS (engine indicating and crew alerting system) screens. All of the systems worked satisfactorily. The systems and position of the on-board flight recorders were checked. These were behind the passenger cabin, and it was verified that they were in order and operational. The inertial reference systems (IRSs) were verified and the control display units (CDUs) were programmed, with

(Seven sets of initials)

the data from the fatal flight being entered. The screens of the EFISs (electronic flight instrument systems) and flight data were verified.

Radar: the operability, sweep and test position were verified.

b) Functional test of the ground proximity warning system

GPWS: this was tested and it was verified that the audible alarms and their warning lights were operational. The seven operational modes were verified.
RADIO ALTIMETER: this was observed to be operating correctly and its alarm light was seen to be functioning at the preselected altitude in test mode.
ALTIMETERS: these were cross-compared with the same altimeter setting and also in the QFE (atmospheric pressure at aerodrome elevation) position. It read correctly in accordance with the aircraft's position above sea level.

c) Verification of isogonic variation

The charts were checked to determine the magnetic variation and it was found that for 1996 a variation of 2° EAST must be taken into consideration.

d) Investigation of magnetic deviation between instruments

RMI: its bearing was compared with the magnetic compass, and no difference was found in the readings.

HSI: its bearing corresponded with the reading of the RMI, which it is correlated with or slaved to.

MAGNETIC COMPASS: this was compared with the readings of the instruments described above. There was no difference in its readings or in its precision and accuracy (its deviation card was up to date and correctly installed).

19.- SEQUENCE OF EVENTS

a.- PRELIMINARY ACTIVITIES

(Seven sets of initials)

In accordance with the analysis carried out using the information obtained from the events and activities before the accident, the following can be established:

a.1) The maintenance service completed the work requested, and the maintenance reports were established, with two blades of the right-hand turbine being changed as they had been damaged by avian ingestion (FOD). The hydraulic pump in the right-hand engine was also repaired, and the aircraft was then ready for the flight to be carried out. In addition, the polishing of the lower front part of the fuselage was scheduled, and it is the normal procedure to cover the static ports with adhesive tape, in this case masking tape, to avoid the static ports' becoming obstructed with the material used for polishing or with any other foreign material.

a.2) When a large part of the fuselage was recovered, it was observed and verified that the static ports were covered with the adhesive tape used when an aircraft is polished, an indication that the tape had not been removed or duly detected by the various checks which are mandatory when work on an aircraft undergoing maintenance is completed and it is subject to a quality control test. It is then handed over to the duty supervisor, who hands it over to the line chief, who then hands it over to the pilot scheduled for the flight. It would appear that this sequence was not properly completed, with the presence of the adhesive tape (masking tape) not being detected.

III.- CONCLUSIONS

1.- <u>RESULTS</u>

a.- The pilot, **ERIC SCHREIBER**, made a series of errors and omissions which generated factors liable to lead to the accident, which caused an emergency situation known as a CFIT, culminating in the accident in the sea off the coast of Lima Department. To all of this must be added the following:

a.1) The staff who carried out the polishing work on the lower part of the aircraft, on the basis of the evidence found, did not remove the protective adhesive

tape when they had finished their work, which meant that the static ports were covered.

a.2) There was a possible failure of the quality control staff in not supervising the end of the work done.

a.3) The principal supervisor was replaced owing to illness by another supervisor who appointed the line mechanic responsible for attending to the aircraft on the apron, who did not carry out the pre-flight visual inspection correctly.

a.4) There was a failure in the crew's pre-flight visual inspection, since they did not detect the presence of the adhesive tape on the static ports.

a.5) There is evidence of tunnel vision and mental confusion on the part of the technical crew.

a.6) There was a lack of specific training to recognise the problem which arose.

a.7) The FSIBs (flight standards information bulletins) issued by the NTSB following the investigations into the Boeing 757 accident in Puerto Plata, Dominican Republic, were not distributed immediately to Boeing 757 and 767 operators.

b.- On this flight in particular, the co-pilot, Mr DAVID FERNÁNDEZ REVOREDO, cooperated adequately with the pilot-in-command until, unable to concentrate in order to recognise the failures and adequate solutions because of the confusion factors based on erroneous information, which were caused by the problems with the static ports and the lack of reliable information, he did not take the most suitable and correct decisions to rectify the situation, which led to certain actions and decisions, because of the following:

b.1.- He was unable to cooperate with the pilot-in-command as would have been most appropriate because of the lack of correct information, in particular information specific to emergencies such as this one, which are not in the manuals or training programmes of most airlines operating this aircraft.

(Seven sets of initials)

b.2.- He was not convincing enough to advise the pilot to follow the evasive procedure when the GPWS alarms were activated, because of the confusion and lack of credibility relating to all the illogical incongruities which were gradually unfolding and increasing, causing him to become fixated on things or elements of little importance which prevented him from taking a balanced approach in order to adequately assist in the operation of the flight and resolution of the emergency.

b.3.- He was unable to give the pilot-in-command the necessary indications because of a lack of knowledge specific to these problems, which arose owing to circumstances created by human error on the ground and incorrect checking, with no one managing to detect the adhesive tape obscuring the static ports.

b.4.- He allowed the pilot to descend without noticing the indications of the radio altimeter, which is activated at 2,500 ft. This was all due to the tunnel vision described above.

c.- On the basis of the maintenance log, timetable and calendar, and the quality control of the work completed during the programme of structural checks, the Boeing 757 aircraft with registration N52AW was in optimal condition to carry out the scheduled flight planned for 2 October 1996.

d.- The performance tables for Boeing 757 aircraft equipped with PW 2037 engines indicate that they can operate safely to perform a scheduled flight from an airport which has a runway with the characteristics of the runway at Jorge Chávez.

e.- The fuel used in the Boeing 757 aircraft with registration N52AW dated 31 May 1996 was in optimal condition to be used by aircraft. In addition, the quantity of fuel at take-off exceeded what was required for the flight in question.

f.- The take-off weight of the Boeing 757 aircraft with registration N52AW on 2 October 1996 for the flight was approximately 83,500 kg, which is within the minimum margins.

(Seven sets of initials)

f.1) The control tower at Jorge Chávez Airport carried out coordination and communication with Lima ATC in accordance with the established rules for a scheduled flight.

f.2) Lima tower carried out coordination and communication with approach control at Jorge Chávez Airport and with the Boeing 757 aircraft with registration N52AW in accordance with the rules established for a scheduled flight.

f.3) The crew of the Boeing 757 aircraft with registration N52AW did not have specific preparation to control the complexity of the problems which arose. Moreover, the manufacturer, Boeing, has not designed specific recommendations, or procedures, or any recommendations at all, up to now.

f.4) The accident of the Boeing 757 aircraft with registration N52AW must be considered in the CFIT category, since it was a controlled flight with GPWS warnings but with no adequate response from the crew owing to mental confusion.

g.- AeroPerú has extensive experience of operating passenger aircraft of varying performance at international level.

h.- AeroPerú's maintenance service has extensive experience of repairing all types of aircraft and is authorised to carry out repair work on various aeroplanes.

i.- The meteorological conditions at Jorge Chávez during the flight of the Boeing 757 aircraft with registration N52AW were acceptable and above the minima.

2.- PREVIOUS ACCIDENT

It can be deduced from the analysis of the flight that the emergency could have been controlled through the use of the performance tables applicable to flying with the static and dynamic ports covered.

(Seven sets of initials)

This table, which is in the aircraft's performance manual, must be put in the quick reference handbook (QRH).

After the accident in Puerto Plata, the NTSB sent to the FAA and to Boeing Flight Standards Information Bulletins (FSIBs) A-96-15 to A-96-20, which were not distributed to Boeing 757 and 767 operators with the necessary urgency. These are class II priority action bulletins.

ISSUE AN AIRWORTHINESS DIRECTIVE TO REQUIRE THAT THE BOEING 757/767 AIRPLANE FLIGHT MANUAL BE REVISED TO NOTIFY PILOTS THAT THE SIMULTANEOUS ACTIVATION OF THE "**MACH/SPD TRIM**" AND "**RUDDER RATIO**" ADVISORIES IS AN INDICATION OF AN AIRSPEED DISCREPANCY. (**A-96-15**)

REQUIRE THAT THE BOEING COMMERCIAL AIRPLANE GROUP MODIFY THE CREW ALERTING SYSTEM OF THE BOEING 757/767 TO INCLUDE A "**CAUTION**" ALERT WHEN AN ERRONEOUS AIRSPEED INDICATION IS DETECTED. (**A-96-16**)

REQUIRE THE BOEING COMMERCIAL AIRPLANE GROUP TO MODIFY ITS BOEING 757/767 OPERATIONS MANUAL TO INCLUDE A DETAILED EMERGENCY PROCEDURE ADDRESSING THE IDENTIFICATION AND ELIMINATION OF AN ERRONEOUS AIRSPEED INDICATION. (**A-96-17**)

ISSUE A FLIGHT STANDARDS INFORMATION BULLETIN TO DIRECT PRINCIPAL OPERATIONS INSPECTORS TO ENSURE THAT THE OPERATING MANUALS OF THE BOEING 757/767 OPERATORS INCLUDE A DETAILED EMERGENCY PROCEDURE ADDRESSING THE IDENTIFICATION AND ELIMINATION OF AN ERRONEOUS AIRSPEED INDICATION. (**A-96-18**)

ISSUE A FLIGHT STANDARDS INFORMATION BULLETIN TO NOTIFY PRINCIPAL OPERATIONS INSPECTORS OF THE CIRCUMSTANCES OF THIS ACCIDENT AND TO HAVE THEM ENSURE THAT TRAINING PROVIDERS EMPHASIZE THE IMPORTANCE OF RECOGNIZING AN AIRSPEED INDICATION MALFUNCTION DURING THE TAKEOFF ROLL. (**A-96-19**)

(Seven sets of initials)

ENSURE THAT ALL BOEING 757/767 TRAINING PROVIDERS INCLUDE AN EFFECTIVE SCENARIO IN THE FLIGHT SIMULATOR DURING WHICH THE STUDENT IS TRAINED TO APPROPRIATELY RESPOND TO THE EFFECTS OF A BLOCKED PITOT TUBE. (**A-96-20**)

3.- PROBABLE CAUSES

In accordance with the facts presented above, the analyses performed and the conclusions set out, this Aviation Accident Investigation Board has determined that the probable causes of the aviation accident which befell the **BOEING 757 AIRCRAFT** with **REGISTRATION N52AW** on 2 October 1996 are as follows:

a.- PROBABLE PRINCIPAL CAUSE

ERROR OF THE MAINTENANCE STAFF INCLUDING THE CREW

It can be deduced from the investigation carried out that the maintenance staff did not remove the protective adhesive tape from the static ports. This tape was not detected during the various phases of the aircraft's release to the line mechanic, its transfer to the passenger boarding apron and, lastly, the inspection by the crew responsible for the flight (the walk-around or pre-flight check), which was carried out by the pilot-in-command, ERIC SCHREIBER, according to the mechanic responsible for the aircraft on the day of the accident.

b.- CONTRIBUTING CAUSES

b.1) PERSONAL ERROR OF THE CREW

The pilot-in-command, **Mr ERIC SCHREIBER LADRÓN DE GUEVARA**, made a personal error by not complying with the procedure for GPWS alarms and not noticing the readings of the radio altimeters in order to discard everything which he believed to be fictitious.

b.2) PERSONAL ERROR INCLUDING THE CREW

(Seven sets of initials)

The co-pilot, **Mr DAVID FERNÁNDEZ REVOREDO**, made a personal error by not being more insistent, assertive and convincing in alerting the pilot-in-command much more emphatically to the ground proximity alarms.

(Seven sets of initials)

IV.- SAFETY RECOMMENDATIONS

For aeronautical activities, operational problems such as this one need to be disseminated so that their study and analysis can serve to establish better procedures, improvements in training programmes and the use of CRM with recommendations resulting from the errors and operational observations. Such problems could cause an incident or accident if the necessary corrections are not made.

1.- **OPERATOR**

a) Familiarise crews with specific emergencies involving erroneous speed indications and design a procedure for flying with erroneous or no altitude indications.

b) Conduct practical sessions in a specific simulator, and also refresher courses including simulated flight with the erroneous speed indication failures, using the specific tables for the procedure in the various flight phases, and follow United Airlines' advanced manoeuvre programme.

c) Design eye-catching covers for protecting the static ports when maintenance and polishing work is done on an aircraft.

d) Make the crew aware that it is mandatory to follow the evasive procedures in response to GPWS terrain alarms and conduct practical sessions in flight simulators.

e) There must be better use and observation of, and reliance on, the radio altimeter.

f) Establish special regulations and procedures for flights experiencing problems with the indications of instruments receiving information from the ADCs, and for the interpretation and appropriate use of alternative means.

g) Comply strictly with the procedure designed by the Flight Safety Directorate for the documentation of an aircraft's release from when it leaves maintenance to its acceptance by the crew assigned to the flight, in order to inculcate safer and more efficient operational discipline.

(Seven sets of initials)

2.- AEROPERÚ MAINTENANCE SERVICE

a) Implement a better quality control system.

b) Carry out better documented pre-flight checks (at present the static ports are not specifically mentioned).

c) Select higher quality technical staff, with continuing training and the creation of incentives for staff to perform more effectively in the interests of operational safety.

d) Monitor the manufacturer's standards and recommendations, and comply strictly with the future recommendations issued as a consequence of this accident.

e) Implement regulations for flights after maintenance in relation to polishing, painting or other similar work.

3.- CORPAC

a) Raise the level of operational technical knowledge in practical terms for controllers, putting them in situations in which they play the role of the pilot, so that they can analyse the type of information which could cause confusion, since the pilot relies on the controller's correct information.

b) Assess controllers with a view to effective selection, rejecting staff with insufficient English and aeronautical culture.

c) Retrain the rejected staff for a second practical operational assessment.

d) Carry out coordination exercises (simulations) with SEI staff. Work with the SEI staff and evaluate the minimum reaction time needed to resolve the emergency. Make resolution and implementation plans for all types of emergency.

(Seven sets of initials)

e) Give controller resource management (CRM) courses so that controllers have better situation awareness and decision-making abilities in emergency cases, training controllers in human factors and problem-solving.

f) Recommend team integration work, and advice and support for the recognition of emergency situations in radio communications, with the use of English and the correct application of phraseology as soon as the emergency is declared.

g) Implement the international airport's terminal and area radar system as a matter of urgency and priority for practical, safe and expeditious air traffic operations.

h) Implement an automatic terminal information service (ATIS) in accordance with the importance of the workstations.

4.- DGTA

a) Create a communication system through the publication of technical bulletins, safety circulars, flyers and specific documents on operational matters, in conjunction with the airlines' representatives on topics related to safe operations and accident prevention programmes.

b) Plan seminars, workshops and conferences relating to operational safety, human factors, accident prevention and specific matters such as operational integration through CRM or similar programmes.

c) Be more demanding and drastic in the penalties against operators with a view to their complying with the established operations and airworthiness procedures.

5.- FAA

a) Immediately release and communicate technical information issued by the NTSB, such as FSIBs (flight standards information bulletins). Such information is not always accepted by the FAA but is very important for the operator as essential information obtained from accident investigations. It must be circulated given the

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importance of the safety elements it involves, which are useful to the operator and manufacturer, without prejudice to the FAA's opinion.

b) Work with manufacturers on the improvement of procedures relating to the interfaces between crews and automated cockpits and the reliability limit to produce a guide on how to investigate the factors contributing to an error involving contradictory alarms.

c) Determine the contributing factors regardless of their origin, whether they result from errors associated with the pilot, mechanic, dispatcher, air traffic controller or any other participant in the operational system.

d) In order to obtain positive results, the conclusions must be communicated immediately to all staff who were a contributing factor, so that appropriate and effective measures can be taken in accordance with the recommendations.

6.- <u>BOEING</u>

a) Give more importance to flight training based on attitude and power in the various operational phases, which are not adequately covered in the training programmes or in the manufacturer's specific manuals.

b) Implement systems which avoid conflicting or contradictory alarms, such as overspeed and stick shaker being activated at the same time.

c) Introduce a "caution" alert when the speed and altitude are not reliable on the EICAS screen.

d) Design a procedure with all the steps and actions to be followed in the event of a total failure of the dynamic and static instruments (to be included in the QRH).

e) Advise airlines for the establishment of specific guides to the problem of static port blockages.

(Seven sets of initials)

7.- DIRECTORATE OF SEARCH AND RESCUE COORDINATION OPERATIONS

From the conversations between the control tower at Jorge Chávez Airport and the Coast Guard's Directorate of Search and Rescue Coordination Operations, a complete lack of coordination can be noted in the emergency procedures.

Once communication was established, there was a delay of approximately 15 minutes in the Coast Guard's reply, before the control tower was eventually told to communicate direct with Air Group No 8.

Following insistent calls from the control tower to Air Group No 8, the response after eight minutes was, "We have no crew for the helicopter or the Antonov. Contact Air Group No 3."

Then came the reply from Air Group No 3, which stated that the duty helicopter crew was not trained in the use of the night vision equipment, and therefore could not take off.

Six hours after receiving the emergency message, Air Group No 8 received a Tucano aircraft from Pisco Air Base in order to start the search.

The remains of the Boeing 757, however, had already been found by a navy aircraft.

As can be appreciated, there was a complete lack of coordination and a delay in the search and rescue.

RECOMMENDATIONS

a) Reorganise the search and rescue system in accordance with the norms and methods recommended in ICAO Annex 12, "Search and Rescue", incorporating it into the COSPAS-SARSAT system.

b) Develop a specific manual for our situation, tailored to the Peruvian geosystem and topography, using as a basis ICAO Doc. 7333-AN/859, "Search and Rescue Manual", and ICAO Circular 185, "Satellite-aided Search and Rescue".

COSPAS: *Cosmicheskaya Sistyema Poiska Avariynich Sudov* (Space system for searching for vessels in distress)

(Seven sets of initials)

SARSAT: Search and Rescue Satellite-aided Tracking

[sgd] **LIMA, DECEMBER 1996**

(Seven sets of initials)