Bureau Enquêtes-Accidents

R E P O R T

on the accident
to the Air France Boeing 747-428 B
registered F-GITA
on September 13 1993
at Tahiti Faaa

F-TA930913

MINISTERE DE L'EQUIPEMENT, DES TRANSPORTS ET DU LOGEMENT
INSPECTION GENERALE DE L'AVIATION CIVILE ET DE LA METEOROLOGIE
FRANCE

FOREWORD

This report presents the technical conclusions reached by the Accident Investigation Office (Bureau Enquêtes-Accidents) on the circumstances and causes of this accident.

In accordance with Annex 13 of the Convention on International Civil Aviation and with directive 94/56, the analysis of the incident and the conclusions and safety recommendations contained in this report are intended neither to apportion blame, nor to assess individual or collective responsibility. The sole objective is to draw lessons from this occurrence which may help to prevent future accidents or incidents.

Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations

SPECIAL FOREWORD TO ENGLISH EDITION

This report has been translated and published by the Bureau Enquêtes-Accidents to make its reading easier for English-speaking people. As accurate as the translation may be, please refer to the original text in French.

GLOSSARY

AP	Auto-pilot
ATH	Auto-throttle
BEA	Bureau Enquêtes-Accidents
CMC	Central Maintenance Computer
CVR	Cockpit Voice Recorder
DAR	Direct Access Recorder
DME	Distance Measuring Equipment
DMU	Data Management Unit
ECU	Engine Control Unit (engine internal computer whose job is to regulate and control the motor)
ED	End of Descent—Low point of the approach profile as defined by the FMS
EICAS	Engine Indicating and Crew Alerting System
FD	Flight Director
FMA	Flight Mode Annunciator
FMC	Flight Management Computer
FMS	Flight Management System
FSO	Flight Safety Officer
GPWS	Ground Proximity Warning System
HMU	Hydromechanical Unit
MAPt	Missed Approach Point
MCP	Mode Control Panel (control panel handling AP/FD automated modes and parameters)
N1	Engine thrust
Nm	Nautical mile
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PFD	Primary Flight Display
PNF	Pilot not Flying
QFU	Magnetic orientation of runway
QNH	Altimeter setting indicating airdrome altitude
RA	Radio Altitude
RFFS	Rescue and Fire Fighting Service
Thrust ref	Thrust reference (flight phase function displayed on the EICAS)
UFDR	Universal Flight Data Recorder
UTA	Union des Transports Aériens (Airline)
UTC	Universal Time Coordinated
VNAV	Vertical Navigation Mode
VOR	Visual Omnidirectional Range (horizontal radio navigation equipment indicating the angular position of the aircraft in relation to a selected radial)
Vref	Reference speed

SYNOPSIS

Date and time
13 December 1999 at 07 h 05 UTC, expressed in local time as 12 September 1993 at 21 h 05 p.m. [1]

Aircraft
Boeing 747-428 B
Registered F-GITA

Site of accident
Tahiti Faa'a International Airport, French Polynesia

Owner
Wingtip Finance Ltd.

Operator
Air France

Type of flight
Scheduled flight AF072

Persons on board
2 Flight crew
14 Cabin crew
256 passengers

Summary

On final approach, the pilot flying countermanded an automatic go-around initiated by the automatic flight system. He continued the approach by overriding the autothrottle. During landing, the outside left engine went into full forward thrust; the aircraft left the runway to the right and came to a halt in the lagoon.

Consequences

	Persons			equipment	cargo	3rd party
	killed	injured	uninjured			
Crew	-	-	16	damaged	intact	N/A
Passengers	-	4	252			

[1] The dates and times in this report are expressed in local Tahiti time, that is to say UTC mins 10 hours.

1 - FACTUAL INFORMATION

1.1 History of the Flight

Boeing B747-400 F-GITA was operating flight AF 072, Paris-Los Angeles-Tahiti. A new flight crew came on board in Los Angeles. On 12 September at 23 h 32 UTC, the aircraft took off from Los Angeles bound for Tahiti. The descent began at 20 h 38 (13 September at 6 h 38 UTC) for a VOR-DME approach to runway 22 at the Faa'a airport in Tahiti.

There was nothing unusual about the early stages of the approach. It was nighttime, and meteorological conditions were favorable. The copilot was at the controls. At about 4,500 feet, the captain read the FMA Speed/VNAV Path instructions.

At 10 Nm from the runway, the landing gear was extended, the flaps raised to 30° and speed maintained by the autothrottle at Vref +5 (149 kt); the autopilot was disconnected.

The flight crew kept track of the descent path by checking height as a function of DME distance and with the assistance of the PAPI.

After the radio altimeter announced 500 feet, the captain read out the FMA Thrust Reference/VNAV Speed instructions. At this moment, power increased on all four engines. The aircraft went slightly above the descent path and speed increased to reach 180 kt at 150 feet.

The copilot indicated that during this phase, the controls were tending to move forward and that he had to hold them back in idle position. He also stated that he was unable to disconnect the auto-throttle.

Touchdown occurred at 21 h 05, at a speed of 168 kt.

Power to engine number 1 (outside left) began to increase two seconds after touchdown, then stabilized at 107% of N1 in forward thrust. Because of the forward thrust on engine no. 1, the spoilers were not extended and the automatic braking system was disarmed.

During taxiing, the flight crew applied reverse thrust on engines 2, 3 and 4, then canceled this action—sensing that thrust was uneven—before applying the thrust reversers to engines 2 and 3 only.

Up to the point at which the aircraft came to a stop, the pilots used the brakes and the nose wheel steering to attempt to decelerate and control the trajectory.

The airplane went off the runway laterally and stopped even with the end of the runway. The tail was even with the turn-around area, the forward section in the water of the lagoon and the landing gear bent back toward the rear of the aircraft. Engines 2, 3 and 4 stopped after taking in water, rocks and coral. Engine 1 kept idling. The flight crew was unable to cut engine 1.

Evacuation took place without panic in shallow water; a few passengers and crew members suffered minor injuries from coral and sea urchins. Firemen extinguished engine 1 by spraying water into the inside of the engine once evacuation was completed.

1.2 Injuries to Persons

injuries	crew	passengers
minor	-	4*
uninjured	16	252

- These are the passengers who went to the hospital; they were all out within 24 hours. Persons having suffered minor cuts from coral and urchins during evacuation were not recorded.

1.3 Damage to Aircraft

The forward section of the aircraft and engines 2 and 3 (inner) sustained significant mechanical damage and were soaked in seawater for a week. Engine 4 (outer) also ingested a quantity of pebbles and coral.

1.4 Other Damage

Faa'a Tahiti airport was closed to international traffic for about 14 hours, then reopened with operational limitations until the aircraft was moved.

1.5 Flight Crew

1.5.1 Captain

Captain: Male, aged 59 years.

Certificates and Licenses

- License: Airline Transport Pilot's License 1186 issued in 1965, valid through 30 November 1993

- Total hours flown: 14,082
- Hours flown on B747: 4,329
- Hours flown on type (B747-400): 1,414 (including 135 h in PEQ 2)
- Hours flown in past six months: 186

- B747-400 (PEQ 2) rating obtained on 8 October 1989 at the Boeing training facility (in Seattle)

- Last line check made on 17 June 1993
- Last base check made on 13 March 1993

This pilot was director of operations for UTA until that airline merged with Air France.

1.5.2 Copilot

Male, aged 46 years.

Certificates and Licenses

- License: Airline Transport Pilot's License 3391 issued in 1989 and valid through 30 November 1993

- Total hours flown: 13,750
- Hours flown on type: 536 (including 171 h in PEQ 2)

- B747-400 rating (task sharing with three crew members) obtained on 23 July 1992 at the Air France training facility (in Vilgénis); PEQ 2 conversion module obtained in May 1993

- Last line check: 13 May 1993
- Last base check: 8 June 1993

This pilot was a captain for Aéromaritime, a UTA subsidiary. He was recruited as a copilot when UTA merged with Air France.

Notes: these two pilots had flown together in the past. During one of their flights together, they had performed a go-around at another airport (for reasons linked to air traffic). They had previously performed the approach to the Tahiti airdrome.

1.6 Aircraft Information

1.6.1 Airframe

Manufacturer: The Boeing Company
Type: B747-428 B
Serial Number: 24969
Registration: F-GITA
Total hours flown: 9901

1.6.2 Engines

Manufacturer: General Electric
Type: CF6-80C2 B1F

The following table presents basic data on the engines:

Position	1	2	3	4
serial number	702443	703112	703114	702442
hours run	9901	9901	9901	9901
number of cycles	1934	1934	1934	1934

1.7 Meteorological Information

At the time of the landing meteorological conditions were as follows:

- Wind: 180°/4kt
- Visibility: greater than 10 km
- Clouds: scattered at 2000 feet, broken at 5000 feet
- Temperature: 26 °C
- Dew point: 23 °C

1.8 Aids to Navigation

The “TAF” VOR-DME and the PAPI used by the flight crew for the approach provided consistent data.

The PAPI is a visual approach angle indicator that provides the pilot with information on his vertical position as relates to a descent corridor containing the nominal descent path. It is made up of a bar of four lights perpendicular to the runway.

Lights can shine red or white depending on the vertical position as relates to the nominal descent path:

- 4 white lights : aircraft too high
- 3 white lights, 1 red light : aircraft slightly too high
- 2 white lights, 2 red lights : aircraft on descent path
- 1 white light, 3 red lights : aircraft slightly too low
- 4 red lights : aircraft too low

The difference between the setting angles for each light is 20 minutes. Thus, the indication three white lights, one red light means that the airplane is located between 10 and 30 minutes above the nominal descent path.

The PAPI located on runway 22 at Faa’a Tahiti is set at 5.2%.

1.9 Radio Communications

The various frequencies used by air traffic control and the airplane during approach and landing were recorded. They have been transcribed for the period including the time of the accident.

The first contact for the approach was made at 20 h 52 min 40 s. The airplane was authorized to land at 21 h 01 min 30 s at which time it was at 9 Nm on the VOR DME TAF (see section 1.10.1) and the wind speed, 4 kt, 180°, was communicated to the airplane.

The airplane landed at 21 h 05.

Next, on the Ground frequency, we hear a number of exchanges between the control tower and fire service vehicles. The firemen indicate that they are going to check on the airplane, then confirm that it has left the runway before the official alarm signal was set off.

Next, there are a number of exchanges pertaining to organization of the rescue response. Firemen are particularly concerned about the engine that is still running and the height of aft doors.

At the same time, on the Regional Control Center frequency, the control tower announces the accident to an ATR that had taken off for Faa'a from Rangiroa half an hour earlier. The pilot asks whether he should turn back. The ATC answered that he should continue his flight.

At 22 h 40, on the Ground frequency, the controller asks an airport police vehicle to close the runway between the crossing road and threshold 22 as well as the road itself, so that the ATR may land. Then other conversations specify that vehicles must not go back towards threshold 22.

At 22 h 46, an Air Tahiti vehicle adds "OK, I'm parking all units beside the runway; we won't move until the ATR has landed, roger."

At 22 h 47 min 48 s, the ATR is authorized to land: "(415) authorized to land, 22, wind is calm, so the runway is closed through to the international expressway."

1.10 Airdrome Information

1.10.1 VOR DME Approach Procedure, Runway 22

The VOR DME approach procedure on runway 22 (see maps in appendix 1) is based on the VOR DME "TAF," frequency 112.9 Mhz, channel 76 x. The ground facility is located at approaches to the runway.

The initial approach for aircraft arriving from Los Angeles is to head for the "TAN" point, which is the basis of the TAN holding pattern. This point is defined as being

30 Nm from TAF on radial 043 (QDM 223°). Arriving aircraft can fly at an altitude as low as 8,900 feet QNH.

The intermediate approach begins at the TAN point.

When aircraft go past this point they decrease altitude to about 5,600 feet QNH and maintain level flight to 18.6 Nm from TAF. The descent to landing is then carried out at a 5% incline.

The final approach begins at 10 Nm from TAF. Aircraft must then pass 3,000 feet QNH. During the final approach, altitude is checked at 6 Nm, then 4 Nm from TAF, at which points aircraft must cross 1,750 feet QNH and 1,150 feet QNH, respectively.

It is worthwhile to note that, considering the position of the ground facility to the right of runway 22, the final trajectory is displaced 2° to the left of the runway center line, crossing this axis at 3.3 Nm from the displaced threshold.

Air France's B 747 minima for this type of approach are 700 feet of vertical visibility and 3,500 meters of forward flight visibility. For a go-around, the aircraft must go up to radial 221° from TAF at about 5,600 feet QNH (safe altitude) to get back to the TFS point located at 21 Nm from TAF, or follow instructions from the control tower.

1.10.2 Infrastructure

The Tahiti Faa'a airdrome is equipped with a runway 3,415 meters long, 45 meters wide and set at 041-221° (see map in appendix 2).

There is a stopway 60 meters long at each end, and threshold 04 is displaced by 115 meters. Each left-hand portion of the thresholds widens out into a turn-around area .

Threshold 04 is right next to the lagoon. A channel, which has points as deep as 30 meters, is located at about 20 meters from the edge.

Day marking and airport lighting on the runway and roadways comply to international standards.

1.11 Flight Recorders

In accordance with applicable regulations, the aircraft was equipped with two protected flight recorders. They were removed immediately after the accident. They were in the aft portion of the aircraft and were intact. The airplane was also equipped with an unprotected recorder used for maintenance, called DAR, kept in the electronics bay. The tape from this recorder was found underwater.

1.11.1 The Flight Data Recorder

The flight data recorder is a Sundstrand Universal Flight Data Recorder (UFDR):
P/N: 980-4100-BXUN
S/N: 83-69

This recorder records 291 parameters on 64 12-bit words.

Examination of data reveals the following occurrences (see graphs in appendix 3):

- The aircraft left flight level 390, cruising altitude, at 20 h 38, about 26 minutes before touchdown.

- The order to lower landing gear was issued at about 4,000 feet (reference 1013 hPa). At this moment, the airplane was aligned with magnetic heading 222.

- The airplane was in landing configuration, flaps 30 and landing gear extended at approximately 2,900 feet (1013 hPa), speed stabilized at about 150 kt.

- At 21 h 04 min 10 s (at a height of 550 feet) the auto-throttle went into “Thrust Ref.” and the four engines’ N1 ratings increased. They went from 68% to 96% in 19 seconds. Between this instant and touchdown, speed varied between 150 and 182 kt. at 116 feet (at 21 h 04 min 39 s).

- As the airplane reached 176 kt at 306 feet above ground level, the engine speed suddenly dropped to 36% two seconds before touchdown.

- Between two and three seconds before touchdown, the N1 rating for engine one started to increase, reaching 107% in seven seconds and maintaining this speed until the recorders were cut off.

- At touchdown, at 21 h 04 min 50 s, the speed was 168 kt.

- Thrust reversers on engines 2, 3 and 4 were actuated soon after touchdown, then retracted at 80 kt. From this instant, the heading gradually increased, going from 223° to 248° at the moment at which the recorders were cut off.

1.11.2 The Cockpit Voice Recorder

The Cockpit Voice Recorder (CVR) is a Loral Fairchild:
P/N: 93-A100-30
S/N: 6713

The transcript of this recording is in appendix 4.

The recording yields the following information:

The descent began at 20 h 38.

- the Approach Checklist was performed at 20 h 49.
- the PF disengages the autopilot at 20 h 58 min 59 s.
- the PNF announces sighting the runway at 21 h 00 min 40 s.
- the Landing Checklist was performed at 21 h 01.
- the airspeed set index marker was positioned at 149 kt (Vref + 5 kt) at 21 h 01 min 22 s.
- The control tower authorized landing at 21 h 01 min 27 s.
- At 21 h 02 min 35 s, 21 h 03 min 49 s and 21 h 04 min 14 s, the PNF announced that the airplane was slightly high on the descent path.
- At 21 h 04 min 14 s, an increase in engine speed was perceptible.
- At 21 h 04 min 17 s, the PNF called out “Thrust reference VNAV Speed.”
- At 21 h 04 min 25 s, the PNF repeated “we’re above the descent path;” the PF acquiesces.
- At 21 h 04 min 28 s, the PNF added “Watch your speed, you’re going too fast now, we’re going way too fast, hey, a hundred eighty nine.”
- The PF answered “I haven’t got (incomprehensible word)” and a reduction in engine speed was perceptible. Then the PF added “What’s happening? Oh yeah, it’s because.”
- At 21 h 04 min 38 s, the PF said “OK, disconnect” without further elaboration. The PNF did not respond.
- Touchdown is audible at 21 h 04 min 50 s simultaneously with an increase in engine speed.
- Then an “Uh oh!” from the PNF.
- At 21 h 04 min 57 s, the PNF asked « What’s going on here? » to which the PF responded « I dunno. »
- At 21 h 04 min 59 s, and 21 h 05 min 11 s, there were several utterances regarding the thrust reversers, ending with “great, one of the reversers isn’t kicking in” from the PF.

The recording ends with a loud noise corresponding to the aircraft leaving the runway.

1.12 Wreckage and Impact Information

1.12.1 Examination of Tire Tracks

The first tire tracks recorded and identified were located 1,700 meters from threshold 22. They were on the right-hand half of the runway, as the main outside left gear is 2.5 meters to the right of the center line.

Tracks from the four main landing gear elements were intermittent for the first 200 meters. Then, they became quite constant, with the main outside left gear leaving a pronounced rubber deposit, and ran parallel to the runway's center line for 600 meters.

Then the path veered steadily to the right; at 2,600 meters from threshold 22, the main outside left landing gear is 4.4 meters from the center line; at 2,800 meters, 8.9 meters. Then the deviation increased markedly, reaching 25.50 meters at 3,100 meters. It is important to note that from the point at which the trajectory began to veer right, the forward landing gear left a heavy rubber deposit.

At 3,150 meters from threshold 22, tracks for all main landing gear were observed in the grass.

Magnetic bearing of the aircraft when it went off the runway was approximately 240°. The airplane swiveled to the right just before coming to a rest.

1.12.2 Examination of Airplane

The airplane came to a rest at a bearing of 300°. The fin, about 65 meters from the runway's center line, hung out over the turn around area at threshold 04. The nose rested in the water of the lagoon, three meters deep, the forward landing gear having buckled after hitting the big rocks along the shore. The main landing gear was soaked in water that varied between thirty and 60 centimeters deep, according to the tide.

Thrust reversers for engines 2, 3 and 4 were actuated. The engine 1 reverser was in the retracted position. Opening the thrust reversers manually showed that their deployment was in no way hindered by mechanical jamming.

Spoilers were retracted.

The flaps were completely extended on both sides. An impact mark was observed on the inside left flap.

Engines 2 and 3 were partially underwater. They sustained significant internal damage (ingestion of rocks) and external damage (fan cowling bent and partially ripped off). A warp in the wing is visible at the level of the engine 3 attachment point (two fitting bolts observed to be broken off). Engine 4 sustained a considerable damage under the fan cowling, causing warping in the direction of

the rotation of several blades. Engine 1 had no visible damage; the fan spun freely.

Two over-pressurization hatches were open on the inside panel of engine strut 1. A black substance was observed in line with the hatches on the lower wing surface (this came from the water sprayed into the engine by the firemen).

The buckling of the nose landing gear bent the electronics bay upward, ripping through the floor in the first class seating area at the multi-purpose unit. The forward portion of the first class cabin had taken in water.

Inspection of transducers (the units that transform the mechanical position of the throttle controls into an electrical signal) was performed visually after removing the First Class ceiling. No anomalies were observed. Mechanical transmission of the throttle controls to the transducers was checked from minimum to maximum thrust as was the thrust reverser shift into “interlock” and “max reverse.”

The electrical circuit between the transducer and the engine 1 ECU was checked. All values recorded are in accordance with those specified by the engine manufacturer.

1.12.3 Examination of Cockpit

The following indications were recorded:

Front panel of cockpit:
- Tiller: normal position on the left side, abnormal on the right (broken control cable observed)
- N/D selector: VOR on the left, MAP on the right (scale 40 Nm)
- F/D: on
- A/T: arm
- IAS: 149 kt
- HDG: 223°
- ALT: 5,600
- Auto brake: disarm
- Selector HDG: normal
- FMC: left
- Landing gear lever: down

Upper left-hand panel:
- EEC: normal
- IRS: off
- Sby power: off
- APU: off
- Battery: off
- Pump hyd: off
- Storm: on

Upper central panel:
- EMER light: armed
- Serv int: off
- Fuel shut-off valve: (extinguisher control) 1 and 3 pulled and turned to A
- 2 and 3 pulled and turned to B
- APU flame arrester: pulled and turned
- Landing lights: on
- Compass: 300°
- Bus ties: off

Upper right-hand panel:
- Pack 1,2,3: norm
- Beacon: off

Central control panel:
- Speed brake: down
- Controls:
    - thrust on idle
    - thrust reversers “not actuated”
    - flaps at 30°
- FUEL CONTROL: cut off

Breakers:
- FLT COMP LEFT servo: tripped
- ILS ANT W right: tripped
- VIB AMP eng 1 et 2: tripped
- IRS DC left, central, right: tripped

Note: the position of levers and buttons in the crew station is to be taken cautiously due to the fact that the crew went through the Passenger Evacuation checklist at night and other people passed through before the inspection carried out by investigators.

It is especially important to note that the *speed brake* lever, found in the DOWN position, had been seen in the ARM position by the field investigator who arrived on the scene immediately after the aircraft left the runway.

1.13 Medical and Pathological Information

On request from the BEA, the Civil Aviation Medical Council provided the information that the captain had an exemption. They added that “nothing in the medical file and no medical observations made on Mister X (the captain) during checkups at the CEMPN were of the sort that they might have an effect on his perception of information from the cockpit or the copilot. »

In addition , during an interview with BEA representatives, the captain informed them that he had hearing problems (these problems are not the subject of the exemption).

1.14 Fire

The RFFS chief said that he saw a fire starting at the main left landing gear while the airplane was taxiing on the runway (this fire was extinguished when the landing gear entered the water).

Moreover, a flight attendant noticed a light, translucent smoke accompanied by a burnt rubber smell coming from the electronics bay just after the airplane came to a stop (the electronics bay was submerged when the airplane's nose went into the lagoon).

1.15 Survival Aspects

As soon as the airplane came to a stop, all six firemen on duty were on the scene of the accident with four vehicles and readied themselves to fight a fire should one break out. Subsequently, two of them, along with the RFFS chief (who was not on duty, and had come from his home) joined the RFFS rescue boat crew and assisted with the sea-based evacuation.

In the airplane, the captain and the chief flight attendant ordered evacuation after making sure that passengers put on their life jackets and checking outside conditions (earth, water, depth of water, and so on) at the bottom of each emergency slide.

Evacuation was essentially through doors 2L, 2R and 4R. About 10 passengers were evacuated through door 1L and four through door 5R. The firemen's rescue boat loaded passengers at the bottom of emergency slide 2R.

Reinforcement firemen also arrived from Faa'a, Punauai and Papeete. These fireman do not have specific training in dealing with aircraft fires. But they do participate in alarm and response drills (as part of the emergency response plan), they are quite familiar with RFFS equipment and the site of the airport and they have been trained to provide backup assistance with their equipment (for example, filling the water tanks of VIM 2B type trucks with their hoses).

During evacuation, the airdrome director asked them to handle protecting passengers from the blast from engine 1 and to accompany them to threshold 04 away from the airplane.

1.16 Tests and Research

1.16.1 Examination of Equipment

The following equipment items were submitted for non-volatile memory readout and/or expert analysis:

- the DAR
- ECUs for all four engines
- the HMU for engine 1
- 2 FMCs
- 2 CMCs
- 1 DMU

Readout of these memories did not turn up any anomalies previous to the accident. The anomalies observed can be explained as consequences of the aircraft's leaving the runway and the enforced shutdown of engine 1 by dowsing it with water.

The data found in these calculators confirms the information obtained by other means.

1.16.2 Information on the VNAV Approach Mode

Under these conditions:

- mode VNAV engaged, standard VOR approach
- autothrottle control active
- at least one autopilot or flight director active

the approach takes place as follows:

- the airplane follows the descent path entered in the FMC (provided there are no altitude restrictions) until it reaches the point defined as the End of Descent (indicated by the abbreviation E/D in green letters on the navigation screen).

  If there is no speed selected on the MCP, the speed held by the ATH is either the speed displayed on the MCP or the speed defined by the FMC.

  Possible FMA displays are:

THR	VNAV	VNAV SPD

THR	LNAV	VNAV PTH

- At the End of Descent, when this point is not confused with the MAPt, the airplane goes into level flight at the altitude that corresponds to this point in the FMC, the ATH still maintaining the previously defined speed.

The FMA display is then:

SPEED	-	VNAV PTH

To continue the approach, before reaching the End of Descent point, the pilot must take one of the following actions:

- Go into manual pilot mode by disconnecting the autothrottle control and, if active, the autopilot.
- Specifically leave VNAV mode (for example, by going into V/S mode).
- Deactivate autopilots and flight director. This action automatically cancels the VNAV mode. As the autothrottle control is active, the airplane goes into SPEED mode.

- At the Missed Approach Point

First case: one autopilot is active:

a- If the altitude displayed on the MCP is greater than the MAPt altitude in the FMC:

* The ATHR displays the maximum power reference (a function of the fictitious temperature displayed on the EICAS and of the airplane's configuration). The FMA display is then:

THR REF		VNAV SPD

with a transitional phase to avoid displaying the power too suddenly.

* The AP displays the nose-up pitch attitude that will make it possible to maintain the assigned speed.

b- If the altitude displayed on the MCP is less than the MAPt altitude in the FMC, the airplane levels off at the FMC MAPt altitude while the speed is maintained by the ATHR at the value previously defined. The FMA display is then:

SPEED		VNAV ALT

Second case: an automatic flight system is active (and the PA is deactivated)

* For the ATHR everything takes place as if the AP were active,
* The flight director indicates the attitude to take to maintain the assigned speed.
If the pilot follows FD instructions, everything takes place as if the autopilot were active.

If the pilot does not follow these instructions, the speed varies according to the pilot's actions on the controls.

If the pilot cuts the flight directors, the FMA sequence is as follows:

THR REF	VNAV	SPD
SPEED		

On the MCP, the THR REF mode is automatically replaced by the SPEED mode.

1.16.3 Behavior of Certain Automatic Systems on Landing

For accident analysis, it is worthwhile noting the behavior on landing of the following systems.

Autothrottle Control

If the autothrottle control is still active during landing, it disconnects automatically 2 seconds after touchdown of the main landing gear.

Autobrake Function

The Autobrake function is armed by positioning the “Autobrake” selector on one of the five available deceleration rates.

The brakes are applied automatically when the ground mode (information taken on the landing gear) and a wheel speed are detected and the engine power control levers are in the idle position.

If at least one of the thrust control levers is beyond the positive idle position after landing, the autobrake function is disarmed and the brakes are not applied automatically.

Spoilers

Spoilers are automatically extended at landing if of the following conditions are met all at once:

- spoiler control lever in the Armed position or thrust control lever 2 or 4 in reverse thrust position
- thrust control levers 1 and 3 in idle position
- ground reference present
- hydraulic pressure for circuit 1 or 4 available

The spoilers are retracted if the thrust control lever 1 or 3 is moved forward (in relation to the positive idle position).

1.16.4 Electrical Power Supply

1.16.4.1 Engines

During the accident engines 2, 3 and 4 shut down after ingesting water and rocks. Engine 1, on the other hand, kept running (this engine was out of the water and did not ingest any foreign bodies).

The crew managed to slow it down to idle speed using the power control lever, but was unable to shut down the engine completely as the controls for the shut-off valves, flame arrester and extinguisher were ineffective.

However :

- All of these controls are electrical.
- Power for the engine 1 thrust control lever (in the cockpit) is supplied directly by the engine via its ECU.
- Power to controls for shut-off valves, the engine flame arrester and the extinguisher is supplied by the airplane's normal electrical energy sources (batteries and alternating current).

As the electrical power supply of the airplane cut out following the impacts and the submersion of the electronics bay underwater, only the throttle hand lever remained effective.

1.16.4.2 Communication Systems

Power to communication systems between the cockpit and the cabin, on the one hand, and internally within the cabin, on the other, is supplied by the airplane's electrical power supply.

Because of this, and in the absence of an autonomous power supply, these systems became inoperable after the airplane ceased functioning. The consequences of this are presented in section 1.17.

1.16.5 Airline Actions Regarding Non-Stabilized Approaches

Within the scope of the inquiry, the Bureau Enquêtes-Accidents analyzed recorded actions taken by the airline concerning the reduction of the number of non-stabilized approaches. This examination concerned the years 1991 to 1993. Actions taken were of a number of different types: some being targeted at all flight crew; others being more specifically aimed at Air Operations managers. A breakdown of these actions follows:

- Actions aimed at flight crew in general.

- Bulletins including the fleet-wide rate of non-stabilized approaches were posted in flight division facilities. These bulletins were updated every six months.

- Publication of a bi-annual flight analysis newsletter. In this newsletter there are, among other things, articles analyzing numerous incidents related to non-stabilized approaches.

- Actions aimed at Air Operations managers

- Issuing of summary reports on the work of the Flight Analysis Commission.

- Establishment of indicators for non-stabilized approaches and GPWS alarm rates and, starting with the first quarter of 1992, publication of the graph showing results for each aircraft type under examination in relation to the airline's overall average to each associated flight division and subdivision.

- Forwarding the Flight Analysis Commission's recommendations, to which divisions concerned were required to respond in writing.

The Commission regularly reiterated the high rate of non-stabilized approaches (notably, in annual summary reports). The Commission analyzed these approaches and made a number of recommendations on the subject.

A few pertinent excerpts from 1991 flight analysis results:

« . . . the family of non-stabilized or rushed approaches is still the most significant, with about the same proportion: 37 % of cases presented in 1991 versus 39 % in 1990.

This trend is confirmed by examination of automatically generated statistics concerning approaches not stabilized at 500 feet:

4.15 % of approaches not stabilized for the year 1990
3.85 % of approaches not stabilized for the year 1991

revealing a slight, insignificant positive trend.

However, if we look at the "seriousness" of these anomalies, we observe a very marked positive trend . . . ».

« ... 1.1 Rushed Approaches

Analysis of the cases examined this year brings us no new information regarding the causes and contributing factors previously identified.
Observations made in previous years are confirmed.
All rushed approaches occurred on visual approach under CAVOK conditions or with good visibility below the cloud cover . . . «
« Survey of causes and contributing factors:

. . .
Ineffective crew coordination (cross-checking).
. . .
Failure to act on non-stabilization call-outs made by PNF.
Lack of crew motivation to stick to stabilization directives.

The latter factors are important and are worth commenting on:

If the new call-out instruction "Approach not stabilized » has begun to be applied by PNF's, PF's do not necessarily act on the call-out (three cases identified)).

When feedback is available (RDC's, Responses to documentation, Interview Procedures), we often observe that the crew recognizes its failure to stick to stabilization directives at 1,000 or 500 feet, but that circumstances surrounding the flight allowed them to continue the approach "safely" without needing to undertake corrective maneuvers. It will certainly be necessary to take action to motivate crews by showing that a non-stabilized approach can only reduce safety margins..."

In the Summary of the Flight Analysis Commission's work in 1992, we find the following items:

« . . .
The group of non-stabilized or rushed approaches is improving, with 30 % of cases versus 37 % in 1991 and 39 % in 1990.

This trend is confirmed by examination of automatically generated statistics concerning approaches not stabilized at 500 feet:

4.15 % of approaches not stabilized for the year 1990
3.85 % of approaches not stabilized for the year 1991
3.38 % of approaches not stabilized for the year 1992
... »

« Rushed approaches
...
Causes and contributing factors:
...
Failure to act on non-stabilization directives.
Confusing objectives and minimum stabilization limits.

The two latter factors must be the subject of vigorous action, as acting in accordance with these directives is the last defense against the "natural" tendency to continue the approach simply because the meteorological conditions are good. Only if motivated through a thorough briefing will a Captain be in a position to make the right decision, rather than putting it off until touchdown.

A non-stabilized approach brought about a go-around at 100 feet.

« Recommendations of the Commission

...
The Commission recommends that Technical Services study the introduction in the briefing on stabilization objectives which would anticipate the bases set by the airline.
... »

In the summary report for 1993 (published after the F-GITA accident), we note the following items:

- in the covering letter:

« . . .
Enclosed, please find the Flight Analysis Case Summary for flights examined or presented to the Flight Analysis Case Commission in 1993 . . . This report is characterized by the ever constant presence of non-stabilized approaches, especially on wide-body aircraft, in spite of a slight improvement in the overall rate and a very marked improvement in results regarding use of the airplane."

- in the report itself:

the elements of analysis previously mentioned in 1991 and 1992

- in the recommendations:

« ...
The Commission recommends that instruction for the two areas of specialization, Pilot and Navigator, emphasize the necessity of making technical call-outs as indicated in the Operating Manual generalities.

The Commission recommends that FSO's take action so that Line Pilots and Navigators be made fully aware of the necessity of quick action when a situation starts to deteriorate.
. . ."

1.16.6 Recent Previous Incident at the same Airline

On 2 July 1993, an Air France Boeing 747-128A left Roissy-Charles de Gaulle bound for Saint Martin where it landed after a flight of 8 hours and fifteen minutes. After stopping for an hour and fifteen minutes, it took off for Santa Domingo, a leg taking an hour and twenty minutes.

The copilot was the pilot flying. During the descent, then the approach, the control tower made three different runway in service announcements: 35, then 17 then 35 again. The crew had the runway in sight at FL 40, and at 10 Nm from the airdrome, they requested and were authorized to make a visual approach.

Dense (cumulonimbus) cloud masses were visible north of the airfield as well as to the south, at about 10 Nm DME along approach path 352 and at the level of the holding pattern. The pilot flying continued the approach, cutting across the 10 Nm DME arc to pass to the north of the cloud mass and flew past the descent path. The airplane was aligned with the runway center line at just one mile from the

threshold, reaching the threshold at a height of over 150 feet and at a speed of 170 kt.

The airplane made its final approach, then, too high and too fast. During the flare, which lasted between six and nine seconds, the airplane descended through a heavy squall which was sweeping over the runway. Touchdown took place at approximately 1,700 meters past threshold 35. The deceleration, using the spoilers and thrust reversers at full power, was effective, but braking action was nil due to hydroplaning. The B 747 remained centered, went past threshold to runway 17 (at 3,350 meters from threshold 35) and came to a stop in the sand with the main landing gear against a concrete pad at the very end of the taxiing extension - 150 to 180 meters long.

Although, during the descent, preparations were in fact made for go-around for runways 17 and 35, at no moment during the visual approach did the crew consider a go-around.

Note: The airline's crews had been informed of the circumstances and causes of this incident prior to the F-GITA accident.

1.16.7 Taxiing Distances on Landing

At the request of the BEA, the airplane manufacturer calculated taxiing distances on landing based on the following conditions:

- magnetic bearing of the runway: 221°
- sea level
- dry runway
- runway slope nil
- wind 180°/4 kt
- outdoor temperature 20 °C
- weight of the airplane: 559,500 pounds
- speed (IAS) at touchdown: 168 kt
- flaps 30
- spoilers armed

Results are given for four different cases, below:

1) Thrust reversed on all four engines; automatic braking system active in selection position 2.
stopping distance = 7,025 feet (2,141 meters)
2) Thrust reversed on all four engines; automatic braking system active in selection position « MAX.
stopping distance = 4,230 feet (1,289 meters)
3) Thrust reversed on two engines; maximum manual braking
stopping distance = 3,413 feet (1,040 meters)
4) Thrust reversed on all four engines; maximum manual braking
stopping distance = 3,221 feet (982 meters).

1.17 Summary of Testimony from Cabin Crew

Investigators met with cabin crew on 15 and 16 September 1993 in Tahiti.

Testimony is consistent for the most part. What differences there may be seem to be the result of a slight confusion in recalling events and their chronology due to a stressful situation and the rapid sequence of events.

The flight and the beginning of the approach proceeded without difficulty.

Some members of cabin crew considered that the airplane was too high on the final approach; others felt roll or yaw oscillation.

The landing was firm (only one member of the cabin crew described it as “heavy.”) During taxiing, there were several sequences of braking and application of engine thrust in the “reverse” position.

The airplane pulled to the right and the last part of the taxiing was very bumpy. Cabin crew deduced from this that the airplane had left the runway, but it did not occur to them that it was partially in the water.

When the aircraft came to a stop, regular lighting went out. Backup lighting took over immediately. However, some cabin crew indicated that the floor lighting might not have been working.

The public address system was no longer working. All cabin crew were hindered by the lack of information and the impossibility of obtaining rapid orders as to how to behave. For this reason, many of them, after passing responsibility for their door to a colleague or passenger, moved around the cabin to get orders from the chief flight attendant or pass on messages from the flight crew. Subsequently, there was a lot of movement in the cabin by the cabin crew in search of information. Then the evacuation was carried out independently at each door without any true coordination or exchange of information.

There was no panic in the cabin, only a few passengers needing to be calmed or reassured at the beginning.

Cabin crew asked passengers to put on their life jackets, which they did calmly with the guidance of the cabin crew, who explained the procedure again (although they had already done so at the beginning of the flight) and helped those passengers who needed assistance.

The chief flight attendant from the upper deck went through the main deck cabin with a megaphone to reassure passengers and to ask them to stay seated and remain calm.

A few minutes after the airplane came to a stop, the captain met the main cabin chief flight attendant at door 2L. Cabin crew had already opened this door after

disarming the emergency slide, to see if the airplane was over land or water and to ascertain outside conditions for evacuation, whereupon they armed the slide, then re-opened the door automatically and deployed the slide.

Subsequently, the captain and the main cabin chief flight attendant went through the cabin, opening doors 1L, 1R, 2R and 4R, and going to the bottom of the slides to check how deep the water was and how best to handle evacuation.

At door 2L, the main cabin chief flight attendant sent a member of the cabin crew to examine the depth of the water and the possibilities for evacuating through this zone. Diving into the shallow water, he scratched his face on the coral, then waded to the shore, noting that the path a few meters in front of engine 1-still running-did not present any difficulty.

Evacuation was then undertaken through this door, with a member of cabin crew providing assistance at the bottom of the slide.

Some military servicemen who had got out quickly offered to help. At first, they guided passengers to the shore, steering them away from engine 1. Then, when the human chain had been organized, they provided assistance at the bottom of the slide, freeing the cabin crew to get back on board the aircraft to help passengers at the door.

The same procedure was used at door 4R: after the door was opened automatically, two members of the cabin crew went to the bottom of the slide, then got into the water, observing that it was waist deep; they then assisted passengers at the bottom of the slide.

At door 2R, while the cabin crew studied outside conditions, a rescue boat with three airport firemen on board arrived. As soon as the rescue boat reached the slide, evacuation through this door began. It was rather slow for two reasons:

- As the slope of the slide was not very steep, passengers slid down it slowly.
- As the rescue boat's boarding platform was about one meter above the slide, cabin crew and firemen had to help many of the passengers to climb on board.

It was decided that doors 1L and 1R would not be used for the evacuation because the slides were not steep enough, the water was apparently deeper and the shore was farther away. Nevertheless, about ten people left the airplane through door 1L.

Door 5L was not used because cabin crew considered that the evacuation would be dangerous because of the extremely steep slope of the slide coming down on rocks and the proximity of engine one, which was still running.

Door 5R was opened automatically, and three to five people, among them a chief flight attendant, went down the slide using the slide's straps. Evacuation through this door was then stopped by the flight attendant because of the very high risk factor (the slide had a slope of more than 45%).

Number 3 doors were not opened in accordance with Air France directives, which specify that door 3 slides must not be used when the landing gear is extended because of interference with door 4 slides.

The passengers seemed to respect the cabin crew's firm instructions and the fact that they remained active at all times while still taking care of the passengers.

After the order to put on the life jackets was given, all passengers were in fact able to find their life jackets, but some were unable to open the plastic bags that held the life jackets, and others were unable to put them on.

Because it was impossible to use the public address system, megaphones were the only remaining means for middle-distance communication. Cabin crew observed, however, that they were insufficient and even that the number of megaphones (four) was insufficient.

One of the megaphones was broken when the flight attendant who was carrying it fell (without injury, incidentally).

After evacuation of the passengers, the cabin crew who were outside the airplane climbed back inside, and all crew members searched the airplane to be sure no one was left on board.

Because of on-board technical communication problems, the absence of a state of emergency (fire, mounting water, etc.) and the time taken to study the outside situation, evacuation of the first passengers began approximately 10 minutes after the airplane came to a stop. The evacuation itself was carried out in five minutes.

2 - ANALYSIS

The sequence of events which led to the accident was started by the automatic go-around initiated on passing the « End of Descent » point by the B 747-400 automatic flight system.

2.1 Configuration of Automatic Flight systems

The final approach was carried out with the following configuration:

- autopilot off
- flight director(s) active
- autothrottle control active,
- mode VNAV active, standard VOR DME approach

Two points require comments:

- The autothrottle control is active, receiving commands from the automatic flight system. It manages engine power, except when the pilot overrides it.

- At least one of the flight directors is active, giving the pilot the flying instructions required to follow the path projected by the automatic flight systems.

  The automatic flight system gives attitude instructions to the flight director and power directives to the autothrottle as long as speed and climb rates have not been reached.

2.2 The Philosophy and Functioning of the VNAV Mode on VOR DME from the End of Descent Point through to Landing

Using the vertical navigation mode on a standard VOR approach, it is possible to follow the approach procedure either automatically— with the autopilot—or manually—with the pilot following the instructions of the flight director.

The instrument approach path is defined (and drawn on the charts) up to the point that corresponds to the decision height. From this point, the go-around path takes over. The segment between this point (decision height) and the runway is not defined (or drawn), as it is done visually.

The End of Descent point, and the MAPt, correspond to the decision height; at this point, either the pilot has enough visual reference points to continue the approach or he makes a go-around.

It is part of the design of the automatic flight system that if the End of Descent point is reached with the system still active, the automatic flight system concludes

that the visual approach has not occurred and, therefore, the missed approach procedure must be applied. The characteristics of the VNAV (VOR) mode are then the computer-based equivalent of the FIR approach procedure.

When the automatic flight system initiates an automatic go-around, the autothrottle commands increased engine thrust to obtain the reference thrust displayed by the EICAS while the flight director gives nose up instructions to maintain the speed displayed on the MCP (or the calculated safe speed).

If the pilot does not follow the instructions of the FD because his objectives are not the same as those of the automatic flight system, his actions on the elevator are inconsistent with the commands of the autothrottle controlling thrust.

In addition, the airplane's logic does not provide for handing over complete authority to the pilot (by disconnecting the autothrottle automatically) and only warns him of this persistent inconsistency through the abnormal effort required on the throttle controls.

In the case of this accident, the pilot did not follow the flight director's instructions. As he used manual controls to reestablish a path with a descent rate of 500 feet per minute and pulled the controls back towards the idle position and held them there, the increased thrust command was maintained, as the reference thrust had not been reached and the autothrottle was not deactivated.

The pilot overrode the autothrottle without difficulty during the approach, the force to override being relatively manageable at a few daN. We will turn to the operational aspects of this override elsewhere.

Two to three seconds before the main landing gear touched, perhaps when he positioned his hand to shift into reverse thrust, control lever no. 1 slipped from his grip and, controlled by the autothrottle, moved forward and increased engine power.

The autothrottle deactivated automatically two seconds after touchdown of the main landing gear, as it is designed to do. Engine 1's then reached 107 % of N_1, this speed being maintained until the airplane came to a stop, as the control handle was not brought back to the idle position during taxiing.

What is more, as this engine was above idle when the airplane touched down, the spoilers, although armed, did not extend, and the automatic braking system, also armed, deactivated. In effect, the logic of the system interprets the position above idle speed as signifying an intention to perform a go-around.

2.3 The Crew's Perception of the Event

The crew was made aware of the automatic go-around in several ways:

- the FMA displays (noticed and called out by the captain)
- the increase in engine thrust and the effort required to hold the controls in the idle position
- the indications of the flight director

Yet neither of the pilots was fully aware of the situation. Several reasons can be cited to explain this situation:

a) The pilots were not aware of this feature of the VNAV mode.

It is worthwhile noting the following points:

- Boeing and Air France pilots qualified on the B 747-400 who participated in the technical investigation were not aware of this feature either. It was necessary to call on the expertise of specialists in the Boeing design office to obtain this information.
- Boeing's documentation did not mention this feature (some information has since been added), nor did Air France or UTA's.
- The captain indicated that when he went through qualification training on the B747-400 at Boeing, instructors told him that the VNAV mode operating in VOR mode still had some glitches to be ironed out. He had since received no additional training on the subject. We can thus see that the particular point in question was neither studied, nor introduced, in the course of other exercises.
- Air France instructors were not aware of this feature of the airplane and were therefore unable to include it in their training of the copilot or in periodic training of pilots.

Note: according to some indirect testimony, several Air France pilots had previously encountered this problem and handled it by disengaging the AP and the autothrottle. But they had not understood the origin of the problem and had not reported it, and so it had not been identified.

b) The crew did not analyze the change in the FMA display:

- The captain (PNF) made the call-out (notably, Thrust Reference). He called out it as prescribed by the instructions, but in a mechanical fashion, without analyzing the content of the message (as indicated in his testimony).
- The copilot did not confirm.

The captain was even less likely to understand the meaning of the Thrust Reference display, as he was unaware that the throttle controls were pushing forward and that the copilot had to hold them back to keep them in the idle position (we shall develop this point further in section 2.5 regarding crew communication).

c) The crew, having moved into visual flight some time before and having the runway and the PAPI in sight, were not looking at the flight director; their attention being focused on maintaining the visual descent path by monitoring the instruments and the automatic flight controls (we shall develop this point further in our analysis of task sharing).

The B747 Flight Crew Training Manual recommends going into manual operation below decision height; which involves disconnecting the autopilot and the autothrottle.

Note: Analysis of indications given by the instruments would undoubtedly not have provided the crew with sufficient information for total understanding of the situation (considering the time factor and information available), but they would have seen that the equipment was not performing according to their expectations. They could have then decided either to perform a go-around or to continue manual flight after deactivating all automatic controls.

2.4 Operational Aspects

2.4.1 Flight Prior to Approach

This flight is the second leg of the Paris-Papeete trip, after a rest period of 67 hours in Los Angeles. Lasting nine hours, the flight proceeded without difficulty.

The pilots had made the approach to Papeete, which presents no particular difficulties, many times before.

There was no other air traffic on arrival; the crew was authorized to land very early on; meteorological conditions were good; the runway was visible from more than 20 Nm, and the wind was calm. The airplane locked into the approach path with good parameters.

In this context, where everything seems trouble-free, conditions were ripe for decreased vigilance, perhaps accentuated by a certain level of fatigue.

2.4.2 Preparation for Approach and Landing

The following may explain the various points raised when analyzing the crew's conversations:

- There were various imperfections or omissions in the call-outs and checklists. For example, the speed reduction call-out (at 20 h 56) was not made at the moment when the value changed on the MCP, and no check was made to confirm that the system had accounted for the change.
- When the FMS problem occurred—loss of VOR feedback, a problem known to the airline and the subject of a bulletin distributed to pilots—the copilot mixed up his explanation. This incident poses the problem of transmitting and

assimilating information in such a way that it can be applied in real time at the opportune moment.
- The go-around was not mentioned in the arrival briefing.

What is more, as authorization to land had been granted by the control tower very early on and the runway was visible, the crew never really considered the possibility of a go-around. This point is important: the possibility of a go-around should always be present in the minds of the crew right up to landing, since one out-of-tolerance flight parameter must lead to a go-around. In practice, the criteria for these parameters are met in nearly all flights, the only parameter which is sometimes critical being minimum visual references in cases of a low cloud ceiling or reduced visibility. Thus, in practice, when pilots have the runway in sight, they generally consider, perhaps unconsciously, that there are no further obstacles to landing and do not really consider a go-around as an option.

We may note that this argument, along with others, was in fact presented by the captain to explain his decision to continue with the landing.

2.4.3 Approach Prior to the End of Descent Point

The approach was made calmly; the atmosphere in the cockpit was apparently relaxed.

Note that the moment at which the decision height point was passed was not called out, in all likelihood because the crew had already changed to a visual approach earlier.

We shall develop these points further in section 2.4.5, which deals with task sharing.

2.4.4 Approach subsequent to « End of Descent » Point

At 21 h 04 min 11 s, the moment at which the aircraft passed the End of Descent point, the automatic go-around was activated, as explained in section 2.2.

From this moment, the sequence of events accelerated:

- At 21 h 04 min 17 s the PNF called out the change of mode.

- Meanwhile, due to the increased thrust, the speed increased and the airplane went above the descent path.

- At 21 h 04 min 28 s the captain noticed and called out the excessive speed, without ordering the go-around required by the magnitude of the excess speed (Vref + 30 kt) at this height (300 feet) (see section 2.6).
- At about 21 h 04 min 29 s the PF reacted by pulling back the control handles towards the “idle” position, but did not announce this.

- From this moment, in all probability, both pilots were looking outside, their attention taken up by the path of the aircraft. No one was monitoring the instruments any longer. This is probably why:

- At about 21 h 04 min 47 s throttle control 1 slipped from the hands of the pilot flying and engine 1 went into full forward thrust, undetected either by the PF or by the PNF.

This occurred when engine speed had reached idle speed during flare. In all probability, this is when the PF let go of the control handles to grasp the reverser controls, getting ready to go into reverse thrust immediately upon touchdown. He was most certainly conscious of the high speed and the necessity to apply the brakes and the reverse power as early as possible.

- After touchdown at 21 h 04 min 49 s the PNF neither noticed nor called out the non-actuation of thrust reverser 1, the non-extension of the spoilers nor the disarming of the autobrake.

- During taxiing, the PF quickly noticed the uneven thrust and the anomalous braking. He did not express this clearly and, apparently, did not really understand what was happening. In addition, the PNF was probably not looking at the engine parameters; in any case, he did not announce them, depriving the PF of information of fundamental importance.

It is also possible that the captain did not hear his copilots' remarks clearly - which could be attributed to the hearing problems that he mentioned.

The fact that the PNF was looking outside during landing and did not perform the instrument checks nor the required call-outs meant that anomalies were neither detected nor corrected, and braking time was lost.

The approach and landing sequence leads us to a detailed examination of task sharing and communication between the pilots.

2.4.5 Task Sharing

Crew selection is characterized by a significant difference in experience and hierarchical background.

This certainly played a role in the fact that the captain, the pilot not flying, got more and more involved in managing the descent path, to the point where he no longer paid attention to anything but this path, once he had noticed that the aircraft had gone above it. From this moment on, it is practically certain that he only looked outside of the aircraft, so as to make sure it returned to its correct descent path.

The consequence of this is that the planned task sharing was no longer observed and both men focused on one aspect of the situation. Thus, they completely forgot to perform the instrument checks (engine parameters, thrust reverser actuation,

spoilers extension, etc.) which would have helped them to understand the problem they faced and to take the necessary corrective action (one of the following):

- initiating a go-around before landing, or
- reducing power to engine 1 and extending the spoilers manually after landing

2.4.6 Communication between the Pilots

The CVR reveals clear inadequacies in communication between the pilots. This contributed to a failure to stick to procedures during the approach, then to the unsatisfactory management of the problem:

- Errors in the checklists were not corrected.

- The absence of preparation for a go-around during the briefing was not noticed.

- At 20 h 45 min 42 s the PF indicated that he had « checked the map a while ago" He had not announced it. This is all the more important, as there was a difference of 1.8 Nm with the DME, which is a significant amount just before starting the approach.

- At 21 h 00 min 09 s the PF requested « cursor flaps twenty, please. » The response of the PNF « OK, done, flaps 20, green » shows that he misunderstood the request. Hence the correction "yeah . . . cursor, reduce speed for me a hundred and sixty."

- AT 21 h 04 min 17 s, when the PNF called out « Thrust reference VNAV Speed », the PF should have acknowledged and commented on this call-out. He did not. Here, they missed an opportunity to understand what was happening.

- The PF did not indicate that the throttle controls were tending to move forward, although this is information that is of fundamental importance. All he said was "I dunno what's happening . . . oh yeah, because," which, in reality, amounts to a meaningless message. What is more, this message failed to elicit a response from the captain, if indeed he heard it.

- Similarly, the message « OK . . . disconnect . . . » is not explicit. He should have said specifically that it was the autothrottle control that needed to be disconnected (there are numerous such utterances on the CVR in which the copilot does not finish his sentences). Here again, the captain did not respond to the request.

- Following touchdown, the PNF did not make the required call-outs, and the PF did not comment on this matter.

It was 21 h 05 min 11 s when the copilot said “That’s it, one of the reversers hasn’t actuated,” about 20 seconds after the moment when the problem should have been detected.

What is more, the captain did not seem to have heard the latter message, nor the three preceding "Apply reverse thrust again." We cannot exclude the possibility that the captain’s hearing problems contributed to his lack of response to these requests.

Some of the communication problems described above may have been amplified by:

- the captain’s desire not to interfere with the actions and decisions of the copilot, who was at the controls

- a hesitancy that the copilot may have felt in making observations to his captain, vastly more qualified and experienced than he (contrast between hierarchical relations and functional relations)

2.4.7 Failure to Initiate a Go-around

2.4.7.1 Previous Events at the Airline

In section 1.16.4, we saw that prior to the accident, the airline had launched a campaign to heighten crew awareness of the dangers inherent in non-stabilized approaches. This effort was redoubled following the various incidents of this type observed in 1993.

The incident that had the most serious consequences (described in section 1.16.6) occurred less than three months before the F-GITA accident. This incident—which provided particular educational value because of the cut and dried nature of the causes and the potential seriousness of the consequences—had been the subject of a bulletin issued to all pilots in the company.

2.4.7.2 The Continued Approach Following the Automatic Go-Around

Following the automatic go-around that occurred at about 700 feet, the airplane continued its descent, the speed increasing. The airplane then left the approach window (passing above the descent path at excessive speed). It is worthwhile noting that the airline’s flight analysis service starts a specific flight analysis procedure when during the approach (configuration flaps 25° or 30°) one of the parameters diverges from the following values:

$$V_{ref}-5\ kt < V < V_{ref}+30\ kt$$

glide deviation < 1.3 points (for a precision approach)

At 7 h 04 min 25 s the captain declared in an emphatic tone of voice “we’re above the descent path” (altitude 350 feet), then at 2,000 feet “Watch your speed, you’re

going too fast here ! We're going much too fast, eh! A hundred eighty nine knots." (that is, Vref + 35 kt). The call-out was not a standard one, but the tone of voice certainly lent impact to the message. Thus, it is clear that both crew members were aware of the situation.

The magnitude of the difference between the actual speed of the airplane and the reference speed, combined with the low altitude, should have brought about an immediate decision to initiate a go-around, in compliance with airline directives.
The captain explained that he did not make such a decision because of the following favorable factors:

- good meteorological conditions (visibility, low wind)
- dry runway
- long runway

Note: these first two factors are indeed favorable for a short landing distance.

Published landing distances are calculated with substantial safety margins, and the measurements during flight testing are made without using thrust reversers. On the other hand, landing tests used as the basis of calculations are carried out under optimal conditions: test crews perfectly trained to perform this maneuver, flawless airplane, optimum speed and descent rate, spoilers out and autobraking applied immediately at touchdown. Margins are therefore safety factors meant to cover the variations inherent to operations or incidents.

The captain also indicated that in the course of a number of his training or line flights, landings carried out after fast or poorly stabilized approaches had gone well with reasonable landing distances. As he was not aware of any systems malfunctioning or operating below full performance (such as braking or a deactivated thrust reverser), he thought that he could continue the approach.

In effect, in the case of this accident, in spite of the excessive speed and the touchdown at approximately 900 meters beyond the threshold, the length of runway remaining was sufficient to stop the airplane with the spoilers extended (automatically or manually), the autobrakes applied and the engines in reverse thrust.

However, by failing to observe operational limitations, the crew removed safety margins at a phase of flight when they had no time to analyze failures and little time to make corrections. Thus, they did not have time to deal with the consequences of the forward thrust on engine 1.

2.5 Evacuation and Rescue Operations

2.5.1 The Phase Preceding Passenger Exit

During landing, the cabin crew understood that the airplane had left the runway. Once the airplane had come to the stop, considering the attitude of the airplane, they were certain that an evacuation would be necessary.

Based in Tahiti, they were all perfectly familiar with the Faa'a landing field. They thought they might be in the water, but could not confirm this in the dark of night. This led to procrastination, all the more so because they had no contact among themselves nor with the cockpit due to the loss of the intercom system.

Contact between the pilots (on the upper deck) and the chief flight attendant (on the lower deck) was handled by a member of the cabin crew who shuttled back and forth repeatedly. Contact among the cabin crew themselves, to report and receive instructions, also required a lot of back-and-forth footwork.

This situation was a potential safety hazard for several reasons:

a- Lost time spent on communications delayed analysis of the situation and the decision to evacuate. It is worthwhile recalling that the fire chief had seen flames coming from the main landing gear while the airplane was taxiing and that a member of the cabin crew had seen smoke coming out of the electronics bay and smelled a burnt rubber just before the airplane came to a halt. If these probable fires had not been dowsed when the airplane entered the water, a fire might have developed. In such a case, speed and coherence in evacuating passengers and crew would have been essential.

b- The impossibility of dialogue without moving around the aircraft was a hindrance to the decision making process, the transmittal of instructions and the coordination of crew members.

c- The fact that some of the cabin crew had to leave their stations to report and receive instructions could have led to reactions of panic on the part of some passengers. What is more, they left a door unattended, which could have developed into a dangerous situation had a passenger opened the door in an untimely manner—especially if it had been one of the aft doors.

2.5.2 Door Opening

Checking outside conditions at each door before beginning the evacuation is useful and included in emergency directives. However, disarming the emergency slides before opening the door to make the check is not in line with these directives and could be dangerous.

In effect, when the door is opened manually, the emergency slide is not deployed when the door opens. If outside conditions turn out to be favorable to an evacuation through this door, the member of the cabin crew must then close the door again and rearm the emergency slide before opening the door once again, this time in automatic operation, then wait for the emergency slide to deploy. The evacuation is delayed by the amount of time it takes to go through this sequence of operations (if there are no particular problems, this takes about a minute), and the certification objective of evacuating the airplane in 90 seconds (using half of the available emergency exits) then becomes completely unrealistic. In addition, an accident can bring about structural deformations that prevent closing the door or rearming the emergency slide.

Note: The emergency directives in force, if applied, would have addressed the concerns of cabin personnel without the disadvantages mentioned above. The door should be opened in automatic operation mode. After examining the outside situation, if conditions prove to be unfavorable cabin personnel jettison the (inflated) emergency slide before closing the door again (additionally now free from the weight of the slide). On the other hand, if conditions are favorable, the slide is ready for use and evacuation can begin immediately through this door.

2.5.3 Evacuation

The first passengers exited approximately 10 minutes after the airplane came to a stop. This is a very long time. The positive aspect is that this gave the cabin crew time to carry out the evacuation under the least dangerous conditions possible, in the crew's judgment. Still, it is remarkable that there was no panic on the part of any passengers during this period. In addition, this delay could have been catastrophic had there been a fire or another potentially dangerous situation evolving (if the aircraft had been sinking into the lagoon, for example).

We may also note that the internal batteries for emergency backup lighting have a functional autonomy of fifteen minutes. Had there been an additional slight delay, the passengers could have found themselves in total darkness, which would have slowed evacuation and might have led to panic.

In this case, the crew did not observe any dangerous phenomena in the short term and preferred careful preparation to a fast exit. The absence of serious injuries during evacuation shows that they obtained the sought-after result.

Evacuation was through doors 1L, 2L, 2R and 4R whose emergency slides came down into the water. This was the sensible choice, considering the attitude of the airplane (aft door very high), the shallowness of the water and the presence of the firemen's rescue boat at the bottom of the slide from door 2R.

We may note, however, that the use of door 2L took passengers past engine 1, which was still running. This was potentially dangerous, even though the member of cabin personnel at the bottom of the slide had taken the precaution of asking two servicemen who were flying as passengers to keep the passengers at some distance from the engine.

The action of the cabin crew both in the airplane and at the bottom of the slides was very efficient and facilitated a successful evacuation.

2.5.4 RFFS Actions

The airport firemen were in position in close proximity to the runway a quarter of an hour before the airplane's arrival, as is their practice for all wide-body landings. When they saw the B 747 landing long and fast, they thought it might go off the runway and set out immediately without waiting for the alarm. Their four vehicles were therefore on hand as soon as the airplane came to a stop. They readied themselves along the shore of the lagoon to fight a fire should one break out.

The fire chief was not on duty, but from his home, he saw the airplane arrive and the runway excursion. He immediately went to the site of the accident. After a rapid examination of the situation, he took two firemen to launch the rescue boat, which arrived at the airplane at the moment when the emergency slides hit the water (so probably between five and eight minutes after the airplane came to a stop). The rescue boat was positioned at the bottom of the slide from door 2R and embarked about 50 passengers.

The remaining four firemen of the airport were mobilized in the vehicles' cabs, ready to intervene should a fire break out.

They were joined by firemen from neighboring villages, as specified in the emergency response plan. These firemen's lack of aeronautical training undoubtedly explains why they remained on the shore while cabin personnel would have preferred to have them come to the bottom of the slides to assist in catching passengers as they came down.

2.5.5 Control Tower Actions

Once the airplane had gone past the control tower, the controller lost sight of it (all lights went out due to the loss of electrical generation controller). When unable to establish radio contact, he immediately triggered the alarm, then notified and alerted the organizations mentioned in the emergency response plan.

Subsequently, the Faa'a control tower received a call from an ATR 72 having just taken off from Rangiroa and due to arrive at Faa'a more than two hours later. After being informed of the accident by the controller, the pilot asked whether he should turn back, the pilot asked if he should turn back. The controller answered that he should continue his flight.

An inspection of the first part of runway 22 was carried out to check to be sure no components of the B 747 were found. When the ATR 72 arrived, the passengers were walking back along the runway to the terminal. The ATC issued a radio request to airport personnel and gendarmes located on the runway to clear it for the landing of the ATR.

The fly-over of the airplane and the instructions to clear the runway brought on a wave of panic among passengers. Some fled into the darkness, luckily remaining on firm ground.

Additionally, the controller could not be certain that no passengers had lost their bearings and gone back out onto the runway where the ATR was coming down.
To avoid this, it would have been preferable to close the airport completely, as stipulated in the emergency response plan, and request that the ATR return to Rangiroa.

3 - CONCLUSIONS

3.1 Findings

- The crew held the certificates, licenses and ratings required for the flight.
- The airplane was certified and maintained in compliance with regulations.
- The flight was incident-free up until the approach to Tahiti Faa'a.
- Meteorological conditions were night flight conditions with calm wind. The runway was dry.
- The crew sighted the runway from more than 10 nautical miles and kept it in sight for the rest of the approach.
- Radio navigation facilities were working normally.
- The crew made a standard VOR DME approach to runway 22.
- The copilot was at the controls.
- The autothrottle control and at least one flight director were active.
- The vertical navigation mode (VNAV) for a standard VOR approach was engaged.
- The B 747 Flight Crew Training Manual recommends that the crew disconnect the autopilot and the autothrottle, thus flying manually, before passing the final decision height.
- At the « End of Descent » point the automatic flight system went in to the go-around configuration to climb to the altitude displayed on the MCP, as it was designed to do.
- This feature of the automatic flight system was not mentioned in the manufacturer's or the operator's documentation. It was not addressed in crew training. Neither of the F-GITA pilots were familiar with this feature.
- Controlled by the autothrottle, the thrust began to increase, and the FMA display changed from THR to THR REF. The pilot not flying called out this change.
- The pilot flying did not follow the instructions of the flight director and continued the descent.
- N1 engine speed increased from 68 to 96 % in 19 seconds. The speed increased, reaching Vref + 35 kt at 200 feet. At this point, the airplane's path moved above the normal descent path.

- At about 300 feet above ground level, the speed was Vref + 30 kt. The pilot not flying called this out, and the levers were brought back to the idle throttle stop.

- The autothrottle continued to try to pull the levers forward. It did not disconnect nor was it disconnected by the crew.

- Immediately following the radio altimeter call-out « 200 feet », the pilot flying said “OK, disconnect” without further elaboration. The other pilot did not react.

- Touchdown took place at about 900 m past the runway threshold.

- Two seconds before touchdown, thrust lever no. 1 moved forward and the speed of the outside left engine increased to 107% of N1 in seven seconds.

- Because of this, the autobrake function deactivated automatically at touchdown and the spoilers were not extended.The pilot flying moved the three remaining levers into reverse thrust position.

- The pilot not flying did not call out the failure of the engine 1 thrust reverser to engage, the deactivation of the autobrake function or the failure of the spoilers to extend.

- The pilot flying repeatedly requested actions on the thrust reversers.

- Engines 2, 3 and 4 were brought back to idle speed, then shifted into thrust reverse.

- The airplane left the runway at approximately 3,150 meters past threshold 22.

- The airplane came to a stop, partially in the lagoon, by the crossing road at the end of the runway.

- Engines 2, 3 and 4 stopped due to impact with and ingestion of water.

- Engine 1 continued to idle. The crew was unable to shut down this engine due to the loss of power generation.

- The airport firemen readied themselves along the shore of the lagoon immediately after the airplane came to a stop.

- The crew started evacuating passengers approximately ten minutes after the airplane came to a stop after assessing outside conditions.

- Engine 1 was cut by the firemen, who sprayed water into the interior.

- While the passengers were walking back along the runway to the terminal, an ATR 72 was authorized to land on the first part of the same runway on QFU 22.

3.2 Probable Causes

The accident was caused by a non-stabilized approach and a strong forward thrust application to engine 1 on landing, consequences of an idiosyncrasy of the automatic flight system that caused a shift into go-around mode at a point in the path that corresponded to the à la decision height.

This caused:

- a long touchdown at excessive speed
- a trajectory that pulled right so that the airplane left the runway sideways

Failure to observe operational procedures regarding call-outs during approach and landing as well as the lack of communication between the pilots were factors that contributed greatly to the accident. In particular, deviations from the norms for several flight parameters should have led to initiating a go-around.

The absence of information from the manufacturer to operators and crews regarding this particular feature of the automatic flight system was also a contributing factor to the accident.

4 - RECOMMENDATIONS

4.1 Preliminary Recommendations

Evidence brought to light in the course of the investigation led the Bureau Enquêtes-Accidents to issue the following safety recommendations in the preliminary report issued in October 1994:

Operation

Examination of the circumstances of the accident showed that the possibilities of a go-around during approaches using the vertical navigation and autothrottle modes are apparently not well-known to crews. What is more, documentation obtained as of this date is not explicit regarding this point.

Consequently, the Bureau Enquêtes-Accidents recommends:

that crews be informed of the circumstances surrounding the accident

that as a temporary measure, use of the autothrottle controls and the automatic modes of the AFDS in standard approach be prohibited below the decision height

Note: distribution of the preliminary report could be one means of informing flight crews.

Aircraft

Following the accident, normal electrical power sources (alternating current and batteries) cut out following damage to the electronics bay and its submersion.

Thus, communication systems between the cockpit and the cabin, as well as the public address system, were not working, and action on the shut-off valves, fuel shut-off valves and extinguishers were ineffective (the engine kept running throughout the evacuation), as power to all of these systems is supplied by normal electrical sources.

However, all systems in the airplane did not shut down. For example, the electrical power providing for transmission of the signal giving the position of the throttle controls between the transducer and the corresponding engine was supplied directly by the engine through its ECU.

Consequently, the Bureau Enquêtes-Accidents recommends:

that a study be undertaken to examine the possibility of supplying electrical power directly from the engines to controls for shut-off valves, engine fuel shut-off valves and extinguishers

that a study be undertaken to examine the possibility of having an autonomous battery-run power supply for communication systems between the cockpit and the cabin and within the cabin.

The Control Tower

During evacuation of passengers from the airplane who were on threshold 04, the Tahiti Faa'a airport control tower allowed an ATR 72 inbound from Bora Bora to land at QFU 22 on the part of the runway between threshold 22 and the service road located 2,100 meters from threshold 22 (or 1,300 meters from threshold 04).

The following measures were taken prior to the airplane's landing:

The portion of the runway cited above was inspected to ensure that no foreign bodies were present.
The service road was closed.
A radio call was issued to personnel present on the accident site (firemen, gendarmes or the captain) requesting that they clear the runway of passengers and vehicles.

When the ATR came in for landing, a great many passengers and crew members were walking along the runway towards the terminal in darkness. The announcement that an airplane was about to land (without mention of the type) caused slight panic.

Passengers, some of whom were barefoot, were herded off the runway into the brush and towards a swampy area.

In addition, no check was made to make sure that no passengers were still on the portion of the runway to be used for landing..

Consequently, the Bureau Enquêtes-Accidents recommends:

that following an accident on or near a runway, said runway be closed totally until rescue operations are completed

4.2 Intermediate Recommendation

As a result of several accident investigations in which the Bureau Enquêtes-Accidents was involved, the following recommendation was issued on 24 January 1995:

Various incidents or accidents (see summary in appendices) involving wide-body passenger carriers have the following characteristics in common:

1) Configuration: Autopilot and/or auto-controls (or autothrottle) in operation.

2) Circumstances: the pilot at the controls overrides (voluntarily or involuntarily) the automatic flight system, or performs actions contrary to the instructions of the flight director.

3) Aggravating Circumstances:

a) The pilot flying is not always conscious that his actions contradict those of the automatic flight systems and never notices the consequences of them.

b) The pilot not flying (even an instructor) is not aware of the contradictions between the pilot at the controls and the automatic flight systems.

4) Consequences:

** The reaction of automatic flight systems causes potentially dangerous configurations: out of trim, engine thrust incompatible with the path chosen by the pilot, ...*

** The crew—*

- *is either unaware of the situation and therefore cannot take appropriate corrective action,*
- *or notices the configuration of the airplane but fails to understand the causes. This lack of understanding (also linked to a limited knowledge of systems) leads to a waste of time in analyzing the situation, or even an erroneous analysis, usually combined with a lack of communication among crew members.*

This has caused very dangerous attitudes: extreme pitch or roll attitudes, loss of speed (leading to stalls) excessive speed, etc...

Consequently, the Bureau Enquêtes-Accidents recommends:

that a study be commissioned so that the priority of the pilot over automatic flight systems be maintained under all circumstances.

This could translate into either or both of the following actions:

a) Disconnecting automatic flight systems (autopilot and autothrottle or autothrottle) in cases where pilot actions are in contradiction with those of the automatic flight system or the flight director.

b) Providing for a clear message (or possibly an alarm) in the cockpit alerting the crew to such a contradictory situation.

APPENDIX, Reminders regarding the following events:

1. *Incident involving an A 300-B4 on the approach to Helsinki (Finland) on 9 January 1989*
2. *Accident involving the A320-231 VT-EPN in Bangalore (India) on 14 February 1990*
3. *Incident involving the A310 D-ADAC on the approach to Moscow on 11 February 1991*
4. *Accident involving the B747-400 F-GITA at Tahiti-Faa'a on 13 September 1993*
5. *Accident involving the A310-300 F-OGQS near Novokuznetsk (Siberia) on 22 March 1994*
6. *Accident involving the A300-600 B1816 in Nagoya on 26 April 1994*
7. *Incident involving an A310-325 on the approach to runway 26 at Orly on 24 September 1994*

Caution: information presented below does not purport to be a summary of the accidents or incidents, but rather a reminder of those circumstances and characteristics pertinent to the enclosed recommendation.

Incident involving an A 300-B4 on the approach to Helsinki (Finland) on 9 January 1989

During an ILS approach with the autopilot (AP) and autothrottle engaged, the pilot accidentally engaged go-around.

To remedy the situation, the pilot disconnected the autothrottle and pulled back on the thrust levers after four seconds while countermanding the AP by pushing forward on the control column for 10 seconds to avoid having passengers undergo a sudden change in attitude.;

The trimmable stabilizer reached 8° nose-up pitch (the initial approach value was 5.5° nose-up pitch).

Subsequently, the AP was disconnected or disconnected itself without the crew noticing.

Then, seeing that the approach had not stabilized, the pilot performed a Go-around by selecting the autothrottle go around mode.

The combined effect of the pitch-up moment of the engines and the nose-up pitch of the trimmable stabilizer took the airplane to an attitude of 35.5° then 94 kt indicated airspeed in spite of the crew's pushing forward on the control column.

Not long before reaching these values, the crew moved the trimmable stabilizer to 0°. The speed increased again while the attitude decreased.

Accident involving the A320-231 VT-EPN on 14 February 1990 in Bangalore (India)

During a "Captain's" inspection flight the pilot at the controls made a visual approach with the autothrottle and the flight director active (in mode V Speed: vertical speed holding).

On final approach, he requested display and selection of a vertical descent speed of 700 ft/mn on the Flight Control Unit (FCU). For unknown reasons, the pilot not flying –the instructor- displayed an altitude below that of the airfield on the FCU (instead of the vertical speed requested) and did not make the call-outs required when making a change to the FCU.

Subsequent to this action, the active mode of the automatic flight systems went from Speed Vspeed (speed holding-vertical speed) to Idle Open Desc (engine in flight idle- change of level in descent).

The pilot at the controls was not aware of this, and the instructor did not call it out clearly.

To maintain the descent path—visually—the pilot at the controls pulled the control column gradually back, causing the landing angle to increase and the speed to decrease, engine thrust being in flight idle.

The anti-stall function led to an increase in the rate of descent, and the alpha floor initiated an automatic go-around. This occurred at too low a level and the airplane touched the ground and hit a mound

The airplane caught fire. 92 persons were killed and 22 were seriously injured.

Incident involving the A310 D-ADAC on 11 February 1991 on the approach to Moscow

During a go-around procedure in autopilot mode (CMD mode), the pilot tried to limit the pitch-up attitude, which he thought to be excessive, by pushing on the control column (14° nose down). The autopilot then ordered the trim to -12 nose up in an attempt to maintain the specified parameters.

On arrival at the safety altitude, the autopilot went into Altitude Acquire mode and disconnected automatically because of the effort on the controls exerted by the pilot (disconnection is inhibited below the safety altitude).

The crew then found itself in manual control with a significant pitch up moment caused by the out of trim pitch, to which was added the pitch up moment caused by the engines in go-around power mode. The movement of the elevator control was insufficient to countermand this combined pitch-up and prevent an increase in attitude. The airplane stalled three times in a row, pitching down and recovering at 2.5 g each time.

The pilot regained control of the airplane by reducing engine power. The out of trim correction phase occurred later.

Accident involving the B747-400 F-GITA at Tahiti-Faa'a on 13 September 1993

The crew made a visual VOR DME approach, with instrument confirmation, with the flight director engaged and the auto-throttle controls active in VNAV (vertical navigation) mode.

The copilot (pilot flying) was following the flight path manually while the auto-throttle controls controlled the speed.

In keeping with the logic of the active mode of the automatic flight system, this system triggered an automatic go-around upon arrival at the End of Descent point (located at 2.3 Nm from the runway threshold) and displayed it on the FMA (on the upper portion of the Primary Flight Display cathode-ray tube).

The pilot not flying called out the change in mode status on the FMA, but made no comments or analysis.

The airplane went above the descent path and the speed increased (eventually reaching Vref + 35 kt at a height of 150 feet).

The pilot at the controls pulled the throttle levers back and held them in the idle position. He indicated that he felt the handles "pulling forward" and tried to disconnect the auto-throttle, but did not find the instinctive disconnect button located on the levers.

Following a remark from the captain regarding the excessive speed, the pilot at the controls mumbled a confused response without referring to the problem he was having with the throttle levers, and he continued the approach, holding the levers in the idle position.

Approximately 2 seconds before touchdown, throttle levers no. 1 slipped out of his hand, the auto-throttle still active in Go-around mode. Lever no. 1 and the thrust of engine no. 1 went into full forward thrust and stayed there, without the crew noticing it, until the airplane came to a stop.

Consequently, upon landing, the spoilers were not raised, the autobrake function was disarmed and thrust was very uneven.

The airplane left the runway and came to a rest in the lagoon with no bodily injuries.

Accident involving the A310-300 F-OGQS near Novokuznetsk (Siberia) on 22 March 1994

Cruising in autopilot with auto-throttle engaged, the captain's son sat in the front left pilot's seat, then, with his father's authorization, moved the wheel and rolled the aircraft.

This overrode the autopilot, causing the roll to become more and more pronounced.

At first, the captain and the duty pilot —both at the back of the cockpit—did not understand the origin of the roll and came to an erroneous conclusion.

When they seemed to realize what was happening, a communication problem between the copilot and the captain's son made them lose time, and by the time someone took over the controls, the airplane was out of control.

After a series of uncontrolled maneuvers, the airplane hit the ground.

All 75 persons on board were killed instantly.

Accident involving the A300-600 B1816 in Nagoya (Japan) on 26 April 1994

The crew was making an ILS approach in manual operation with flight directors active (in ILS mode), under night visual flight conditions.

At about 1100 ft, the pilot at the controls accidentally engaged the go-around actuator. As a result, the automatic flight systems went into « Go-around » mode. Speed increased and the airplane went above the descent path.

The crew reduced the throttle, disarmed the go-around and engaged the autopilot (probably thinking they could more easily regain the approach path), failing to note that it was in go-around mode.

In addition, the crew pushed the control column forward to regain the approach path, thus countering the autopilot, which was moving the trimmable stabilizer to pull up until a balance was reached between the trimmable stabilizer at 12.3° nose-up pitch and the elevator at 9° nose-down pitch.

The alpha floor initiated another automatic go-around, leading to a decision by the crew to abandon the approach and continue with the go-around thrust.

The combination of the pitch up moment linked to the engine thrust and the trimmable stabilizer in full nose-up pitch was such that the movement of the elevator in full nose-down pitch was not sufficient to prevent an increase in attitude.

The attitude reached 52° while the airplane stalled, then hit the ground during recovery.

264 persons on board were killed, and 7 were seriously injured.

Incident involving an A310-325 on the approach to runway 26 at Orly on 24 September 1994

The captain (PF), during the approach to landing on runway 26 at Orly (AP and auto-throttle (ATH) engaged), wanted to make an ILS approach with ILS autocapture. Seeing that the aircraft was not intercepting the glide, he disengaged the AP and continued the interception in manual operation with Vertical Speed Holding (V/S) in longitudinal mode and Localizer (LOC) in horizontal mode, and ATH still engaged (the fact that the glide was not intercepted was consistent with the logic of this airplane; it cannot be intercepted before the LOC). The airplane's configuration was then landing gear extended, slats, flaps 15°, altitude selected on the FCU of 4,000 feet and calculated airspeed 205 knots decreasing.

The airplane was lined up on the LOC and above the descent path. The crew selected the flaps at 20 degrees; the calculated airspeed was then 197 knots.

With the AP disengaged, the flight director and the ATH activated, the A 310 has a protective feature in V/S mode that shifts automatically into «Level Change» mode in case of excessive speed on the path. It has been established that selecting the 20° position for the flaps at a speed of 197 knots, just over the maximum speed for this configuration (which is 195 knots) triggered activation of this feature. The crew did not identify the causes of the airplane's behavior.

They observed that the thrust levers were moving forward and that engine power was increasing.

The crew countermanded the power increase by a nose-down action on the elevator, with the ATH still engaged. The thrust levers were then brought back to idle position. At the same instant, the trimmable stabilizer moved into a nose-up position. This tendency to pull up was countermanded by pushing on the control column. When the trimmable stabilizer reached its maximum nose-up value (-13°), and the elevator reached its maximum nose-down value (+14.7), the thrust levers surged forward to their mechanical stop (TRA = 84°). The airplane's attitude increased + 6° to 59° and the airplane climbed to an altitude of 4,000 feet at a calculated airspeed of less than 45 knots (minimum recorded value). No longer receiving information on speed, the ATH disengaged automatically. Witnesses saw the airplane stall first on the right wing, then on the left wing—before assuming a pronounced negative attitude (-32,7°). The flaps were retracted.

The crew regained control of the airplane at about 800 ft. The landing gear was retracted. The crew circled the airport, then landed.

4.3 Other Recommendations

4.3.1 Analysis of the accident showed that there was a lack of communication and decision-making between the two pilots, especially after the automatic go-around engaged and during the final, non-stabilized approach.

Consequently, the Bureau Enquêtes-Accidents recommends:

that crew training in cockpit resource management be used to:

- **improve the effectiveness of reciprocal exchange of information between crew members, including during phases of flight with a heavy workload,**

- **encourage crew members to continuously analyze parameters and information linked to how the flight is proceeding so as to make the necessary decisions in a timely manner**

4.3.2 Following the investigation of the accident involving the A320 F-GGED on 20 January 1992, the Commission which investigated that accident had issued the following recommendation in its final report:

> ***« 41.7 – Generalities on Call-outs***
>
> *The investigation has shown that during the accident flight, there were significant discrepancies with call-out procedures stipulated by the airline. Our analysis reveals that the failure to make these call-outs may have contributed to undermining cross-checking and each pilot's awareness of the real situation.*
>
> *More generally, it seems clear that in this airline's daily practice, the average rate of call-outs has diminished in relation to stipulated call-outs, without the reasons for or scope of this phenomenon being known. It is important to note that cross-checking is critical to safety, especially in the latest generation of aircraft.*
>
> *Consequently, the commission recommends:*
>
> - ***that a study be undertaken to determine normal practice regarding call-outs as well as the cause of the deterioration of standard practices in this area and to find methods and procedures to consistently ensure effective reflex responses as well as cross-checking between crew members***

Similar discrepancies with stipulated call-out procedures were also brought to light during analysis of the of the F-GITA accident.

Consequently, the Bureau Enquêtes-Accidents issue a reminder of the pertinence of the above recommendation.

4.3.3 Within the framework of the technical investigation, and with reference to information provided verbally by the captain, the Bureau Enquêtes-Accidents requested access to certain data in his medical records in order to confirm in writing the information provided. This was not possible because of “medical secrecy.”

If the pilot had not provided this information of his own volition, the investigators would not have been aware of it and would have been unable to take it into consideration in analyzing the accident.

Consequently, the Bureau Enquêtes-Accidents recommends:

- **that in every country, a doctor who is part of (or who regularly works for) the organization responsible for technical investigations be given unrestricted access to the medical records of personnel involved in an accident or incident and inform the designated investigator of relevant data.**

Note: Law N°99-243 of 29 March 1999 relating technical investigations of accidents and incidents in civil aviation changed the legal situation in France in line with the above recommendation.

Appendices

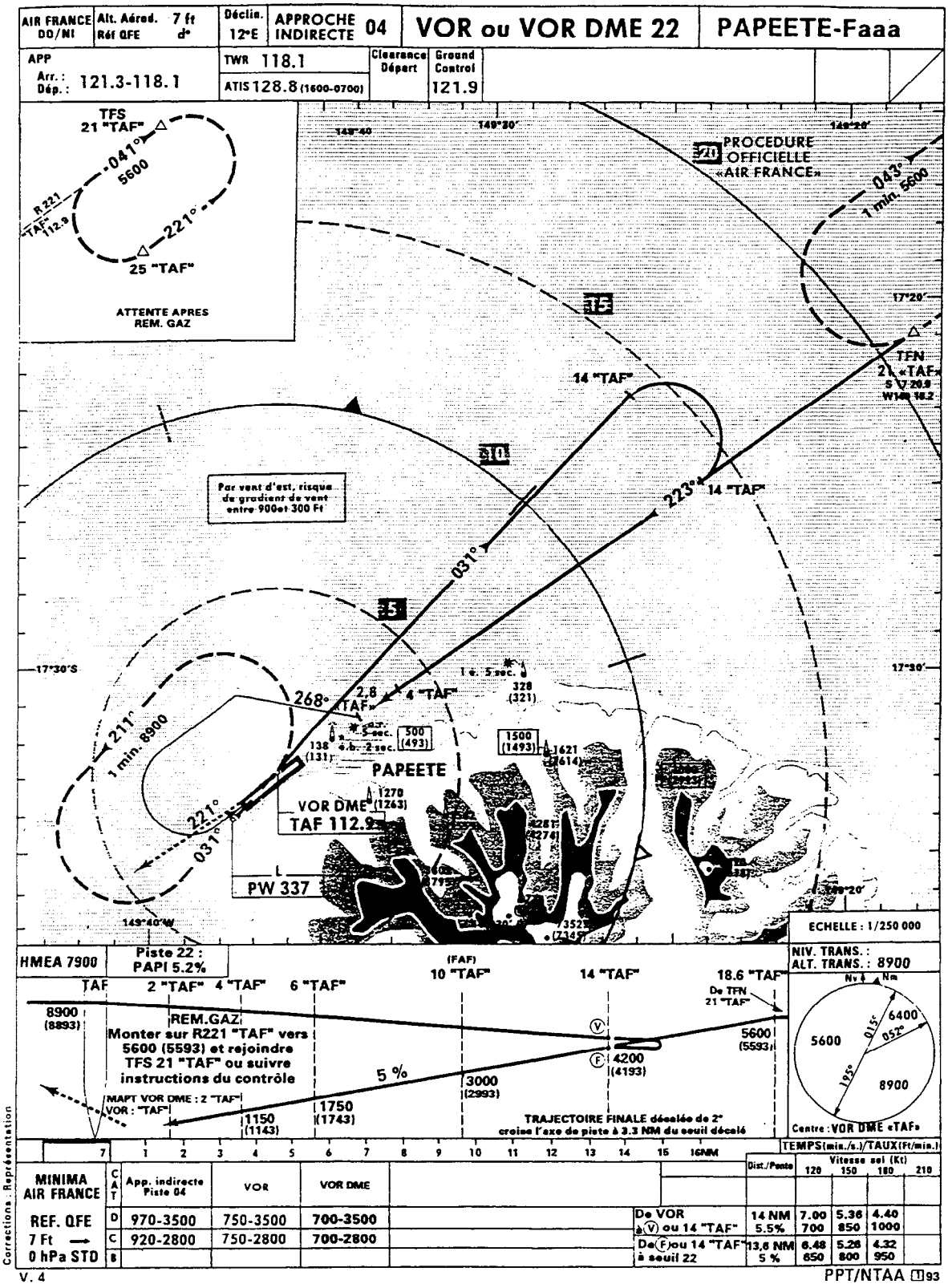
APPENDIX 1
VOR-DME approach procedure for runway 22
at Tahiti-Faa'a airdrome

APPENDIX 2
Description of the runway at Tahiti-Faa'a airdrome

APPENDIX 3
Extract from FDR data
Graphs – Map of final approach

APPENDIX 4
CVR Transcript

APPENDIX 5
Photographs


AIR FRANCE DO/NI
Alt. Aérod. 7 ft
Réf QFE d°
Déclin. 12°E
APPROCHE INDIRECTE 04
VOR ou VOR DME 22
PAPEETE-Faaa
APP
Arr. : 121.3-118.1
Dép. :
TWR 118.1
ATIS 128.8 (1600-0700)
Clearance Départ
Ground Control 121.9
TFS 21 "TAF"
041°
5600
221°
25 "TAF"
R 221 "TAF" 12.9
ATTENTE APRES REM. GAZ
PROCEDURE OFFICIELLE «AIR FRANCE»
043°
1 min. 5600
TFN 21 «TAF»
14 "TAF"
223°
031°
Par vent d'est, risque de gradient de vent entre 900et 300 Ft
211°
1 min. 8900
268°
2,8
4 "TAF"
PAPEETE
VOR DME
TAF 112.9
PW 337
ECHELLE : 1/250 000
HMEA 7900
Piste 22 : PAPI 5.2%
NIV. TRANS. :
ALT. TRANS. : 8900
TAF
2 "TAF"
4 "TAF"
6 "TAF"
(FAF) 10 "TAF"
14 "TAF"
18.6 "TAF"
De TFN 21 "TAF"
8900 (8893)
REM.GAZ
Monter sur R221 "TAF" vers 5600 (5593) et rejoindre TFS 21 "TAF" ou suivre instructions du contrôle
5 %
MAPT VOR DME : 2 "TAF"
VOR : "TAF"
1150 (1143)
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3000 (2993)
4200 (4193)
5600 (5593)
TRAJECTOIRE FINALE décalée de 2° croise l'axe de piste à 3.3 NM du seuil décalé
Centre : VOR DME «TAF»
TEMPS(min./s.)/TAUX(Ft/min.)
Dist./Pente
Vitesse sol (Kt) 120 150 180 210
MINIMA AIR FRANCE
CAT
App. indirecte Piste 04
VOR
VOR DME
REF. QFE
7 Ft
0 hPa STD
D 970-3500 750-3500 700-3500
C 920-2800 750-2800 700-2800
B
De VOR ou 14 "TAF" 14 NM 5.5% 7.00 700 5.36 850 4.40 1000
De ou 14 "TAF" à seuil 22 13,6 NM 5 % 6.48 650 5.28 800 4.32 950
Corrections : Représentation
V. 4
PPT/NTAA 93

CARTE D'OBSTACLES D'AÉRODROME O.A.C.I.

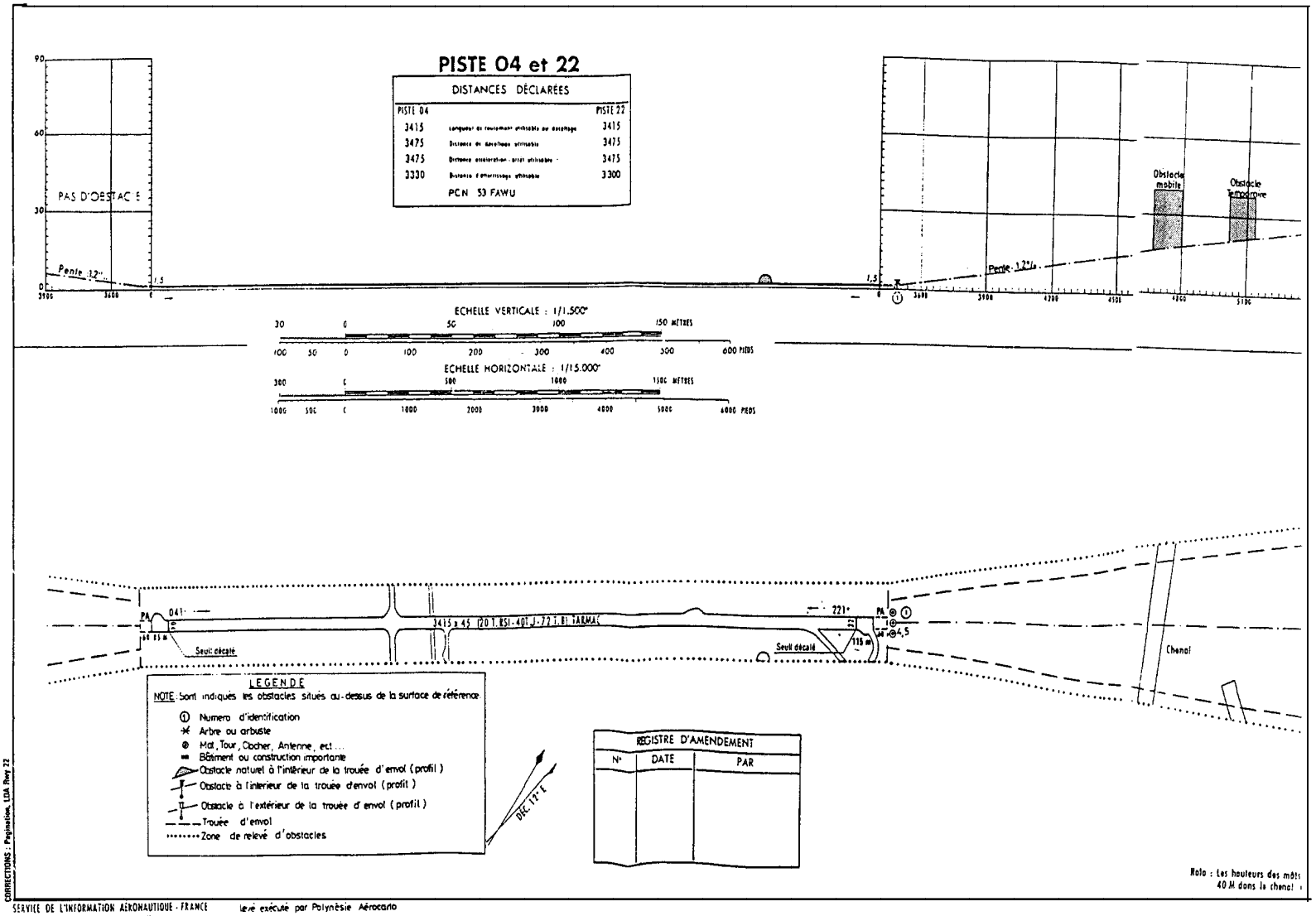
AGA 2 09 01
91 05 02

TYPE A - APPLICATION DES LIMITES D'EMPLOI DES AVIONS

DIMENSIONS ET ALTITUDES EN MÈTRES

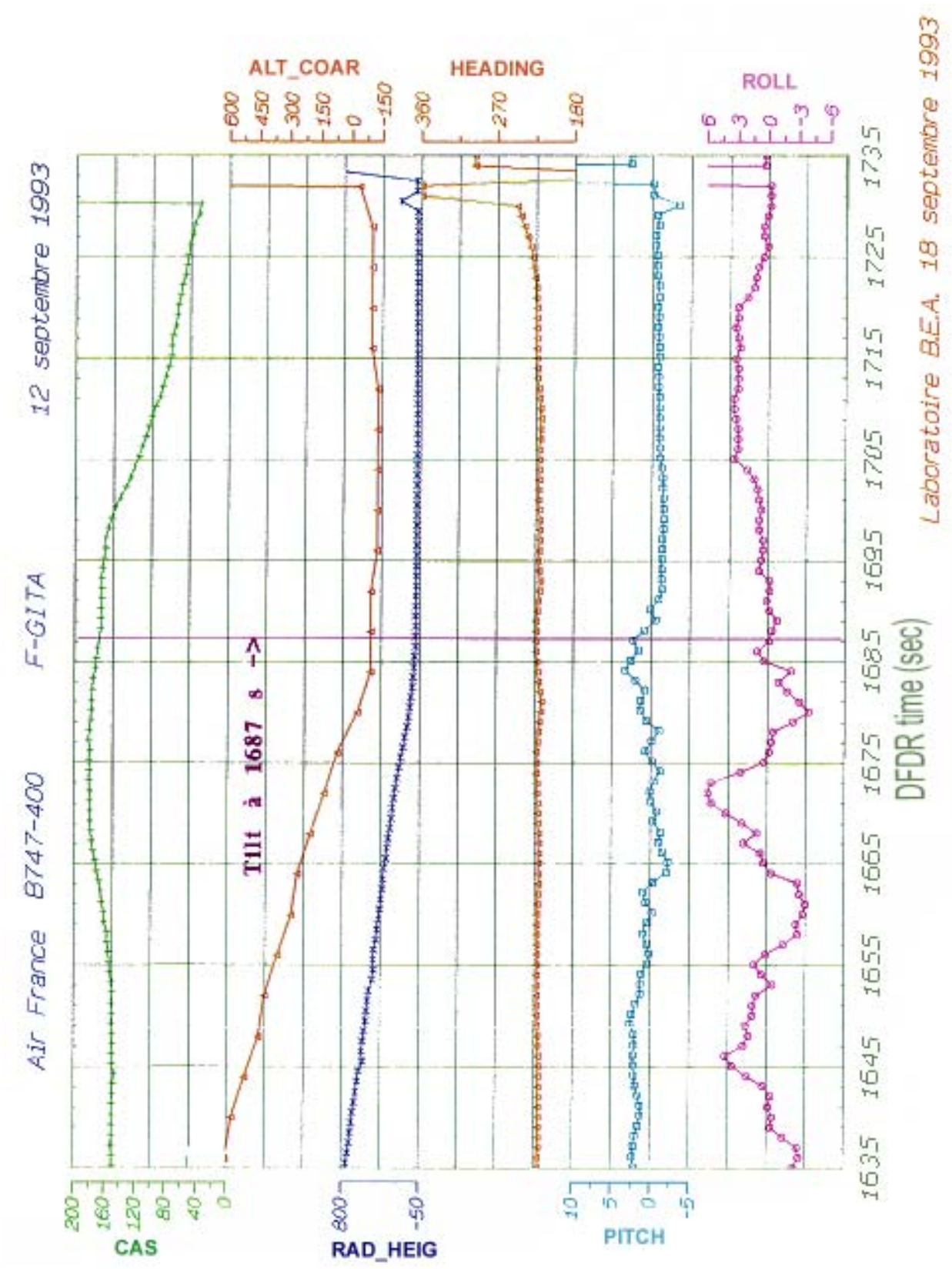
TAHITI-Faaa

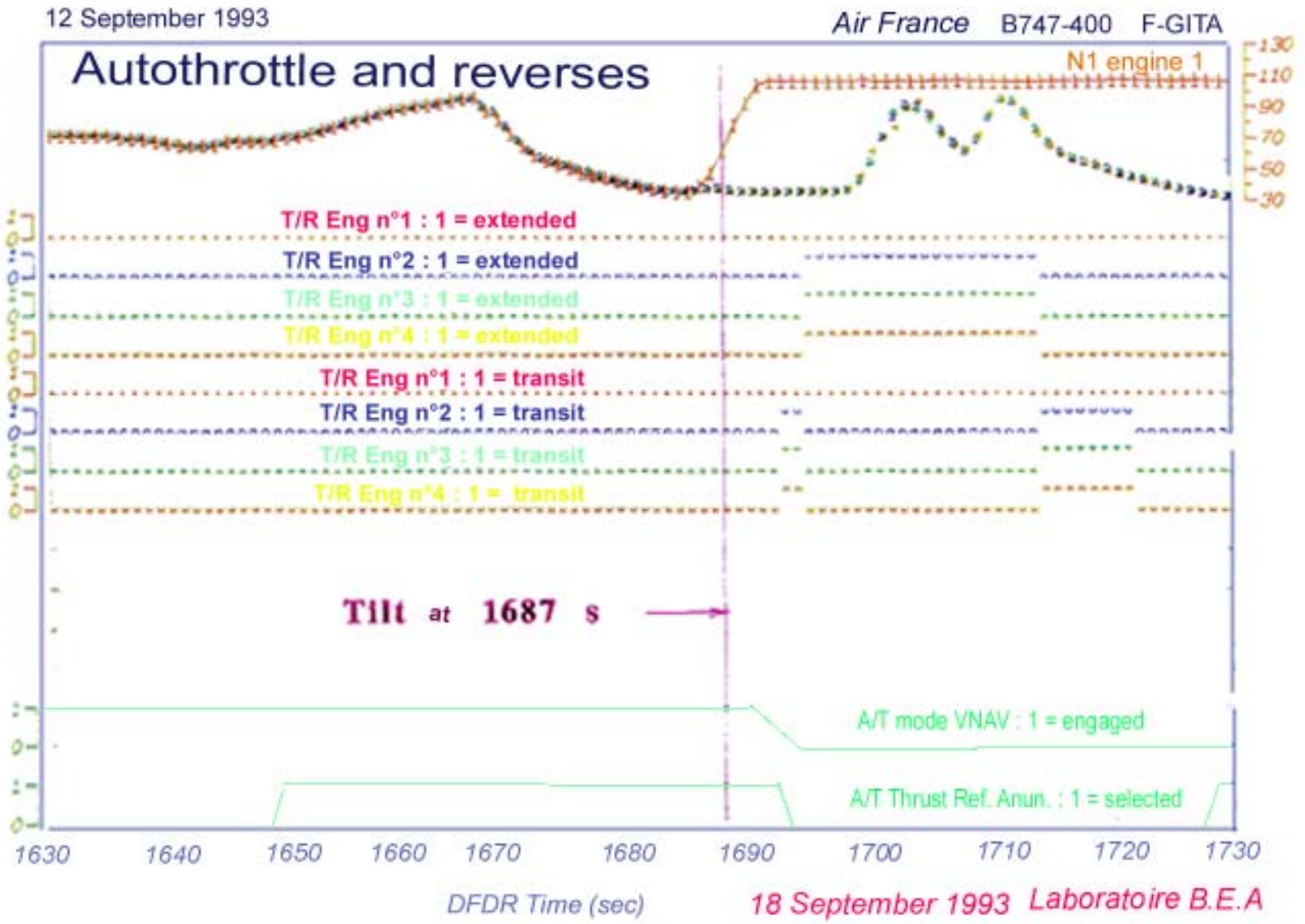
ARCHIPEL DE LA SOCIÉTÉ

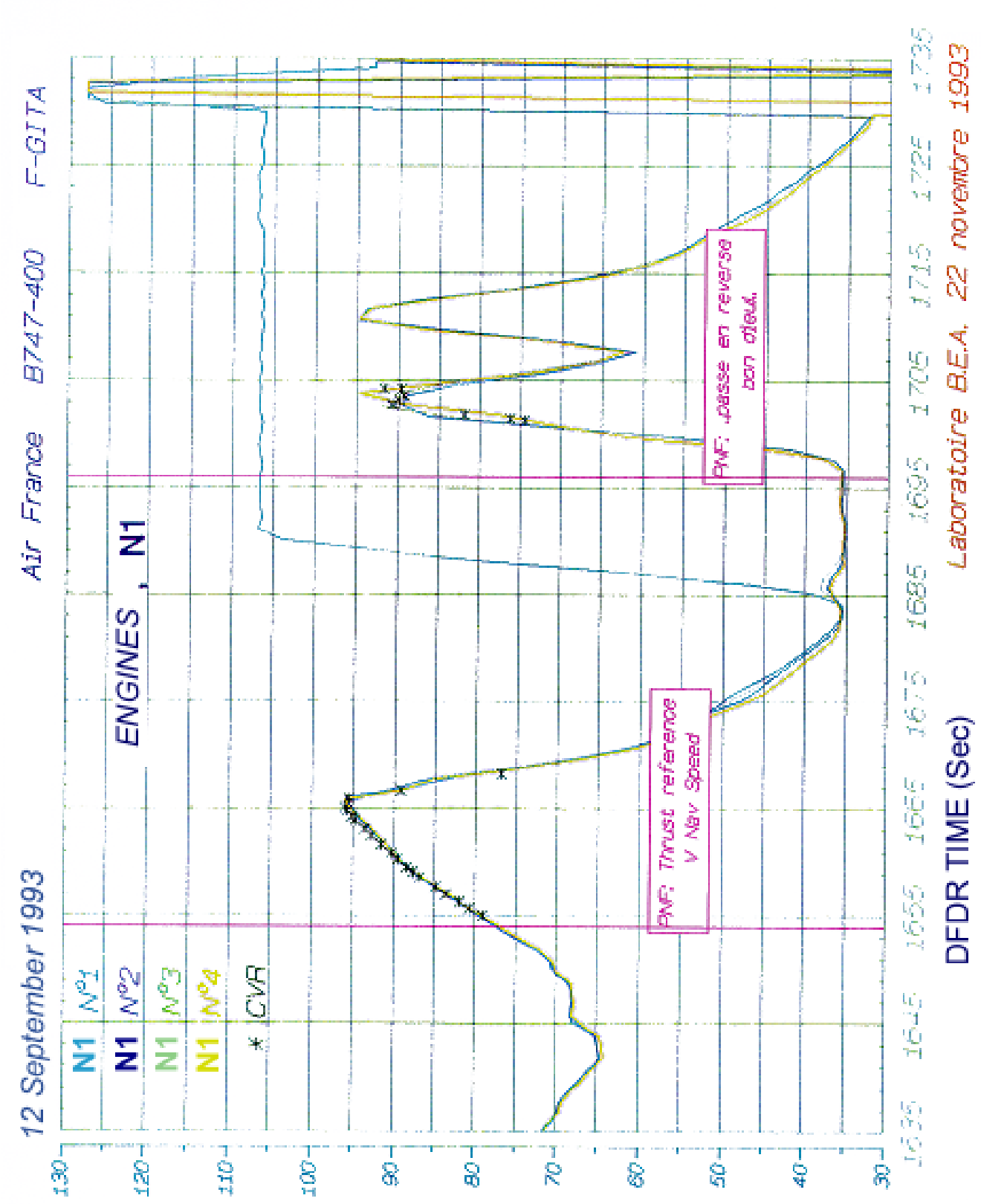


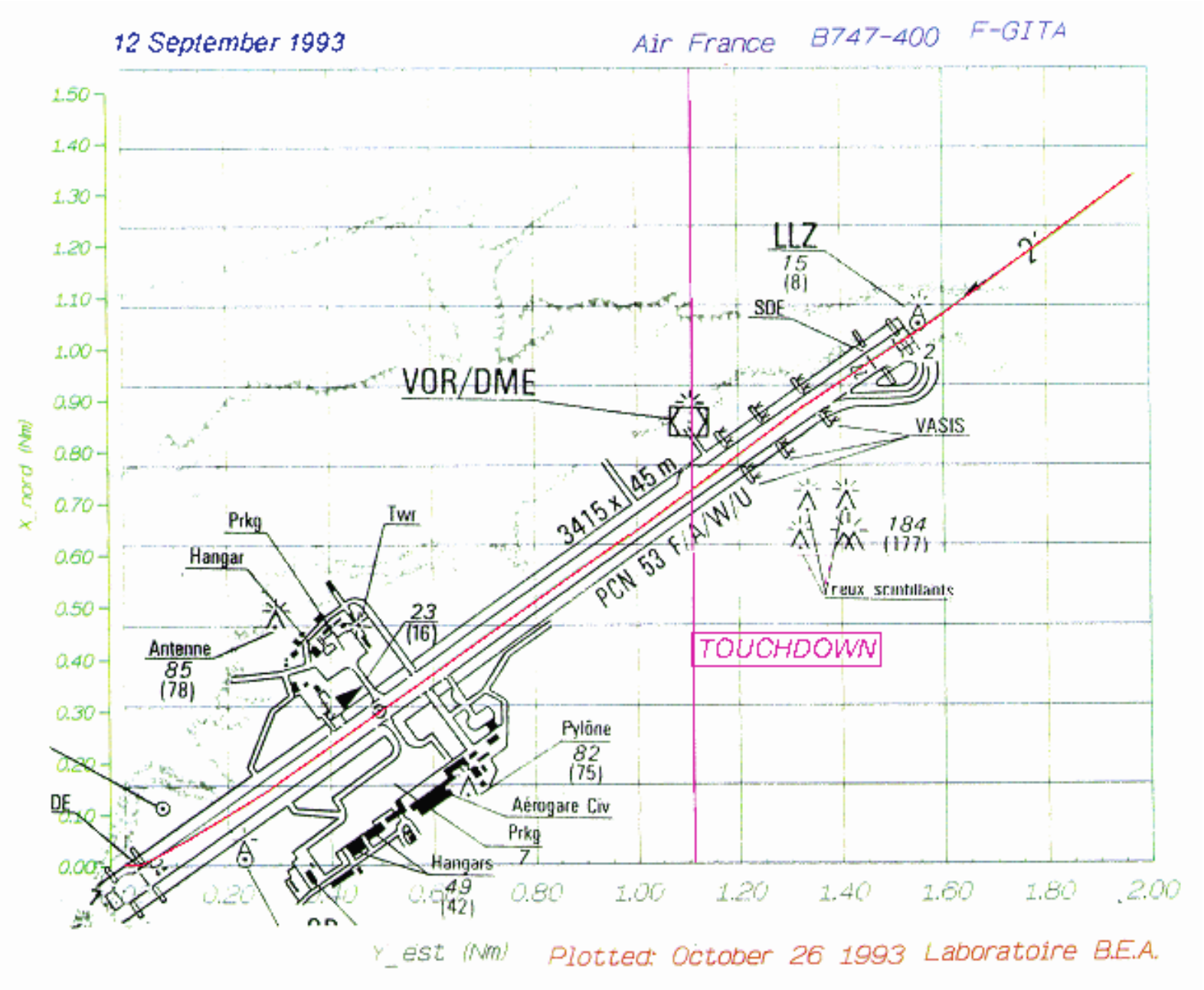
CORRECTIONS : Pagination, LDA Rwy 22

levé exécuté par Polynésie Aérocarto en Aout 1989


Air France B747-400 F-GITA 12 septembre 1993
Laboratoire B.E.A. 18 septembre 1993
ALT_COAR
HEADING
ROLL
Tilt à 1687 s ->
CAS
RAD_HEIG
PITCH
DFDR time (sec)


12 September 1993
Air France B747-400 F-GITA
Autothrottle and reverses
N1 engine 1
130
110
90
70
50
30
T/R Eng n°1 : 1 = extended
T/R Eng n°2 : 1 = extended
T/R Eng n°3 : 1 = extended
T/R Eng n°4 : 1 = extended
T/R Eng n°1 : 1 = transit
T/R Eng n°2 : 1 = transit
T/R Eng n°3 : 1 = transit
T/R Eng n°4 : 1 = transit
Tilt at 1687 s
A/T mode VNAV : 1 = engaged
A/T Thrust Ref. Anun. : 1 = selected
1630
1640
1650
1660
1670
1680
1690
1700
1710
1720
1730
DFDR Time (sec)
18 September 1993 Laboratoire B.E.A


12 September 1993
Air France B747-400 F-GITA
ENGINES , N1
N1 N°1
N1 N°2
N1 N°3
N1 N°4
* CVR
PNF: Thrust reference V Nav Speed
PNF: passe en reverse bon dieu.
DFDR TIME (Sec)
Laboratoire B.E.A. 22 novembre 1993


12 September 1993
Air France B747-400 F-GITA
X_nord (Nm)
Y_est (Nm)
LLZ
15
(8)
SDE
VOR/DME
VASIS
3415 x 45 m
PCN 53 F/A/W/U
184
(177)
Feux scintillants
TOUCHDOWN
Prkg
Hangar
Twr
23
(16)
Antenne
85
(78)
Pylône
82
(75)
Aérogare Civ
Prkg
7
Hangars
49
(42)
DE
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.20
0.80
1.00
1.20
1.40
1.60
1.80
2.00
Plotted: October 26 1993 Laboratoire B.E.A.

CVR TRANSCRIPT

* FOREWORD *

The following is a transcript of elements which were comprehensible, at the time of the preparation of the present report, on the cockpit voice recorder. This transcript contains conversations between crew members, radiotelephonic messages between the crew and Air Traffic Control services and various noises corresponding, for example, to the use of controls or to the alarms.

Those parts of the recording which were not understood or which remain doubtful are marked with an asterisk (*). Exchanges with no connection to the conduct of the flight are marked as such but are not transcribed.

Words or groups of words in parentheses were only identified after specialized study and are only recognizable after extensive repeated listening.

The reader's attention is drawn to the fact that the recording and transcription of the CVR are only a partial reflection of events and of the atmosphere in the cockpit. Consequently, the utmost care is required in the interpretation of this document.

Times mentioned in the CTL column are based on the UTC times recorded by the control tower in question.

* GLOSSARY *

Ctl Time	: CVR readout time based on UTC time recorded of ATC
FDR Time	: Time as recorded by the Flight Data Recorder
CAM	: Cockpit Area Microphone
PNF	: Pilot not flying, as recorded through the Captain’s hot mike
PF	: Pilot flying, as recorded through the Copilot’s hot mike
(SV)	: Synthesized voice of aircraft as recorded by the CAM
VHF	: VHF conversations with ATC
Ctl	: Air Traffic Control
(*)	: Words or groups of words not understood
(@)	: Various noises, alarms
(...)	: Words or groups of words which, at the time they were spoken neither interfered with the normal conduct of the flight nor add any elements useful for the analysis or understanding of this event.
( )	: Doubtful words or groups of words or those which required specific listening or study.

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
	06.36.41	0	Tahiti from Air France zero seventy-two descent in two minutes		As PNF	
01.38	06.36.46				Ctl: Air France zero seventy-two roger you go down nine thousand feet on Tango Alpha November with a QNH of one thousand sixteen unit zero unit six	
01.50	06.36.57	16	OK nine thousand feet on Tango Alpha November Air France zero seventy-two		As PNF	
02.00	06.37.05			Nine thousand feet		Song hummed by PNF
02.35	06.37.42	61	There's a forty feet difference between the altimeters			
02.38	06.37.45			Yeah		
03.22	06.38.29		(*)			
03.24	06.38.31	110	VSI	Eh ?		
03.25	06.38.32			Two point eight miles		
03.27	06		VSI descent			
03.31	06.38.38			That's Idle		
03.32	06		Idle			
03.34	06.38.41			That's it it's automatically gone into descent page, V NAV PATH		
03.47	06		(...)			Discussion with CAM 3
04.05	06.39.12	151	Hold			
04.06	06			Hold		
04.11	06.39.18		CAM 3: Did you give the temperature ?			
04.13	06.39.20		Twenty six degrees			
06.31 07.06	06.41.39 06.42.04	298	(...)			Discussion on Pointe Noire and lights
08.40	06.43.49				Ctl: Air France zero seventy-two your estimate for Tango Alpha	

CVR	TIME		COCKPIT AREA MICROPHONE		VHF	Observations
	UTC/Ctl	FDR	PNF	PF		
					November	
08.46	06.43.55	434	At six fifty three	Tango Alpha Nov...	AS PNF	
08.50	06.43.59				Ctl: Roger	
09.15	06.44.24	463	Descent path deleted			
09.17	06.44.26			Eh ?		
09.18	06.44.27		There was that			
09.19	06.44.28			What was wrong with it ?		
09.20	06.44.29		Descent path deleted you did it ... you did something			
09.25 09.55	06.44.34 06.45.04		Er Yes	No you know that I tried ... I put runway twenty-two, so as I put runway twenty-two because you know look what happens, here for the descent it it's marked « end of descent » at five hundred sixty feet M A twenty two, so I selected leg and here I was going to put, so after the M A twenty two I put runway twenty two for the simple fact that I did that that I put that, so the path, that's why the track had disappeared and it's been restored		
10.01	06.45.10			In fact the track exists		
10.06	06.45.15			It's fine there		
10.13	06.45.22		So then ...			
10.15	06.45.27	526	TAF zero eighty six we'll put it there T A F zap ! so zero eighty five eighty four, eighty three, there's a mile and a half difference			
10.32	06.45.41			Oh Yes because		
10.33	06.45.42		Zero fifteen that's good for that...	The chart I checked it a while ago		
10.40	06.45.49	548	The track is good but there's a mile difference, one point two miles, it's resetting now			
11.54	06.47.03	622	One point eight miles that's a bit much anyway shouldn't we try to			

CVR	TIME UTC/Ctl	TIME FDR	COCKPIT AREA MICROPHONE PNF	COCKPIT AREA MICROPHONE PF	VHF	Observations
			clear it?			
11.57	06.47.06			Eh ?		
11.58	06.47.07		Maybe I'll clear it			
12.10	06.47.19		Because it's not resetting there			
12.13	06.47.22			IRS Yeah otherwise we'll clear it		
12.15	06.47.24		Eh ?			
12.16	06.47.25			let's clear it		
12.18	06.47.27		OK			
12.19	06.47.28	647		clear confirmed		
12.22	06.47.31			Need to confirm it		
12.36	06.47.45			IRS still		
12.39	06.47.48		It's resetting there			
12.50	06.47.59		No it's not resetting Eh			
12.54	06.48.03		Zero eighteen path it's good			
13.01	06.48.10			Zero nineteen, zero...		
13.10	06.48.19			Seventy sixty-seven there's a mile and a half Yes		
13.47	06.48.57	736	We'll watch the DME we'll see			
13.49	06.48.59			Yes		
14.17	06.49.27			Well we'll just have to select QNH, since we're authorized at nine miles		
14.20	06.49.30		OK select QNH OK			
14.22	06.49.32			When I say go it will be seventeen thousand		
14.24	06.49.34	773		Go		
14.26	06.49.36		Check			
14.28	06.49.38			OK approach check list please		
14.30	06.49.40		And the approach check list			
14.33	06.49.43			It's still in IRS then		
14.35	06.49.45		Recall			

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
14.37	06.49.47			Checked		
14.43	06.49.53		Landing parameters			
14.45	06.49.55			Entered checked sorry		
14.48	06.49.58		Entered			
14.49	06.49.59			Oh entered yeah		
14.50	06.50.00		and altimeter QNH			
14.53	06.50.03			QNH thousand ...		
14.54	06.50.04		Compared	Compared		
14.55	06.50.05	804	Approach check list completed			
14.59	06.50.09			Thanks		
15.29	06.50.40	839		IRS NAV only It didn't register		
15.32	06.50.43		Well well			
15.38	06.50.49		But why did it do that (...) ?			
15.41	06.50.52			Well shall we clear it a second time ?		
15.44	06.50.55		Yeah			
15.45	06.50.56			We can only clear it Eh		
15.53	06.51.04	863		That's right clear it		
16.29	06.51.40			Oh Yes it's still not resetting Eh		
16.31	06.51.42		No			
16.35	06.51.46		We'll work on the DME on the other hand the path is good			
16.39	06.51.50			OK		
16.46	06.51.57			Zero twenty eight, zero twenty seven, OK		
17.03	06.52.14	933	Tahiti Air France zero seventy-two passing through twelve thousand one hundred twenty towards nine thousand feet, seventeen miles from Tango Alpha November	As PNF		
17.12	06.52.24				Ctl: Zero seventy-two roger you change with approach one hundred	

	TIME		COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
					twenty-one three call later	
17.16	06.52.28		Bye		As PNF	
17.20	06.52.32	951	Tahiti approach Air France zero seventy-two good evening we are passing one hundred ten towards nine thousand		As PNF	
17.29	06.52.41				Ctl: Roger Air France zero seventy-two hello you are authorized for final approach now VOR DME twenty two call back at ten miles	
17.37	06.52.50	968	OK, clear approach twenty two we'll call back from ten miles Air France zero seventy-two	Yeah	As PNF	
17.41	06.52.54			Four thousand two hundred initially		
17.43	06.52.56		So how much shall I put for you ?			
17.45	05.52.58			Four thousand two hundred		
17.46	06.52.59		Four thousand two hundred	That's it		
17.47	06.53.00		You've got it Eh			
17.48	06.53.01			Yeah Yeah that's it Yeah		
17.49	06.53.02		You can go below Eh that's good			
17.50	06.53.03			OK er... oh... Yes as you like		
17.53	06.53.06		That's OK now we can put it at ...			
17.55	06.53.08			Just put seven hundred feet Eh		
17.57	06.53.10		You've got it here Eh			
17.58	06.53.11			Yes Yes I've got it Yes		
18.00	06.53.13		There	That's it		
18.02	06.53.15	993	I'll select five hundred feet for you			
18.04	06.53.17			There you go, that's it		
18.05	06.53.18		And then when it's on the descent well I'll put you on...			

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
18.09	06.53.22		There it is	... OK for the go around which is ... we said ... climb		
18.13	06.53.25		Thirty nine			
18.14	06.53.27			Five thousand six hundred		
18.19	06.53.32			The go around is at five thousand six hundred feet or above		
18.22	06.53.35		Yes that's right five thousand six hundred feet eh			
18.24	06.53.37			OK		
18.26	06.53.39			Level one hundred headlights on ON		
18.28	06.53.41	1019	Yes			
18.29	06.53.42			And the LOGO		
18.41	06.53.54			Once we're lined up you select RAW DATA please		
18.44	06.53.57		Yes			
18.47	06.54.00			That's it		
18.49	06.54.02			Thanks		
18.52	06.54.05		One point and a half from V O R			
19.15	06.54.28		Er here it's resetting Eh			
19.17	06.54.30			Eh ?		
19.18	06.54.31	1069	It's resetting now			
19.19	06.54.32			Erm VD Yeah		
19.20	06.54.33		That's it it's reset			
19.21	06.54.34			Yeah		
19.23	06.54.36		It's reset for distance and it's OK now			
19.25	06.54.38			OK		
19.30	06.54.43			VOR DME		
19.32	06.54.45		Good I'm going to select progress like that I'll have the distance			
19.36	06.54.49	1087		Yeah		

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/CtI	FDR	PNF	PF		
19.37	06.54.50		One point from the V O R			
19.40	06.54.53			Checked		
19.42	06.54.55			Hey this light doesn't help me much		
20.02	06.55.16		Er it's reset			
20.04	06.55.18			Thanks		
20.08	06.55.22	1120	We're arriving on the V O R	Track two hundred twenty-three OK		
20.25	06.55.39		Well	Thirty miles eight thousand feet we're on the right path		
20.30	06.55.44		Well			
20.32	06.55.46		So repeating ten miles ten miles three thousand feet			
20.37	06.55.51		So four thousand two hundred feet it's fourteen...	DME confirmed		
20.40	06.55.54	1152	TAF fourteen			
21.12	06.56.26		OK the V O R is centered			
21.14	06.56.28			Thanks		
21.23	06.56.37		Maybe we can start extending the flaps, no ?			
21.25	06.56.39			Yeah in fact I've just reduced speed flap one		
21.28	06.56.42		OK			
21.29	06.56.43			There you go		
21.32	06.56.46		V NAV speed, flaps one	Flaps one how how far out are we, twenty five? flaps one Yes ?		
21.35	06.56.49	1207	@			Noise similar to selection of flap
21.47	06.57.01		Flaps one green			
21.48	06.57.02			OK		
22.03	06.57.17			OK six thousand six hundred		
22.12	06.57.26		You're going above the slope			
22.14	06.57.28			Yeah flaps five		
22.17	06.57.31	1249	flaps five @			Noise similar to

	TIME		COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
						selection of flap
22.30	06.57.34			Oh sorry		
22.35	06.57.50			Hey what's wrong ?		
22.36	06.57.51		A little cloud			
22.37	06.57.52			Right on the path ? Hey wait		
22.40	06.57.55		Yes but I see lights behind they're just little scattered clouds			
22.48	06.58.03		Flaps five green			
22.49	06.58.04			OK Thanks		
23.14	06.58.29	1306		We are at eighteen DME		
23.17	06.58.32		So at fourteen DME four thousand two hundred feet			
23.19	06.58.34			Confirmed		
23.25	06.58.40			Then at ten DME we must be at three thousand		
23.28	06.58.43	1320	You're six hundred feet above the descent path			
23.31	06.58.48			Oh well		
23.39	06.58.54			OK I'll disconnect the AP There it is (*) we'll finish by hand		
23.43	06.58.58		Yes			
23.44	06.58.59	1336	(@)			AP disconnection
23.45	06.59.00			OK F D AP disconnected		
24.10	06.59.25		So four thousand five			
24.11	06.59.26			So flaps ten		
24.14	06.59.29		Speed V NAV path	OK		
24.16	06.59.31	1368	Flaps ten	Flaps ten		Noise similar to selection of flap
24.17	06.59.32			Cu... cursors		
24.18	06.59.33				Ctl: seventy two is the airfield in sight ?	
24.20	06.59.35		Ten green	Yes confirm airfield in sight... negative		
24.23	06.59.38	1376	Ermm ...not yet Air France zero		AS PNF	

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
			seventy-two there's a little cloud in front		Ctl: @	Transmit/receive click
24.29	06.59.44			So flaps five ten green		
24.32	06.59.47			Cursor flaps ten ah that's good		
24.33	06.59.48	1385	So we've passed ... That's good fourteen thousand two hundred			
24.35	06.59.50			That's good		
24.37	06.59.52		So now three thousand feet ten miles	OK so we've got		
24.39	06.59.54			Yeah		
24.41	06.59.56			err the landing gear on extend		
24.44	07.00.00	1397	@			Noise of landing gear extension selection
24.46	07.00.01		Gear extend @			Single Chime
24.47	07.00.02			And flaps twenty		
24.49	07.00.04		Flaps twenty			
24.50	07.00.04	1401	@			Noise similar to selection of flap
24.54	07.00.09		And speed...	Cursor flaps twenty please		
24.56	07.00.11		Yes that's it flaps twenty green			
24.57	07.00.12			Yes ... cursor reduce the speed for me		
25.01	07.00.16			One hundred sixty		
25.03	07.00.18	1414	Cursor speed one hundred sixty			
25.05	07.00.20			Right thanks, so the next ten miles three thousand feet		
25.09	.07.00.24		Confirm			
25.12	07.00.27		Hey I don't see the V O R any more			
25.14	07.00.29			Eh ?		
25.16	07.00.31			I see the DME here Eh		
25.19	07.00.34			You have you haven't got it any more ?		

	TIME		COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
25.20	07.00.35		What's going on there ?	(*)		
25.25	07.00.40	1437	Hey we see the runway in front down there			
25.26	07.00.41			However there's no signal the signal		
25.27	07.00.42		Why can't we see the ?			
25.32	07.00.47			Er it's disappeared the course has disappeared on yours		
25.35	07.00.50			The course we'll just put it back at two hundred twenty three		
25.39	07.00.54		That's it			
25.41	07.00.56			Er Yes that's why		
25.46	07.01.01			OK		
25.48	07.01.03	1461	Runway in sight Air France zero seventy-two		AS PNF	
25.50	07.01.05			Flaps thirty		
25.53	07.01.08	1467	@			Noise of selector
25.54	07.01.09		Flaps thirty		Ctl: Roger call back at ten miles	
25.57	07.01.12	1471	That's it we're passing ten miles		AS PNF	Engine speed increases
25.59	07.01.14			Cursor one hundred fifty please		
26.02	07.01.17			Or even a little less if the wind...		
26.04	07.01.19	1478	One hundred forty-nine			
26.05	07.01.20			That's it		
26.06	07.01.21					Engine speed decreases
26.09	07.01.24	1483	Air France zero seventy-two we're passing nine miles now		AS PNF	
26.12	07.01.27				Ctl: Roger landing authorized twenty -two wind from one eighty degrees at four knots	
26.19	07.01.35	1494	OK landing authorized twenty - two Air France zero seventy-two	OK	AS PNF	

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
26.22	07.01.38			Landing check list		
26.24	07.01.40		So landing check list	Yeah		
26.25	07.01.41					Noise of taking out checklist
26.33	07.01.49	1508	Before landing airbrakes armed			
26.36	07.01.52		Landing gear			
26.38	07.01.54			Extended green		
26.39	07.01.55		Flaps			
26.40	07.01.56		@ Thirty green			Noise of putting away checklist
26.41	07.01.57	1516	Pre-landing check list			
26.44	07.02.00			Thanks		
26.48	07.02.04		So the next point is			
26.52	07.02.08			Six point five at eleven hundred feet		
26.56	07.02.12			That's it isn't it ?		
26.57	07.02.13		Seventeen hundred fifty feet			
26.58	07.02.14			Seventeen hundred fifty feet at six		
27.00	07.02.16	1535	Six	Right		
27.11	07.02.27		So not bad we can see the VASIS it looks good			
27.14	07.02.30			Eh ? yeah		
27.15	07.02.31		We can see the VASIS It looks good so we arrive at six one...			
27.19	07.02.35	1554	Six ten eight hundred we are a hundred feet too high			
27.24	07.02.40		Which is no big deal			
27.27	07.02.43		So the next point is?	Yeah		
27.28	07.02.44		@			Noise of selector
27.34	07.02.50	1569	Four eleven hundred fifty			
27.35	07.02.51		@			Noise of selector
27.36	07.02.52			Err yeah OK		
27.40	07.02.56		You've got the VASIS now eh,			

	TIME		COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/CtI	FDR	PNF	PF		
			do you see it there ?			
27.43	07.02.59			Yeah yeah I see it		
27.50	07.03.06	1585	Well five thousand six hundred feet			
27.54	07.03.10		Selected			
27.55	07.03.11			Thanks		
28.00	07.03.16			You see it memorizes something eh? ...it memorizes its slope and then even when we select check list finished		
28.06	07.03.22		Yes			
28.07	07.03.23			Thanks		
28.10	07.03.26			Oh yeah		
28.13	07.03.29			I see the VASIS		
28.23	07.03.39	1618	(SV): One thousand			
28.32	07.03.49		We have three yellows and a red			
28.36	07.03.53		Tahitians sleep in peace			
28.38	07.03.55			Eh ?		
28.39	07.03.56		Tahitians sleep in peace, we're going over them now			
28.41	07.03.58			OK		
28.45	07.04.02	1640	We've just passed decision height			Engine speed decreases
28.49	07.04.06			OK in sight		
28.53	07.04.10		I'll put on the lights for you	Please		
28.56	07.04.13	1651	@			Noise of selector
28.57	07.04.14		We're a bit high			Engine speed increases
28.59	07.04.16	1654	(SV): Five hundred			
29.00	07.04.17		Thrust reference V NAV speed	OK I'm going I'm going to visual		
29.06	07.04.23	1661	(SV): Four hundred			
29.08	07.04.25		We're above the glide descent path			

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
29.09	07.04.26			Yeah		
29.11	07.04.28		Watch out the speed you're going too fast here			
29.13	07.04.30	1668	We're going much too fast eh	(@) (SV): Three hundred		Reduction in engine speed
29.16	07.04.33		One eighty knots	I haven't got (*)		
29.17	07.04.34			What's happening		Noise of selector
29.18	07.04.35			Oh yeah because		
29.20	07.04.37	1675	(SV): Two hundred			
29.21	07.04.38			OK disconnect		Noise of selector
29.24	07.04.41	1679	(SV): One hundred			
29.28	07.04.43		(SV): Fifty			
			(SV): Forty			
29.29	07.04.46		(SV): Thirty			Noise of selector
29.30	07.04.47		(SV): Twenty			Noise of selector
29.31	07.04.48		(SV): Ten			
29.32	07.04.49		Gently Gently Gently Gently Gently			
29.33	07.04.50	1688	Here it is	(@)		Wheels touch down Increase in speed of engines
29.34	07.04.51			Oh-oh!		
29.40	07.04.57		What's going on here ?			
29.42	07.04.59		apply reverse (...)	I dunno yeah, yeah		
29.44	07.05.01			All reversers wait		
29.47	07.05.04	1703		There's a reverser		Engine speed increases
29.48	07.05.05			Apply number one reverser		
29.50	07.05.07	1706		Apply reverse thrust again		engine speed decreases
29.51	07.05.08			Apply reverse thrust again		
29.53	07.05.10			Apply reverse thrust again		

TIME			COCKPIT AREA MICROPHONE		VHF	Observations
CVR	UTC/Ctl	FDR	PNF	PF		
29.54	07.05.11			That's it one of the reversers hasn't actuated		
29.55	07.05.12	1711				Engine speed increases
29.57	07.05.14		(...) what's	Watch out, watch out, watch out		
29.58	07.05.15	1714				Engine speed decreases
30.01	07.05.18			Oh-oh!		
30.04	07.05.21		(...) but what's happening (...)			Increase in background noise similar to a runway excursion
30.10	07.05.27	1726	(...) !	Oh-oh!		
30.13	07.05.30	1729	(...) !			
30.16	07.05.33	1732	End of Recording			


AIR FRANCE