

FINAL REPORT

SERIOUS INCIDENT
To B737-800, Registration EI-DAV,
On approach to Rome Ciampino and Fiumicino Airports
September 7th 2005

AGENZIA NAZIONALE
PER LA SICUREZZA DEL VOLO

www.ansv.it

e-mail: safety.info@ansv.it

TABLE OF CONTENTS

TABLE OF CONTENTS.....	I
OBJECTIVE OF THE TECHNICAL INVESTIGATION	III
PRELIMINARY REMARKS.....	IV
CHAPTER I - FACTUAL INFORMATION.....	1
1. FACTUAL INFORMATION	1
1.1. HISTORY OF THE FLIGHT	1
1.2. INJURIES TO PERSONS	9
1.3. DAMAGE TO THE AIRCRAFT	9
1.4. OTHER DAMAGE.....	9
1.5. PERSONNEL INFORMATION	9
1.5.1. Flight crew	9
1.5.2. Flight experience	9
1.5.3. Air traffic controllers	10
1.6. AIRCRAFT INFORMATION	10
1.7. METEOROLOGICAL INFORMATION.....	10
1.8. AIDS TO NAVIGATION	13
1.9. COMMUNICATIONS	13
1.10. AIRPORT INFORMATION.....	13
1.11. FLIGHT RECORDERS	14
1.12. WRECKAGE INFORMATION.....	14
1.13. MEDICAL AND PATHOLOGICAL INFORMATION.....	14
1.14. FIRE	14
1.15. SURVIVAL ASPECTS.....	15
1.16. TESTS AND RESEARCH.....	15
1.16.1. Weather radar	15
1.17. ORGANIZATIONAL AND MANAGEMENT INFORMATION.....	15
1.17.1. Operations Manual – Part A.....	16

1.18. ADDITIONAL INFORMATION.....	17
1.18.1. NTSB safety alert.....	17
1.18.2. Aircraft approaching at Rome Fiumicino (LIRF)	17
1.18.3. Final approach	18
1.19. USEFUL OR EFFECTIVE METHODS OF INVESTIGATION	18
CHAPTER II - ANALYSIS	19
2. ANALYSIS	19
2.1. FLIGHT OPERATIONS	19
2.1.1. Pilots.....	19
2.1.2. The flight	20
2.1.3. Visual approach	26
2.1.4. Weather conditions	26
2.1.5. Air Traffic Control	27
2.1.6. Aids to navigation.....	27
2.2. HUMAN FACTOR.....	27
2.2.1. Psychological and physiological factors	27
CHAPTER III - CONCLUSIONS.....	33
3. CONCLUSIONS	33
3.1. GENERAL	33
3.2. FINDINGS	33
3.3. CAUSE AND CONTRIBUTORY FACTORS	34
CHAPTER IV - SAFETY RECOMMENDATIONS	37
4. RECOMMENDATIONS	37
4.1. RECOMMENDATION ANSV-23/782-05/1/I/08.....	37
LIST OF ATTACHMENTS.....	38
ATTACHMENT A	39
ATTACHMENT B	40
ATTACHMENT C	41
APPENDIX Air Accident Investigation Unit - Ireland (AAIU) comments	42

OBJECTIVE OF THE TECHNICAL INVESTIGATION

The technical investigation relative to the event concerned, as provided for by Art. 827 of the code of navigation, was conducted in conformity with the provisions of Annex 13 to the Convention on International Civil Aviation, agreed in Chicago on December 7th 1944, approved and implemented in Italy by legislative decree no. 616 dated March 6th 1948, ratified by law n. 561 of April 17th 1956.

The Agenzia Nazionale per la Sicurezza del Volo (the Italian Air Safety Board) conducts technical investigations within its jurisdiction with “*the sole objective of preventing accidents and incidents, excluding any evaluation of blame and liability*” (Art. 3, paragraph 1, legislative decree n. 66 of February 25th 1999).

For every investigation into an accident the Agenzia Nazionale per la Sicurezza del Volo compiles an accident report while, for every investigation into an incident, it compiles an incident report. The accident and incident reports may contain safety recommendations, aimed at the prevention of accidents and incidents (Art. 12, paragraphs 1 and 2, legislative decree n. 66 of February 25th 1999).

In accident reports the safeguard of the right to confidentiality of those involved in the event as well as of those who provide information in the course of the investigation is carefully respected; in incident reports also the safeguard of anonymity of those involved in the event, is respected (Art. 12, paragraph 3, legislative decree n. 66 of February 25th 1999).

"In no case the concern of accident and incident investigation reports and safety recommendations is to apportion blame or liability" (Art. 12, paragraph 4, legislative decree n. 66 of February 25th 1999).

Although great attention has been paid in the translation of the report into the English language, the Italian language version is to be considered as the only official reference text.

PRELIMINARY REMARKS

The event occurred on September 7th, 2005, at 12.25 UTC (14.25 local time) in the Rome airports area (Ciampino and Fiumicino) and involved a B737-800 aircraft, registration marks EI-DAV.

The event was reported to the ANSV by the equivalent Irish investigation authority (Air Accident Investigation Unit – AAIU) on January 13th, 2006.

On January 18th, 2006, after the acquisition of further pertinent information, ANSV proceeded with the institution of a serious incident investigation.

The Agenzia Nazionale per la Sicurezza del Volo, under the terms of legislative decree n. 66 of February 25th 1999, conducted the technical investigation in conformity with Annex 13 to the Convention on International Civil Aviation (Chicago, 1944).

The AAIU appointed an accredited representative to participate to the technical investigation conducted by ANSV.

Note:

- All times given within the report are UTC (Coordinated Universal Time) which, at the time of the event, corresponded to local time minus two hours).
- Altitudes referred to within the report are taken from the radar recording, the values of which refer to a standard pressure of 1013 hPa and are generically referred to as “altitudes”.
- Airspeed in the present report should be interpreted as Ground Speed (GS), unless otherwise specified.

CHAPTER I

FACTUAL INFORMATION

1. FACTUAL INFORMATION

1.1. HISTORY OF THE FLIGHT

On September 7th 2005 flight RYR 9672, a scheduled flight with 166 passengers on board, departed from Niederrhein airport (Germany) with destination Rome Ciampino airport (hereafter referred to as Ciampino).

Before the event flight, the same morning the crew had already completed three legs, first take-off was from Ciampino at 04.15 towards Treviso, from Treviso take-off was at 05.55 back to Ciampino and finally from Ciampino at 07.35 towards Niederrhein.

The captain stated verbally that, before departure for the event flight from Niederrhein, he had checked Ciampino airport weather reports and that he had requested 8200 kg of fuel, figure that included the minimum fuel quantity necessary for the flight and an additional fuel quantity of 950 kg for any eventual unexpected circumstances, such as particular weather conditions.

The first part of the flight was operationally uneventful. The crew declared that when at 80 NM from destination they had observed thunderstorm activity that required a series of deviations from the planned route.

Both pilots were based in Ciampino, and during the last month they had performed approximately 25 approaches and landings on this airport, therefore they were familiar with the airport.

Approaching Bolsena lake, the co-pilot made a first request to air traffic control (Rome ACC, on radio frequency 124.2 MHz), asking if there was any expected delay on landing, to which he received a negative reply.

Descent phase already started and under radar vectoring, to avoid storm activity, the crew of RYR 9672, asked for weather reports of Pescara airport (first operator's alternate airport) and of Ciampino. At 11.55.01, after having received weather reports, RYR 9672 was instructed to contact Rome ACC (arrivals sector) on frequency 125.5 MHz.

On first radio contact, RYR 9672 asked Rome ACC if landings were currently being conducted at Ciampino. The controller answered that three aircraft were diverting from Rome Fiumicino

(hereafter referred to as Fiumicino) to Ciampino and that one was in the landing phase. Approximately three minutes later, at 11.59.27, RYR 9672 requested clearance to proceed, after PEMAR reporting point, directly to Ciampino Runway 15 Outer Marker. Rome ACC cleared RYR 9672 to proceed towards Guidonia Locator (GUI) and to report when able to perform a visual approach.

Initially the crew accepted to proceed towards Guidonia, but soon after, they asked again to proceed directly to the Outer Marker because of adverse weather conditions over Guidonia (ref. position “A” in figure 1).

Later the air traffic controller cleared RYR 9672 to descend to flight level 90 (FL90), to proceed towards the Outer Marker and to report, approaching the marker, if visual flight conditions were present in the area.

At 12.03.47 Rome ACC air traffic controller, realizing that RYR 9672 was not proceeding towards the Outer Marker as instructed, asked for how many more miles they needed to maintain the present heading. The crew answered with the following not very clear communication («We intercept ... to the Outer Marker and we need further descent RYR 9672»), requesting clearance for further descent (ref. position “B” in figure 1).

Rome ACC cleared the flight to 6000 ft , requesting it to perform a rapid descent and communicating the barometric pressure for the altimeter setting.

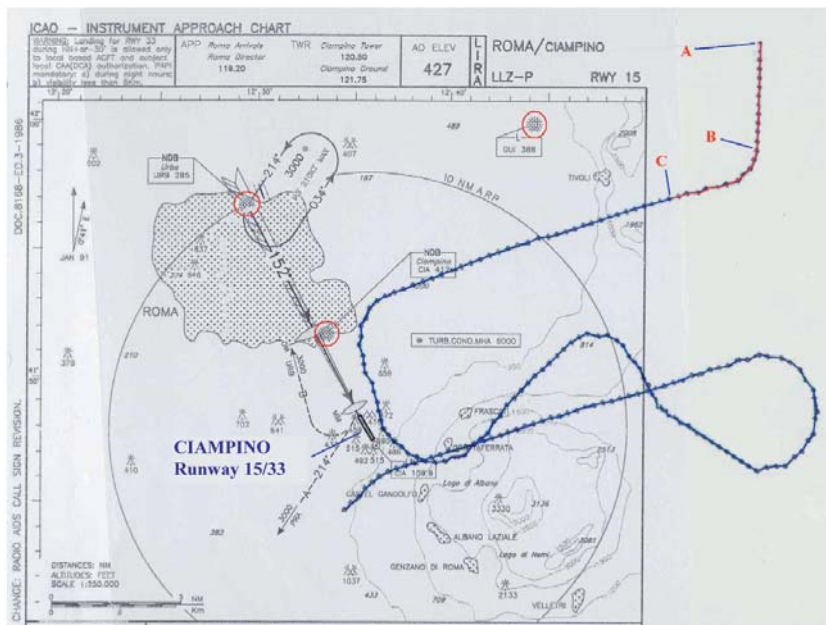


Figure 1: The path of the aircraft approaching CIA, positions A, B and C.

At 12.05.10, when RYR 9672 was about 13 nautical miles from the Outer Marker, with ground speed approximately 260 knots, Rome ACC communicated that the active runway at Ciampino had now been changed because of a change in wind intensity and direction: «now in Ciampino is reported tail wind from 25 knots and so

runway in use is landing 33»

Rome ACC requested RYR 9672 if they were able to proceed to Urbe (URB) holding pattern, but RYR 9672 replied that they wanted to perform a visual approach to RWY 33 (ref. position “C” in figure 1).

Rome ACC communicated to RYR 9672 that they were number two in the landing sequence, after another aircraft presently in the traffic pattern, and instructed the flight to maintain 6000 ft.

At 12.07.11, RYR 9672 turned left onto an heading of approximately 170° (ref. position “D” in figure 2).

In order to separate RYR 9672 from the preceding traffic on downwind, the air traffic controller requested RYR 9672 to perform a left turn of 360°. RYR 9672 confirmed and simultaneously started the left turn, but at 12.08.44 communicated that it was unable to complete the turn because of the presence of a large build-up of storm clouds and that they were not in visual flight conditions (ref. position “E” in figure 2): « unable to try 360 due to huge build-up and we are not visual».

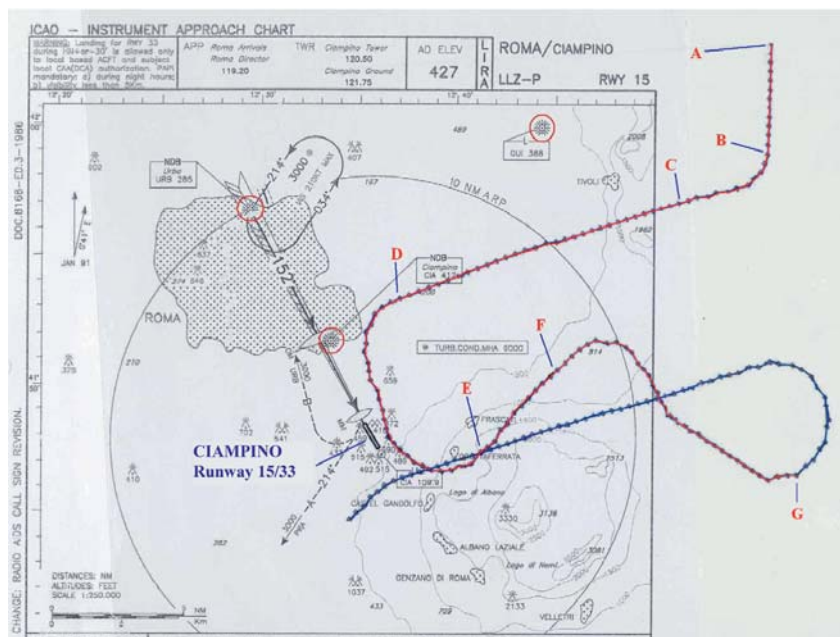


Figure 2: the path of the aircraft on approach to CIA, positions D, E, F and G.

Rome ACC air traffic controller asked if they could continue the left turn until heading 290°, but RYR 9672 replied that it had to maintain a heading of 050° to avoid the storm. At 12.10.13, RYR 9672 requested to turn to the right to avoid large cloud formations on its left, and received clearance to assume heading 150° (ref. position “F” in figure 2).

At 12.11.37 Rome ACC, requested the pilot to change radio frequency to 131.25 MHz to receive instructions for landing.

At 12.11.59, on the new frequency, RYR 9672 communicated to the controller that it was maintaining a heading of 130° and an altitude of 6000 ft. The controller requested if they were able to turn right for a visual approach to Runway 33, RYR 9672 replied requesting a left turn. The request was accepted with instruction to turn to an heading of 250°. Approximately one minute

later, RYR 9672 requested to descend to 3000 ft in order to be able to perform a visual approach to Runway 33; alternatively they would have had to divert to Fiumicino or Pescara; the air traffic controller pointed out to the crew that minimum safe radar altitude in that position was 6000 ft (ref. position “G” in figure 2).

One minute after this last radio communication, at 12.14.11, RYR 9672 informed Rome ACC to have ground visual contact and was then cleared to descend to 5000 ft.

At 12.14.47, RYR 9672 asked Rome ACC if any aircraft were landing at Ciampino at that time. ATC replied that no traffic was landing on Runway 15 nor on Runway 33.

At this point RYR 9672 requested information about the weather conditions at Ciampino. Rome ACC requested in turn if RYR 9672 had the field in sight, and receiving a negative reply, insisted with the instruction to continue to maintain altitude 5000 ft (minimum safe radar altitude - ref. position “H” in figure 3): «ACC: maintain 5000 ft due to minima radar we have below to you the Cavo Mountain».

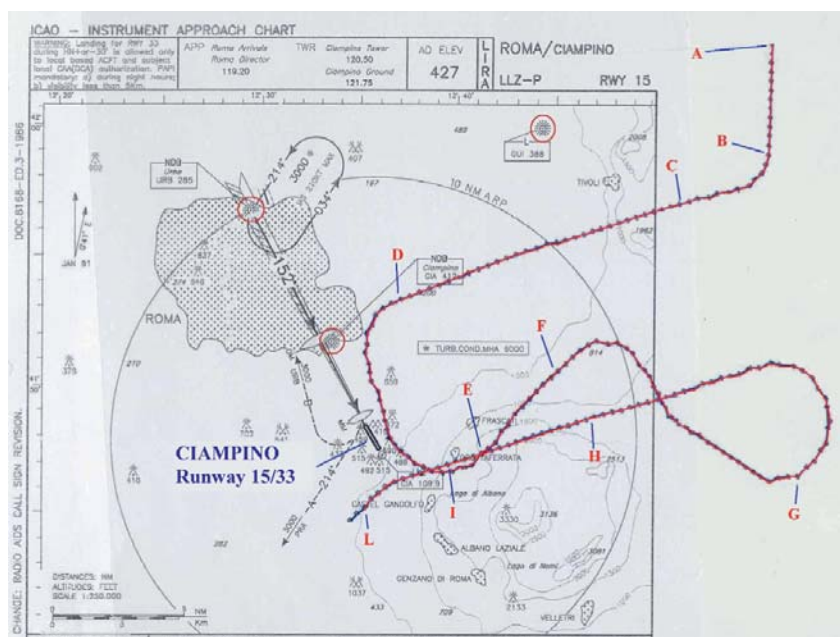


Figure 3: the path of the aircraft in approach to CIA: positions H, I and L.

At 12.16.41 the air traffic controller communicated to RYR 9672 the distance to the airport runway 33 (about 8 nautical miles), receiving as answer «no visual contact at the moment».

At about 12.17, the air traffic controller proposed RYR 9672 a positioning for a landing on runway 15, without informing the crew that the wind had

again changed in that same moment. The crew, who was most probably still convinced that the wind was still northerly, requested further information on the weather conditions at Ciampino. The air traffic controller communicated that the actual wind was from 130°/11 knots, with presence of cumulonimbus clouds and a partial cloud cover.

At almost the same time, RYR 9672 requested to turn left onto heading 230° and to descend, due to severe turbulence (ref. position “I” in figure 3).

At approximately 12.18.21 (ref. position “L” in figure 3), RYR 9672 requested to proceed towards Pratica di Mare (PRA) and then Fiumicino for an eventual landing. The clearance was issued with the constraint to maintain 5000 ft. The crew was further requested to confirm that they were able to perform the approach and landing on Fiumicino airport. The answer was affirmative.

The air traffic controller then asked RYR 9672 on which runway they would have preferred to land, 34R or 34L, providing, on specific request by the crew, the weather conditions on the airport: wind from 050° intensity 7 knots with gusts up to 34 knots, visibility 4 km, present thunderstorm, cumulonimbus at 1,500 ft.

RYR 9672, after having received the weather report, asked again for information on landing traffic at Fiumicino, and after confirmation that two aircraft had landed 5 minutes earlier, requested which runway was closer to its current position.

While RYR 9672 was approaching PRA at altitude 5000 ft, Rome ACC asked them whether they would have preferred to perform a holding pattern over PRA to wait for an improvement of meteorological conditions or, alternatively, perform a precision approach.

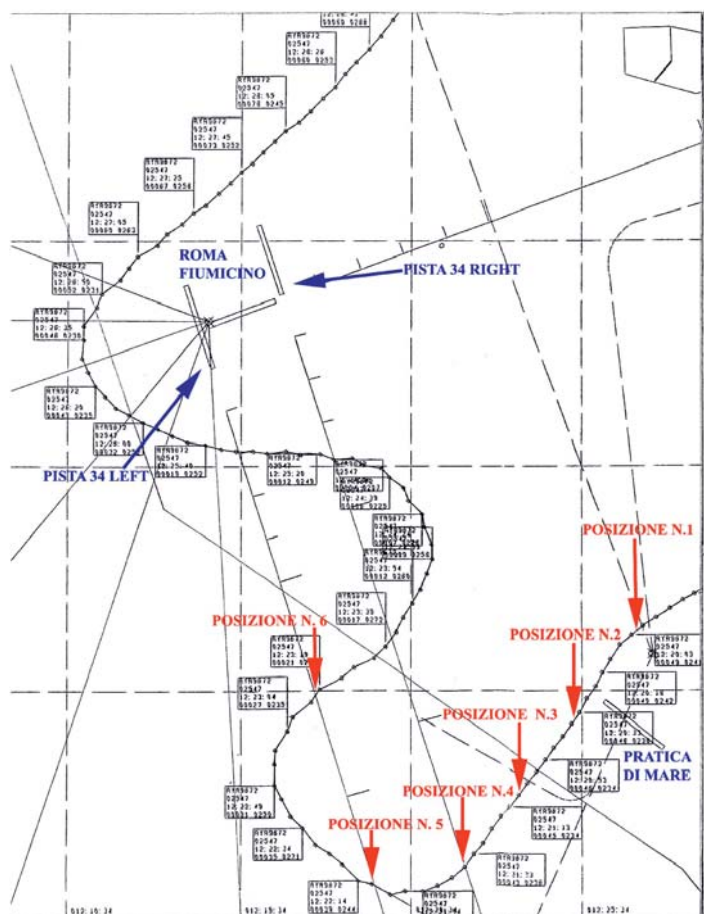


Figure 4: positions of the aircraft during final approach to Fiumicino

RYR 9672 replied that they wished to perform an immediate left turn to heading 210° and to continue descent under radar vectoring until visual ground contact was achieved. At that moment the aircraft was at an altitude of 4900 ft, with a ground speed of 245 knots (ref. position n. 1 in figure 4). Rome ACC instructed RYR 9672 to maintain heading 210° and to descend to 4000 ft.

At 12.20.35 RYR 9672 again requested information about the runway in use.

The aircraft was at an altitude of 4700 ft, with ground speed 235 knots (ref. position n. 2 in figure 4). Rome ACC instructed RYR 9672 to turn right onto heading 310°, to

establish on Runway 34R approach, and received acknowledgment from RYR 9672 of the clearance issued.

But at 12.21.07, approximately 32 seconds after the preceding communication, the air traffic controller instructed RYR 9672 to turn onto heading 310° and to establish on Runway 34L approach (the aircraft was at an altitude of 4520 ft with speed 234 knots; ref. position n. 3 in figure 4).

From the transcript of communications exchanged on frequency 119.2 MHz it can be deduced that the change of runway assignment to RYR 9672 was determined by the need to coordinate a parallel approach to runways 34R and 34L. Flight ISG 332, coming from the south-east, had in fact been cleared for a Runway 34R approach and RYR 9672, as a result, had been cleared for a Runway 34L approach. The air traffic controller operating on frequency 119.2 MHz informed flight ISG 332 about the presence and position of RYR 9672. The controller in contact with RYR 9672 on frequency 131.25 MHz, had communicated to the flight only the runway change, so the crew of RYR 9672 had not been informed about the presence and the proximate position of the other aircraft.

RYR 9672 did not turn immediately to the right onto heading 310°, to intercept the localizer 34L as instructed, but kept on maintaining heading 210°. At 12.21.38, the aircraft was at altitude 4255 ft, with speed 240 knots (ref. position n. 4 in figure 4) and crossed the extension of Runway 34R centreline with heading approximately 210°, at a distance of about 13.5 nautical miles from the runway threshold.

At 12.22.09, altitude 3880 ft and speed 240 knots RYR 9672 started a right turn (ref. position n. 5 in figure 4) and crossed the extension of the centreline of Runway 34L.

Worth of note is the fact that during the preceding descent phase, the captain had disconnected the autopilot and continued in manual mode due to severe turbulence.

The air traffic controller confirmed the previous instruction to align with Runway 34L and to change frequency to 119.2 MHz for the final phases of approach and landing and thanked RYR 9672 for the cooperation, unaware of the fact that RYR 9672 was not informed about the reason for the sudden change of runway.

The co-pilot did not select the new frequency 119.2 MHz and at 12.23.15, still on the previous frequency of 131.25 MHz, requested to descend to 2000 ft while again crossing the extension of the centreline of Runway 34L on heading 040°.

Actually RYR 9672, as detected from the radar plots, had already left altitude 3000 ft before receiving any clearance. The aircraft was, in fact, at altitude of 2120 ft maintaining a speed of 255 knots (ref. position n. 6 in figure 4).

The air traffic controller, who had not noticed RYR 9672 unauthorized descent below 3000 ft, replied instructing them to descend immediately to 1000 ft, because of other traffic to their right (flight ISG 332) established on ILS Runway 34R, which was in contact on frequency 119.2 MHz, and was also descending to 2000 ft.

At 12.23.43, RYR 9672 crossed Runway 34R centreline extension at an altitude of approximately 1650 ft, on heading 030° and a speed of approximately 270 knots, about 3 nautical miles behind ISG 332, who was proceeding on the ILS of the same runway 34R with a slower speed (ref. position n. 7 in figure 5).

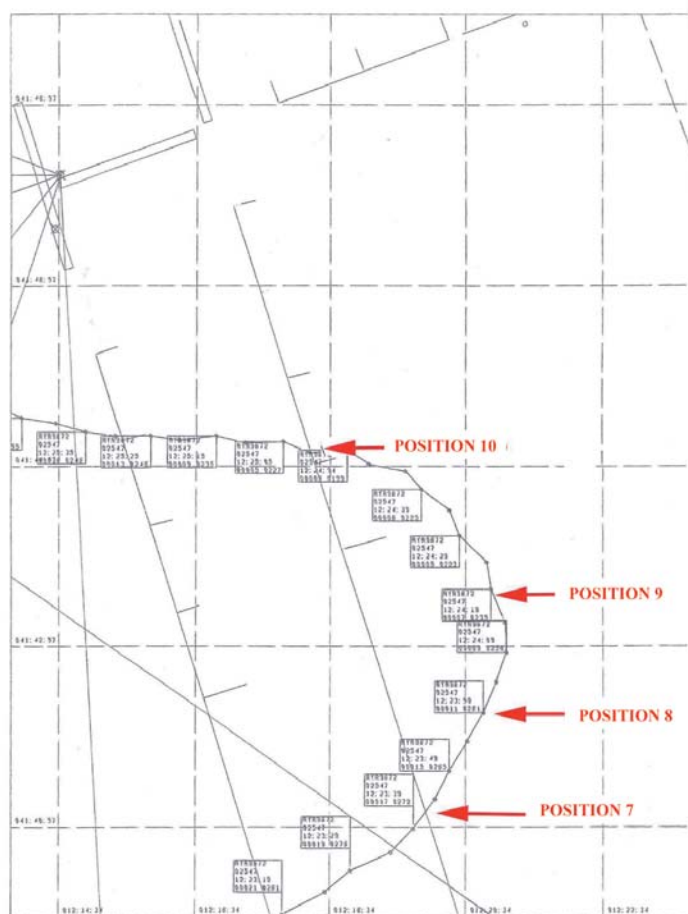


Figure 5: Radar tracking with indication of the positions referred to.

34R. At that moment the aircraft was on a heading of 022° turning left, with a speed of 265 knots and at an altitude of approximately 1300 ft (ref. position n. 8 in figure 5). The air traffic controller did not inform RYR 9672 that the altitude, indicated on the Instrument Approach Chart, for that position was 2200 ft, while the aircraft was flying at 1300 ft, 900 ft too low. The captain declared that at about this altitude the aircraft encountered a strong downdraft (*microburst*). RYR 9672 replied: «Stand-by 9672».

At 12.23.45 the air traffic controller, communicated RYR 9672 the distance from the field (8 nautical miles) and instructed them to report field in sight.

At that moment the aircraft was at a speed of 265 knots and altitude 1430 ft. Altitude 1430 ft is approximately 770 ft lower than the altitude of 2200 ft, at which they should have been in that position according to the correct approach profile (ref. runway 34L Instrument Approach Chart).

Rome ACC air traffic controller did not warn RYR 9672 that its altitude was too low. Shortly afterwards the same controller instructed the flight to turn left to align with runway

A few seconds later the air traffic controller again transmitted on the frequency: «RYR 9672, 6 nautical miles to the field able to approach or otherwise to climb». The crew replied that they were compelled to start a climbing manoeuvre.

At 12.24.17 RYR 9672 had reached an altitude of 735ft, while according to the Instrument Approach Chart, the altitude in that position should have been 1900 ft., and had assumed an heading of 335 degrees, with a speed of 245 knots (ref. position n. 9 in figure5).

Rome ACC, reported to RYR 9672 the new distance from Fiumicino airport (5 nautical miles), and repeated that their assigned runway was 34R. The crew replied that they had just started to climb.

At 12.24.59 RYR 9672 started the missed approach manoeuvre. At that moment, the aircraft again crossed the localizer of Runway 34 Right, on a heading of 284 degrees, speed 200 knots and an altitude of approximately 370 ft (ref. position n. 10 in figure 5; this altitude is referred to the standard setting 1013 hPa and is equivalent to an altitude of 454 feet on an altimeter set on the QNH, which at the time was 1016 hPa). In that position the correct altitude, according to the normal descent profile for landing, as indicated on the runway 34R Instrument Approach Chart should have been approximately 1300 ft.

At 12.25.41, the captain decided to divert to Pescara airport and finally interrupted the approach manoeuvre to Fiumicino airport.

Yet, even after having decided for the diversion, the crew asked for the present weather conditions at Ciampino airport, receiving information of a severe storm currently affecting the airport. At this point RYR 9672 confirmed the intention to divert to Pescara, requesting for a radar vectoring direct to the airport.

The aircraft landed at Pescara at 12.50 with 1520 kg. of fuel on board.

The pilots declared, during their interview with ANSV, that throughout the approach, performed initially at Ciampino and afterwards at Fiumicino, the weather radar on board had constantly shown a green colour clutter, indicating clouds with high water content but with no storm cells indication.

1.2. INJURIES TO PERSONS

<i>injuries</i>	<i>crew</i>	<i>passengers</i>	<i>others</i>
fatal	-	-	-
serious	-	-	-
minor	-	-	-

1.3. DAMAGE TO THE AIRCRAFT

None.

1.4. OTHER DAMAGE

None.

1.5. PERSONNEL INFORMATION

1.5.1. Flight crew

Captain age 37, male, Polish nationality.
Flight crew license: valid Airline Transport Pilot Licence (ATPL).
Medical certification: valid.

Co-pilot: age 24, male, Dutch nationality.
Flight crew license: valid Commercial Pilot Licence (CPL).
Medical certification: valid.

1.5.2. Flight experience

Captain

Total flight hours: 7400h.
Total flight hours on aircraft type: 2300h.
Preceding 24h: 08h 16'.
Preceding 7 days: 08h 51'.

Co-pilot

Total flight hours:	475h.
Total flight hours on aircraft type:	300h.
Preceding 24h:	07h 31'.
Preceding 7 days:	28h 29'.

1.5.3. Air traffic controllers

ATC frequency 125.5 MHz:	age 49, male, Italian nationality.
Qualifications:	Radar area controller.
Medical certification:	valid.
Hours on duty on the event day:	10 hours (05.00/15.00).

ATC frequency 131.25 MHz:	age 54, male, Italian nationality.
Qualifications:	Radar area controller.
Medical certification:	valid.
Hours on duty on the event day:	7 hours (13.00/20.00).

1.6. AIRCRAFT INFORMATION

Considering the dynamics of the event, detailed information on the characteristics and performance of the aircraft are not deemed relevant. The technical and administrative documentation supplied by the Operator was current and valid.

1.7. METEOROLOGICAL INFORMATION

The Operator declared that relevant weather information for its scheduled flights is available on a dedicated telematic network. In the event case, the weather information necessary for flight planning was available on a specific web site viewable at the operator's premises.

Both captain and co-pilot declared that the complete set of meteorological documentation had been made available to them. It must be, however, remarked that ANSV was not able to retrieve such documentation.

For the sake of completeness of information, at Ciampino airport, the air traffic services reporting information office run by the Italian Air Force, prepares for each scheduled flight folders containing weather reports, forecasts and weather analyses on the ground and at different altitudes. There is no evidence that the operator of the event flight made use of this service.

The meteorological information (METAR and TAF), collected by ANSV, relative to Rome Ciampino (LIRA) and Rome Fiumicino (LIRF) airports on the day of the event are the following:

Metar Rome Ciampino

LIRA: 071155/Z 14011KT 110V180 9999 SCT021 FEW023CB SCT070 28/20 Q1016.

[Day 7, time 11.55 UTC: wind from 140 degrees, intensity 11 knots, variable wind direction from 110 degrees to 180 degrees, visibility more than 10 km, scattered cloud coverage (equivalent to a coverage of 3/8 up to 4/8 of the sky) at the altitude of 2100 ft, few (1/8 up to 2/8 of the sky) storm cells (CB) cloud coverage at the altitude of 2300 ft, scattered (3/8 to 4/8) cloud coverage at the altitude of 7000 ft, temperature 28°C, dew point 20°C, QNH 1016 hPa].

LIRA: 071245Z 36005G15KT 3000 TSRA SCT014 FEW18CB SCT025 19/19 Q1019.

[Day 7, time 12.45 UTC: wind from 360 degrees, intensity 5 knots, wind gusts up to 15 knots, visibility 3000 m, thunderstorm with moderate rain, scattered (3/8 to 4/8) cloud coverage at the altitude of 1400 ft, few (1/8 up to 2/8) storm cells (CB) cloud coverage at the altitude of 1800 ft, scattered (3/8 to 4/8) cloud coverage at the altitude of 2500 ft, temperature 19°C, dew point 19°C, QNH 1019 hPa].

Note: from 11.55 to 12.45 the automatic system did not issue any other METAR.

Metar Rome Fiumicino.

LIRF: 071115Z 16014KT 8000 FEW020 SCT045 BKN090 27/18 Q1016 BECMG TSRA FEW018CB.

[Day 7, time 11.15 UTC: wind from 160 degrees, intensity 14 knots, visibility 8000 m, few (1/8 up to 2/8) cloud coverage at 2000 ft, scattered (3/8 to 4/8) cloud coverage at the altitude of 4500 ft, broken (5/8 to 7/8) cloud coverage at the altitude of 9000 ft, temperature 27°C, dew point 18°C, QNH 1016 hPa, evolving in the next 2 hours to thunderstorm with moderate rain and to few (1/8 to 2/8) storm cells (CB) cloud coverage at the altitude of 1800 ft].

LIRF: 071145Z 32021G34KT 4000 TSRA FEW 015CB SCT045 BKN090 19/16 Q1016 WS RWY 16L NOSIG.

[Day 7, time 11.45 UTC, wind from 320 degrees, intensity 21 knots, gusts up to 34 knots, visibility 4000 m, thunderstorm with moderate rain, few (1/8 to 2/8) storm cells (CB) cloud coverage at the altitude of 1500 ft, scattered (3/8 to 4/8) cloud coverage at the altitude of 4500 ft, broken (5/8 to 7/8) cloud cover at the altitude of 9000 ft, temperature 19°C, dew point 16°C, QNH 1016 hPa, wind shear recently reported on Runway 16L, no significant changes foreseen].

LIRF: 071215Z 03014KT 1200 R34R/0900V1300U R25/P1500VP1500N TSRA SCT012 SCT015CB 18/16 Q1017 NOSIG.

[Day 7, time 12.15, wind from 030 degrees, intensity 14 knots, visibility 1200 m, runway visual range on runway 34R variable between 900 m and 1300 m increasing, runway visual range on runway 25 variable between more than 1500 m and more than 1500 m, thunderstorm with moderate rain, scattered (3/8 to 4/8) cloud coverage at the altitude of 1200 ft, scattered (3/8 to 4/8) storm cells (CB) cloud coverage at the altitude of 1500 ft, temperature 18°C, dew point 16°C, QNH 1017 hPa, no significant changes foreseen].

TAF Rome Ciampino.

071100Z 071221 12014KT 9999 SCT020, SCT070 TEMPO 1218 4000 TSRA SCT018CB BKN025.

[Day 7, from time 11.00 to 12.00 UTC, wind from 120 degrees, intensity 14 knots, visibility more than 10 km, scattered (3/8 to 4/8) cloud coverage at the altitude of 2000 ft, scattered (3/8 to 4/8) cloud coverage at the altitude of 7000 ft. Temporary variations of duration shorter than 1 hour, between time 12.00 and 18.00 UTC, visibility 4000 m, thunderstorm with moderate rain, scattered (3/8 to 4/8) storm cells (CB) cloud coverage at the altitude of 1800 ft, broken (5/8 to 7/8) cloud cover at the altitude of 2,500 ft].

TAF Rome Fiumicino.

071100Z 071221 14015KT 9999 SCT030 TEMPO 1215 5000 SHRA FEW018CB BKN020.

[Day 7, from time 11.00 to 12.21 UTC, wind from 140 degrees, intensity 15 knots, visibility more than 10 km, scattered (3/8 to 4/8) cloud coverage at the altitude of 3000 ft. Temporary variations of duration shorter than 1 hour, between time 12.00 and 15.00, visibility 5000 m, showers and rain, few (1/8 to 2/8) storm cells (CB) cloud coverage at the altitude of 1800 ft, broken (5/8 to 7/8) cloud cover at the altitude of 2000 ft].

On the operative flight plan used by the crew, the following meteorological reports of Ciampino (CIA) and Fiumicino (FCO) were copied by the co-pilot:

CIA: 10.45 120/12 VRB 090/150 10T S022 S070 28/19 Q1015.

FCO: 10.45 170/15 VRB 140/200 9000 F020 S045 B090 27/17 Q1015 BEC015 TSRA F018CB.

FCO: 11.15 160/14 8000 F020 S045 B090 27/18.

1.8. AIDS TO NAVIGATION

Radio aids used for the approaches to Ciampino and Fiumicino airports were all operational. It was observed that Rome ACC approach radar sector, was not provided with readily available weather radar information necessary to furnish a more accurate assistance to aircraft in relation to the weather conditions present in the area of the event. The only weather information on which they could rely was that included in weather reports and in pilot's radio reports.

It has been further observed that Rome ACC approach radar is not provided with the Minimum Safe Altitude Warning function able to alert air traffic controllers of an aircraft flying below Minimum Sector Altitudes.

1.9. COMMUNICATIONS

Radio communications between the aircraft and the involved air traffic control units did not show technical problems of any kind.

1.10. AIRPORT INFORMATION

Rome Ciampino Airport - situated 6,5 nautical miles South/South East of the city of Rome – has an elevation of 427 ft and is open H24; the aerodrome has an instrument Runway 15/33, 2207.5 m long and 47 m wide. Runway 15 is equipped with an ILS for CAT I operations. Runway 33, at the time of the event, was available only for circling approach procedures.

Rome Fiumicino Airport - situated 18,9 nautical miles West/South West of the city of Rome – has an elevation of 15 ft and is open H24. The aerodrome has four runways: 16R/34L (3900 x 60 m), 16L/34R (3900 x 60 m), 16C/34C (3600 x 45 m) and 07/25 (3309 x 45 m). Runway 16C/34C is in fact identified and used as a taxiway (TWY D) and, in particular circumstances, can be used as a runway on condition that runway 16L/34R is contemporaneously closed and that a specific NOTAM is previously issued. 07/25 is normally used as main runway for take-offs, while runways 16R/34L and 16L/34R are used as main runways for landings. In certain operating conditions the relevant air traffic control unit may assign runways in a different manner depending on the wind direction and intensity and on specific pilots' requests. In particular, the longer 16L-R/34L-R runways (3900 m) unlike runways 07/25 and 16C/34C, are preferred for intercontinental flights, which normally operate at high masses.

At the date of the event the available ILS equipment was the following: 16L CAT II, 16R CAT IIIB and CAT I for the remaining runways.

The distance between the Ciampino and Fiumicino airports is approximately 15 nautical miles.

1.11. FLIGHT RECORDERS

Cockpit Voice Recorder (CVR) data was not available for the investigation because the ANSV was informed of the event only after a few months from its occurrence. The information regarding the phase of the flight under investigation had been overwritten during the subsequent operational activity of the aircraft concerned. After landing at Pescara, the crew did not disconnect the CVR power supply, as prescribed in the operator's procedures, by pulling the relevant circuit breaker.

The Flight Data Recorder was disembarked from the aircraft by the operator on September 9th 2005, and data was subsequently made available to the ANSV.

1.12. WRECKAGE INFORMATION

Not relevant.

1.13. MEDICAL AND PATHOLOGICAL INFORMATION

The captain had returned to operational duty, for the event flight, in a peculiar psychological state because his son, only three months old, had died after a long illness. The funeral and burial ceremony had taken place just a few days before the flight concerned. During his days off, the captain had continuously travelled from his base, Rome Ciampino, to Warsaw (Poland) where his family lived. The captain declared during the interview (attended also by an accredited representative of the Irish investigating agency) that he did not immediately inform the operator of his son's death, for concern of losing his job. In addition the captain, the same day of the event, ferried the aircraft back from Pescara to Ciampino, without reporting to the operator the occurrence experienced in the previous flight.

In relation to the concern expressed by the captain, it must be noted that, in a note to the chief pilot dated November 2005, the captain thanked him for his "extraordinary support" after the event.

1.14. FIRE

Not relevant.

1.15. SURVIVAL ASPECTS

Not relevant.

1.16. TESTS AND RESEARCH

1.16.1. Weather radar

The technical logbook of the event aircraft does not report any failure to the on-board weather radar. No remarks of malfunctions had been reported by the crews who had flown the same aircraft during the days preceding the event.

1.17. ORGANIZATIONAL AND MANAGEMENT INFORMATION

The operational organisation of the operator prescribes for a certain number of pilots (approximately 15% of the total, that is about 200 out of 1200) to be based on various sites away from home base.

Duty away from home base is organized in two different ways. In particular, 60% of the 200 pilots based away from home is based on a fixed site (as for example Ciampino) and is employed on regular work shifts of five days on duty and three days off. The remaining 40% based, as per their choice, on changing sites, is employed with work shifts of five days on duty and five days off.

During the investigation evidence emerged that the captain signed a fixed-term contract, subject to the English law, with a United Kingdom based aeronautical personnel recruitment agency. The contract included a clause that employment would be by the operator of the subject event.

While the co-pilot was employed directly by the operator.

Daily shifts were normally scheduled on a four legs basis. Planned turnaround time between legs was twenty-five minutes.

The annual average number of hours flown by the pilots employed by the operator of the event aircraft is about 800-870. 900 hours is the Irish Aviation Authority regulation (State of the Operator's) maximum flight time per year, in compliance with JAA requirements (JAR-OPS 1.1100).

On the day of the event, the captain was on his second consecutive daily shift, while the co-pilot was on his fifth.

The preceding day, September 6th 2005, the Co-pilot had performed four legs: Ciampino-Montichiari-Ciampino-Dublin-Ciampino.

The captain had performed a ferry flight to transfer an aircraft from Fiumicino to Ciampino and two line flights: Ciampino-Eindhoven-Ciampino.

On September 7th 2005, the crew had performed the following flight activity:

at 04.15 take-off to Treviso San Angelo, where it landed at 05.17, transit time 38 minutes;

at 05.55 take-off to Rome Ciampino, where it landed at 06.59, transit time 36 minutes;

at 07.35 take-off to Niederrhein (Germany), where it landed at 09.47, transit time 28 minutes;

at 10.15 take-off to Rome Ciampino, diversion to Pescara where it landed at 12.55;

at 15.15 take-off to Rome Ciampino (ferry flight) where it landed at 15.55.

1.17.1. Operations Manual – Part A

Chapter 6, paragraph 6.4 “Personal Stress-Family Death” of the Operations Manual, valid at the date of the event, states: «There are a number of stressful events or situations which warrant Flight Crew Members being relieved of their flying duties by the Chief Pilot [*omissis*] the stress implicit in a death within the immediate family has the potential to cause a degradation of operating performance and judgement.».

The captain had not informed the operator about his family situation, so preventing the operator to adopt the relative relevant decisions.

The same paragraph, after the subject event, has been significantly changed, as follows: «There are a number of stressful events or situations which warrant Flight Crew Members being relieved of their flying duties by the Chief Pilot (PHFO) in the interests of maintaining the safety of the operation. [*omissis*] It is the individual pilot’s responsibility to immediately bring such events to the attention of the Chief Pilot or his Base Captain before engaging in any flight operations.».

Subsequent to the event, on a communication sent by the operator to the above mentioned personnel recruitment agency, it is stated that in case of personal traumas (as for example death of a close relative), the operator itself would have arranged for allowances not mentioned on the basic contract, such as an additional payment (to the discretion of the operator) for absence up to three working days, in case of particular circumstances following the loss of a close relative.

1.18. ADDITIONAL INFORMATION

1.18.1. NTSB safety alert

On October 11th 2006, the National Transportation Safety Board (NTSB, the United States safety investigation agency) issued a Safety Alert concerning flights conducted in storm cells affected areas. The alert “Thunderstorm Encounters” reported in detail some accidents which had, as contributing factors, particularly critical meteorological conditions. The following conditions were common to all the described accidents:

- all the aircraft were flying in IFR and were in radio contact with an air traffic control unit;
- none of the pilots was aware of the particularly critical meteorological conditions they would have encountered or they were in possession of incomplete information;
- in all the events an alternate airport was available and if used, the event could have been avoided;
- none of the air traffic controllers had received appropriate training on reporting those weather information necessary for the pilots to make adequate decisions.

1.18.2. Aircraft in approach to Rome Fiumicino (LIRF)

In order to give a comprehensive view of the situation present at the time of the event, following is the list of the arriving aircraft at Rome Fiumicino within the same time interval of RYR 9672.

At 12.00 flight ADH 943, diverted from Fiumicino to land at Ciampino.

At 12.09 flight VLG 7381 landed at Fiumicino on runway 34R.

At 12.12 flight SWR 1736 landed at Fiumicino on runway 34R.

At 12.12 aircraft with registration marks I-ELYS landed at Ciampino on runway 33.

At 12.14 flight AB 8284 landed at Fiumicino on runway 34R.

At 12.17 flight AZA 1784 performed a go around at Fiumicino on runway 34L and diverted to Napoli.

At 12.18 flight ISG 332 left Pratica di Mare heading towards Fiumicino.

At 12.24 flight RYR 9672 interrupted the approach to Fiumicino and performed a go around five miles out on the extension of Runway 34R.

At 12.28 flight VLG 332 landed at Fiumicino on runway 34R.

At 12.30 flight SWR landed at Fiumicino on runway 34R.

At 12.34 flight AZA 1742 landed at Fiumicino on runway 34R.

At 12.39 flight MLD 891 landed at Fiumicino on runway 34R.

1.18.3. Final approach

The flight path followed by the subject flight during the final phases of the approach shows five crossings/intersections of the extensions of runways 34R and 34L centre lines (ref. Attachment C).

- 1) The first crossing/intersection of the extension of runway 34R centre line took place from East to West, on heading approximately 225°, at an altitude of 4255 feet and at a distance of about 13 nautical miles from the threshold of the runway, with a ground speed of 240 knots.
- 2) The second crossing/intersection of the extension of runway 34L centre line took place from East to West, on heading approximately 300°, at an altitude of 3800 feet and at a distance of about 12 nautical miles from the threshold of the runway, with a ground speed of 244 knots.
- 3) The third crossing/intersection of the extension of runway 34L centre line took place from West to East, on heading approximately 040°, at an altitude of 2070 feet and at a distance of about 7 nautical miles from the threshold of the runway, with a ground speed of 235 knots.
- 4) The fourth crossing/intersection of the extension of runway 34R centre line took place from West to East, on heading approximately 030°, at an altitude of 1650 feet and at a distance of about 8 nautical miles from the threshold of the runway, with a ground speed of 272 knots.
- 5) The fifth crossing/intersection of the extension of runway 34R centre line took place from East to West, on heading approximately 284°, at an altitude of 370 feet and at a distance of about 4 nautical miles from the threshold of the runway, maintaining a ground speed of 200 knots. In that position the correct altitude according to the ILS descent path should have been 1300 feet (on QNH 1017).

Note: It must be pointed out that the altitudes of the flight recorded by the radar were referred to an altimeter set to a standard pressure of 1013 hPa, while the altitudes reported on the procedure charts (1300 ft) are referred to an altimeter set to the actual pressure (QNH 1016 hPa). In this specific case, the altitude of 370 feet referred to an altimeter set to QNH 1016 hPa is to be considered equivalent to 454 feet.

1.19. USEFUL OR EFFECTIVE METHODS OF INVESTIGATION

Not relevant.

CHAPTER II

ANALYSIS

2. ANALYSIS

2.1. FLIGHT OPERATIONS

2.1.1. Pilots

Both pilots held valid licenses and certifications to perform the event flight.

The co-pilot, a Dutch citizen with limited flight experience, had been hired by the operator with an open-ended contract when he had just achieved the necessary qualification to perform commercial flights. During the interview in ANSV, he declared that it was his first flight experience in adverse weather conditions.

The captain had been hired eight months earlier, with a fixed-term contract, through an agency specialised in recruitment of aeronautical personnel. He had a consolidated commercial flight experience built up during his previous activity with different operators.

In the months immediately before the event, the captain had spent his free time in continuous journeys from Ciampino, where he had his operating base, to Warsaw (Poland), residence city of his family, due to a serious illness of one of his sons, who died a few days before the event on issue. The captain had resumed normal flight activity without communicating this family problem to the operator; during the interview in ANSV he declared that he had not been aware that, as a result of his son's death a few days earlier, his psychological condition was not suitable to properly perform operational activity.

The day of the event, the crew was performing its forth leg of the day, they had started duty early in the morning respecting short turnaround times; conditions that, it can be reasonably assumed, lead to a considerable amount of operational stress being accumulated.

Furthermore the lack of suitable professional support by the co-pilot, who had a limited professional experience, considerably reduced the available on board resources necessary to manage the situation.

However it is necessary to underline that it was the co-pilot who decided to suggest to initiate the go-around manoeuvre, when the captain was evidently not capable to manage the situation.

2.1.2. The flight

Considering the necessary turnaround operations performed prior to the flight concerned, and the time in which they were actually performed (28 minutes), it is reasonable to suppose that the crew had a limited time to analyse the weather conditions foreseen along the route and, in particular, at the destination airport.

However, the captain declared that due to the weather conditions he had requested 950 kg of fuel additional to the normal quantity, but that he did not expect the weather situation to evolve in the manner then effectively encountered.

Weather conditions met during the first three legs of the day may have led the crew not to foresee such a violent change, however it is reasonable to believe that a more detailed analysis of the meteorological documentation could have provided an indication of its dynamic development during the flight.

To better understand the behavioural dynamics of the crew, the flight has been divided, down to the final phase of recovery of the flight profile with the missed approach procedure, into several phases characterized by the changing conditions that influenced the decision making processes and behaviour.

Initial descent

The initial part of the flight was operationally uneventful.

During the whole flight the captain was the Pilot Flying (PF) and controlled radar information, while communications were assigned to the co-pilot (Pilot Not Flying – PNF).

Change of radio frequency to 125.55MHz / Pemar – Ciampino segment

Weather conditions encountered during the approach to Ciampino after PEMAR reporting point induced the captain to follow flight paths and descent profiles different from the planned ones. Comparing declared intentions with actual profiles, a situational awareness not consistent with spatial positions and flight parameters was noted.

The approach appeared difficult from the start. The continuous variations in headings and the request of weather reports updates show that the crew was realising that the atmospheric conditions were worse than expected. The captain declared that he had disconnected the autopilot in this phase.

Change of runway / Ciampino - Ciampino segment

The change of runway in use at Ciampino further complicated the situation. The air traffic controller requested RYR 9672 if they could proceed toward Urbe NDB holding pattern and RYR 9672, despite the adverse weather conditions found over Guidonia, replied requesting to proceed with a visual approach.

The air traffic control communication of the change of runway for tailwinds above permitted maximum limit, suddenly obliged the crew to face an unexpected situation. Their request to proceed for a visual approach identifies a decision made in a very short time, in a not well defined context, resulting from a compulsory rapid analysis.

The aircraft was proceeding parallel to the runway maintaining heading approximately 170°, and when the air traffic controller requested to perform a 360° turn, to be adequately separated from the traffic ahead landing on the new runway, the crew initially confirmed, to declare, only approximately one minute later, that they were unable to complete the turn, affirming furthermore that they were not in visual flight conditions.

The alternative, to perform a 360° turn to the left in the area of the OM (Outer Marker), proposed by the air traffic controller, represented to the crew a solution that would have permitted RYR 9672 to return to the previously planned approach path and was therefore accepted. The unexpected presence of cumulonimbus clouds on the indicated path, which rendered the instruction impracticable, despite the on-board weather radar returns which indicated a presence of rain only (as reported by the crew) lead the crew to reconsider the decision taken.

At this point the crew directed its attention to look for a routing which would have allowed to avoid the most critical cumulonimbus formations, still maintaining the intention to land at Ciampino, possibly with a visual approach in ground contact, as Runway 33 was only available conducting a circling approach.

Change of radio frequency 131.25MHz / Ciampino - Ciampino segment

After the frequency change, the instruction of the air traffic controller to proceed for a visual to RWY 33 may have reinforced the crew's conviction of the probability of encountering better weather conditions than the actual ones and to be able to continue the approach and landing at Ciampino.

This expectation probably determined the request by the crew for a descent to a lower altitude as soon as they had caught sight of the ground through small breaks in the clouds, without considering, however, that the area they were over-flying was characterized by high terrain above 3.000 feet of altitude.

In fact, the following communication, made at 12.13.11, confirms that the crew had not adequately updated the briefing for the approach and that the planned profile was not consistent with the actual profile *«and ... we are able to make ... we descend to 3000 we are able to make visual 33 otherwise we have to divert... to aerodrome Fiumicino or Pescara.»*.

This request again seems to underline the crew's difficulties in determining its geographical position compared to the field.

In the following sequence of messages, air traffic control supplied weather information that may have not helped the crew in developing a structured analysis process, considering the high workload involved in the actual management of the flight.

At 12.14.47 the pilot requested information of any aircraft landing at that moment at Ciampino, where an aircraft with registration marks I-ELYS had just landed on Runway 33 at time 12.12. The air traffic controller replied that there was no aircraft landing at the time.

Considering the fact that the flight was experiencing severe turbulence, this reply may have convinced the pilots of the potential difficulty of landing at Ciampino.

In the following communications the crew, who reported that it was experiencing severe turbulence, requested to proceed to Pratica di Mare and also requested information on traffic landing at Fiumicino, receiving as reply that two aircraft had landed five minutes earlier.

This information, added to the previous one of no traffic landing at Ciampino, probably contributed to reinforce the crew's decision to divert to Fiumicino despite the fact that the weather conditions at Fiumicino were definitely worse than those at Ciampino. It is important, however, to note that the planned alternate airport for this flight was Pescara.

The crew decided to divert to Fiumicino and requested descent to acquire ground visual contact.

Diversion to Fiumicino / Ciampino-Fiumicino segment

The crew had registered fairly recent information but not updated to the present meteorological conditions at Fiumicino Airport, which were continuously and rapidly changing.

Previously, the same airport had been subject to severe weather conditions which had caused some aircraft to divert, a fact known to the crew.

The captain declared that in this phase he was convinced that Fiumicino airport was operable, although affected by meteorological phenomena, and that he believed it was appropriate to divert to Fiumicino.

The diversion was therefore performed without adequate planning for an instrument approach, in undoubtedly adverse weather conditions, and with manual handling difficulties due to severe turbulence.

During his interview at ANSV, the captain declared that he was concentrated exclusively on manual piloting the aircraft without realizing which flight path he was following. The co-pilot, at his first experience in such adverse weather conditions, declared that, due to the high level of turbulence, he had not been able to tune the appropriate navigation radio aids, and consequently he did not have the possibility to correctly set up the flight management system (FMS) for the diversion to Fiumicino.

Approach to Fiumicino segment

The lack of diversion planning to Fiumicino and consequent lack of available information in the cockpit as result of the missing selection of radio aids and data in the FMS, increased the crew's difficulties in determining its geographical and spatial position. Consequently, it was also impossible to enable the automatic activation of some of the functions of the navigation system available on board (course intercepts, automatic speed reduction).

Analysing the flight path and the communications it is evident that the crew crossed the extensions of the two runways, 34L and 34R, the first time westward and then eastward, without verifying its position compared to the alignment of the two runways.

The landing runway initially assigned to RYR 9672 was 34R and, after 32 seconds, 34L.

This sudden change of runway could appear not to have created further evident difficulties to the crew, however, in fact, it may have contributed in increasing the complexity of the situation, as the crew was not capable to perform an instrument approach as it missed to select the ILS frequency.

It must be evidenced that generally runway changes communicated by air traffic control in very short sequence impose significant changes in radio aids management, particularly in highly sophisticated electronic aircraft. And therefore should be avoided.

Pilots had been instructed to contact Rome ACC on frequency 119.2 MHz, but they had continued to communicate on frequency 131.25 MHz, giving the impression not to be aware of the instruction received.

The air traffic controller on frequency 131.25 MHz at this point, realising, from the context of the exchange of communications, of the difficulties in which RYR 9672 crew was, continued to use the previous frequency, failing although to inform them that their altitudes were too low in respect to those required.

The captain and the co-pilot declared, during the interview at ANSV, that they were continuing flying the aircraft without situational and position awareness, and to have descended without adequate instrument control.

Final segment at Fiumicino

The severe turbulence and the lack of automatic speed reduction, due to the missed loading of data in the FMS, increased the captain's workload and forced him to dedicate all his attention to manual flight control.

The co-pilot did not interfere operationally and continued to accomplish the communication task without providing any other kind of operational support.

The rapid chain of events that followed evidenced the crew's progressive and increasing loss of awareness of the aircraft's flight profile.

The flight continued without instrument approach indications, and without a defined or assumed strategy, as the attention was totally concentrated on primary flight instruments with the only aim to maintain the aircraft's capability to fly. The decision process was substantially absent.

The co-pilot declared he was not able to determine the exact position of the aircraft and suspected that the captain had reached the limit of his operational capacity.

He decided, therefore, to intervene by touching him firmly on the shoulder, with the intent to draw his attention back to reality. Evidently, his experience was too limited to have the strength of mind to intervene in a more direct manner, personally taking control of the aircraft.

Until that moment the co-pilot had relied on captain's decisions and manoeuvres, without any form of appropriate critical attitude, as highlighted in CRM (Cockpit Resource Management) training.

The captain declared that when the co-pilot touched him on the shoulder, asking him if everything was alright, he had the impression of regaining control of the aircraft and performed the missed approach manoeuvre.

The co-pilot affirmed that while he was touching the captain's shoulder with his left hand, simultaneously, with the other hand was pulling the control column to reduce the rate of descent of the aircraft. At this time the go-around was initiated.

The recorded flight profile and the sequence of actions undertaken demonstrate how the crew was not completely conscious of the flight paths followed and of the planning of eventual actions to regain the correct profile.

Missed approach manoeuvre (G-oAround)

The manoeuvre performed by the captain moved the aircraft away from the danger situation and from the most critical environmental conditions; this allowed the crew to slowly regain the situational awareness and control of the flight.

Once regained the mental conditions necessary to develop decisions, the captain decided to divert to Pescara airport, even though a new request for meteorological conditions at Ciampino was made to air traffic control, receiving as answer that a severe storm was currently affecting the area.

The rest of the flight to the alternate aerodrome was conducted in undemanding environmental conditions which allowed cockpit activity to be stabilized.

An analysis of the movements of other aircraft direct to Rome Fiumicino indicates regular operations and that all aircraft landed without particular difficulties despite the adverse weather conditions, with the exception of flight AZA 1784 which at time 12.17 performed a missed approach manoeuvre and diverted to Napoli Capodichino airport.

All aircraft performed precision instrument approaches. The captain of flight AZA 1742 declared that in the Rome area, he had observed on the weather radar display, several cumulonimbus formations and affirmed that during the landing the visibility was very low due to heavy rain but that he had not observed any significant speed variations during the approach.

The pilots of RYR 9672 declared that throughout the approach, initially at Ciampino and subsequently at Fiumicino, the on-board weather radar had constantly shown a green coloured clutter, indicating a presence of clouds with a high water content but an absence of significant storm cells. Since no radar malfunctions had been reported it may be supposed that the captain had not properly managed the tilt of the antenna and/or the gain control, and that the co-pilot was not able to act to correct the situation.

It is interesting to note that also in this event, almost all the conditions listed in the NTSB safety alert happened to occur (ref. paragraph 1.18.1):

- the aircraft was flying in IFR and was in contact with the air traffic control unit;
- the pilots were not aware or only partially aware, of the particularly critical weather conditions they would have encountered;
- an alternate airport was available (Pescara Airport) which, if used previously would have avoided the event to happen;
- air traffic controllers had not received appropriate training in providing pilots with weather information in order for them to make adequate decisions.

2.1.3. Visual approach

During the initial phase of the descent the crew requested to proceed from the PEMAR reporting point directly to Ciampino runway 15 Outer Marker; this routing is not reported in any AIP Italia instrument approach procedure and can only be flown in visual flight conditions. The request probably had some influence on air traffic control decisions, which at 11.59 asked RYR 9672 to «report if able to the visual approach for runway 15» and, at 12.01, asked the pilots to «report if you have the visual condition approaching the marker».

During the interview the pilots reported that they never had continuous visual contact with the ground. They only had sporadic visual contact of the terrain. This is also substantially evidenced in the radio communications recording.

2.1.4. Weather conditions

Weather conditions during the first hours in the morning of the event were not considered prohibitive, but a significantly worsening evolution of the situation could have been anticipated with a careful analysis made while still on the ground. In the first hours of the morning a conspicuous storm cell was already present off the coast of Lazio and was moving from South-West to North-East, it reached the area of Rome airports exactly at the time of the arrival of flight RYR 9672.

The weather conditions reported in METARs could have depicted a situation not completely consistent with the development of the atmospheric situation, but a comparison with the synoptic charts could have offered an overview consistent with the scenario encountered.

2.1.5. Air Traffic Control

Air traffic controllers in contact with RYR 9672 realized the difficulties encountered by the crew caused by the adverse weather conditions, and tried to satisfy all their requests and suggested them to wait for an improvement in weather conditions over Pratica di Mare or alternatively to perform a precision instrument approach. The air traffic controller on duty on frequency 131.25 MHz did not remark to the pilots that they had omitted to change to their new assigned frequency (119.20) and continued to provide assistance on the previous frequency 131.25 MHz. The replies by air traffic controllers, relative to the approaches undergoing at Ciampino and Fiumicino, were not clear nor correct, thus increasing the level of uncertainty on board.

It is necessary to point out that the air traffic controller did not communicate to RYR 9672 that they had left 3000 feet, altitude to which they were cleared, and that they had continued descent down to 2000 feet without clearance (as evidenced on radar plots).

Furthermore, during the attempted approach the crew was not informed that at five nautical miles from the threshold, the aircraft was almost 1000 feet below the correct descent path reported in the Instrument Approach Chart.

2.1.6. Aids to navigation

The investigation evidenced that Rome ACC approach radar sector, was not provided with readily available weather radar information necessary to furnish accurate assistance to aircraft in relation to the weather conditions present in the area of the event.

It has been further observed that Rome ACC approach radar is not provided with the Minimum Safe Altitude Warning function able to alert air traffic controllers of an aircraft flying below Minimum Sector Altitudes.

2.2. HUMAN FACTOR

2.2.1. Psychological and physiological factors

A significant component connected to behavioural dynamics rises to evidence from the analysis of the facts and of the statements made by the crew.

In order to correctly understand this component, facts connected to human factor aspects which contributed to the event, are analysed hereunder.

Crew's status

For quite a long period of time the captain had been under emotional stress due to a personal situation ended, only a few days before the event, with the loss of his three months old son. The captain, in addition, was also concerned about the application, in these cases, of the provisions of the Flight Crew Operating Manual (Chapter 6, paragraph 6.4) relative to a possible temporary removal from operational activity, which the captain perceived as a potential condition leading to the termination of his employment.

The decision not to inform the Chief Pilot of the situation, and to continue the regular planned activity indicates a biased status influencing his decision making process.

The co-pilot had started with commercial flight operations only a few months earlier and, although motivated, objectively did not have a significant consolidated experience, especially in operations in adverse weather conditions.

During the first three legs of the day, operations were conducted in a normal environment and in normal conditions without any inconvenience.

During the fourth leg of the day, having started duty early in the morning and respecting turn-around times of approximately 30 minutes, it is reasonable to believe that a certain amount of operational fatigue had begun to accumulate.

The crew's basic condition (captain's emotional condition and co-pilot's limited experience) and, to some extent, the fatigue accumulated during the performance of normal operational activity, had reasonably had an influence in the level of the crew's on board available resources.

Situational Awareness

The sequence of events shows a progressive loss of situational awareness.

During the initial phase of descent, despite a series of variables depending on deteriorating weather conditions, route changes, air traffic control limitations and a continuous increase in workload, the crew managed to maintain a sufficient awareness of the events.

However communications with the air traffic control evidenced the fact that the crew seemed to be not really aware of the increasing chances of the impossibility to perform a visual approach at Ciampino, as they had planned and as requested several times.

The request to proceed with a visual approach even after the change of runway at Ciampino, the presence of other traffic in downwind and of cumulonimbus in the area, and to be at an altitude too high to perform a correct approach path, demonstrates their unclear understanding of the weather conditions and of the actual operational dynamics.

The radar vectoring by air traffic control and the manoeuvres requested by the crew to avoid storm cells, did not facilitate the recovery of total awareness, so that the crew maintained a state of only partial understanding of the events and of the immediate management of the aircraft.

When the crew finally considered that the landing procedure at Ciampino could no longer be continued and requested to divert to Fiumicino, the information of weather conditions they had, although recent, was not updated due to the rapidly worsening evolution of such conditions.

The heavy workload which the crew was undergoing did not leave them sufficient mental capacity to acquire and analyse the updated information with the purpose of identifying adequate strategies.

During the following phase, the missed loading of the FMS with destination data, left the crew without any reference useful to identify its spatial position in relation to Fiumicino airport.

The lack of the on-board radar storm cells representation, which the captain declared was not available, as the radar only indicated heavy rain (uniform green colour clutter), further increased the unawareness of the environment surrounding the aircraft. Most probably the radar antenna tilt was not properly set.

The consequent crossing of the storm area with severe turbulence increased even more the crew's workload, which is evidenced also by the frequent, synthetic and sharp replies to air traffic control. The crew, engaged in a complex operational scenario from a weather and air traffic control point of view, seemed therefore unable to perceive their own level of available resources in relation to the difficulties which they had to face.

In particular, during the approach, the declared intention to look for visual ground contact as a possible reference point for the approach, again underlines the improvisation and the lack of awareness of the real difficulties related to the developing meteorological events.

The co-pilot's firm act of physically putting a hand on the captain's shoulder, had the effect to have the latter awake from the funnelled attention in which he had fallen, even if the recovery was only partial because of the heavy workload of piloting the aircraft.

It has not been possible to determine with certainty which elements, shortly afterwards, made the captain decide to perform the go-around, but it may be supposed that they are related to the callouts of the Ground Proximity Warning System (GPWS) and the co-pilot's action on the controls. These elements probably allowed the captain to become aware of the signs of excessive

deviation from the intended flight situation and, although not completely aware of what was happening, he decided to perform the missed approach procedure.

It is also most probable that the captain may have interrupted the approach by reducing the rate of descent and by initiating a climb, subsequent to the following air traffic control communication: «Able to approach or otherwise to climb». To this last communication the crew replied: «I have to climb».

This manoeuvre reduced the crew's workload and allowed them to recover sufficient cognitive capacity to regain control of the flight and divert to Pescara safely.

Crew Coordination and Crew Integration

At the start of descent, on board tasks sharing was organised with the captain piloting the aircraft and controlling the radar, leaving to the co-pilot radio communications with air traffic control units.

The co-pilot agreed with the task sharing as assigned by the captain.

There are no signs of any change in this task sharing during the prosecution of the approach. Consequently, the captain directed all his resources into piloting the aircraft, initially in automatic mode, and in manual mode (without autopilot and auto-throttle) later, supporting a heavy workload due to the perturbed weather; while the co-pilot continued maintaining radio communications.

The stress conditions the crew had then to face altered its decision making process.

In terms of crew integration there is evidence, in two occasions only, of action by the co-pilot deciding to point out situations considered serious.

The first when he drew the captain's attention, to verify if he was incapacitated, firmly touching him with a hand on his shoulder, with the result of partially regaining the captain's attention.

The second occasion when he acted on flight controls with the intent of assisting the captain in reducing the rate of descent before the missed approach manoeuvre.

There is no further evidence of an efficient contribution of the co-pilot aimed at regaining a correct management of the flight: this lack of efficient contribution is probably due to his limited flight experience in adverse weather conditions.

Decision Making

The evident, progressive loss of situational awareness influenced the crew in applying adequate decision making processes.

Decisions which led to having to face progressively more demanding environmental conditions, consequently generated a continuously increasing workload.

In the crew behaviour there is no evidence of strategies aimed at limiting the increasing workload in order to have sufficient mental capacity to regain proper awareness of the events and activate adequate decision-making processes.

The decision to proceed with a non feasible visual approach during the first approach to Ciampino, as the subsequent requests to descend to lower altitudes to perform a visual approach, evidenced a decision making process influenced by an incomplete awareness of the actual environmental situation.

In a position approximately immediately over Ciampino airport the crew requested to divert to Fiumicino.

The analytical process, developed without acquiring updated information in a highly changeable and complex situation, demonstrates the need to privilege rapidity in defining a solution.

The cognitive effort of the captain was divided between two important requirements, piloting the aircraft and processing a diversion plan.

The task of piloting the aircraft, first in automatic then in manual mode, being highly demanding for the continuous and immediate need of action on controls, was the captain's priority absorbing task, to the disadvantage of the planning of a diversion strategy which was consequently restricted solely to the identification of the new destination.

Piloting the aircraft continued to take almost all the captain's available resources at the cost of his cognitive capacity.

The captain's decision to divert to Fiumicino thus remained marginal to the overall basic evaluation of the circumstances, without a defined strategy and without ways out.

In this phase, the adoption of a rapid decision process, also permitted the captain to dedicate more attention to piloting, which remained his primary necessity.

The co-pilot, who was carrying out his task of maintaining radio contact with air traffic control units, acknowledged the captain's decision who had declared an objective to be reached (diversion to Fiumicino) without indicating however the manner to achieve the objective, including the necessary planning and related operations.

The co-pilot's behaviour can be reasonably attributed partly to the lack of complete instructions from the captain and partly to his limited experience which, in that situation, did not allow him to provide the necessary support or to take initiatives. As a result of this situation it is to remark that no FMS data loading was performed and appropriate radio aids were not selected.

Listening to radio communications the crew realised that an aircraft had landed at Fiumicino only a few minutes before, this probably reinforced their conviction that the decision to divert to this airport was correct; this in spite of not having updated meteorological information and, most important, without knowing which runway to use and the type of approach to perform. Only after the request by air traffic control as to which runway they intended to use at Fiumicino, did the pilots feel it necessary to perform a minimum research to acquire the relevant meteorological and operational data.

The extremely short reply («we take the closest runway») to define the runway to use for the approach, confirms that the crew needed to give attention to other priorities.

The repeated communications from air traffic control, to which the co-pilot did not reply, the missed change of frequency requested by the same air traffic control, and the communications with interrupted sentences, demonstrate a crew with attention funnelled into the management of a difficult and demanding situation.

The captain declared that, in this phase, he felt to be burdened by a level of workload that did not allow him to elaborate decisions; in fact, there is no evidence of any further decision-making process until the moment the missed approach procedure was performed. The decision to carry out this procedure appears to be the result of a generic perception of a dangerous situation, rather than the result of a structured cognitive process.

After having performed the manoeuvre and the subsequent re-establishment of normal operations in the cockpit, the captain made the decision to divert to Pescara airport.

CHAPTER III

CONCLUSIONS

3. CONCLUSIONS

3.1. GENERAL

Relevant probable causes and contributing factors, in determining the event, are identified and listed hereunder.

3.2. FINDINGS

- The aircraft had all the necessary technical requirements to perform the flight concerned.
- The crew was correctly qualified and trained to perform the flight concerned.
- There is no evidence of failures of the on-board weather radar.
- The flight crew confirmed that they had all the necessary meteorological information to perform the flight.
- The co-pilot declared that this was his first flight experience in adverse meteorological conditions.
- The captain declared that he had performed the flight in not perfect psychological conditions. He had suffered a serious griever for the death of a close family member, only a few days before the event.
- The crew was performing the fourth planned flight leg of the day. The first take-off was performed at 04.15.
- Weather conditions at Fiumicino, during the diversion from Ciampino, were actually worse than those at Ciampino.
- The flight crew had adequately planned the approach to RWY 15 in Ciampino, but had not planned the eventual diversion to Fiumicino, as their planned alternate was Pescara.
- During the approach, the air traffic controller instructed the event flight to change frequency, from 131.25 MHz to 119.2 MHz, but the co-pilot continued to use frequency 131.25 MHz.
- Air traffic control had initially assigned RYR 9672 runway 34R and, 32 seconds later, runway 34L.

- During the approach pilots descended below 3000 ft, which was their assigned altitude, but air traffic control did not warn them.
- Passing through 2000 ft, RYR 9672 was in a position of traffic conflict with another aircraft cleared to the approach for RWY 34R. At this moment air traffic control communicated to RYR 9672 «9672... 9672 we have traffic on your right descend immediately 1000 ft».
- The aircraft continued its descent and started the missed approach procedure, only when at an approximate altitude of 454 feet (altimeter set on QNH 1016 hPa) at 5 NM from the threshold, position at which this altitude is approximately 770 feet lower than that published in AIP Italy Instrument Approach Chart.
- The co-pilot, at his first experience in such critical weather conditions, declared not to have been able to select the proper radio aids on the navigation equipment, because of the high level of turbulence, and consequently not been able to adequately re-plan the Flight Management System (FMS) and radio aids for the diversion to Fiumicino.
- From 11.55 to 12.34, 2 aircraft landed at Ciampino, 7 at Fiumicino and one diverted from Fiumicino to Naples.
- The investigation evidenced that Rome ACC approach radar sector, was not provided with readily available weather radar information necessary to furnish accurate assistance to aircraft in relation to the weather conditions present in the area of the event.
- It has been further observed that Rome ACC approach radar is not provided with the Minimum Safe Altitude Warning (MSAW) function able to alert air traffic controllers of an aircraft flying below minimum sector altitudes.

3.3. CAUSE AND CONTRIBUTORY FACTORS

The event in question was determined by a series of interconnected circumstances, which finally led to the missed approach manoeuvre at Fiumicino airport in unsafe separation with the ground and with a situation in the cockpit characterised by lack of awareness of the particular present situation.

The cause of the event is to be assigned to the incorrect management of the flight, during the unplanned diversion to Fiumicino, by the flight crew.

Considering the dynamics of the event, it is necessary to take into consideration different factors which, to various degrees, contributed to the event. The particular environmental and meteorological conditions under which the event developed have certainly influenced these dynamics, as well as the flight crew choices/performance and the management of control of the flight by air traffic control.

The factors that contributed to the event can be summarised as follows:

- the particular mental state of the captain, whose recent family situation was characterised by the loss of his three months old son;
- the flight crew's progressive loss of situational awareness;
- the co-pilot's limited experience;
- the poor flight crew coordination and integration;
- some inappropriate information by air traffic control transmitted using non standard phraseology;
- the not adequate analysis of the weather information by the flight crew;
- the non correct use of the on-board weather radar;
- the lack of readily available weather radar information in the Rome ACC approach radar sector, necessary to be able to provide a more accurate assistance in relation to the weather conditions present in the area of the event;
- the absence in Rome ACC approach radar, of the Minimum Safe Altitude Warning (MSAW) function, able to alert air traffic controllers of an aircraft flying below Minimum Sector Altitudes.

CHAPTER IV

SAFETY RECOMMENDATIONS

4. RECOMMENDATIONS

4.1. RECOMMENDATION ANSV-23/782-05/2/I/08

Reason: the investigation evidenced that Rome ACC approach radar sector, was not provided with readily available weather radar information necessary to furnish a more accurate assistance to aircraft in relation to the weather conditions present in the area of the event.

It has been further observed that Rome ACC approach radar is not provided with the Minimum Safe Altitude Warning (MSAW) function able to alert air traffic controllers of an aircraft flying below Minimum Sector Altitudes.

Addressee: ENAV S.p.A.

Text: Increase/improve Rome ACC equipment: implementing the installation and use of a weather radar, the information of which may be provided to aircraft in flight; implementing the MSAW function in Rome ACC approach radar. Evaluate to increase/improve above said equipment in all approach radar control centres.

LIST OF ATTACHMENTS

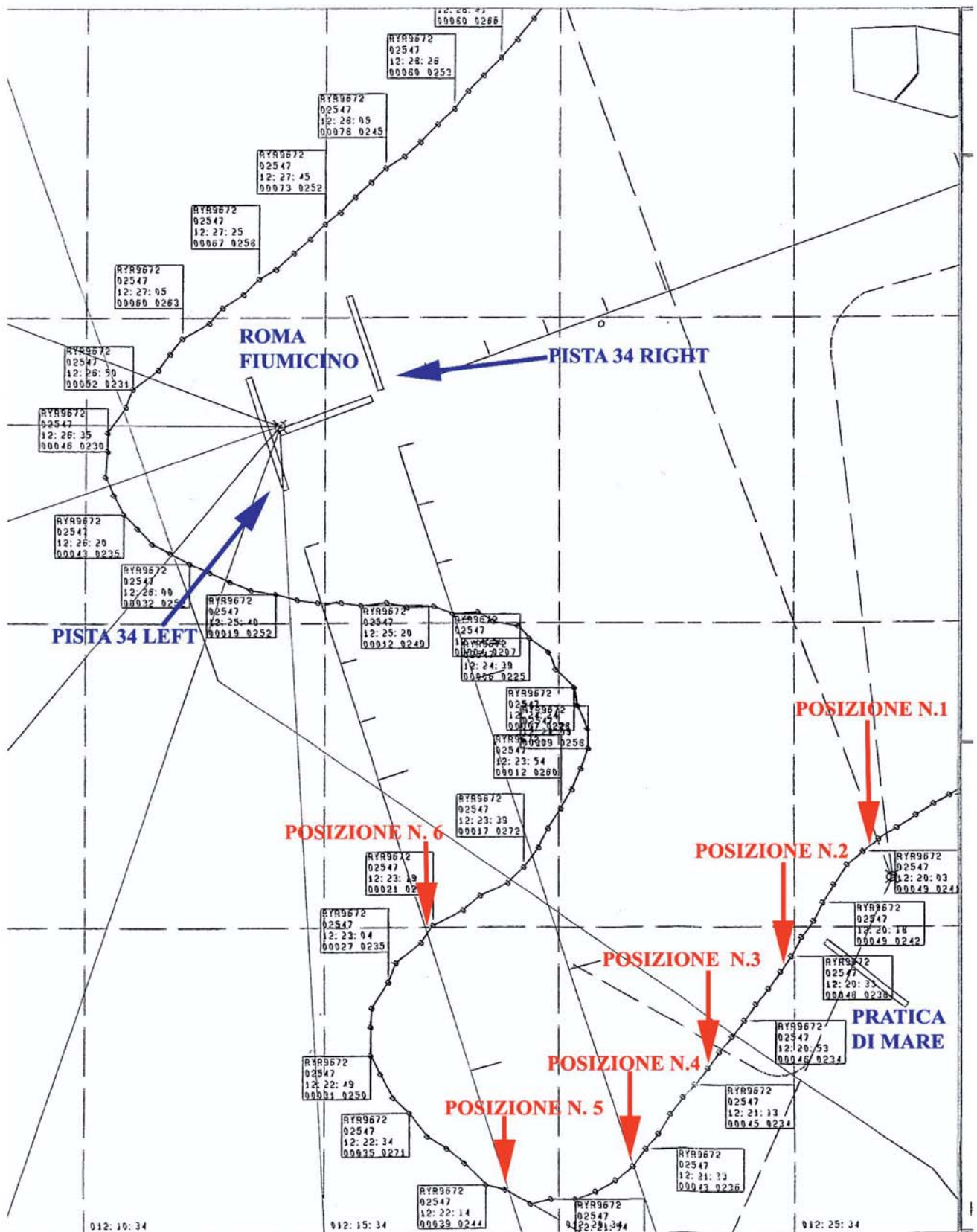
ATTACHMENT A: radar plots of the diversion to Rome Fiumicino.

ATTACHMENT B: radar plots of the final approach to Rome Fiumicino.

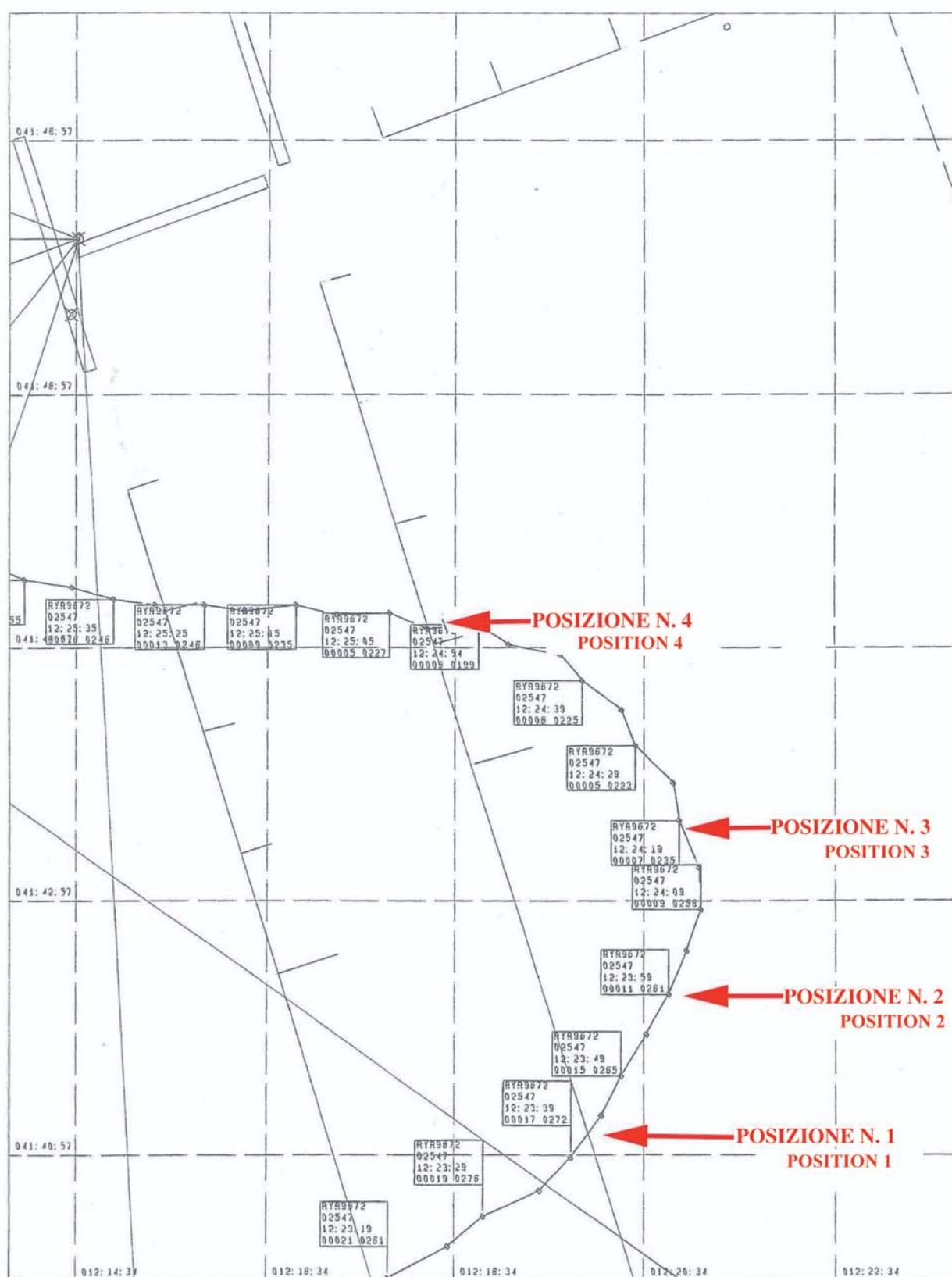
ATTACHMENT C: reconstruction of the radar tracking on an Instrument Approach Chart.

APPENDIX: Ireland AAIU comments.

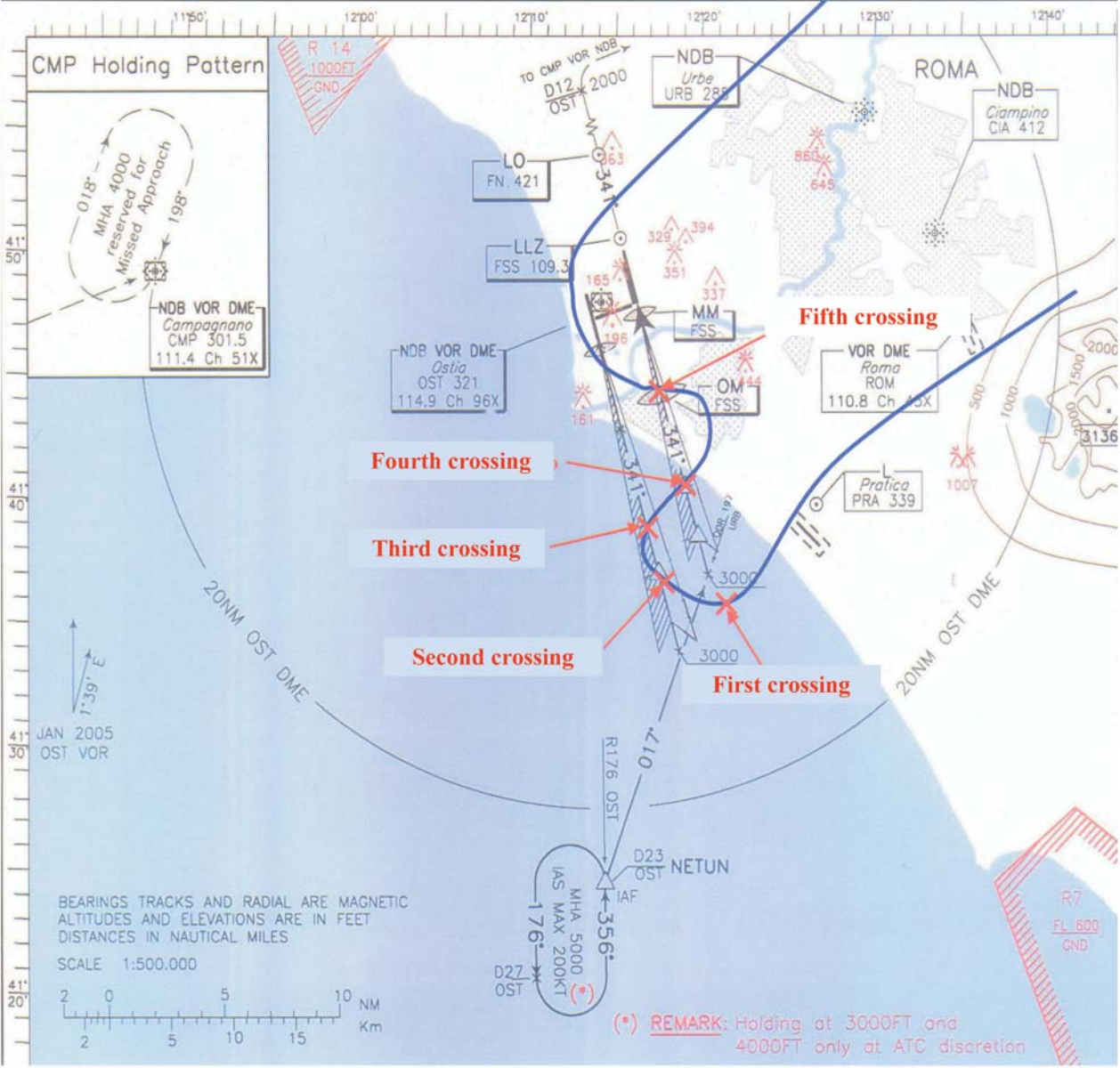
The attachments listed above are a true copy of the original documents deposited at the “Agenzia Nazionale per la Sicurezza del Volo”. The anonymity of persons involved in the event has been safeguarded in the attached documents in accordance with the terms of the legislative decree n. 66 of February 25th, 1999.



Recording of the radar tracking of the final flight path of the diversion from LIRA to LIRF.



Recording of the radar tracking of the final approach.



Reconstruction of the flight path of the aircraft in relation to runways 34R and 34L approach paths.

Note: the present flight path has been reproduced exclusively with the aim to provide an approximate view of the flight path followed by the aircraft in relation to runways 34R/L approach paths.

Air Accident Investigation Unit – Ireland (AAIU) comments

17 November 2008

Mr Vincenzo Pennetta
Head of Investigation Dept
ANSV
Via A. Benigni, 53
00156-ROMA-ITALY

2. Your Ref: n.2168/INV/782/05/08

RE: Draft Final Report, EI-DAV, Serious Incident **at Rome FCO on 7 September 2005**

Dear Mr Pennetta,

Your Draft Final Report on the above Serious Incident, dated 27 August 2008 refers.

As the Air Accident Investigation Unit (AAIU) appointed ACCREP, I immediately copied the Draft to the Irish Aviation Authority (IAA), [omissis - name of operator], and the crew concerned, Captain [omissis] and F/O [omissis].

The IAA had no subsequent comment to make on the Draft Report.

[Omissis - name of operator] made a detailed reply, while both pilots also replied to the Draft Report.

Given the extensive nature of these three replies, it was agreed that the most productive and expeditious manner to deal with the replies was to conference them in the ANSV offices in Rome.

The Draft Report and the replies thereto were discussed at length over four full working days at ANSV, on 23/24 and 29/30 October 2008.

The meetings went through each point raised by [omissis - name of operator] and the flight crew of EI-DAV. Throughout the four days much discussion ensued and the Draft was amended each time there was full agreement by the ANSV/AAIU personnel. Overall, the majority of the points raised by [omissis - name of operator] and the pilots were accepted and the Draft amended, accordingly.

I wish to confirm, that, after four days of discussions and changes/amendments, the Draft Final Report agreed on 30 October 2008 is acceptable to the AAIU and should be ready to move to the Final Report stage.

Yours sincerely
Frank Russell
Inspector of Air Accidents
(ACCREP)