Unconventional Aeronautical Investigatory Methods

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The Case of Alitalia Flight AZ 112

By

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He looked up to heaven and with a deep sigh said to him,
“Ephphatha!” (which means “Be opened!”).
Mark 7:34

CONTENTS

AERONAUTICAL ABBREVIATIONS

AD Airworthiness Directive
A/M Aircraft
ADF Automatic Direction Finding [Equipment]
ADS Air Data System
AHRS Attitude and Heading Reference System
AOA Angle of Attack
AOS Angle of Sideslip
AP Autopilot
APP Approach
ATC Air Traffic Control
ATCAS ATC Automation System
CAA Civil Aviation Administration
CG Centre of Gravity
C_L Lift Coefficient
DAFCS Digital Automatic Flight Control System
DME Distance Measuring Equipment
EFIS Electronic Flight Instrument System
FAA Federal Aviation Administration (USA)
FDR Flight Data Recorder
FL Flight Level
FOD Foreign Object Damage
FTB Flying Test Beds
GNC Guidance Navigation Control
GPS Global Positioning System
IAS Indicated Air Speed
ICAO International Civil Aviation Organization
M Mach Number (= the ratio of flow velocity past a boundary to the local speed of sound, at sea level is about 340m/s)
MAC Mean Aerodynamic Chord
(M)MEL (Master) Minimal Equipment List
METAR Meteo Report
MFC Multi Function Computer
NM Nautical Mile (= 1.852m)
OAT Outside Air Temperature (°C, °K, °F External Air)
PF Pilot Flying

PNF Pilot Not Flying
QNH Pressure value (hPa, hectopascals) in the altimeter sub-scale. When calibrated according to the ICAO-type atmosphere, it indicates the elevation of the airport, if the aircraft is on the ground at this point
SAT Static Air Temperature
SOP Standard Operation Procedures
TAS True Air Speed
TAT Total Air Temperature
TCAS Traffic Collision Avoidance System
TTSN Total Time Since New
UTC Universal Coordinated Time
VOR VHF Omni-directional Range
XPNDR Transponder

PART 1

CHAPTER ONE

PROLOGUE

Fig. 1 View of Punta Raisi (Montagna Longa can be seen behind the airport grounds).

Almost 50 years after the disastrous Alitalia flight AZ 112 crash, the aerospace industry now uses new technical expertise in the form of aeronautical investigative technologies with a new approach, processed by high-speed computers, and highly sophisticated and costly computer programmes. These developments confirm that the Montagna Longa plane crash was not caused by pilot error but by an on-board detonation and subsequent deflagration that occurred when the aircraft was aligned with the axis of Runway 25 at Punta Raisi airport. The final trajectory up until the impact has been calculated using computer models that were unimaginable in 1972, applying the complete equations of Flight Dynamics. This new approach will reveal aspects that have not been previously known, namely, the likely impact dynamics, the final approach radial, the radio silence, the plane's trajectory up until the crash, and the factual accounts of witnesses on the ground.

This exposé is innovative in the sense that it uses mathematical models of design, thermo fluid dynamics and seven laboratory experiments exploring the combustion of aeronautical kerosene in order to confirm, for the very first time, that there is tangible evidence that on board the aircraft during flight AZ 112, a detonating device firstly exploded and secondly deflagrated. This caused severe damage to the aircraft's manoeuvring system, leading to its operational collapse and the consequent disaster. This conclusion was drawn based on the principle of energy conservation.

In the final chapter of Part I all these new deductions will be presented together with the aim of shining a new light on the events of that tragic AZ 112 flight of the evening of 5 May 1972.

In doing so, all the parameters, deductions, implemented models, and the inductive and deductive results will come together to give a definitive, concrete explanation for the disaster of the McDonnell Douglas I-DIWB aircraft on that fateful evening.

Readers less well-versed in technical/aeronautical investigatory methods should be aware of a further point, especially since this refers to a cold case dating back over 50 years. The plane crash at Montagna Longa was the most tragic aviation crisis in Italy’s history. During the 70s and into the 80s, two Public Prosecutors’ Offices became involved, as well as one Ministerial Commission and several boards of experts, and for decades, it has sparked widespread interest among investigative literature and the Press. Many questions were asked by the magistrates at the time regarding the reasons behind the disaster. Only one response was ever given by all of those involved in the case: the Montagna Longa plane crash occurred due to negligence at the hands of the pilots in command.

Fifty years on, in this study, we propose a new question: following the discovery of new aerospace calculations, scientific processes, new simulation tools and high-speed computers, if new mathematical models were scientifically applied, is the same answer still valid? Or, through this more modern and cutting-edge approach, can we now reconstruct the so far undocumented events that took place in the skies above Punta Raisi Airport on the evening of 5 May? The short answer is yes. The details will be explained here. Again, in the name of investigatory consistency, even the grounds of Palermo Airport must be analysed according to new parametric criteria dictated by international regulations. To do so, we must consider the previous history of the Palermo airport.

In the Palermo airspace, in 1943, there were several bombings, on 3 February, 1 and 22 March, 4, 5, 17 and 18 April. On 9 May, the Allied troops unleashed a hellish bomb raid, unnecessarily bloody given the condition of the infrastructure of the port and the Boccadifalco airport in Palermo at the time. Some 312 bombers, with 500- and 300-pound bombs, escorted by 178 heavy fighters, dropped 400 tonnes of explosives on the Sicilian capital. Hundreds of people were injured or killed. During the same night, the nightmare was repeated, and with 2000 kg HC bombs, the remaining built-up areas were destroyed too.

In 1953, the Palermo Airport Consortium wanted to redevelop the Boccadifalco airport (15 minutes by car from the centre of Palermo), deeming it obsolete. Experts and scholars had to start considering other possibilities. They came up with many ideas, with the notable exception of rebuilding it at Punta Raisi. Ignoring this advice, the Consortium indeed chose to rebuild the airport at Punta Raisi, against the wishes of many pilots and experts, one of whom was the brilliant Professor Lanzara from the University of Palermo (the first person in the world to design and create a 1:1 scale prototype for a magnetic levitation train in the early 1970s).

The next important step in Palermo's aviation history came in early 1960, when the 07-25 runway was completed (the two numbers in its name indicate its degrees with respect to magnetic North, 07 meaning 70°N and 25 for 250°N), at Punta Raisi airport (35 km west of the centre of Palermo).

On 5 May 1972, on Montagna Longa, a barren mountain ridge where cows and goats graze (illegally) today, that rises from South to North perpendicular to the axis of runway 07-25, the most serious air disaster of Italian civil aviation occurred (the 118 victims of the SAS flight SK 686 from Milan Linate to Copenhagen, that happened years later on 8 October 2001 included 4 baggage handling personnel from the airport whose lives were claimed on the ground). A McDonnell Douglas DC-8-43, operating the Alitalia flight AZ 112 from Rome, crashed, claiming the lives of all 115 of its passengers.

In 1978, a Learjet 35 aircraft, operated by Maniglia Costruzioni, in private flight from Rome Ciampino disappeared on approach into the sea at Punta Raisi, causing the deaths of all three people on board.

In Palermo, on 23 December 1978, a DC-9 plane, on Alitalia flight AZ 4128, coming from Rome, crashed into the stretch of water at the Gulf of Terrasini. There were 108 people killed, and 21 survivors.

On 14 January 1980, a DC-9-32 plane, on Alitalia flight AZ 864 from Rome to Tunis, was hijacked, with 93 passengers on board. It landed in Palermo, and the hijacker surrendered.

A few miles from Palermo, on the island of Ustica, on the evening of 17 June 1980, a DC-9-15 aircraft, owned by Itavia, took off from Bologna, and on its way to Palermo, crashed into the waters surrounding the island. This incident claimed the lives of all 81 people on board.

On 27 September 1989, a DC-9 ATI aircraft heading for Milan suddenly lost altitude and fell onto a dirt road. Disaster was only just avoided.

On 6 August 2005, an ATR72 aircraft, operated by the Tunisian company Tuninter took off from Bari Palese, heading to Djerba. It ran out of fuel at 23,000 feet and due to negligence at the hands of the pilots, who were later prosecuted, disastrously “landed” in the waters in front of Capo Gallo. Sixteen people died. The Palermo Prosecutor's Office closed the investigation one year after the disaster with the help of its consultants and the National Flight Safety Agency (ANSV).

On 24 September 2010, a Wind Jet Airbus 319, flight IV 243, was journeying from Rome to Palermo. The pilot was attempting to land at night on the main runway on the Terrasini side (RNW07–70°N) in a raging storm. He was flying too low, completely destroyed its landing gear on the rocks, and landed on the slippery ground at the edge of the runway. Only the torrential rain prevented the aircraft from catching fire. It resulted in a few minor injuries. The captain was struck off, and the Wind Jet company, some time later, declared bankruptcy.

This begs the question: is there any particular reason why so many accidents happen in the Palermo airspace, or is it just pure bad luck? A basic principle must be clarified at this point. A plane crash always has more than one cause. The scientific/theoretical studies of Reason and Hobbs[1], now also used in the ICAO (International Civil Aviation Organization) standards, show, together with the post-impact factual evidence, that it is the combination of several coactions that causes a plane to crash. If these coactions occur separately, they never, ever lead to a catastrophic event.[2]

The safety parameters of a nation and, consequently, of an airport, however, must be calculated in accordance with globalised standard criteria valid on all five continents. The most fundamental parameter involves the number of TKPs (tonnes transported per kilometre and flown to destination). By calculating the TKPs for a country, its aeronautical safety and reliability standard can be obtained. Between 2011 and 2015, China and the United Arab Emirates achieved the best score (as a comparison of millions of tonnes transported per kilometre): a perfect zero. That meant zero accidents occurred for all the TKP under their responsibility. For example, 10 tonnes for 10 kilometres gives a TKP equal to 100. By transferring the TKPs to the number of accidents involving companies and/or airports, the statistical index on the overall safety of a country can be obtained. In terms of this score, the best nation to date, alongside China and the United Arab Emirates, is the United Kingdom. Italy, however, is further down the list in 27th place.

This gets worse if we apply this parameter using just a single airport, and worse still if the airport we apply is Punta Raisi. If we apply the TKP in the double five-year period of 1972-1981, considering the crashes that occurred at the Palermo airport or involving routes headings towards it, this score would fall to the same level as some African countries where there have also been cases of one catastrophic plane crash for every 200,000 take-offs.[3]

I was responsible for investigations regarding the Palermo airspace about ten years ago on behalf of the Public Prosecutor of Palermo (for the Tuninter[4] flight that crashed so tragically over the sea of Capo Gallo). I also

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[1] *Managing Maintenance Error: A Practical Guide*, CRC Press, 8 May 2003; ISBN-10: 075461591X—ISBN-13: 978-0754615910.
[2] S.S. Krause; *Aircraft Safety*, McGraw-Hill, 2003; ISBN: 0-07-140974-2; J.M. Walters & R.L. Sumwalt III; *Aircraft Accident Analysis: Final Reports*, *Aviation Week*, McGraw-Hill, 2000; ISBN: 0-07-135149-3.
[3] Pietro Rinaldi (aeronautical expert), Eco di Bergamo online.
[4] R. M. Ardito Marretta, John A. "Drew" Bedson; Risk assessment of fuel quantity indicator replacement in ATR 72 aircraft, *Proceedings of the Institution of Mechanical Engineers, Part O: Journal of Risk and Reliability. December 2015, vol. 229 no. 6, p. 587-603.*

have experience with other airspaces as authorised personnel under various capacities. However, for this especially disastrous crash at Montagna Longa, I was working on behalf of the Victims' Families Association.

CHAPTER TWO

INVESTIGATION CRITERIA

Fig. 2 View of the McDonnell Douglas headquarters (Saint Louis, USA).

Any aeronautical investigation must begin by assessing the documentation relating to the aircraft involved in the accident. This could include characteristics of the manufacturer, on-board technical notebooks, QTBs, Job Cards[5], reports of ordinary and extraordinary operations, the FCOM airline manual, Flight Crew Operation Manuals, airworthiness certificates, previously called FAA Forms and currently known as EASA forms, etc. Consequently, any documents included in the Judicial Authority file must

[5] In aeronautical maintenance jargon, this refers to the records of scheduled and performed operations on the aircraft.

then be acquired during the trial process. To access these documents now, a formal request must be submitted to the Public Prosecutor's Office which conducted the official investigations (Catania). This request was submitted by the Victims' Families Association through a legal representative. The photographic archive, examined and discussed in detail in the following chapters, is particularly interesting.

Previous experience as an aeronautical investigator is undoubtedly very helpful when dealing with a new case. I was fortunate enough to collaborate with one of the most authoritative US investigators, Vincent LaChapelle, on the case of a catastrophic accident involving a Lockheed F-104 ASAM aircraft, stationed at the 37^{th} Wing of the Italian Air Force at its Trapani Birgi base. He believes that the mandatory steps for solving an aeronautical accident case must also be based on past experience, ICAO standards, and the most thorough examination possible of the technical/operational/ maintenance documentation relating to the aircraft.

Therefore, these were the golden rules that I applied and followed throughout this analysis of the disaster that occurred on the Alitalia DC-8-43 I-DIWB “Antonio Pigafetta” aircraft.

CHAPTER THREE

UNIVERSAL AERONAUTICAL INVESTIGATORY REFERENCES

Fig. 3 The ICAO headquarters in Montreal.

The essential parameters used, which will be integrated with the ICAO directives, will be strictly related to the performance of the aircraft. These include: advancing speed, attitude, contingency factors before and after the incident, and the aircraft's response to external and internal parameters. These parameters will also consider the procedures followed by the pilots as they set up the flight, using the correct values. This way, we can correlate them to the manoeuvres performed by the aircraft both in normal flight as well as in a possible failure phase, in order to have a better understanding of the events preceding the crash. This is not a simple task. On one hand, we are applying a deductive analysis, but on the other, an inductive method can help to confirm whether the initial hypotheses can be justified by the evidence.

This method, applied in mathematical analysis, is used for the demonstration of a criterion or a theorem.

Any designer, airline and industry professional, including aeronautical investigators, must use a universal code that has been established and approved globally, in order to understand the aeronautical world. The ICAO (International Civil Aviation Organization) code was created under the auspices of the UN. This organisation was established at the Chicago Convention in 1946. It defines the standards, recommendations and protocols for both air navigation as well as for the investigation of air accidents that have been entrusted to the local authorities of the member countries, who must carefully follow them. The ICAO 'bible' features annexes that provide and interpret the universal spoken and written code of an aircraft. In numerical order:

- Annex 1: Personnel licensing
- Annex 2: Rules of the air
- Annex 3: Meteorological Service for International Air Navigation
- Annex 4: Aeronautical Charts
- Annex 5: Units of Measurement to be Used in Air and Ground Operations
- Annex 6: Operation of Aircraft
- Annex 7: Aircraft Nationality and Registration Marks
- Annex 8: Airworthiness of Aircraft
- Annex 9: Facilitation
- Annex 10: Aeronautical Telecommunications
- Annex 11: Air Traffic Services
- Annex 12: Search and Rescue
- Annex 13: Aircraft Accident and Incident Investigation
- Annex 14: Aerodromes
- Annex 15: Aeronautical Information Services
- Annex 16: Environmental Protection
- Annex 17: Security
- Annex 18: The Safe Transport of Dangerous Goods by Air
- Annex 19: Safety Management

To begin this investigation into the Montagna Longa crash, we must adhere to the guidelines provided by these annexes, in particular to Annex 13. Annex 13 provides and hierarchically organises the technical, procedural and regulatory guidelines as per document 9859 and Attachment E in accordance with Resolution A35/17 of 23/11/2006. In order to closely examine the 5 May 1972 disaster, we have to make use of aerospace sciences: aerodynamics, aeronautical structures, on-board systems, flight dynamics, systems and logic of controls and servo-mechanisms, along with the objective parameterisation of the variables involved. Moreover, in terms of the directives that must be followed, Chapter 3 of Section 3.1, Annex 13[6], stands out in particular:

> "The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability."

The Italian judicial system, when called upon to investigate an incident of any nature, partly follows the same kind of principle described in ICAO Annex 13[7] (but to a lesser extent than, for example, the Italian National Agency for the Safety of Flight, or the ANSV), at least as far as prevention is concerned, but when assessing any responsibilities, it refers to the provisions of the Italian Law Codes.

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[6] Accident is taken to mean something catastrophic, incident to mean something more minor.

[7] Doc 8973: This contains detailed procedures and guidelines that act as a non-obligatory point of reference for the Member States in the process of adopting and updating their respective national security programmes. An example of this could be how they would manage the presence of a bomb on board an aircraft. It is a highly confidential document. The difference between the annexes and the docs is similar to the difference between the Constitution and the Civil Code in Italy: the Constitution sanctions the right to free association (Art. 18), while the Civil Code regulates it more specifically (Libro Quinto, Titolo VII).

CHAPTER FOUR

GENERAL DATA REGARDING THE DC-8 AIRCRAFT AND DEPARTURE OF FLIGHT AZ 112

Fig. 4 A McDonnell Douglas DC-8 Alitalia aircraft.

Basic design and operational data can be easily obtained, not only from the aircraft User Manual, but also from the official US database[8] (Aviation Safety Network, ASN). This also includes the case history and outcomes of accidents involving aircraft similar to the Alitalia flight AZ 112 of 5 May '72. We know the following information:

Manufacturer: McDonnell Douglas
Country: USA
Inaugural flight: 30 May 1958
Entered service: September 1959 (Delta Airlines)
End of production: 1972
Number of aircraft manufactured: 556

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[8] *Aviation Safety Network.com*

Number of DC-8-43 aircraft: 32
ICAO group: 4
Original design life: 25000 cycles
Design target flight hours: 50000 hours
Operational life: 20 years

As of 2010, this type of aircraft had been involved in 146 significant incidents. Almost half (83) of these incidents were hull-loss, causing major damage to the fuselage structure. It should be noted here that the ASN defines accidents, as opposed to incidents, as any that have minor consequences, as well as catastrophic ones, on the lives of passengers. The DC-8-43 Antonio Pigafetta is similar to many other machines, only it is slightly more complicated; it contains about 100,000 different parts and almost ten times as many elements that make up its overall structure. Here are its basic project parameters:

Length	45.87 m	Cruise speed	876 km/h (0.82 M; 473 kt)
Wingspan	43.41 m	Minimum runway	2800 m (9.300 ft)
Wing sweep height 12.90 m	30°	Landing	1998 m (6.555 ft)
Wing surface area	253.2 m^2	Range	12130 km (6550 NM) (max) 10843 km (5855 NM) (with max load)
Weight when empty	80.100 kg	Service altitude	10668 m (35000 ft)
Max weight at take-off	143000 kg		
Passengers	120-177		
Payload	18890 kg		

Tab.1 Data and geometric/operational characteristics of a McDonnell Douglas DC-8-43.

The McDonnell Douglas DC-8 (in every variant) shone for its reliability, operational life and the flexibility of its use (from medium to long range). McDonnell Douglas' projected 25-year operational life for the DC-8 more than doubled (five DC-8s were still in active service in 2015). It was also very strong in terms of its aerodynamic performance. On 21 August 1961, during a test flight, a McDonnell Douglas DC 8-43 (Canadian Pacific Air Lines) broke the sound barrier at Mach 1.012 (660 mph)[9] on its descent from 41,088 ft. It was the first passenger aircraft to break the sound barrier, before the Soviet Tupolev Tu-144 and the Anglo-French Concorde. It is so fast in the first design phases of models that were breaking the sound barrier, that Douglas engineers had to change the shape of the wings. Early prototypes looked more like a fighter plane than a passenger aircraft.[10]

Starting data recorded from the paperwork from flight AZ 112 on the evening of the 5 May 1972:

Aircraft registration: I-DIWB
Gate departure: 20.35 UTC (Universal Time Coordinated)
Departure delay: 25 minutes
Airways travelled and recorded on the flight plan by the crew: Amber 1—Amber 13 (the flight path that the pilot must follow)
Radio assistance on the flight: ATC Rome Ciampino (air traffic control centre) for 29 minutes and then ATC Punta Raisi at 74 NM to arrive at Palermo airport
Time of impact: 22.24 LT (local Palermo time)

This time is underlined here because it was reported that the impact may have occurred at around 22.24. Now, in the context of aeronautical investigation, the terms “around” or “about” suggest important errors. We will now explore why this is.

[9] Nautical miles per hour.
[10] Wing profiles with variable section from root to tip DSMA 277-280 and DSMA 277-281 (*Douglas Santa Monica Airfoils*).

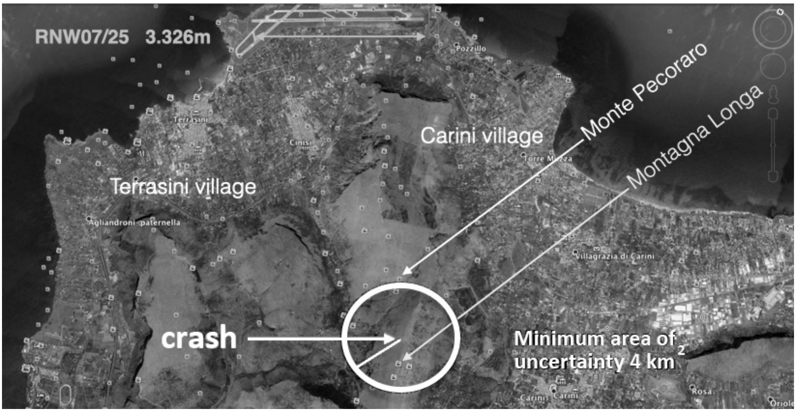

Fig. 5 Google Earth© view of the gulfs at Terrasini (left) and Carini (right).

Following the suggestion that the impact might have occurred around 22.24 local time can reasonably allow for a minimum period of time ranging from 22:23:59 to 22:24:59, or around 60”. The speed of the AZ 112, due to its attitude, its dimensions, its weight, its configuration is, at most with flaps at 25° (reasonable assumption for the final approach speed), was 220 kts (knots),[11] that is, an average speed of 110 m/s. This implies that, along with the uncertain space in time of 60”, a similarly uncertain path in terms of the crash site would be 6600 m.

If we look at Fig. 5 and refer to the layout of runway 07-25 at Punta Raisi, which we know is 3326 m in length, by drawing a circle with a radius subtending a circumference as long as this area of uncertainty, we find it is almost 4 km^2! This begs two questions. The first: what if that uncertain time frame were greater? The second: how can we find out more about the movements of this aircraft in that unknown but very real area of uncertainty?

[11] One knot of speed equals one nautical mile per hour (1852 m/h).

CHAPTER FIVE

RESULTS AND SHORTCOMINGS OF PREVIOUS INVESTIGATIONS

Fig 6. Carlo Alberto Dalla Chiesa (left) with Giuseppe Russo, (middle), Italian carabinieri high officers at the wreckage of the AZ 112. Russo was later killed by the mafia on 20 August 1977, and, on 3 September 1982, Dalla Chiesa suffered the same fate.

For the last 50 years, only the following information has been ascertained: three pilots, all of them known for being good at their job, made the same synchronised mistakes, simultaneously, all of them being deadly enough to cause an unprecedented disaster.

Frankly, more than a few doubts should have crossed the minds of the technicians and magistrates on this case. Moreover, they did not have the most basic, essential aeronautical post-accident investigatory tools:

1. They had no approach radials (unknown because no radar track was acquired);
2. Following the accident, no AD (Airworthiness Directive) was issued;
3. No SOAP (Spectrometric Oil Analysis Programme) was performed (that is, any chemical/physical/mechanical analysis of oil and fuel particles valid within NATO, usually through atomic mass spectrography [author's note]);
4. No McDonnell Douglas, NTSB and/or FAA report was acquired;
5. No flight information from other radar sites was acquired;[12]
6. There were no additional expert consultants collaborating with a fully opposed expert consultant, with regard to flight procedures;
7. There was no verification in terms of the possible presence of explosives;
8. There was no metallurgical analysis of the metal objects worn by passengers and crew.

Now, years after the disaster, the approach we take in this cold case can only be based on the frame of mind adopted by the ICAO that, for example, the Americans of the NTSB[13] have adopted since the founding of the government aerial investigation organisation. Other official and current sources are also very valuable in terms of technical work. Among these are the statements of one of the members of the first commission of enquiry (the Lino Commission), which was formed immediately after the disaster, called for by the Italian ministry of civil aviation at that time, directed by Francesco Lino. It also counted the union representatives of the pilots among its ranks. Records show that this commission concluded its work in 15 days. This information does appear to be false. The director in question did his best to deny everything to the official press on more than one occasion and did so more firmly following a parliamentary questioning by the SEL deputy Claudio Fava on the disaster of '72. He stated that:

> "Finally, after working incessantly every day for nine long days, the Commission, also in accordance with experts from the Douglas Aircraft

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[12] If this was not available from radiogoniometers at the time, the *USAF* sites of Aviano, from 1954 (PN), and S. Vito dei Normanni, from 1961 (BR), existed. The Marsala "marker" would also have been able to intercept as far as Ponza.

[13] Acronym for the *National Transportation Safety Board*, an independent US government investigative agency that investigates and reports on accidents involving aeroplanes, ships, trains, oil and gas pipelines. The NTSB does also investigate incidents outside the United States under certain circumstances.

> company and by engineers from the engine manufacturer, the Commission was able to draw up the conclusions of the technical-formal investigation, as per the mandate[14]."

The Lino Commission established that the Montagna Longa crash was the fault of the pilots and the constraints of Punta Raisi airport. Although the factual evidence, hypotheses of aeronautical calculation and presumed final manoeuvre carried out by pilots were in complete opposition to each other, two Public Prosecutors (from Catania and Palermo, one in charge of the region and the other not) deduced and confirmed that the causes of the disaster were to be exclusively connected to negligent piloting, without any other mitigating factors and/or responsibilities.

Now, we will raise some new questions and discover some answers where possible in order to try to make those same conclusions. However, we will begin by examining some facts that we know to be true. Some of the radio signals of the Punta Raisi beacon (PRS 113 MHz—CH 77x on ICAO AMI documentation; previously PRS 329 kHz and PAL 355.5 kHz) were not working in May 1972. The radio frequency set by the pilots on board approaching the Palermo airport is that of Monte Gradara (PAL 112.20 MHz—CH 70x on ICAO AMI documentation; previously PAL 355.5 kHz), a mountainous area where the villages of Borgetto, Partinico and S. Giuseppe Jato lie, overlooking and 10 miles south of the vertical axis runway 07-25. Pilots had known this for some time, and it was written clearly on their aeronautical maps. The AZ 112 crew would have also been aware of this. Several questions (summarised and simplified here) were asked to the Lino Commission and the expert panels of the two Public Prosecutors. They replied as follows.

> Question 1: Why did no one see Monte Gradara?
> Answer: Pilot negligence.
>
> Question 2: Why is there a difference between altitude/distance/variometrics (descent/ascent rate in feet per minute, ft/min)?
> Answer: Pilot negligence.
>
> Question 3: What about the lack of IFR/VFR integration (instrument and visual flight rules)?
> Answer: Pilot negligence.

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[14] *Avionews* 160222134349-1173407 (*World Aeronautical Press Agency*—22-Feb-2016 13:43).

Question 4: What about the missed approach circuit?
Answer: Pilot negligence.

Question 5: What about the lack of air-ground communication with ATC Palermo?
Answer: Pilot negligence.

Question 6: How was there no visual sighting of RNW25 under ceiling?
Answer: Pilot negligence.

Question 7: Why was the safety margin abandoned?
Answer: Pilot negligence.

How many mistakes did these pilots supposedly make? Seven? I count 21.

The crew in the cockpit of the AZ 112 flight was made up of: Roberto Bartoli, 41 years old (captain, 8565 flight hours, PNF (pilot not flying), that is, pilot not at the controls on 5 May '72), Bruno Dini, 37 years old (first officer, 3117 flight hours, PF (pilot flying), pilot at the controls on 5 May '72), and Gino Di Fiore, 28 years old (on-board engineer and what we now describe as an ATPL pilot, 1124 flight hours).

With these doubts in mind, we can ask ourselves other questions, and see below if there are any plausible answers:

I. If the pilots were known to be good, and the toxicology tests ruled out drugs or alcohol, why did they make such an abnormal sequence of mistakes?
II. Why did some witnesses claim to have seen the aircraft on fire just before the crash?
III. Why is the hypothesis that the AZ 112 approaching from the North-North-East side of the Carini village (I call this hypothesis A)—as established by the Public Prosecutor of Catania—the only hypothesis considered? Why fully refute the possibility of an overflight from the North-North-West Terrasini side (I call this hypothesis B) as theorised by the consultants of the Public Prosecutor of Palermo?
IV. On the other hand, is a third hypothesis technically admissible? Could hypothesis A and hypothesis B coexist and be perfectly congruent and plausible?
V. Does the route followed actually indicate a diversionary or, at least, corrective manoeuvre?