

**American Airlines Flight 965 Accident Report**  
**Cali, Colombia**  
**December 20, 1995**

Paul Mitchell  
Sylvain Bruni

# Outline

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- i. Accident Description**
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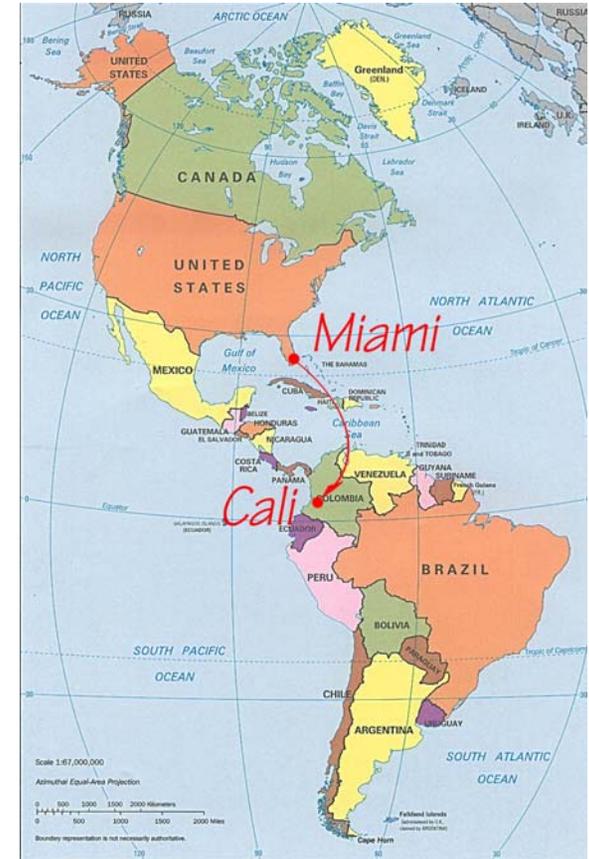
# Basic Flight Information

## ➤ Accident Description

## ➤ Human Factors

## ➤ Recommendations

- **Boeing 757-233 flight from Miami, FL to Cali, Colombia.**
- **2 hours late taking off, 3¼ hours flight time.**
- **First Officer flying, Captain operating FMS and communicating with ATC.**
- **Cali airspace – ATC had no radar.**
- **Planned approach to runway 01.**
- **To save time, ATC suggested a switch to runway 19.**



Source: [http://www.reisenett.no/map\\_collection/americas.html](http://www.reisenett.no/map_collection/americas.html)

- Boeing 757-233 American Airlines flight from Miami, FL to Cali, Colombia.
- This flight was just a few days before Christmas so everybody was anxious to get to their destination.
- 2-hour delay in Miami and only a 3 ¼ hour flying time meant that the flight was very late and the flight crew was looking to make up time anywhere they could.
- Lateness would begin to have a logistical effect on flights the next day in terms of flight crew rest.
- Flying pilot: First officer, no experience flying into Cali.
- NFP: Captain, 13 flights into Cali, all at night.
- ATC control in Cali had no radar capabilities as they were destroyed by anti-government guerillas in 1992, ie. they had to rely entirely on verbal position reports from incoming aircraft.
- Planned approach was into runway 01, which would require flying south of Cali and doubling back to land – would add several minutes to flight time.
- Cali approach controller suggested a last minute change to runway 19 after approach to runway 1 had already been initiated.
- Change was accepted by flight crew to try and land faster – R19 was a straight fly in approach.

# Navigational Confusion

## ➤ Accident Description

## ➤ Human Factors

## ➤ Recommendations

- Speed and altitude too high for this stage of the new approach – speedbrakes deployed.
- ATC had cleared 965 to execute the Rozo One arrival, a charted standard instrument arrival route to Cali VOR via Tulua VOR/Rozo NDB.
- Flight crew thought they had been cleared direct to Cali and were confused when the ATC asked 965 report at Tulua.
- Flight crew asked to fly direct to Rozo which ATC wrongly confirmed.
- Captain programmed into the FMC an erroneous waypoint, Romeo NDB waypoint 132 miles NE of Cali, resulting in a wide turn to the east.

2134:59 ATC Roger, is cleared to Cali VOR, uh, descend and maintain one, five thousand feet, altimeter three zero zero two.

2135:09 ATC ...no delay expect for approach. Report uh, Tulua VOR.

2135:14 965 OK understood. Cleared direct to Cali VOR. Uh, report Tulua and altitude one five, that's fifteen thousand three zero...zero...two. Is that all correct sir?

2135:25 ATC Affirmative.

2137:29 965 Can American Airlines uh, nine six five go direct to Rozo and then do the Rozo arrival sir?

2137:36 ATC Affirmative. Take the Rozo One and runway one niner, the wind is calm.

Source: Aeronautica Civil of the Republic of Colombia Accident Report

- Speed and altitude too high for this stage of the new approach, so the first officer deployed the speedbrakes. They remained in effect the remainder of the flight.
- ATC cleared 965 to execute the Rozo One arrival, a charted standard instrument arrival route to Cali VOR via Tulua VOR then the Rozo NDB.
- VOR = Very High Frequency Omnidirectional Range, NDB = Non Directional Beacon.
- Flight crew thought they'd been cleared directly to Cali and were confused by "report Tulua".
- Asked for confirmation of approach adding in "direct" to Cali that ATC had NOT originally used, ATC confirmed.
- Flight crew could not find the Tulua identifier in the FMS – the direct to command had removed intermediate waypoints, and the identifier was ULQ which the crew did not recognize as being Tulua.
- After ATC wrongly confirmed 965 could go direct to Rozo Captain put in a wrong waypoint.

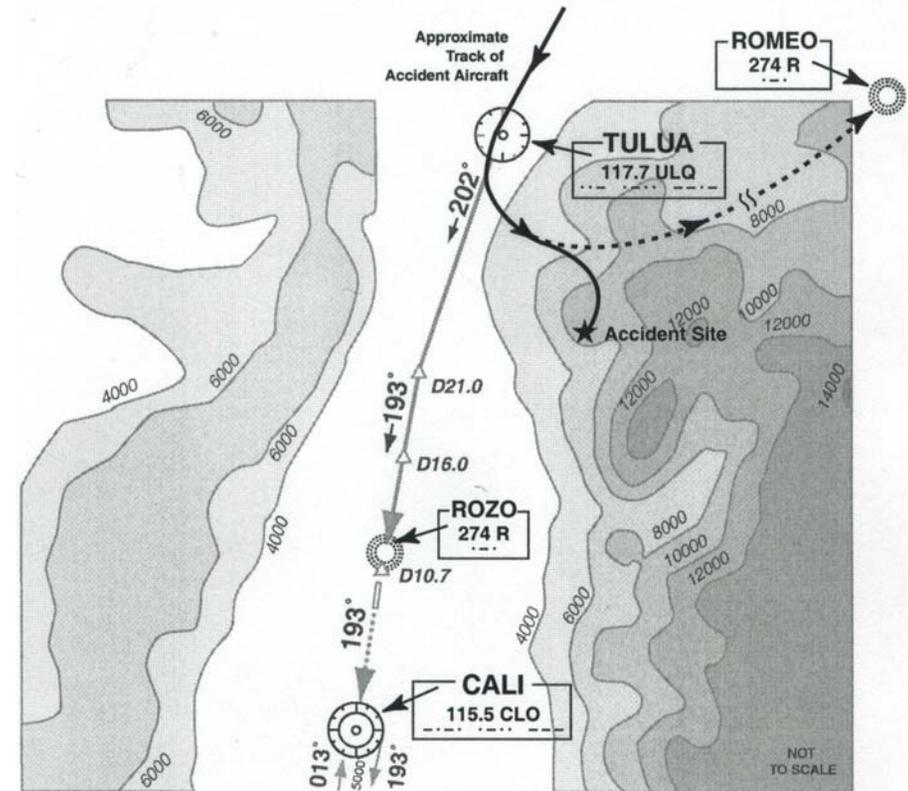
# Controlled Flight Into Terrain

## ➤ Accident Description

- Flight crew knew something was wrong because Rozo 1 was a straight approach.
- Knowing Cali was south the flight crew turned the aircraft right while trying to get a fix on their relative position.
- GPWS kicked in before impact and the pilots performed a terrain avoidance maneuver, applying full throttle and increasing pitch until the 757 “stick shaker” warned of aerodynamic stall.
- Plane struck the mountainside only 250ft below the summit of a ridge.

## ➤ Human Factors

## ➤ Recommendations



Source: Flight Safety Digest

- Feeling the aircraft start to turn the flight crew got even more concerned, Rozo One arrival was a straight approach.
- Could not find relative position of airplane.
- GPWS kicked in before impact and the pilots performed a terrain avoidance maneuver, applying full throttle and increasing pitch until the 757 “stick shaker” warned of aerodynamic stall.
- Plane struck the mountainside only 250ft below the summit of a ridge, belly up, riding on the trees briefly before ploughing into the mountainside.

# The Aftermath

➤ **Accident Description**

➤ **Human Factors**

➤ **Recommendations**

- **Crash elevation approximately 8900ft MSL.**
- **160 fatalities; 4 passengers and a dog survived.**

# Human Factors Issues

➤ Accident Description

➤ Human Factors

➤ Recommendations

- **Over-Reliance on Automation**
- **Lack/Loss of Situational Awareness**
- **Communication Problems**
- **Complacency/Time Pressure**

# Over Reliance on Automation

➤ Accident Description

➤ Human Factors

➤ Recommendations

- **Radio navigation was not used when FMS-assisted navigation became confusing and cognitively demanding during a critical segment of flight.**

- Programming of direct-to Cali VOR dropped all intermediate waypoints.
- Captain's incorrect selection of Romeo NDB when intention was to select Rozo NDB.
- Discrepancy between the approach chart and FMS waypoint representation.

# Lack/Loss of Situational Awareness

## ➤ Accident Description

## ➤ Human Factors

## ➤ Recommendations

- **Relative location of navigational waypoints**

- Flew past Tuluva VOR as they were trying to locate it.
- 965's crew did not detect the flight's deviation from the proper approach until it was too late.

- **Proximity to terrain**

- No terrain information displayed by the FMS or approach charts
- First officer had never been to Cali and relied on the captain's experience.

- **Vertical navigation**

- Speedbrakes remained deployed from approach runway change until crash.

# Communications Issues

➤ Accident Description

➤ Human Factors

➤ Recommendations

- **Between ATC and the flight crew of 965**

- The ATC's lack of basic English skills beyond "routine aeronautical communications".
- ATC had no way of knowing 965's position without verbal confirmation.
- Non-pertinent phone conversation, music and other distractions were present for the ATC.
- Ambiguous communications were not clarified by both parties.
- Confirmation bias.

- **Between the first officer and captain**

- An appropriate approach briefing was not done.
- Captain did not verify provisional path on the FMS display or confirm with the first officer before executing it in at least two separate cases.

# Complacency and Time Pressure

➤ Accident Description

➤ Human Factors

➤ Recommendations

## Complacency

- **An adequate approach review was not performed.**
  - Difficulties included lack of airport experience, night landing, proximity to terrain, no ATC radar and language barrier.

## Time Pressure

- **Amended approach clearance to runway 19 was accepted without proper evaluation.**
  - Neither the captain or first officer had prior experience with the runway 19 approach procedure.
- **Failure to abort approach despite the flight crew being rushed, confused and uncertain of their position.**

# Recommendations

➤ Accident Description

➤ Human Factors

➤ **Recommendations**

- **Training**
- **FMS/Approach Charts**
- **Obstacle Avoidance Aids**

These are recommendations mainly from the accident investigation report, but also from flight safety digest. They fall into three main categories.

# Recommendations

➤ Accident Description

➤ Human Factors

➤ **Recommendations**

- **Specific CFIT training in the following areas**
  - When levels of automation should be “stepped down”.
  - Ensuring comprehensive approach briefings take place.
  - Detection of ambiguous ATC clearances and procedures for clarification.
  - Careful evaluation of unexpected runway changes by ATC.
  - One pilot must always monitor and control the flight path.
  - Verify all waypoint changes with another crew member.
  - Proper completion of all checklists.
  - To delay landing if unsure of any aspect of the approach.

# Recommendations

➤ Accident Description

➤ Human Factors

➤ **Recommendations**

- **FMS/Approach Charts**

- Modify FMS logic to retain intermediate waypoints when a direct command is entered.
- Make waypoint selection in the FMS more user-friendly.
- Match FMS displays to approach charts more closely and use the same naming conventions for navigational information in both.
- Implement graphical terrain information into flight displays.
- Require that all approach charts display nearby terrain.

- **Obstacle Avoidance Aids**

- Have the speedbrakes automatically disengage when full throttle is commanded.
- Install an easy to interpret angle of attack indicator in all large airplanes.
- Development of an enhanced GPWS.

# References

➤ Accident Description

➤ Human Factors

➤ Recommendations

Aeronautica Civil of the Republic of Colombia (1996). *Aircraft Accident Report, Controlled Flight Into Terrain, American Airlines Flight 965, Boeing 757-233, N651AA, Near Cali, Colombia, December 20, 1995*. Santaf, de Bogota D.C., Colombia.

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