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Misrepresenting Reality: Limitations of Accident Documentaries for Airline Pilot Training

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ABSTRACT

Previous research indicates that many pilots believe studying past accidents is important for current airline safety. Furthermore, TV documentaries are a common source of information about accidents. This study examines how accurately the 1990 Avianca 052 accident is represented in one influential documentary. The analysis compares the documentary with information in the NTSB accident report and finds that extensive and significant changes were made. The adaptations include: use of an omniscient narrator, language change, dialog transformations, paralinguistics, the addition of visual information and other voices. The implication is that the documentary is a simplified and inaccurate representation of the Avianca 052 accident. This is problematic because the documentary continues to be widely used as an information source. The paper concludes with a caution concerning the use of accident documentaries in airline pilot training.

Keywords: Airline accident, Avianca 052, ICAO, Pilot training, TV documentary

INTRODUCTION

Airline accidents are complex events that typically do *not* result from a single cause but instead involve a combination of multiple factors (Dismukes, Berman & Loukopoulos, 2007). Contemporary approaches to accident analysis in high-risk complex systems include Reason's Swiss Cheese model and the Human Factors Analysis and Classification System (HFACS). These approaches recognize that accidents usually result from the co-incidence of factors operating at various levels, from the acts of individuals to the influence of organizational culture or regulations (Wiegmann & Shappell, 2003; Reason, Hollnagel & Paries, 2007).

In a previous study (Cookson, 2019, 2021), I conducted a survey of airline pilots' awareness of, and attitudes towards, four accidents cited in the International Civil Aviation Organization (ICAO) language proficiency program. The respondents overwhelmingly agreed that studying past accidents is important for airline safety. For three of the four accidents, the most common source of information was TV documentaries. This is worrying since documentaries are created primarily for entertainment, not as educational resources. In this paper, a TV documentary of one accident from the

survey, the 1990 crash of Avianca flight 052, is analyzed to determine how its representation of the accident differs from the official report.

AVIANCA FLIGHT 052

On 25th January 1990, Avianca 052 was scheduled to fly from Bogota, Colombia, to John F. Kennedy International Airport (JFK) in New York. The Boeing 707 aircraft left Bogota at 13:10 Eastern Standard Time (EST) on the first leg. After a brief refueling stop at Medellin, it took off at 15:08 bound for New York. As the plane reached the north-eastern United States it encountered adverse weather conditions. Air traffic controllers instructed the pilots to enter three holding patterns, lasting a total of 77 minutes. At 20:46, during the third holding period, the Avianca first officer notified ATC they could only hold for about five more minutes and could not reach their alternate airport in Boston because they were running out of fuel. When the aircraft finally descended towards JFK, the pilots had to execute a missed approach at 21:23 due to wind shear. They attempted a second approach, but lost power in all four engines due to fuel exhaustion. At approximately 21:34 the plane crashed at Cove Neck, Long Island. Of 158 passengers and crew, 73 died as a result of the crash. The fatalities included all the crew except for one flight attendant.

The National Transportation Safety Board (NTSB) investigated the accident and published its report in 1991. The 295-page report contained a detailed description of fuel calculations and extensive listings of flight crew and ATC communication. The probable cause was found to be "the failure of the flightcrew to adequately manage the airplane's fuel load, and their failure to communicate an emergency fuel situation to air traffic control before fuel exhaustion occurred" (NTSB, 1991, p. 76).

A 47-minute TV documentary recounting the story of Avianca 052 was broadcast on 27th February 2005 in Season 2 of the "Mayday" series. It was titled "Missing over New York" in Canada and the United States, and "Deadly Delay" in the United Kingdom, Australia and Asia. The opening sequence of the documentary states (Jorgensen, 2005): "This is a true story. The reconstruction contains certain composite characters, and the dialogue has been adapted from actual recordings." No details are given about the changes. Furthermore, it is not made clear whether the reconstruction is based on actual audio from the cockpit voice recorder (CVR) and ATC recordings, or instead based on transcripts in the accident report. The NTSB is prohibited from releasing CVR recordings under US law (49 U.S. Code § 1114).

METHOD

A comparative analysis of the TV documentary and the NTSB report was carried out, focusing on the communication of the flight crew and controllers. This involved viewing the documentary multiple times and transcribing most of the dialog using a simplified transcription protocol. The NTSB report and documentary were found to provide substantively different representations of the accident. Some differences were obvious; others were elucidated

Table 1. Differences between accident representations.

	NTSB REPORT (1991)	DOCUMENTARY (2004)
(1) Knowledge of the outcome	Report begins with executive summary describing the crash	Omniscient narrator says what will happen as drama unfolds
(2) Language of the flight crew	Report shows intra-cockpit dialog in Spanish with English translation	Flight crew shown speaking only in English
(3) Flight crew and ATC dialog	Report includes 1 CVR transcript and 7 ATC transcripts showing flight crew and ATC dialog	Dialog differs from transcripts by (a) re-ordering, (b) omission, (c) rewriting, and (d) fabrication
(4) Para-linguistics	CVR and ATC transcripts do not include paralinguistic information	Cockpit scenes use tone and speed of speech to indicate mood
(5) Visual information	There was no cockpit video recorder and no flight crew survived the accident	Cockpit scenes show gestures, gaze information and fuel gauges
(6) Other voices	Report has dissenting comments from 2 NTSB staff and a letter from DAAC in Colombia	Documentary has comments from 2 NTSB investigators, Avianca lawyer, passengers and a medic

using the conversation analysis technique of "unmotivated looking" to identify patterns in the data (Liddicoat, 2007). Table 1 gives an overview of the differences.

RESULTS

Below is a summary of the analysis results for the six categories shown in Table 1, highlighting key features of the accident representation in the documentary.

(1) Knowledge of the Outcome

The documentary uses the device of an omniscient narrator who, with the benefit of hindsight, gives a commentary on the accident. In the opening sequence, the narrator informs the audience about the outcome of the flight: "They are going to crash … The plane has hardly a drop of fuel left. They cannot land … Flight fifty two is about to crash somewhere over New York. How could that happen?" (00:59-01:18) The omniscience of the narrator is illustrated in a sequence about deteriorating weather conditions and increased congestion, when he says: "On flight fifty two they know none of this. The crew neither receives nor requests the weather for New York, or for their alternate airport, Boston." (07:05-07:16) During the first approach to JFK, the narrator again shares his knowledge of the outcome. Shortly before the wind shear, and 14 minutes before the crash, he states: "With the weather deteriorating and flying on fumes, the crew of flight fifty two will have only

Table 2. Excerpt of crew/ATC communication during first approach.

	NTSB REPORT (21:20 EST)	DOCUMENTARY (24:12-24:23)
(1) TWR	Avianca zero five two say airspeed	Avianca zero five two say airspeed
(2) FO	zero five two is ah one four five knots	one four five knots
(3) CAPT	ya nos dio libre atterrizar no	are we cleared to land now?
(4) FO	si senor estamos autorizados a aterrizar	yes sir we are cleared to land

one chance of getting their one hundred and forty nine passengers safely on the ground." (24:01-21:11).

Some information given by the narrator is incorrect. After introducing the captain and first officer, he describes the flight engineer: "The third man in the cockpit, flight engineer Matias Moyano, is experienced, but … he has only four months of flight time in the seven-oh-seven." (08:05-08:15) Actually, as noted in the NTSB report, the flight engineer had 3,077 flight hours in the Boeing 707. He qualified for the 707, then flew 727s, then *re*-qualified for the 707 in October 1989. In addition, the narrator's commentary includes speculation about the actions and thoughts of the crew. For example, during the third holding pattern, the Avianca first officer asks ATC for an estimate of when they can proceed. Then the narrator says, "The crew wait silently and hope…" (17:01-17:03) This occurred 9 minutes before the start of the CVR recording, so it is impossible to know whether the flight crew were silent at this point or what they were thinking.

(2) Language of the Flight Crew

Throughout the documentary, the Colombian flight crew are shown only speaking English. They actually talked to each other in Spanish, with the first officer switching to English for radio transmissions. In the NTSB report, the CVR transcript has an English translation of the crew's speech alongside the original Spanish. No indication is given in the documentary that their speech has been translated into English.

Table 2 contains an excerpt of the communication of the Avianca crew and ATC during the first approach to JFK. The dialog from the NTSB report shows how the tower controller (TWR) and first officer (FO) initially spoke English in lines (1) and (2), then the captain (CAPT) and first officer spoke Spanish in lines (3) and (4). By contrast, the corresponding documentary dialog is entirely in English.

A different approach to the Spanish language issue is taken in the final part of the documentary. Comments from the narrator and a medic are intercut with survivors talking about the crash and subsequent rescue activities. Two of the surviving passengers speak in Spanish, with a voiceover providing an English translation.

Table 3. Excerpt of flight crew communication during first approach.

	DOCUMENTARY (00:41-01:02)
(1) FO	gear down
(2) FE	glide slope!
(3) FO	rate five hundred feet
(4) GPWS	glide slope glide slope glide slope
(5) CAPT	lights
(6) CAPT	the runway, where is it?
(7) FO	I don't see it, I don't see it
(8) FO	this is the wind shear
(9) CAPT	landing gear up, landing gear up

(3) Flight Crew and ATC Dialog

The documentary has numerous reconstructed scenes showing the communication of the Avianca crew and controllers. Almost all the dialogs in these scenes have been transformed from the speech recorded in the NTSB transcripts. The analysis identified four transformation processes: (a) re-ordering of utterances; (b) omission of utterances; (c) rewriting of phrases or utterances; and (d) fabrication of utterances or dialogs. As a result of these transformations, many of the documentary dialogs are significantly shorter than the actual exchanges.

The first two transformation processes are illustrated in Table 3, which shows another excerpt from the first approach to JFK. The participants are the first officer (FO), flight engineer (FE) and captain (CAPT), with oral warnings from the ground proximity warning system (GPWS). All the lines of this documentary dialog can be found in the CVR transcript, but the order is different: 1-8-2-3-3-5-6-4-7-9-4. In addition, numerous lines in the CVR transcript are omitted from the documentary dialog. The documentary dialog lasts 21 seconds; the corresponding lines in the CVR transcript span 4 minutes 20 seconds.

The third transformation process, rewriting, is found in many sections of documentary dialog. Table 4 shows a typical example from an exchange between the first officer and a New York ARTCC center controller during the third holding pattern. The controller's message in line (1) is changed in the documentary by the addition of the preposition "at", making it clearer that "zero one three nine" is a time. The first officer's response in line (2) is simplified by deleting the time and adding "roger". The rewritten response is not consistent with the language use of the first officer, who consistently used standard phraseology to read back instructions. The CVR and ATC transcripts show him using the word "roger" only three times, with two of these occurring in the final minute of the flight.

Finally, the documentary includes several sections of dialog that appear to have been completely fabricated. One section involves a Washington center controller and the first officer during the first holding pattern (19:04-19:23 EST). The controller uses easy-to-understand language: "Avianca zero five

Table 4. Excerpt of crew/ATC communication during third holding pattern.

	NTSB REPORT (20:17 EST)	DOCUMENTARY (15:16-15:22)
(1) ATC	Avianca zero five two ah expect further clearance zero one three nine	Avianca zero five two expect further clearance at zero one three nine
(2) FO	Ok zero one three nine ah Avianca zero five two heavy	Avianca zero five two heavy roger

two heavy, Washington Center, roger, Avianca zero five two I'd like you to make a right three-hundred-and-sixty degree turn. And I need you to get a pencil ready for holding instructions at Norfolk." (08:35-08:45) This exchange is not in the NTSB transcripts, and the documentary does not indicate where it came from. However, a similar situation *was* recorded after the third holding pattern. At 20:54 EST an approach controller said, "Avianca zero five two turn right right turn heading two two zero I'm gunna have to spin you sir". In this actual instruction, the controller used colloquialism ("I'm gunna") and idiomatic language ("spin you") to instruct the Colombian crew.

Many sections of the documentary combine two or more transformation processes. A notable example is a 33-second scene (19:19-19:52) in which three controllers discuss the traffic congestion. This features re-ordering, extensive omission, rewritten utterances and a fabricated line. The corresponding dialog in the NTSB transcripts involved four controllers and lasted 10 minutes 12 seconds.

(4) Paralinguistics

Several cockpit scenes in the documentary portray the Avianca captain speaking rapidly in an angry, raised voice. The NTSB report makes no mention of the captain's anger or rapid speech, and the transcripts do not include information about paralinguistic features such as intonation or loudness. Moreover, the transcripts only give utterance start times to the nearest second and do not include end times, so it is not possible to calculate the rate of speech.

One of these documentary scenes (28:28-) occurs after the missed first approach. The approach controller says, "Avianca zero five two heavy ah I'm gunna turn you about fifteen miles north east and then bring you back onto the approach is that okay with you and your fuel". The captain demands, "what did he say". The reconstruction has the controller speaking with a calm and helpful tone, in contrast to the captain's anger. This is curious because, as the CVR transcript indicates, the flight engineer then said, "the guy is angry". The only reasonable interpretation is that the flight engineer was referring to the *controller's* anger (Garrison, 1991). The paralinguistics in this scene of the documentary are not supported by the evidence.

(5) Visual Information

The documentary shows multiple scenes of crew in the cockpit and passengers in the cabin. These views inside the aircraft give authenticity to the program.

However, there was no video recording of the actual flight, and, while a number of passengers survived the accident, none of the flight crew did. The cockpit reconstruction (with non-verbal communication such as facial expressions, gestures and eye gaze) is thus based on speculation informed by the ATC and CVR recordings. The CVR recording only covers the final 40 minutes of the flight, so intra-cockpit communication in earlier scenes (e.g., the holding patterns) is pure speculation.

Visual indications of the deteriorating fuel situation punctuate the documentary. One series of images shows a fuel gauge: the needle rises above 80,000 pounds during fueling in Colombia; later it falls to 15,000, 10,000 and then near 5,000 pounds. The needle falls at an exaggerated speed. Another series of images shows fuel slopping inside a fuel tank: the fuel level becomes progressively lower as an onscreen message warns that "FUEL REMAINING" is "89min", "30min", "18min", "9min", "8min" and finally "3min". The actual fuel calculations were complex and the crew did not have access to a simple display of the remaining time.

(6) Other Voices

The documentary combines actual participants, who were involved in the accident or investigation, and actors, who appear in the reconstruction. Two NTSB investigators feature prominently and give credibility to the documentary as a true account of the accident. The narrator observes that the NTSB are "the world's finest air crash detectives" (01:19). The investigators talk about the wind shear, missed approach, fuel problem and inoperative flight data recorder. They make a number of critical comments about the actions of the Avianca crew, for example: "It was time for the flight engineer to say, 'This is the only approach we're going to be able to make.' And he didn't." (24:40-24:47) They do not comment about the performance of the air traffic controllers, even though the NTSB report included a dissenting statement from one of the investigating team about inadequacies in the actions of ATC.

Other participants in the documentary are surviving passengers, a medic, and a lawyer who represented Avianca in post-accident litigation. In response to the charge that the captain was to blame for the crash, the lawyer says: "He was sucked into a situation by air traffic controllers where he ran out of fuel." (41:34-41:38) The lawyer notes that many opportunities to prevent the accident were missed: "If you listen and read the tapes, the transcripts of the tapes … you'll find twenty places where this accident could have been avoided if somebody had done something differently." (45:07-45:24)

DISCUSSION

The crash of Avianca 052 was a complex accident that involved the coincidence of multiple causal factors. The NTSB report provides one representation of the accident. However, the investigation was impeded because it did not have access to certain information: the aircraft's flight data recorder was inoperative; the Federal Aviation Administration (FAA) did not provide toxicological test results for the controllers; and the FAA report for JFK traffic management "was not retrievable because of computer problems"

(NTSB, 1991, p. 45). In addition, the findings of the report were challenged by dissenting statements from two NTSB members and Avianca.

The documentary provides a different representation of the Avianca 052 accident. As shown in this analysis, the documentary differs from the NTSB report in several regards: knowledge of the outcome; the language of the flight crew; the flight crew and ATC dialog; paralinguistics; visual information; and other voices. The following sections discuss the implications of these differences in terms of (1) hindsight bias, and (2) the simplification involved in creating the documentary.

Hindsight Bias

An omniscient narrator is a useful device for providing an audience with information in an efficient way. There is a risk, though, of introducing hindsight bias. At the outset of the documentary, the narrator tells the audience that "Flight fifty two is about to crash". This knowledge of the outcome acts as a block for anyone who tries to understand the situation faced by the participants *as events actually unfolded*. The flight crew did not have all the information provided by the narrator (or the NTSB investigators) in the documentary. The crew did not know that they would only have one chance to land, that they would encounter severe wind shear, or that they were going to crash. It becomes more difficult to make sense of the crew's decision making if we know the outcome. Dekker (2006, p. 27) notes the importance of avoiding hindsight bias: "You must guard yourself against mixing your reality with the reality of the people you are investigating. Those people did not know there was going to be a negative outcome, or they would have done something else."

Avoiding hindsight bias when analyzing accidents requires considerable effort. It is essential to try to understand the information and cues that were available to the participants, and how they perceived the situation facing them. The techniques of conversation analysis (Nevile, 2006) and the concept of bounded rationality (Dekker, 2001) are useful tools for combating this bias. It is also necessary to have as accurate a representation of the accident as possible.

Simplification

Creating a documentary of a complex accident necessarily involves simplification. In the case of Avianca 052, the 295-page accident report was distilled into a 47-minute program. One way in which the documentary simplifies the accident is by changing the flight crew's language from Spanish to English. As a result, it does not show the first officer's frequent code switching between the two languages as he integrated radio and cockpit communication. This code switching imposed a substantial cognitive load, which may have impaired the first officer's ability to communicate effectively, especially when the level of stress was increasing late in the flight.

Another part of the simplification is the transformation of the dialogs. The documentary does not accurately portray the communication of the flight crew or controllers. For instance, it does not show the overlapping speech

and radio messages that may have distracted the first officer when the captain told him to declare an emergency during the missed first approach. The dialog transformations lead to a significant compression of time. The simplification of the excerpt shown in Table 3, with more than 4 minutes of the CVR record reduced to 21 seconds, is typical. This compression of time masks an important issue: fatigue. Although downplayed in the NTSB report, the CVR transcript indicates that the captain was suffering from fatigue after more than six hours flying the Boeing 707 manually (Duke, 1992).

CONCLUSION

This analysis has identified substantive differences between the representations of the Avianca 052 accident provided by the NTSB report and an influential documentary. Specifically it has identified four transformation processes applied to dialogues in the documentary. As a result, the documentary does not accurately depict the communication or decision making that took place during the accident. Only one documentary was examined in this study, but it is probable that the findings are applicable to other accident documentaries. Namely, the use of an omniscient narrator increases the risk of hindsight bias, and the process of simplification leads to a sacrifice in accuracy. Documentaries are a common source of information for airline pilots about accidents. However, this analysis indicates that they may contain significant adaptation of accident report information, including fabrication of dialogs, and that the changes may not be specified. If documentaries are used as resources for pilot training, for example in human factors courses, they should be used in conjunction with other source material such as accident reports.

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