Log 2295

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: June 24, 1991

In reply refer to: A-91-33 through -36

Honorable James B. Busey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On Thursday, January 25, 1990, at approximately 2134 eastern standard time,[1] Avianca Airlines flight 052 (AVA052), a Boeing 707-321B with Colombian registration HK 2016, crashed in a wooded residential area in Cove Neck, Long Island, New York. AVA052 was a scheduled international passenger flight from Bogota, Colombia, to John F. Kennedy International Airport (JFK), New York, with an intermediate stop at Jose Maria Cordova Airport, near Medellin, Colombia. Of the 158 persons aboard, 73 were fatally injured.[2]

The Safety Board determines that the probable cause of this accident was 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. Contributing to the accident was the flightcrew's failure to use an airline operational control dispatch system to assist them during the international flight into a high-density airport in poor weather. Also contributing to the accident was inadequate traffic flow management by the FAA and the lack of standardized understandable terminology for pilots and controllers for minimum emergency fuel states.

Flightcrew/ATC Communications

The first indication that the flightcrew had some concerns about weather, and possibly the fuel state, occurred about 2009. At this time, AVA052 requested information about delays into Boston from the Washington Air Route Traffic Control Center (ARTCC) controller. The flight had been in

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[1] Unless otherwise indicated, all times shown are eastern standard time, based upon the 24-hour clock.

[2] For more detailed information, read Aviation Accident Report--"Avianca, the Airline of Colombia, Boeing 707-321B, HK 2016, Fuel Exhaustion, Cove Neck, New York, January 25, 1990." (NTSB/AAR-91/04)

holding about 26 minutes at BOTON intersection. The controller informed the flightcrew that Boston-Logan International Airport was open and accepting traffic and that the flight could expect as much as 30 additional minutes of holding in the New York (NY) ARTCC airspace. There was no further indication from the flightcrew about AVA052's fuel state until after the airplane had been in holding at CAMRN (an intersection 39 nmi south of JFK) for about 28 minutes. By that time, the flight had been assigned to holding on three occasions at three different fixes for a total of 1 hour and 6 minutes.

Because the cockpit voice recorder (CVR) retained only 40 minutes of intracockpit conversations, the Safety Board could not determine whether the crew discussed, prior to their departure from CAMRN, the minimum fuel level that they should have had aboard when commencing the approach. However, while in holding at CAMRN, it is apparent from air-to-ground transmissions (the expressed need for "priority" around 2045, and the indications that they could hold only 5 minutes and that they could not reach Boston) that the crew were aware of and concerned about the fuel problem.

Whether the captain, or first officer, or both, believed that these transmissions to air traffic control (ATC) conveyed the urgency for emergency handling is unknown. However, at 2054:40, AVA052 was given a 360^{0} turn for sequencing and spacing with other arrival traffic. The flightcrew should then have known that they were being treated routinely. This knowledge should have prompted them to question the clearance and reiterate the criticality of their fuel condition. At that time, they could have declared an emergency, or at least requested direct routing to the final approach in order to arrive with an acceptable approach minimum fuel level. Shortly thereafter, however, intracockpit conversations beginning about 2109:21 suggest that the flightcrew assumed that the flight was receiving priority handling.

The second officer had just completed briefing the procedure for less than 1,000 pounds in any tank when, at 2109:29, he said, "they already know we are in bad condition." The captain said, "no, they are descending us," and the first officer said, "one thousand feet." The captain replied, "ah yes," as if to acknowledge that the controller was giving the flight priority. The second officer responded immediately, "they are giving us priority." This conversation suggests that the flightcrew believed that ATC was aware of their critical situation and that ATC was providing "priority" service. However, the events and time involved in the vectoring for the approach should have indicated much earlier to the flightcrew that they were only receiving routine service, and they should have made inquiries to verify the situation.

After the flight discontinued an unstabilized approach to JFK (initiated about 2123:28, when the captain called for the landing gear to be raised), the captain advised the first officer, "tell them we are in emergency." However, the first officer acknowledged an ATC altitude and heading instruction from the JFK tower controller, adding to his response, "...we're running out of fuel." He did not use the word "emergency," as instructed by the captain, and therefore did not communicate the urgency of the situation. Thus, the controller was not alerted to the severity of the problem. When the tower controller advised AVA052 to contact the New York Terminal Radar

Approach Control (NY TRACON) again for vectors for the second approach, he did not advise the TRACON controller that AVA052 was running out of fuel; however, when AVA052 contacted the TRACON controller, the first officer again stated, "...we're running out of fuel sir," after acknowledging a clearance to climb to 3,000 feet.

Shortly thereafter, at 2124:22, the captain again advised the first officer to, "advise him we have an emergency." Four seconds later, the captain said, "did you tell him?" The first officer replied, "yes sir, I already advised him." Further, at 2125:08, the captain said to the first officer, "advise him we don't have fuel." He asked again, at 2125:28, "Did you advise him that we don't have fuel?" The first officer again said, "yes sir, I already advise him...."

These intracockpit conversations indicate a total breakdown in communications by the flightcrew in its attempts to relay the critical fuel situation to ATC. It is obvious that the first officer failed to convey the message that the captain intended. The evidence strongly suggests that the captain was unaware, at times, of the content of the first officer's transmissions and that he did not hear or understand the ATC communications. The captain may have been preoccupied with flying the airplane and was most likely paying little attention to the first officer's ATC radio transmissions. However, the Safety Board believes it more likely that his limited command of the English language prevented him from effectively monitoring the content of the transmission. The Safety Board further believes that this deficiency might have been a factor in the accident, particularly if the captain believed that the first officer had adequately expressed the criticality of the fuel situation upon departure from CAMRN.

The Safety Board concludes that the communications from ATC personnel and the handling of AVA052 were proper, considering the information that the controllers received from the flightcrew. Nevertheless, the Safety Board is concerned that the controllers and ATC managers interviewed after the accident did not place significance on the word "priority."

In its published procedures, Avianca Airlines uses the term "priority" regarding the communication of low fuel status. However, when ATC controllers were asked the phraseology that they would respond to immediately when a flightcrew indicated a low fuel emergency, they replied "MAYDAY," "PAN, PAN, PAN," and "Emergency." The controllers stated that, although they would do their utmost to assist a flight that requested "priority," the word would not require a specific response and that if a pilot is in a low fuel emergency and needs emergency handling, he should use the word "emergency."

Foreign, as well as U.S. pilots can, and often do, routinely ask for clarification of instructions, even when the radio frequencies are busy, as on the night of the accident. It is therefore necessary that the few terms used by pilots and controllers to convey emergency or other critical information be precise and understandable. The Safety Board believes that the FAA should work with the International Civil Aviation Organization (ICAO) to develop a standardized glossary of terms and words with clear definitions

to be disseminated to the international airline industry. For example, if "emergency low fuel" were defined to mean that 20 minutes remain until tanks are dry, and pilots and controllers understand that language, the tendency should be reduced to try to convey the situation with less precise information, such as "we need priority, please," when a true emergency exists.

As a result of the evidence collected by the Safety Board early in the investigation, on February 21, 1990, it issued a letter to the FAA Administrator recommending:

> Immediately notify all domestic and foreign air carriers to emphasize that all pilots operating commercial air transport flights in the United States (U.S.) National Airspace System (NAS) must be thoroughly knowledgeable of the flight operating and air traffic control (ATC) rules and procedures, including standard phraseology, for operating in the U.S. NAS. (Class I, Urgent Action) (A-90-9)
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> Immediately disseminate the contents of this safety recommendation letter (A-90-9 through -11) to all air carrier operators involved in commercial air transport operations in the United States National Airspace System. (Class I, Urgent Action) (A-90-10)
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> Immediately issue a General Notice (GENOT) directing management of all air traffic control (ATC) facilities to formally brief all air traffic controllers on the circumstances of the January 25, 1990, accident of Avianca Airlines flight 052 and to emphasize the need to request from flightcrews clarification of unclear or ambiguous transmissions that convey a possible emergency situation or the need for additional ATC assistance. (Class I, Urgent Action) (A-90-11)

On April 12, 1990, the FAA Administrator responded to Safety Recommendations A-90-9 through -11. Regarding recommendations A-90-9 and -10, the FAA issued Action Notice 8430.53, notifying all principal operations inspectors to advise all domestic and foreign carriers to emphasize the need for pilots to be thoroughly knowledgeable of the flight operating procedures and pertinent air traffic rules and procedures. The action notice transmitted a copy of the Safety Board's safety recommendation letter to the inspectors. The FAA also incorporated the contents of the action notice in FAA Order 8430.17, Air Carrier Operations Bulletin. As a result of these actions, on June 22, 1990, the Safety Board classified A-90-9 and -10 "Closed--Acceptable Action."

Regarding A-90-11, the FAA issued a GENOT requiring all ATC facility managers to ensure that all ATC facility personnel were briefed on the contents of the Safety Board's safety recommendations resulting from the AVA052 accident. The GENOT also emphasized the need for complete and thorough communications between controllers and pilots. Based on those actions, on June 22, 1990, the Safety Board classified A-90-11, "Closed--Acceptable Action."

In spite of these corrective actions, the Safety Board believes that there is a need for the FAA to review all official definitions of words and phrases used to describe minimum and emergency fuel. The Safety Board believes that the FAA should also coordinate any review of this subject with ICAO to ensure that the FAA's ATC phraseology is consistent with the Standards and Recommended Practices of ICAO. The evidence gathered by the Safety Board during its investigation of the Avianca accident suggests that the FAA ATC phraseology is not always understood by foreign pilots.

The Safety Board believes that a number of terms that are clearly understood by both pilots and controllers should be developed and disseminated worldwide to help prevent another accident similar to AVA052. The Safety Board's examination of other "minimum fuel" incidents involving both U.S. and foreign airlines suggests that language confusion and imprecise understanding of critical words exist that could lead to another accident.

Air Traffic Management/Central Flow Control

The ground delay program for JFK was negotiated and implemented based on the assumption that runway 13 left would be the arrival runway for the afternoon and evening shift of January 25, 1990. The weather forecast for the time the program was needed, 1900Z until 0300Z, indicated that strong southeast winds would be at the surface, a situation that would require the use of runway 13 left as the only arrival runway.

Early in the morning, the day shift supervisor at the Central Flow Control Facility (CFCF) had several discussions with the NY TRACON specialist (N90) at the Traffic Management Unit (TMU). During negotiations about the airport acceptance rate (AAR), the N90 TMU specialist believed that the AAR should be set at approximately 28 arrivals per hour. The CFCF supervisor asked the specialist if it would be possible to land 30 to 32 airplanes per hour. The N90 specialist then referenced the engineered performance standards (EPS) and advised the CFCF supervisor that the EPS reflected an arrival rate of 26 airplanes per hour for runway 13 left under the forecast weather conditions.

After the program had been developed, the CFCF supervisor informed the N90 specialist via telephone that the program rate had been set at 33 arrivals per hour. The N90 specialist who took the call was not the same individual who had the earlier discussion with the supervisor. The supervisor explained to the specialist that the program had been "built" at an arrival rate of 33 arrival airplanes per hour and stated, "figuring in the disruption with the rest of the system and one or two guys quitting, I feel that's a fair ground delay...but I want your blessings also." The supervisor explained that building the program at a lower rate would cause an excessively high number of ground delays and that if the ground delays went as high as 3 hours, they would not be acceptable. The N90 specialist stated, "well why don't you go with it."

The supervisor informed Safety Board investigators that even though the program was set at a computer rate of 33 airplanes per hour, the objective was to achieve a 28 airport acceptance rate as the N90 specialist had

requested. The specialist who actually "built" the program informed Safety Board investigators that his understanding was that the computer rate and the airport acceptance rate were to be the same, 33 arrivals per hour, and that this number was the one he entered onto the program worksheet. He briefed his relief, the specialist for the afternoon shift, that the airport acceptance rate was to be 33. He was also under the impression that the program had been computed based on the use of runways 22 left and 22 right at JFK, and he was never aware that the program was based on the use of runway 13 left. The JFK ground delay program was transmitted successfully to all domestic ARTCC's at approximately 1525Z.

Copies of the EPS for the JFK airport were provided to Safety Board investigators. According to the EPS for runway 13 left, the highest number of arrivals that can be accommodated on that runway during instrument meteorological conditions is 24 airplanes. The highest number of arrivals that can be accommodated on runway 22 left during these conditions is 23 airplanes. The specialists and supervisors from CFCF informed Safety Board investigators that the EPS figures are not necessarily the figures that the CFCF would use when determining the need for or the computing of a ground delay program. They stated that the terminal facility actually determines the airport acceptance rate and that the rate is normally higher than the designated EPS number. The Assistant Manager for Traffic Management at the CFCF informed investigators that the 33 rate for runway 13 left was "a little high" but that it was based on the assumption that the high number of programs in place and the number of cancelled flights expected on January 25 would make the 33 rate acceptable. He also stated that a 33 rate for runway 22 left was an "excellent rate."

Although the cause of this accident clearly involved the inadequate actions of the flightcrew of AVA052, the weather and air traffic conditions at JFK during the hours before the accident set the stage for the delays that led to the holding of the flight for more than 1 hour en route. The normal high density of traffic in the New York area was made worse by the prevailing weather during the day. The FAA CFCF had a program in place beginning at 1400 to attempt to prevent problems, including excessive airborne holding. However, this program failed for several reasons.

The investigation revealed that the traffic management program in effect for JFK did allow for the arrival of sufficient numbers of airplanes to accomplish an airport acceptance rate of 33 arrivals per hour (except during the first hour of the program when only 17 airplanes landed) for which the program was set. However, the program was compromised when the weather deteriorated to less than that needed for aircraft to land on runway 22 right, and missed approaches began on runway 22 left.

Although the program was still allowing 33 airplanes per hour into the system for JFK, CFCF personnel did not react appropriately or timely enough to prevent the large numbers of airplanes that ended up in holding patterns waiting for the weather conditions to improve. When CFCF did react by implementing a ground stop for traffic destined for JFK, the action was not sufficient to abate the airborne holding which had already begun.

Many of the flights inbound to the JFK airport had departed from overseas or other long distance airports. When it first became necessary to implement the ground stop for JFK arrivals, most of the long distance traffic was already airborne and a ground stop, therefore, was not effective for those flights. However, a review of the data from CFCF revealed that at 1600, when runway 22 right was already below minimums and the missed approaches had already begun on runway 22 left, approximately 38 airplanes from the ZDC (Washington ARTCC) and ZNY (New York ARTCC) centers had not departed for JFK. Nationwide, more than 100 airplanes were still scheduled to depart for JFK from domestic airports.

A ground stop implemented at 1600 and remaining in effect for a sufficient number of hours would have affected the overall air traffic system to a considerable extent, but it would not have been effective in alleviating the large inventory of airborne flights waiting to land at JFK. The Safety Board, therefore, believes that CFCF did not implement a ground stop for traffic landing at JFK in time to prevent the excessive airborne holding that occurred on the evening of the accident. After the ground stop was implemented, it was not of sufficient duration nor did it include a sufficient number of ARTCCs to be effective in alleviating the airborne holding that was occurring.

The investigation also revealed that National Weather Service (NWS) personnel working in the Weather Service Units at CFCF and ZNY did not inform traffic management personnel of the severe wind conditions that affected the controller's ability to provide appropriate separation in the approach control airspace of the JFK sector on the evening shift of January 25. These winds, as well as the deteriorating weather conditions, were causing the missed approaches.

Traffic management personnel informed the Safety Board that if they had known about the wind conditions, the program could have been implemented at a lower airport acceptance rate, thereby reducing the airborne inventory of airplanes arriving at JFK during each hour of the traffic management program. The Safety Board believes that the NWS personnel failed to communicate this information to the CFCF traffic management specialists.

The JFK program was implemented based upon forecast weather conditions that should have permitted the continuous use of the instrument landing system (ILS) approach to runway 22 left and the use of runway 22 right for arrivals until 2000. The visibility was expected to deteriorate to 1/2 mile. In fact, the visibility was 1/4 mile as early as 1600. The minimum prevailing visibility required for the ILS approach to runway 22 right is 3/4 mile, and for runway 22 left, 1/2 mile. If approaches had continued on both runways until 2000, the airborne inventory of airplanes might have been much smaller.

The Safety Board believes that the forecast was inaccurate and that the traffic management program was implemented based upon a forecast of better weather conditions than those that actually existed. If the forecast had been accurate, the program might have been implemented at a lower airport acceptance rate and the inventory of airplanes in holding patterns would

have been much lower. Therefore, the Safety Board believes that the traffic management efforts of the CFCF personnel were neither accurate nor timely for traffic into and out of JFK and that both of these situations contributed to the events that led to this accident.

Airplane Flight Manual and Airline Procedures

The airline's only written procedure for minimum fuel operation was published in its B-707 Operations Manual. The procedure was based on an indicated fuel quantity in any main tank of 1,000 pounds or less. The procedure did not address a minimum fuel quantity for which a flight should be at the outer marker, inbound to the runway.

As a result of a fatal air carrier accident and an incident in which fuel exhaustion was determined to be causal, the Safety Board issued Safety Recommendation A-81-14 to the FAA on February 24, 1981. It urged the FAA to "amend 14 CFR 121 and 14 CFR 135 to require that all air carrier operators include in their flight operations manuals the minimum operational fuel requirements of their aircraft, including fuel quantities below which a landing should not be delayed.... In determining minimum fuel quantities, allowances should be made for fuel quantity measuring system tolerances and for the possibility of a missed approach." The FAA did not act on this recommendation and the Safety Board classified it "Closed--Unacceptable Action."

The Safety Board believes that the circumstances of this accident, as well as other incidents involving low fuel state landings, dictate the need for a review of regulations and airplane flight manual procedures. Consideration should be given to minimum fuel values for various phases of airline flights in which a landing should not be delayed and in which emergency handling by ATC should be requested. Also, criteria should be established in any amended regulations for when pilots are to notify ATC that an airplane has reached such a fuel state that it should be cleared to its destination or alternate airport without the delays associated with routine handling and therefore when emergency handling is required.

Use of Broadcasts to Flightcrews about Delays

The Safety Board is aware that the Air Traffic Control Handbook, paragraph 2-127, provides guidelines to ATC specialists to include on automated terminal information service (ATIS) broadcasts certain items of information. A review of this paragraph indicates that no specific requirement exists for ATC specialists to record information onto the ATIS about arrival delays. Paragraph 4-53 provides guidelines to controllers for informing flightcrews about arrival delays. It states, in part, "Unless a pilot requests delay information, the actions specified in (1) and (2) above [specific requirements are listed in (1) and (2) of this paragraph] may be omitted when total delay information is available to pilots via ATIS." There was no such information recorded on the JFK tower ATIS during the time that AVA052 was in the holding pattern at CAMRN. Although this paragraph does not require that arrival delay information be recorded onto the ATIS, the Safety

Board believes that such information recorded onto the ATIS would provide valuable assistance to controllers and pilots.

The Safety Board is aware that ARTCC's in the U.S. are staffed and equipped with TMU's and that most major approach control facilities and control towers have TMU personnel. The Safety Board believes that these facilities are well-suited to provide recorded information, similar to ATIS recordings, for broadcasting information on arrival delays that affect airports within ARTCC airspace. Recordings that contain the latest delay information would reduce controller workload and enhance a flightcrew's ability to manage fuel more efficiently.

Therefore, as a result of its investigation of this accident, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Develop in cooperation with the International Civil Aviation Organization a standardized glossary of definitions, terms, words, and phrases to be used that are clearly understandable to both pilots and air traffic controllers regarding minimum and emergency fuel communications. (Class II, Priority Action) (A-91-33)
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> Conduct a comprehensive study of the Central Flow Control Facility and the Traffic Management System, by the Office of Safety/Quality Assurance, to determine the effectiveness and appropriateness of training, responsibilities, procedures, and methods of application for the Traffic Management System. (Class II, Priority Action) (A-91-34)
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> Require that transport category airplane flight manuals include procedures specifying minimum fuel values for various phases of airline flights at which a landing should not be delayed and when emergency handling by ATC should be requested. The manual requirement and associated amendments to regulations and procedures should include criteria for when ATC must be notified that the airplane must be en route to its destination or alternate airport via routine handling, and when emergency handling is required. (Class II, Priority Action) (A-91-35)
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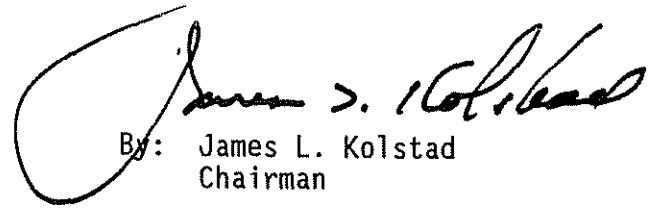
> Incorporate into air route traffic control centers equipment to provide a recorded broadcast of traffic management information that can be monitored by all aircraft within each center's boundaries to provide pilots with early indications of potential delays en route. (Class II, Priority Action) (A-91-36)

Also, the Safety Board issued Safety Recommendations A-91-37 through A-91-38 to the Departamento Administrativo De Aeronautica Civil, Columbia.

KOLSTAD, Chairman, COUGHLIN, Vice Chairman, BURNETT, LAUBER, and HART, Members, concurred in these recommendations.



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