

2. ANALYSIS

2.1 General

The three flightcrew members were certificated and qualified for their respective positions in accordance with company standards and FARs. Information derived during the course of the investigation revealed that the captain was controlling the airplane and the first officer was performing the duties of the nonflying pilot during the approach. Although the crew had no adverse medical histories or life events that would have physically impaired their abilities, fatigue and its relationship to the crew's performance is considered in this analysis.

The airplane was certificated, equipped and maintained in accordance with FAA regulations and company procedures. The weight and balance were within prescribed limits for landing; however, the evidence from the wreckage examination revealed that the flaps were at 50 degrees, a position that is not an "authorized" configuration for normal landings. This is further discussed in the analysis. The investigation disclosed no evidence of preexisting faults in the airplane's structure, systems, or engines that would have contributed to the cause of the accident.

Meteorological information, as reported at the time of the accident, did not reveal significant environmental conditions at Guantanamo Bay. The reported surface winds at the airport were 200 degrees at 7 knots. This wind condition would have favored a landing on runway 28; however, the captain chose to land on runway 10 from a right base turn, an approach that is recognizably difficult for the pilots of large airplanes because of the proximity of the runway touchdown zone to the Cuban border.

In analyzing the circumstances and factors of this accident, the Safety Board evaluated the conduct of the approach to runway 10 with regard to the flight characteristics of the DC-8 airplane, the performance of the flightcrew, the adequacy of the guidance provided to the flightcrew by AIA and DOD, the special airports training provided by AIA, the flightcrew's decision to use runway 10, and the probable effects of fatigue on the flightcrew's performance. The analysis of this accident also addresses the issues of crew flight and duty time policy and regulations as related to flightcrew fatigue, AIA management philosophy with regard to flight operations and training, and FAA oversight and surveillance of AIA.

2.2 The Approach to Runway 10

The proximity of the runway 10 threshold to the boundary fence between U.S. and Cuban territory (and airspace), and the associated restrictions for U.S. aircraft overflying Cuban territory, places a burden upon pilots of aircraft landing on runway 10. This burden is increased with larger aircraft, i.e. DC-8, DC-10, etc. The approach must be conducted so that the airplane remains within the 3/4 mile distance from the runway threshold (as measured along the extended runway centerline) during the turn from base leg to final runway alignment. For pilots of large aircraft, the approach presents challenges that are not normally encountered during routine air carrier line operations. In nearly all other approaches, whether conducted in instrument or visual conditions, the air carrier pilot will ensure that the aircraft is aligned with the runway centerline a minimum of 2 miles from the threshold, and at a height of greater than 500 feet above the threshold. In fact, all air carrier training programs emphasize the safety significance of a stabilized approach where changes to the airplane configuration, descent rate, airspeed and magnetic heading are minimized during the final approach segment. In contrast, the approach to runway 10 at Guantanamo Bay requires the pilot to accomplish a tight radius turn from base leg to final approach using a steeper than normal angle of bank and rolling out on runway heading over or nearly over the runway threshold. The roll out to a wings level attitude is completed at low altitude with minimum distance to correct for runway misalignment.

The difficulty of conducting the runway 10 approach from the right traffic pattern is further increased by a prevailing southerly wind. The effect of the wind on the airplane results in an increased ground speed while on base leg and an increased (inertial) radius of turn to the runway heading at a given angle of bank. To compensate for the southerly wind, the pilot must commence the turn to final sooner and/or use a steeper than normal angle of bank to maintain the proper track over the ground.

The Safety Board determined that the approach to runway 10 was within the theoretical performance limits of the accident airplane using a maximum bank angle of 30 degrees. The DC-8 at the landing gross weight of 236,000 pounds with the flaps extended to 50 degrees would have a wings level stall speed (V_{so}) of about 109 knots indicated airspeed (KIAS), and a nominal approach speed of 147 KIAS ($1.3 V_{so} + 5$). At this approach speed, the radius of turn with 30 degrees of bank is approximately 3,325 feet. Thus, the airplane approaching from the south and aligned precisely with the Cuban border fence should have been able to

complete a turn to the east and return to a wings level attitude on final for runway 10 with about 1,300 feet remaining to the runway threshold. Assuming a touchdown aim point 1,000 feet beyond the runway threshold, and a constant 3-degree-per-second descent path, the airplane would have been approximately 120 feet above the ground as it rolled to a wings level attitude on final approach.

While this approach theoretically could have been negotiated by a DC-8, there are several factors which could compromise the success of the approach and landing on runway 10. First, in order to limit the bank angle to 30 degrees, the turn must be initiated at a precise point as the airplane proceeds north on the base leg. This precise point is located along the extended Cuban boundary line, at a distance south of the runway 10 centerline, established by the radius of the turn and the effects of the prevailing wind. Second, the transition from wings level flight to 30 degrees of bank must be accomplished immediately within 2 seconds of crossing the turn reference point in order to achieve the theoretical turn radius. A variance in either of these factors will affect both the bank angle required throughout the turn to achieve proper runway alignment and distance from the runway threshold, and the height above the ground when the turn to final is completed. If the turn to final is delayed for only 6 seconds, a 45 degree angle of bank would be necessary to complete the turn and be aligned with the runway centerline on roll out. Finally, as the turn is established, the pilot must consider the airplane's load factor associated with the bank angle and the resultant increase in aerodynamic drag and decrease in the airspeed stall margin. This can be accomplished by modulating the engine thrust to maintain the proper airspeed and descent path.

The Safety Board believes that it is unlikely that the pilot of a heavy transport airplane, having a relatively high approach speed, would be capable of adhering to all of the U.S. airspace restrictions associated with the approach to runway 10 at Leeward Point Airfield, Guantanamo Bay, without exceeding safe maneuvering bank angles at low altitude. The downwind leg for the right hand approach is flown over water; thus, there are no visual landmarks to aid the pilot in determining the proper position to initiate the turns to base leg and final approach. During normal operations, a high intensity strobe light located atop of the Marine guard tower on the U.S./Cuban boundary fence line is used to establish the downwind to base leg flight track. However, on the day of the accident and unbeknownst to the crew of flight 808, the strobe light was inoperative.

In addition, the approach to runway 10 is increasingly difficult when the right hand pattern is flown by the captain positioned in the left seat. As the airplane approaches the coastline on the base leg, the captain's visibility from the cockpit becomes progressively restricted. The captain's ability to maintain visual orientation with the runway threshold eventually degrades to the point that he can no longer see the runway. Thus, it is understandable that the captain of flight 808, unfamiliar with the approach, would have had difficulty establishing the proper position to initiate the turn to final, and maintain a reasonable angle of bank and roll out on the heading that would have provided proper alignment with the runway centerline.

2.3 The Performance of the Flightcrew

The flightcrew properly planned the unexpected flight to Guantanamo Bay, but their lack of knowledge or previous flight experience at Guantanamo (except the first officer who had conducted flight operations there many years before and in airplanes much smaller than a DC-8), specifically the runway 10 approach, created confusion upon their arrival.

The three crewmembers had been on duty for nearly 18 hours upon their arrival at Guantanamo Bay, which included being awake all night. Nonetheless, the captain's decision to land on runway 10 was made almost casually and was not questioned by the other crewmembers, although all three knew that Guantanamo Bay was a special airport because the approach to runway 10 involved an unusually short and challenging turn to final approach. This is further emphasized by the discussion in the cockpit at 1641:53, in which the captain proposed landing on runway 10 "just for the heck of it to see how it is." The first officer responded "OK," while the flight engineer said nothing. There was no further discussion of this decision, except for a comment by the flight engineer at 1644:50, "just don't do no rolls on final." The crew did not discuss the airplane's weight or the prevailing winds (which favored landing on runway 28), factors that may have prompted the first officer and flight engineer to advise against this approach.

The captain did not initiate, nor did the other crewmembers request, a briefing of the procedures to be followed in the event that the approach would be discontinued and the missed approach executed. Also, the flightcrew did not discuss the realistic challenges of the runway 10 approach, given the factors such as their unfamiliarity with the approach and their fatigued condition. With almost no

interaction among the flightcrew during the latter portions of the approach, they abandoned what would have been a straightforward approach to runway 28 and set themselves up for a dangerous situation with the approach to runway 10.

As the flight turned northbound toward the coastline, the captain attempted to find the strobe light that would have provided alignment with the Cuban boundary fence line. Having not been advised by the controller that the strobe was inoperative, he continued to look for the light and allowed his attention to be diverted from the tasks necessary to execute the approach. Instead of looking for airport features and attaining/maintaining visual contact with the runway, he fixated on finding the strobe light that the controller had referenced. The success of the approach was dependent upon the proper execution of the turn from downwind to final. However, the captain's fixation led to unstabilized airspeed control for the approach, a lack of situational awareness of the airplane in relation to the runway, and the premature turn to base leg. This resulted in a failure to use all of the available airspace between the runway threshold and the fence line; thus, the distance remaining after the turn to final would not be sufficient for any necessary corrections for runway alignment.

The tower supervisor/local controller assumed the air traffic control duties about 2 hours before the accident. At that time, she notified the Marine Barracks of the inoperative strobe light. In addition, the supervisor was in the process of training a new controller. At the time of flight 808's arrival, the controller trainee was performing all of the radio communications. The trainee provided landing instructions to the flightcrew which included a reference to "...remain within the first fence line designated by the high-intensity strobe."

The strobe is a visual aid for pilots. However, it not a required reporting point nor is its identification mandatory by the flightcrew to execute the approach to runway 10. The Safety Board believes that the failure by both the controller trainee and the supervisor to inform the crew of the inoperative strobe light resulted in the captain concentrating his attention on finding the strobe rather than flying the airplane. Also, the Safety Board believes that the captain's continued focus on locating the strobe and the first officer falsely identifying the strobe were most likely enhanced by their fatigued state. Had the controllers provided the crew with the proper information about the strobe light, it is most probable that the captain would have concentrated his efforts on flying the aircraft, as well as recognized the dangerous situation of slow airspeed, steep bank and low altitude.

A ground track generated from FDR and meteorological data indicated that flight 808 was approximately 3,000 feet west and 2,000 feet south of the runway 10 threshold (approximately 1,000 feet from the shoreline) when the turn from base leg to final approach was initiated. From this position it is probable that the captain, being in the left seat, did not have the runway threshold in sight. However, there is no evidence that he requested assistance from his first officer who was in a better position to view the runway, nor is there any evidence that the first officer volunteered the essential information regarding the position and proximity of the airplane to runway 10. In addition to being too close to the runway threshold on the base leg, the FDR indicated that the captain permitted the airspeed to decrease to 140 KIAS, about 7 knots below the target airspeed. Based on the actual point where the turn was initiated, the required radius to complete the turn and be in a position to cross the runway threshold, aligned with the centerline would have been 2,700 feet. At 147 KIAS, a constant bank angle of 55 degrees would have been required to achieve this turn, an inappropriate maneuver for a DC-8. Additionally, a load factor of 1.7 would have to be developed to maintain such a turn and the stall speed would have increased to 143 KIAS.

The load factor, airspeed, and heading data from the FDR were used to calculate the actual turning maneuver, stall margins and roll angles. The roll angles were determined to be less than 30 degrees at the initiation of the turn from base to final, but increased during the last 7 seconds of flight to beyond 50 degrees right wing down. The increasing bank angles effectively reduced the turn radius but increased the required load factor in order to maintain the turn and a constant rate of descent. The increasing load factor resulted in an additional loss of airspeed. Both the decreasing airspeed and greater load factors required the airplane to be operated at greater angles-of-attack, to the point that the airplane eventually stalled. The Safety Board found no indications that engine thrust was increased nor that the bank angle was reduced during this maneuver. Based on the position of flight 808 when the turn from base leg to final was initiated, the probability of successfully completing the approach was nil. However, the accident was not inevitable until the captain steepened the bank and permitted the airplane to stall. When the captain realized that an abnormally steep bank angle was required to align the airplane with the runway, he should have acted immediately to discontinue the approach by reducing the bank angle, increasing the engine thrust, and performing a go-around.

The Safety Board believes that the lack of communication between the captain and the other crewmembers was a major factor in the accident. The flight engineer's repeated concerns about the deteriorating airspeed did not sufficiently

communicate the urgency of the situation to the captain. Moreover, when the stall warning activated, neither crewmember was successful in re-directing the captain to take positive corrective action to recover to controlled flight.

According to Douglas Aircraft Company (DAC), the loss of roll authority is "minimal" on the DC-8 at the onset of wing stall because the aerodynamic effectiveness of the ailerons is preserved during the flight in the stall regime. Based on the FDR and CVR data, and the performance characteristics of the DC-8, upon activation of the stall warning stick shaker, the captain would have had about 5 seconds to initiate corrective action and eliminate the stall hazard. The data also suggests that conventional stall recovery techniques (maximum thrust and wings level) and the execution of a go-around could have prevented ground impact.

On balance, the three experienced crewmembers failed to respond properly in both their decision-making and the execution of this approach. The performance of this crew on the accident leg was especially surprising considering their extensive experience and the positive evaluations regarding the crewmembers by other pilots. The captain of the accident flight had been described as a good crew manager with better than average skills, including the ability to anticipate and avoid trouble situations. Also, the first officer was characterized as an excellent pilot, while the flight engineer was described as someone who spoke up when there were problems. Considering these commendable qualities, the Safety Board believes that one of the primary issues in this accident was the crew's failure to adhere to the professional standards characteristic of their prior performance in the final moments before the accident.

2.4 Effect of Scheduling and Flightcrew Fatigue

The crew had been on duty approximately 18 hours at the time of the accident, having flown all night before accepting the new flight segment to Guantanamo. In reviewing the performance of the crew, the Safety Board attempted to determine the extent to which this extended duty schedule may have affected the actions observed in the accident.

The evaluation of the captain's performance revealed that he initiated and continued to fly the approach to runway 10 in a manner that placed the airplane in a dangerous flight regime despite warnings from the other crewmembers and the stall warning stick shaker. The Safety Board believes that the substandard

performance by an experienced pilot may have reflected the debilitating influences from fatigue.

In his testimony before the Safety Board at its public hearing, the captain described his memory of the last period before the accident in terms that suggested fatigue:

All I can say is that I was -- I felt very lethargic or indifferent. I remember making the turn from the base to the final, but I don't remember trying to look for the airport or adding power or decreasing power.

On the final -- I had mentioned...that I had heard Tom say something about he didn't like the looks of the approach. And looking at the voice recorder, it was along the lines of, are we going to make this?

I remember looking over at him, and there again, I remember -- being very lethargic about it or indifferent. I don't recall asking him or questioning anybody. I don't recall the engineer talking about the airspeeds at all. So it's very frustrating and disconcerting at night to try to lay there and think of how this -- you know -- how you could be so lethargic when so many things were going on, but that's just the way it was.

The first officer told Safety Board investigators that he felt somewhat fatigued when he accepted the trip to fly to Guantanamo, but that he felt fully alert and exhilarated just before the accident as they approached the airport. He supported the captain's decision to land on runway 10, but failed to adequately monitor and initiate a go-around as the approach escalated to a critically dangerous level. Additionally, there was also an uncertainty in his [the first officer] actions throughout the approach, evidenced by the CVR transcript indicating his confusion between Guantanamo Radar and Havana Center. According to the captain, the first officer reviewed the tower transcript after the accident and "thought he might be more fatigued than he thought he was because of the way he answered some of the transmissions and the way he stuttered in some of the transmissions."

According to his wife, the flight engineer sounded well rested when they talked by telephone just before he reported for duty (about 21 hours before the

accident). Interviews with several persons, including a captain who had flown with him recently, said the flight engineer always verbalized his concerns when he saw something that did not look right. This trait was evident just before the accident, when the flight engineer made several references to the airspeed and expressions of concerns about the approach. However, like the first officer, he was not sufficiently assertive to redirect the captain and stop the deteriorating situation.

2.4.1 Scientific Examination of Fatigue

In the laboratory, it is possible to measure fatigue through the monitoring of brain wave activity and other physiological evidence. Outside the laboratory, however, there is no direct measurement or testing that can be applied, thus fatigue must be inferred from background information and actions.

In accident investigations, three background factors are commonly examined for evidence related to fatigue. They are cumulative sleep loss, continuous hours of wakefulness, and time of day. These areas were examined as follows:

- 1) Cumulative sleep loss: Scientific literature has established that people require a certain number of hours of sleep each day to be fully alert, typically between 6 to 10 hours depending on the individual. As reflected in the recent Special Investigative Report by the Safety Board on the Pegasus Launch procedure anomaly (NTSB/SIR-93/02), there is evidence that only 2 hours less sleep than is usually required by an individual can create major degradation's in alertness and performance (p. 71). Issues of sleep loss have been cited by the Safety Board as issues in previous accidents. For example, fatigue of the third mate was cited as a factor in the probable cause of the grounding of the U.S. tank ship Exxon Valdez (NTSB/MAR-90/04). The report noted that the third mate's total sleep time in the previous 24 hours could have been as few as 5 or 6 hours, and that "impaired task performance could normally be anticipated as a result of these conditions of partial sleep loss" (p. 128).

- 2) Continuous hours of wakefulness: In the recent Safety Study in which the Board reviewed 37 major aviation accidents in which flightcrew performance was determined to be either a causal or contributing factor to the accident, it was found that one factor related to performance and judgment errors was the time that a pilot(s) had been awake. A review of flightcrew-involved, major accidents of U.S. Air Carriers, 1978 through 1990, NTSB/SS-94/01, revealed that flightcrews comprised of captains and first officers whose time since awakening were determined to be elevated substantially higher than average, made more errors overall, and specifically more procedural and tactical decision errors. The study adds to scientific evidence that fatigue problems can increase simply with lack of sleep.
- 3) Circadian disruption (Time of Day): Scientific literature has established that there are two periods of maximal sleepiness in a person's usual 24 hour day. These are determined by physiological fluctuations regulated by the brain, and occur between roughly 3-5 every morning and 3-5 every afternoon. During these periods, the body is primed to sleep. Individuals can remain awake during these periods, but the physiological pressure to sleep is maintained and may affect waking levels of performance and alertness. Failure to sleep during these periods, or efforts to sleep when the body is physiologically primed to be active, are labeled circadian disruption.

The Safety Board received a detailed analysis of the sleep history of the three crewmembers involved in this accident from an expert in the study of fatigue. The sleep histories are summarized in this study and the cumulative sleep debt is explained in appendix E. Based on the information revealed in the expert's analysis, it can be seen that none of the three crewmembers had received his normal level of sleep in the days before the accident. Both the captain and the first officer reported they normally slept about 8 hours per night, but in the 48 hours before the accident, they slept only about 8 hours and 10 hours respectively. The flight engineer reported he normally slept about 9 1/2 hours each night; however, in the same 48 hour period he only slept about 12 hours.

The Safety Board's examination of the flight and duty time revealed the captain had been awake for 23.5 hours at the time of the accident, the first officer for 19 hours, and the flight engineer for 21 hours. In comparison to those pilots sampled in the Safety Board's Air Carrier Study, these values of time since awakening would have put the crew of flight 808 in the top percentile for crewmembers lacking sleep. The accident crewmembers had been awake as long or longer than any other crewmember involved in the special study sample.

The accident occurred at 1656, at the end of the afternoon physiological low period. The crewmembers had been awake for the preceding two nights and had attempted to sleep during the day, further complicating their circadian sleep disorders.

Therefore, the evidence in this accident shows that the flight crewmembers met all three of the scientific criteria for susceptibility to the debilitating affects of fatigue. This is further supported by the comparison of evidence from this accident with that of other accidents and studies conducted by the Safety Board.

The effects of fatigue are particularly prevalent when all three factors overlap, as in the present case, where the flightcrew had received limited sleep in the previous 48 hours, then been awake more than 19 hours during both day and night periods, and then were required to be at a high level of alertness during a period of time (3 to 5 p.m.) associated with sleepiness. In summary, the three "experienced" crewmembers, especially the captain, failed to respond appropriately and effectively to a situation that deteriorated to the level of a stall during the approach, which, although demanding, could have been performed successfully provided the proper techniques and procedures were employed. The academic studies and scientific data are consistent with the flightcrew statements and testimony describing their reduced alertness and decision-making impairment. Based on these data the Safety Board concludes that fatigue was a factor directly leading to this accident.

2.4.2 Company Practices Related to Fatigue

The Chief Executive Officer (CEO) of AIA was interviewed to determine the nature of the company policies and procedures with regard to crew scheduling. He stated that, to remain competitive, the company must often assign

long duty times and "work everything right to the edge" of what was allowed by FARs. He also indicated that this was a common practice in the industry.

According to the AIA chief crew scheduler, there was an unwritten company procedure to avoid assigning crews to more than 24 hours continuous duty time. However, the captain from flight 808 stated that he had been assigned trips with 24-hour duty periods several times previously. The FAA POI said that during his association with AIA, he had observed flightcrews who had been on duty 20 to 24 hours in situations that were "legal." The length of the accident trip therefore was not unique.

Another factor that was examined was the action/reaction of both AIA and the flightcrew members with regard to the refusal to conduct a trip because of fatigue. According to the AIA chief crew scheduler, when a crewmember refused a trip because of fatigue, it was company policy to establish how long a rest period was required by the crewmember, followed by the company providing that crewmember with a hotel room. He indicated that it was very seldom that such refusals happened. The captain of flight 808 stated that he had "felt tired" upon notification of the unscheduled trip to Guantanamo, but accepted the trip because it was "legal." He also said that he never refused a trip because of fatigue and was not aware of any other crewmember that had done so. The first officer of the accident flight said the crewmembers had discussed the trip to Guantanamo and decided that although it was "legal," it seemed like a long day and might be "pushing the edge." He added that based on his previous experience regarding the company's attitude, "if the trip was legal, you better really be tired" to refuse the trip. Several former AIA pilots expressed to the Safety Board their concerns about the scheduling practices at the airline. One pilot stated that he was with a crew that refused to fly a Part 91 ferry flight at the end of a long duty and that he felt the crew was subjected to intimidation by the company.

In reviewing this evidence, the Safety Board was unable to determine the actual company reactions to pilots who refused trips because of fatigue. At the same time, the Safety Board did recognize that the current policy relies heavily on the judgment and integrity of individual pilots. As noted in the fatigue expert's report, individuals are normally poor at recognizing their own fatigue state and tend to strongly underestimate it. Given the pressures of the actual commercial environment, it does not seem realistic to rely on the crews' self assessment and willingness to confront company pressures as a safety mechanism to prevent the assignment of tired crews. The FARs set the baseline of what is permitted legally in

hours of service, and competitive pressures make it likely that air carriers will operate at or near the baseline to maximize crew utilization and company profits. The Safety Board is concerned that companies are unlikely to voluntarily change their policies, or that individual crewmembers will take an aggressive position in the determination of fatigue limits; rather, it will require regulation to enact change to prevent the recurrence of this type of accident.

The Safety Board believes that AIA's scheduling of this crew contributed to their fatigue and substandard performance.

2.5 Flight and Duty Time Regulations

The significance of crewmember fatigue in this accident prompted the Safety Board to examine the FARs that govern flight and duty time for flightcrew members.

The Safety Board's examination revealed that several different crew flight and duty time regulations were applicable to the accident trip. The first portion of the trip, which involved the crew's scheduled domestic flights, were conducted under 14 CFR Section 121.505 for supplemental air carriers and commercial operators. This rule states that a pilot may not be scheduled to fly more than 8 hours, or be on duty more than 16 hours, in 24 consecutive hours. Guantanamo Bay was considered an "international" destination, thus, the flight to Guantanamo would be conducted under 14 CFR Section 121.521 rule applicable to supplemental air carriers on international flights. This regulation provides that a pilot may be scheduled to fly up to 12 hours in 24 consecutive hours; thus, because the pilots of flight 808 would have accumulated about 9.0 hours of flight time and 21 hours of duty time when they arrived at Guantanamo Bay, the time that would have accumulated during this trip would have exceeded the limits of 14 CFR Section 121.505, but not the limits of 14 CFR Section 121.521. Further, once the airplane was offloaded in Guantanamo Bay, the return portion of the scheduled trip would have been flown under 14 CFR Part 91, as a "non-commercial" ferry flight to reposition the airplane back in Atlanta. Currently, there are no flight or duty limits applicable to commercial operators when the airplane is flown under 14 CFR Part 91, to ferry the airplane. The FAA has addressed this issue and provided a legal interpretation that flight and duty time accrued during company required flights conducted under 14 CFR Part 91 must be counted against the flight and duty time accumulated in revenue operation for determining the eligibility to initiate a 14 CFR Part 121 flight. However, because there are no limits applicable to 14 CFR Part 91,

flight and duty time accrued during flights conducted under 14 CFR Part 121 do not prohibit a pilot from initiating a flight under 14 CFR Part 91 at the end of a Part 121 line operation. Therefore, the accident trip was under the provisions of a combination of separate regulations that allowed extended flight and duty times to be scheduled, contrary to safe operating practices.

According to testimony before the Safety Board at its public hearing, the United States and France are the only countries in the world that base their aviation hours of service regulations on flight time while most other countries base it on duty time. The Manager of the FAA Air Carrier Branch, testified that flight and rest requirements in aviation were first established in the 1930s. The FAA has since had continuing interest in updating these regulations and several attempts had been made to revise the regulations in the 1970s but, according to the manager, these failed because the FAA was unable to obtain a consensus from industry and labor groups on new standards. The FAA established an advisory committee in 1983 which resulted in the issuance of new domestic 14 CFR Part 121 rules in 1985. A new advisory group was established in 1992, with participation from a wide segment of the aviation community, to review flight/duty time issues and, if appropriate, develop recommendations for regulatory revision. This group is currently meeting and has not provided feedback to the agency; however, the group's manager indicated that he felt there was a need for revision in the flight/duty time regulations, especially to close the option of 14 CFR Part 91 ferry flights in 14 CFR Part 121 operations. He also indicated that the FAA's present strategy is to develop regulatory change on the basis of input from an outside advisory committee rather than on the basis of new rulemaking initiated by the agency itself. The Safety Board is concerned that this process may not result in a satisfactory solution to this issue and believes that efforts to change existing regulations by means of the committee negotiating process are ineffective.

Issues of fatigue in transportation have been of special concern to the Safety Board in all modes of transportation. In 1989, the Safety Board made three recommendations to the DOT to encourage an aggressive Federal program to address the problems of fatigue and sleep issues in transportation safety:

I-89-1

Expedite a coordinated research program on the effects of fatigue, sleepiness, sleep disorders, and circadian factors on transportation system safety.

I-89-2

Develop and disseminate educational material for transportation industry personnel and management regarding shift work; work and rest schedules; and proper regimens of health, diet, and rest.

I-89-3

Review and upgrade regulations governing hours of service for all transportation modes to assure that they are consistent and that they incorporate the results of the latest research on fatigue and sleep issues

The DOT has initiated programs in each transportation mode to respond to the need for a better understanding of fatigue, and regularly briefs the Safety Board on these activities. These recommendations remain classified "Open--Acceptable Response" pending the completion of these programs.

It is apparent from the accident involving AIA flight 808 that further efforts are needed in aviation to address the third recommendation (I-89-3), which may eliminate some of the problems that continue to plague the industry.

Fatigue issues have been addressed in several major aviation accident reports. In the accident involving a Continental Express Embraer-120 RT on April 29, 1993, Pine Bluff, Arkansas, the Safety Board cited fatigue as a contributing factor in the probable cause of the accident.¹⁶

In January 1994, the Safety Board published a study of 37 major aviation accidents from the period 1978 through 1990, in which human performance issues were cited in the probable cause determinations.¹⁷ Many human performance background variables were compared to the types of errors observed in the accident sequences in an effort to identify factors that might be useful in accident prevention. Several fatigue-related variables were examined, such as time

¹⁶See Aircraft Accident/Incident Summary Report--"In-Flight Loss of Control Leading to Forced Landing and Runway Overrun, Continental Express, Inc., N24706, Embraer EMB-120 RT, Pine Bluff, Arkansas, April 29, 1993" (NTSB/AAR-94/02/SUM)

¹⁷See Safety Study--"A Review of Flightcrew-Involved Major Accidents of U. S. Air Carriers, 1978 Through 1990" (NTSB/SS-94/01)

since awakening, time of day, time zone crossings, and changing work schedules. It was found that the time since awakening for each pilot related to significant differences in performance, in terms of the number and types of errors made by pilots.

As a result of this safety study, on February 3, 1994, the Safety Board issued the following recommendation to the FAA:

A-94-5

Require U. S. air carriers operating under 14 CFR Part 121 to include, as part of pilot training, a program to educate pilots about the detrimental effects of fatigue, and strategies for avoiding fatigue and countering its effects.

The implementation by the FAA of such a program should assist pilots to better recognize their own symptoms of fatigue and to develop personal strategies to help lower its effects in the demanding work schedules to which they are subjected.

In reviewing the evidence, the Safety Board notes with concern the length of time without revision of the current flight/duty time regulations and the continuing slowness and difficulty of the current regulatory review process. New evidence has become available in the past 20 years on fatigue, and it increasingly substantiates that fatigue is a more pervasive and debilitating factor in transportation safety than was previously realized. The Safety Board believes that the FAA should revise the regulations pertaining to permitted flight and duty time. The FAA should also clarify the regulation to prohibit a flight crewmember from initiating a 14 CFR Part 91 ferry flight if before the completion of the revenue flight, the total flight and duty time will exceed that permitted during the 14 CFR Part 121 operations. Currently, the industry practice of ferry flights at the conclusion of revenue operations can lead to excessively long duty days and induce debilitating effects of fatigue on crewmembers.

2.6 The Company

The Safety Board also examined the underlying safety issues developed during the investigation, including the corporate philosophy, operational, and maintenance aspects of AIA.

Since separating the Part 121 supplemental operations from the Part 135 operations in 1985, AIA expanded its fleet of airplanes to provide ad hoc operations worldwide and had also increased the responsibilities of the current management. The individual managers/supervisors could not keep pace with the added responsibilities placed on them because of the increasing rate of expansion of the airline. This situation was evident whenever a problem area arose because either management, the airline operation, or both, were constantly "behind the power curve" in planning or foresight. This was observed on a regular basis by the FAA POI and PMI, and was documented in the various inspection reports prepared by not only the local FAA inspectors, but by the inspectors involved in the FAA RASIP, NASIP, and special inspections, as well as the DOD inspections. AIA's underlying company philosophy with regard to taking corrective action on negative findings determined by these inspections was to solve the problem by "decree." And although changes were made or actions were performed to "correct" the discrepancies, the corrections were not always long term and became repetitive on follow-up inspections. The company's attempts to comply with FARs were described as "minimal," with an attitude of disregard to elevating the level of operation above the minimum standards set forth by the regulations.

The information and concerns expressed by AIA employees to the Safety Board during the investigation suggested that a corporate attitude existed that placed more significance on economic factors than safety. This attitude was cited by the pilots in their concerns about excessive crew flight and duty time; and was expressed as only one of the many causal issues used to support the Teamsters Union being voted to represent the pilots. However, AIA management stated to the Safety Board in general terms that the "lack of communications between management and the pilots" was the reason behind the solicitation of union representation.

Other examples of management anomalies were reflected in the AIA flight operations. The oversight and responsibilities of the diverse airplane fleet (DC-9s, B-727s, B-747s, and DC-8s), were handled by the D/O and the Chief Pilot. AIA did not have fleet managers, nor were there persons assigned to the individual airplane models that could oversee that particular portion of the fleet, and resolve problems, establish or change procedures, maintain all pertinent airplane manuals, or answer questions. Additionally, the D/O was responsible for maintaining the currency of all airplane manuals for the entire fleet of airplanes. This type of work is both time consuming and labor intensive.

FAA inspections found repetitive discrepancies in required paperwork, as well as airplane and flight operations manuals, that reflected either the lack of attention, a reduced priority, or the inability to perform the task because of other work priorities. Because of the repetition of discrepancies in these specific areas, and the lack of urgency on the part of the AIA management to take corrective actions, the POI sometimes resorted to unorthodox means to achieve change. One such action related to the out-dated aircraft operations and maintenance manuals. To effect a change by AIA, the POI threatened to delay the approval of the B-747 operation, pending AIA's establishment of a "manuals office" with a supervisor and staff to monitor revisions and update the manuals. Only then did AIA management initiate efforts to bring the manuals up to acceptable standards.

The Safety Board believes that AIA's management structure and philosophy of "lean management" was insufficient to maintain vigilant oversight and control of the rapidly expanding airline operation. The lack of personnel in key positions (both operations and maintenance) that were capable of reducing the workload of the management staff, and the inability of supervisory staff to make and implement decisions without involving the highest levels of management, are just two of many examples that contributed to the management problems that compromised the safety of this operation.

2.6.1 Special Airport Information and Training

The Safety Board was concerned by the lack of available printed information, and the limited knowledge of the crewmembers regarding the Guantanamo Bay, Leeward Point Airfield. This airport is one of 11 such airports described in the "special airports" qualification video tape used by AIA crewmembers during either initial or recurrent training. The Safety Board found that this training was self-monitored and that no additional or supporting information was provided by the company or the DOD during these training sessions. Although, it was AIA's policy that flight engineers were not required to view the tape on special airports, the evidence in this accident showed that the flight engineer was more knowledgeable and aware of flight 808's position during the approach to Guantanamo Bay than the other two crewmembers.

The Safety Board believes that the lack of a requirement for flight engineers to receive this type of training limits their knowledge about special airports. It further serves to eliminate a critical element of safety when such an

element is needed the most. It is vital that all members of a crew be fully aware of the possible dangers associated with airports that are considered to be special.

In addition, AIA flight crewmembers are at a disadvantage when operating at the special airports because of the randomness of their particular schedules and the time that may have elapsed between their viewing of the videotape and the actual flight into the special airport. The Safety Board also believes that the video tape prepared by DOD does not adequately convey the difficulty and potential hazards involved in the approach to runway 10 at Guantanamo Bay. The tape is a pictorial of the airport, including the coastline and Cuban boundary, as viewed from the cockpit of an airplane during the turn from downwind and base leg on to final. The tape accurately shows that the final alignment with the runway occurs at low altitude and nearly over the runway threshold. However, there is no discussion about the factors that make the approach particularly challenging to the pilots of airplanes with high approach speeds. These factors include steep bank angles and increased approach speeds necessary to compensate for the load factors associated with the bank angle, the adverse effect of a southerly wind, and the criticality of the turn initiation point in achieving proper runway alignment without excessive maneuvering. The Safety Board believes that the video tape should be revised to emphasize these factors.

The video presentation alone does not ensure that the flightcrew members retain all the information necessary to conduct a safe approach or departure from these airports. This was evidenced by the fact that the captain and first officer had viewed the special airports video tape approximately 5 months and 5 days, respectively, before the accident flight and there was still confusion among the crew while preparing for the approach. The Safety Board believes that in addition to the video presentation, it is incumbent upon AIA and DOD to provide crewmembers with up-to-date printed training and reference material for use at Guantanamo Bay.

The Safety Board conducted a survey of other air carriers operating into Guantanamo and it revealed that nearly all use a video tape supplemented by a special airports manual, and require a company briefing before departure, and/or access to the information in a Leeward Point Airfield briefing package. Additionally, several air carriers also require a check airman to accompany an unqualified crew or captain into a special airport. Unlike AIA, several airlines that had dispatch operations kept records of special airports qualifications and currency for crewmembers.

2.7 Crew Resource Management (CRM)

The crew coordination issues were examined by the Safety Board because of the events that occurred in the final minutes of the flight. The Safety Board found that the lack of crew coordination, was probably due, in part, to fatigue, rather than to the more conventional crew coordination problems attributed to personal interactions.

The breakdown in crew coordination was evidenced by the fact that the captain did not include the remainder of the crew in the initial decision-making process to land on runway 10, nor did he solicit the assistance of the first officer during the latter portion of the approach when he was unable to maintain visual contact with the runway. The Safety Board also believes that even though the captain followed his decision with an invitation to the other crewmembers to express their concerns if they did not feel comfortable with any aspect of the approach, coordination continued to deteriorate further when both the first officer and flight engineer expressed concerns that they did not believe they were "going to make it." The captain failed to comprehend and act on the information from the other crewmembers, as subtle as it may have been, to initiate a go-around.

The lack of crew coordination is further evidenced by the fact that the captain failed to recognize and take corrective action to regain the lost airspeed despite the flight engineer's repeated warnings and the activation of the stick shaker. In addition, while it is believed the captain's attention was drawn to finding the strobe light, the first officer failed to assist the captain by providing critical information concerning their proximity to the runway and their steep angle of bank, or by strongly supporting the flight engineer's warnings regarding the slow airspeed. The Safety Board believes that had the first officer and flight engineer been more assertive in volunteering vital information or redirecting the captain's attention to take the appropriate corrective action, the accident may have been prevented.

The Safety Board has advocated training in CRM as a means of enhancing the use of all crewmembers as a coordinated team to improve flight safety. The FAA has provided guidelines on CRM training in FAA AC 120-51A. This circular describes a CRM program consisting of three phases. The first phase consists of definition and discussion of basic CRM concepts in initial class work. The second phase consists of practice and feedback through line-oriented flight training (LOFT). The third phase includes continuous reinforcement as part of an airline's operational philosophy.

Both pilots from the accident trip had completed a 2-day CRM class at Eastern Airlines, and the first officer indicated that he had received some additional informal CRM training at AIA. These classes appear to correspond to the first phase described in the FAA guidelines, and suggest that AIA made an informal attempt to address CRM issues in the company training. The Safety Board believes that further development of this program along the guidelines of FAA AC 120-51A could assist the flight crewmembers and prevent some of the crew coordination deficiencies evident in this accident.

Also, the Safety Board believes that had the crewmembers discussed, as a group, the difficulties of the approach to runway 10 before the execution, they would all have been aware of the criteria necessary to not only complete the approach, but also would have agreed on the criteria to abandon the approach. This probably would have served to assist the crew in recognizing the trouble signs before the approach deteriorated to the point that safety was irreparably compromised. In addition, had the flightcrew been thoroughly indoctrinated in and practiced the principles advocated by AC-120-51A, this knowledge might have offset the debilitating effects of fatigue and helped them to sustain team performance sufficiently to avoid or recover from the hazardous situation. This accident illustrates one more example of the potential safety benefits of CRM and further supports the need to require CRM for all crews in Part 121 operations.

2.8 FAA and DOD Oversight and Surveillance

The Safety Board reviewed the FAA and DOD inspection programs for AIA. The investigation revealed that the FAA had conducted several major inspections of the company, integrated with the normal inspection and surveillance by the POI, PMI, and PAI. The various inspections revealed operational and maintenance-related discrepancies, some of which were repetitive and required only minor changes or modifications. AIA always acknowledged the findings and corresponded with the FAA citing the proposed corrective actions; however, the "fixes" were more temporary than permanent. This situation reinforced the belief of the POI that the company was performing corrective actions at the minimum levels, so as to remain "legal." The enforcement actions and recommended monetary fines against AIA were attempts by the POI and PMI to affect permanent rather than temporary corrections to problems. Similarly, the action by the POI to "withhold" approval of AIA's planned B-747 operation was an effort to force compliance with previously repeated negative findings regarding manual currency.

Many of the flight safety issues brought to the attention of the FAA and the Safety Board were problems that had occurred away from the home base. Due in part to budget constraints, the FAA was dependent upon geographic support for oversight and surveillance of the worldwide operation, especially the B-747 operation in Saudi Arabia. In terms of AIA's ad hoc operations, the geographic surveillance was vital to the POI's oversight responsibility and should have carried a high priority, considering the fact that the foreign operations involved the carriage of passengers, which, unlike cargo, requires different operational rules and regulations.

The Safety Board is concerned that the lack of FAA geographical support required to fulfill the surveillance requirements of the operations, are detrimental to the overall ability of the individual inspectors (POIs, PMIs, PAIs) to ensure that the operations are conducted in accordance with the FARs.

The DOD is recognized as having authority regarding the bidding and awarding of military contracts. However, as a DOD representative testified at the Safety Board's public hearing, the DOD does not have the authority to impose operational or FAR requirements on contract carriers. Any additional needs or requests from the contract airline would come through the contract administrator, who is required at the field of operations.

The DOD does not require civilian flightcrew briefings for flight operations to Guantanamo Bay, but does recognize that information passed on to civilian crews is done at the discretion of the individual base operations. However, the Norfolk NAS Air Transportation Operations Center (ATOC) did have a policy to brief civilian flight crews on operational procedures for flights to Guantanamo Bay from Norfolk. The contract administrator at Norfolk, who was retired from the Air Force, used a briefing package that he developed for the Air Force while on active duty. He stated that he did not provide the crew of flight 808 with the briefing package because he believed that the captain had flown into Guantanamo Bay on previous occasions.

The Safety Board found that the flightcrew of another civilian contract air carrier (Northwest Airlines) had an incident involving a DC-10 airplane landing on runway 10 at Guantanamo Bay. The Safety Board found that the flightcrew had not received any supplemental special airport information from the DOD or the airfield operations office at Cherry Point Naval Air Station, regarding procedures at Leeward Field, even after the accident involving AIA.

Based on these two occurrences, the Safety Board is concerned with the lack of standardization among the many military airfield operations offices regarding the information provided to civilian flightcrews. The Board believes that in an effort to promote safe operations by civilian DOD contract operators at military airports that may be considered as "special," the DOD should make every effort to afford civilian flightcrews with any and all available information about the unique and/or hazardous conditions which may exist at such airports.

2.9 Postaccident DOD Restrictions

As the result of recent aircraft incidents and accidents that have occurred at Guantanamo Bay, on January 5, 1994, the Air Mobility Command issued the following memorandum to all civilian air carriers:

Until further notice, any civil air mission operating under the AMC international airlift contract is prohibited from using runway 10 at Guantanamo Bay. This restriction is placed on our contract operations solely due to safety.

This prohibition against landing on runway 10 is currently reiterated in the written contracts between DOD and civilian air carriers.