3.1 Findings

1. After the flight crew made an initial sighting of Guam, Korean Air flight 801 encountered instrument meteorological conditions as the flight continued on its approach to Guam International Airport.

2. Although flight 801 likely exited a heavy rain shower shortly before the accident, the flight crew was still not able to see the airport because of the presence of another rain shower located between Nimitz Hill and the airport.

3. By not fully briefing the instrument approach, the captain missed an opportunity to prepare himself, the first officer, and the flight engineer for the relatively complex localizer-only approach and failed to provide the first officer and flight engineer with adequate guidance about monitoring the approach; therefore, the captain's approach briefing was inadequate.

4. The captain's expectation of a visual approach was a factor in his incomplete briefing of the localizer approach.

5. For flights conducted at night or when there is any possibility that instrument meteorological conditions may be encountered, the failure to fully brief an available backup instrument approach compromises safety.

6. The Korean Air airport familiarization video for Guam, by emphasizing the visual aspects of the approach, fostered the expectation by company flight crews of a visual approach and, by not emphasizing the terrain hazards and offset DME factors, did not adequately prepare flight crews for the range of potential challenges associated with operations into Guam.

7. The challenges associated with operations to Guam International Airport support its immediate consideration as a special airport requiring special pilot qualifications.

8. Although the captain apparently became confused about the glideslope's status, the flight crew had sufficient information to be aware that the glideslope was unusable for vertical guidance and should have ignored any glideslope indications while executing the nonprecision localizer-only approach.

9. Navigation receivers, including glideslope receivers, may be susceptible to spurious radio signals.

10. The captain may have mistakenly believed that the airplane was closer to the airport than its actual position; however, if the captain conducted the flight's descent on this basis, he did so in disregard of the DME fix definitions shown on the approach chart.

11. As a result of his confusion and preoccupation with the status of the glideslope, failure to properly cross-check the airplane's position and altitude with the

information on the approach chart, and continuing expectation of a visual approach, the captain lost awareness of flight 801's position on the instrument landing system localizer-only approach to runway 6L at Guam International Airport and improperly descended below the intermediate approach altitudes of 2,000 and 1,440 feet, which was causal to the accident.

12. The first officer and flight engineer noted the ground proximity warning system (GPWS) callouts and the first officer properly called for a missed approach, but the captain's failure to react properly to the GPWS minimums callout and the direct challenge from the first officer precluded action that might have prevented the accident.

13. The first officer and flight engineer failed to properly monitor and/or challenge the captain's performance, which was causal to the accident.

14. Monitored approaches decrease the workload of the flying pilot and increase flight crew interaction, especially when experienced captains monitor and prompt first officers during the execution of approaches.

15. The captain was fatigued, which degraded his performance and contributed to his failure to properly execute the approach.

16. Korean Air's training in the execution of nonprecision approaches was ineffective, which contributed to the deficient performance of the flight crew.

17. U.S. air carrier pilots would benefit from additional training and practice in nonprecision approaches during line operations (in daytime visual conditions in which such a practice would not add a risk factor).

18. The Combined Center/Radar Approach Control controller's performance was substandard in that he failed to provide the flight crew with a position advisory when he cleared the flight for the approach, inform the flight crew or the Agana tower controller that he had observed a rain shower on the final approach path, and monitor the flight after the frequency change to the tower controller.

19. Strict adherence to air traffic control procedures by the Combined Center/Radar Approach Control controller may have prevented the accident or reduced its severity.

20. If the ARTS IIA minimum safe altitude warning system had been operating as initially intended, a visual and aural warning would have activated about 64 seconds before flight 801 impacted terrain, and this warning would have likely alerted the Combined Center/Radar Approach Control controller that the airplane was descending below the minimum safe altitude for that portion of the approach.

21. Sixty-four seconds would have been sufficient time for the Combined Center/Radar Approach Control controller to notify the Agana tower controller of the low-altitude

alert, the tower controller to convey the alert to the crew of flight 801, and the crew to take appropriate action to avoid the accident.

22. The Federal Aviation Administration's quality assurance for the minimum safe altitude warning system was inadequate, and the agency's intentional inhibition of that system contributed to the flight 801 accident.

23. A substantial portion of the delayed emergency response was caused by preventable factors.

24. The delayed emergency response hampered the timely evacuation of injured persons, and at least one passenger who survived the initial impact and fire might not have died if emergency medical responders had reached the accident site sooner.

25. Improved formal coordination among Guam's emergency response agencies has not been implemented, and off-airport drills to identify and correct deficiencies in disaster response planning before an accident occurs have still not been conducted in the more than 2 years since the flight 801 accident.

26. Actions taken by Guam's emergency response agencies after the accident have been inadequate because they failed to ensure that emergency notifications and responses would be timely and coordinated.

27. Controlled flight into terrain accident awareness and avoidance training is an important accident reduction strategy and should be mandatory for all pilots operating under 14 Code of Federal Regulations Part 121.

28. By providing vertical guidance along a constant descent gradient to the runway, the use of on-board flight management system- and/or global positioning system-based equipment can provide most of the safety advantages of a precision approach during a nonprecision approach.

29. The safety of executing a nonprecision approach using the constant angle of descent, or stabilized descent technique, would be enhanced by adding to approach charts the cross-referenced altitudes versus distance from the airport.

30. Terrain depiction on the profile view of approach charts could result in increased flight crew awareness of significant terrain on the approach path.

31. Valuable user group reviews of proposed new instrument procedures are hampered by the format in which the information is disseminated; thus, user groups may not be able to effectively evaluate whether a procedure is safe, accurate, and intelligible.

32. At the time of the flight 801 accident, there were underlying systemic problems within Korean Air's operations and pilot training programs that indicated the need for a broad safety assessment of these programs.

33. The Korean Civil Aviation Bureau was ineffective in its oversight of Korean Air's operations and pilot training program.

34. The Federal Aviation Administration's International Aviation Safety Assessment program (which evaluates a foreign civil aviation authority's ability to provide adequate oversight for its air carriers) is not adequate to determine whether foreign air carriers operating into the United States are maintaining an adequate level of safety.

35. An independent accident investigation authority, charged with making objective conclusions and recommendations, is a benefit to transportation safety.

36. It is critical that thorough documentation of the information recorded by a flight data recorder be available for foreign- or U.S.-registered air transport airplanes that fly into or out of the United States.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the captain's failure to adequately brief and execute the nonprecision approach and the first officer's and flight engineer's failure to effectively monitor and cross-check the captain's execution of the approach. Contributing to these failures were the captain's fatigue and Korean Air's inadequate flight crew training. Contributing to the accident was the Federal Aviation Administration's intentional inhibition of the minimum safe altitude warning system at Guam and the agency's failure to adequately manage the system.