National Transportation Safety Board
Washington, DC 20594

Brief of Incident

Adopted 02/05/2004

OPS03IA001

File No. 14770 | 12/17/2002 | Agana, GU | Aircraft Reg No. F-OHZO | Time (Local): 03:35 PST

Make/Model:	Airbus Industrie / 330-301
Engine Make/Model:	General Electric / CF6
Aircraft Damage:	Minor
Number of Engines:	2
Operating Certificate(s):	Foreign Operation
Name of Carrier:	Philippine Airlines
Type of Flight Operation:	Scheduled; International; Passenger Only
Reg. Flight Conducted Under:	Part 129: Foreign

	Fatal	Serious	Minor/None
Crew	0	0	15
Pass	0	0	100

Last Depart. Point:	Manila
Destination:	Same as Accident/Incident Location
Airport Proximity:	Off Airport/Airstrip

Condition of Light:	Night/Dark
Weather Info Src:	Weather Observation Facility
Basic Weather:	Instrument Conditions
Lowest Ceiling:	200 Ft. AGL, Indefinite (V V)
Visibility:	
Wind Dir/Speed:	
Temperature (°C):	Unk/Nr
Precip/Obscuration:	

Pilot-in-Command Age:

Certificate(s)/Rating(s)

Instrument Ratings

Flight Time (Hours)

Total All Aircraft:	Unk/Nr
Last 90 Days:	Unk/Nr
Total Make/Model:	Unk/Nr
Total Instrument Time:	UnK/Nr

OPS03IA001

HISTORY OF FLIGHT

On December 16, 2002, approximately 1735 coordinated universal time (UTC), an Airbus A330, Philippine registration F-OHZO, operating as Philippine Airlines flight 110 (PAL110), struck power lines while executing a localizer-only Instrument Landing System (ILS) approach to runway 6L at A.B. Pat Won Guam International Airport, Agana, Guam (GUM). Instrument meteorological conditions prevailed during the approach. Following a ground proximity warning system (GPWS) alert, the crew executed a missed approach and landed successfully after a second approach to the airport. The aircraft remained on the ground at Agana until departing at 2115 UTC to return to Manila as PAL flight 111. According to information provided by Philippine Airlines, after arriving at Manila the aircraft was inspected and found to have minor damage to the fuselage and landing gear. There were no reported injuries to passengers or crew. The flight was operated under Title 14, Code of Federal Regulations Part 129 as a scheduled passenger flight from Ninoy Aquino International Airport (MNL), Manila, Philippines, to GUM.

At the time of the incident, the GUM Automatic Surface Observation System (ASOS), ILS 6L glideslope, middle marker, and approach light system were all

out of service because of typhoon damage, as was the Nimitz Very High Frequency Omnirange (UNZ VOR). Because of these outages, Guam Combined Center-Radar Approach Control (CERAP) was clearing aircraft for localizer-only ILS approaches to runway 6L.

The pilot of PAL110 first contacted Guam CERAP at 1654:08, stating "Guam Center, Philippine one ten." The CERAP controller asked the pilot to confirm that the aircraft was at flight level 370, and assigned the flight beacon code 2151. The crew acknowledged. At 1702:19, the controller advised the crew, "Radar contact seventy miles southeast of KITSS cleared direct IKOVY expect localizer approach." The pilot responded, "OK direct IKOVY and expect 06 localizer Philippine one one zero."

At 1706:52, the controller cleared the pilot of PAL110 to, "descend at pilot's discretion, maintain twenty six hundred, advise information India, Agana altimeter two nine nine nine." The pilot acknowledged the altitude assignment and confirmed that he had received information India. At 1708:00, the pilot reported that PAL110 was leaving flight level 370 for 2,600 feet and the controller acknowledged. At 1720:14, the pilot of PAL110 transmitted, "Philippine one ten confirm we're landing runway six left?" The controller responded, "Affirmative, runway six left is in use at Agana." At 1720:29, the controller transmitted, "Philippine one ten cross IKOVY at or above two thousand six hundred cleared ILS six left glideslope unusable." The pilot read back, "OK cross IKOVY at or above two thousand six hundred cleared ILS six left glideslope unusable Philippine one ten." The controller then acknowledged and added, "and DME is also out of service." The pilot acknowledged. (Subsequent investigation showed that the DME was unmonitored rather than out of service, so the controller's advisory was incorrect.)

At 1728:39, the CERAP controller called the GUM tower controller to coordinate PAL110's arrival, stating that the aircraft was "twenty five east Philippine one ten heavy Airbus." The tower controller responded, "Who was it?" and the CERAP controller repeated, "Philippine one ten." The CERAP controller then added, "for the ILS six left rw bc." (Controllers use "operating initials" to identify themselves during interphone conversations. The GUM tower controller's operating initials are RW, and the CERAP controller uses BC.) At 1728:59, the CERAP controller transmitted, "Philippine one ten established on the localizer inbound contact Agana tower good day." The pilot acknowledged. According to flight data recorder position information, the aircraft was 23.8 miles from the runway 6L threshold, descending through 5,700 feet.

At 1729:20, the pilot of PAL110 transmitted, "Guam tower, aah, good morning, Philippine one one zero with huh leaving five thousand five hundred." The GUM tower controller responded, "Philippine one one zero Agana tower roger sir. Runway six left cleared to land, wind one zero zero at six." The pilot read back, "Cleared to land runway six, Philippine one one zero."

While PAL110 was on approach to GUM, the CERAP controller was also handling Reach 8223, an arrival to Andersen AFB. At 1734:24, the CERAP controller transmitted, "Reach 8223 heavy fly heading two eight zero vectors tacan final." At 1734:26, during the transmission to Reach 8223, an aural MSAW alert is audible in the background. According to recorded MSAW activation data, the first alert for PAL110 activated at 1734:25 and would have produced a two second aural alert tone at the R4 position. Following the transmission to Reach 8223, the CERAP controller contacted Andersen tower to coordinate the arrival and then continued handling that aircraft.

At 1735:46, there was a brief sound of a transmitter keying on the GUM tower frequency, but no voice. At 1736:15, the pilot of PAL110 reported to GUM tower, "Philippine one one zero making missed approach." The tower controller replied, "Philippine one one zero Agana tower, roger sir, fly runway heading, climb and maintain two thou, correction, two thousand five hundred contact Guam Departure one eighteen seven." At 1736:28, the pilot read back, "OK, two thou (garbled), Philippine roger."

The GUM tower controller immediately called the CERAP and reported, "Philippine one ten missed." The CERAP controller replied, "Really? You're kidding. Your weather that bad?" The tower controller stated, "I don't think it's that bad. It looks pretty clear to me official weather showing six miles visibility." The CERAP controller then said, "OK runway heading climbing to four thousand." Neither controller evidenced any awareness of the MSAW alert or the aircraft's

proximity to Nimitz Hill. At 1736:52, the tower controller transmitted, "Philippine one one zero, tower. You still up freq?" The pilot responded, "Say again, sir?" The tower controller replied, "Roger sir, continue runway heading climb and maintain four thousand, contact Guam departure one eighteen seven." The pilot read back, "OK, four thousand, one eighteen seven, Philippine one one (garbled) switching."

At 1737:30, the pilot of PAL110 transmitted to Guam CERAP, "Philippine one ten with you passing three thousand one hundred." The CERAP controller responded, "Philippine one ten roger turn right heading one eight zero vectors ILS approach." At 1739:04, the pilot of PAL110 reported level at 4,000 feet and heading 180. The CERAP controller responded, "Philippine one ten roger turn right heading two four zero." The pilot acknowledged. At 1740:44, the CERAP controller transmitted, "Philippine one ten descend and maintain two thousand six hundred." The pilot replied, "Descend and maintain two thousand six hundred Philippine one ten." At 1742:32, the CERAP controller transmitted, "Philippine turn right heading three three zero." The pilot of PAL110 responded, "right three three zero Philippine one ten." At 1743:13, the controller instructed the pilot of PAL110 to, "turn right heading three zero zero." The pilot acknowledged the heading assignment, and then asked, "is that three zero zero or two three zero?" The controller replied, "Correction the heading is three five zero Philippine one ten." The pilot acknowledged.

At 1743:46, the CERAP controller issued PAL110's second approach clearance, stating, "Philippine one ten heavy position is five miles west of final approach fix, fly heading zero three zero maintain at or above two thousand until established on final cleared for ILS runway six left approach." The pilot read back, "OK zero three zero maintain two thousand until established on final cleared for ILS six left approach." At 1744:31, the CERAP controller advised the GUM controller that, "Philippine is on the ILS again." At 1745:25, the pilot of PAL110 reported, "Philippine established on the final now runway in sight." The controller then asked, "Philippine one ten you want to fly the visual now?" The pilot replied, "affirm," and the controller responded, "Cleared for the visual approach runway six left contact Agana tower."

At 1745:41, the pilot of PAL110 again contacted the tower, stating, "Hello tower, good morning, Philippine one one zero we're six miles on final, runway in sight, visual." The tower controller responded, "Philippine one one zero Agana tower, roger sir, runway six left cleared to land, wind zero niner zero at six." The pilot read back, "Cleared to land six left, Philippine one one zero." At 1748:29, the tower controller instructed the pilot of PAL110 to, "turn left pilot discretion, contact Ramp Control one two one point six, good morning." The pilot responded, "one two one point six, good morning." There were no further ATC contacts with the flight.

Safety Board and FAA investigators inspected the Nimitz Hill area on January 5, met with four witnesses, and examined the area surrounding their residences. Because of the December typhoon, the island's power transmission systems were heavily damaged. The wires reportedly knocked down by PAL110 were still not repaired because of the higher priority repairs being undertaken elsewhere on the island. Of the original three wires attached to the pole adjacent to the witness residences, two were snapped and one was dislodged from the pole.

Three of the witnesses live in a house located directly beneath the ILS 06 final approach course and approximately 1/2 mile inside the outer marker (OM). On the night of the incident, they were asleep in different rooms. Witness 1's room is located in the southwest corner of the house, with one window facing the outer marker and another facing perpendicular to the final approach course. He stated that he was awakened by an unusual noise at about 3:30 A.M. local time. While lying in bed, witness 1 looked out the window on the southwest side (toward the OM) but didn't see anything. He then looked out through the window on the southeast side of the building and stated that he "…saw an entire airplane go by. The house shook, and it was very bright outside." He also heard "two distinct snapping sounds."

Witness 1 reported that he then ran to the northeast side of the house, expecting to see a crash, but instead saw a jet pitching up and disappearing into the clouds. Witness 2 did not see the jet approaching or passing by the house, but reported being awakened by the noise and vibration. She also ran to the side of the house where she encountered witness 1, who described what he had seen. Witness 3 also heard and felt the aircraft pass by the house, stating that "the whole house was shaking."

In the morning, witness 2 found snapped power lines on the ground in front of her house, and noticed that the power pole had a broken crossbar that had remained intact following the typhoon of the previous week.

At about 0700 she telephoned Guam CERAP to report that she believed an aircraft had struck the wires and almost struck her house, but had difficulty convincing the supervisor on duty that a serious incident had occurred. She was later contacted by the CERAP air traffic manager to discuss the report.

Witness 4, an airline captain, lives in a house located about 150 feet southwest of the residence occupied by the other witnesses. He reported that he and his wife were awakened at about 3:30 A.M. local time by what sounded like a jet passing over and very close to their house. He thought it sounded like the engines were at full power. He did not actually see the jet, but he did look outside after it passed and estimated that the cloud ceiling over the hill was 200 to 300 feet above the ground. He telephoned GUM ATCT at about 2 P.M. local time to inquire about the incident, but the controller on duty had no information about any unusual events during the night.

While on the ground at Agana, PAL110 was serviced by staff from Airports Group International. Safety Board and FAA investigators interviewed the manager of the AGI service facility at GUM, the ramp supervisor, the maintenance supervisor, and the mechanic responsible for services provided to PAL110 on the night of the incident. All four were interviewed together to provide information on the ground handling and condition of PAL110 during its Guam turnaround.

The ramp supervisor stated that the aircraft arrived at the gate at about 0340 local time. The AGI mechanic contacted the cockpit crew via headset immediately after their arrival, and stated that the crew reported no problems with the aircraft. The ramp crew immediately noticed a 3" dent and some scratches on the lower half of the bulk cargo door. They did not attempt to open the door, and called the AGI mechanic to come inspect it. The PAL flight mechanic came off the aircraft, and the AGI mechanic pointed out the damage. The PAL flight mechanic spoke only Tagalog, so they were unable to specifically discuss the dent, but the AGI mechanic stated that the PAL mechanic acknowledged the damage with a nod and a "thumbs up," which the AGI mechanic took to mean that the damage was known to the crew. Later, the AGI mechanic inspected the aircraft logbook and noted an entry about the bulk door, which was carried over as a deferred maintenance item from a previous flight. Log entries on PAL aircraft are often partially in English and partially in Tagalog: the AGI mechanic said that if he has any doubts about a particular entry, he asks a bilingual member of the flight or cabin crew to translate for him.

The AGI mechanic performed a walkaround inspection of the aircraft with a flashlight, but did not notice any of the damage shown in the photos sent by PAL from Manila the following day. The photos did cover areas such as the hydraulic lines that the AGI mechanic and the maintenance supervisor stated are routinely examined as part of the inspection process. One of the photos also showed the previously logged dent. The AGI mechanic initially said that he didn't believe that the other damage was on the aircraft, but later stated that he could have overlooked it as pre-existing wear that could be considered normal for an older aircraft. He saw the PAL mechanic and one of the crewmembers do a preflight inspection before departure, and they did not point out or report any problems to him at that time. The AGI mechanic had no other contact with the crew during their ground time; he stated that the flight crew usually naps aboard the aircraft until shortly before departure time.

The ground crew did not attempt to open the bulk cargo door until they needed to load some last-minute bags and miscellaneous cargo items just before departure. They were unable to operate the door, so the remaining items were loaded through the aft cargo door instead. Other than the difficulty with the bulk door, there were no unusual events affecting the aircraft during its ground time. AGI does not maintain any general logs about aircraft serviced unless specific maintenance activities occur that need to be tracked. This was a normal and routine turnaround, so nothing needed to be logged. The AGI mechanic did not see the crew do any unusual inspections or other activities while PAL110 was on the ground, other than their normal preflight. He did not overhear any comments about a go-around but noted that the crew's conversations are normally conducted in Tagalog, which he does not understand. The AGI mechanic and the maintenance supervisor noted that local contract maintenance staff do not direct maintenance actions: they bring observed abnormalities, if any, to the attention of the PAL flight mechanic, he discusses them with the crew, and they decide how to proceed.

The chief pilot of PAL came to Guam on December 24th and discussed the incident with the ramp supervisor and the AGI mechanic. According to the AGI staff, he was particularly interested in the aircraft's appearance and condition when it arrived on the night of the incident.

PERSONNEL INFORMATION

The flight crew of PAL110 consisted of a captain, first officer, relief pilot, and a flight mechanic. Certification and flight experience information for the crew is not available. At the request of the Philippines Air Transportation Office, the flight crewmembers provided written statements which are contained as an attachment to this report.

AIRCRAFT INFORMATION

PAL110 was an Airbus Industrie model A330 airplane, registration F-OHZO. Further information on the aircraft and its history is not available.

METEOROLOGICAL INFORMATION

At 1735 UTC, the GUM weather observation was wind 110 at 8 kts, visibility 4 miles in drizzle, few clouds at 900 feet, scattered clouds at 1,800 feet, broken clouds at 4,700 feet, temperature 24, dew point 23, altimeter 29.96. The Nimitz Hill witnesses estimated that the cloud layer in their area was 200 to 300 feet above the ground.

WRECKAGE AND IMPACT INFORMATION

After the incident aircraft arrived in Manila as PAL111, ground service personnel noticed numerous areas of damage to the aircraft. Photographs of the damage are contained in attachment 5. The following items were documented in a Flight Safety Service Difficulty Report filed by PAL with the Department of Transportation and Communications:

1. Punctured (1/2 x 1 ¼" hole) fuselage skin between FR 71 and FR 72 stringer 36R, Ground Maintenance Log (GML) 036588.

2. Two each dents (approximately 1 x 3 and 10 x 5) lower portion of bulk cargo door GML 036589.

3. Scratches with dent, forward lower portion of door cut out (bulk cargo) - GML 036590.

4. Scratches with dent, lower aft fuselage FR 70 stringer 43R ? GML 036591.

5. Scratches lower portion fuselage, just below, forward of bulk cargo door cut out ? GML 036592.

6. LH main landing gear ? pitch trimmer hydraulic hose with sign of leak / chafed mark, GML 036593.

7. LH main landing gear ? scratches on "strut servicing* decal and adjacent areas ? GML 036594.

8. LH main landing gear ? deformed / flattened, forward upper electrical conduit and clamps ? GML 036595.

9. LH and RH main landing gears ? scratches on forward edge of trimmer link - GML 036596.

10. RH main landing gear ? missing one each grease fitting at trimmer link - GML 036597.

11. RH main landing gear ? chafed mark on forward and aft upper electrical conduit - GML 036598.

12. RH main landing gear ? chafed mark on pitch trimmer hydraulic hose ? GML 036599.

13. RH main landing gear ? scratches outboard side of upper torque link ? GML 036600.

14. RH main landing gear ? scratches outboard 'inflate tyres with nitrogen only" decal.

TESTS AND RESEARCH

The captain's statement indicates that at 3,600 feet he set the flight path angle function of the aircraft's autopilot to produce a 3.4 degree descent. Both Guam CERAP recorded radar data and flight data recorder information show that the aircraft passed through 3,600 feet approximately 8.1 miles from Nimitz Hill, where the aircraft's descent was arrested and a climb begun in response to the ground proximity warning system alert. The minimum barometric altitude recorded by the flight data recorder during the approach was 752 feet at 1735:35, and the radar altimeter indicated 26 feet at that time. Descent from 3,600 feet to 752 feet in 8.1 miles requires a descent rate of about 351 feet per nautical mile equating to a descent angle of 3.31 degrees. Over 8.1 miles, the altitude difference between a 3.31 degree descent and a 3.4 degree descent is about 73 feet.

ADDITIONAL INFORMATION

Air Traffic Control Information

Guam CERAP, located on Andersen Air Force Base (AFB), is a Federal Aviation Administration facility that provides both en route and terminal air traffic control services within a 250 nautical mile radius of the island. Staffing consists of one manager, two supervisors, one staff specialist, one administrative assistant, and 13 controllers. The facility uses two radar sites: a short range (55nm) Airport Surveillance Radar-8 (ASR-8), and a long range (250nm) Air Route Surveillance Radar-4 (ARSR-4). Both radar sites are located on Mount Santa Rosa, which is on the north side of the island. Radar data processing is performed by an M-EARTS computer located in the CERAP. M-EARTS provides minimum safe altitude warning (MSAW) services, conflict alert (CA) services, and both aural and visual alarms in the CERAP and in Agana Federal Contract Tower (FCT) when either warning system activates. The CERAP controller involved in this incident was working at the combined R4/D3 position. There are two radar displays at the R4 position. Each can be set to display a single-site presentation from either of the ASR-8 or ARSR-4 radars, or a mosaic presentation including combined data from both sites.

A.B. Pat Won Guam International Airport is served by a Federal Contract Tower (FCT) operated by Serco Management Services. The facility is open continuously, and is staffed by one manager and six controllers. The tower is equipped with a M-EARTS Remote Controller Workstation (RCW) that provides controllers with radar traffic information and both aural and visual MSAW alerts for the area surrounding the airport.

MSAW provides two types of alert processing: predicted alerts, where an aircraft is anticipated to violate adapted minimum altitude limits in the next few seconds, and current alerts, where an aircraft is observed by radar to presently be in violation of minimum altitude limits. Predicted alerts must normally persist for three consecutive sweeps before being declared valid and generating a warning to the controller. Current alerts are processed as soon as they are detected.

When a valid alert of either type is declared, the system causes a blinking "MSAW" to appear in the affected aircraft's data block, and an aural alert also sounds. The Guam M-EARTS is configured to provide aural and visual MSAW alerts to both the CERAP and GUM FCT depending on the location of the aircraft.

Recorded M-EARTS Continuous Data Recording (CDR) data and system software documentation indicates that the CERAP MSAW system performed as designed and warned the CERAP controller that PAL110 was descending below the adapted minimum safe altitude. CDR data shows that the MSAW system produced eight predicted alerts for PAL110, beginning at 1733:52 and continuing until 1734:25. At 1734:25, the system sounded the aural alarm in the CERAP and began displaying a blinking "MSAW" in the M-EARTS data blocks at both the CERAP and GUM FCT. Beginning at 1734:30, PAL110's track generated a current alert that continued until 1735:40. At 1735:40, recorded data shows that an aural alert was sent to GUM ATCT. PAL110 began climbing around that time, and the MSAW alert terminated at 17:35:47.

According to recorded M-EARTS data, at 1721:18 the controller pressed the "multifunction" key and entered a "." character, indicating to the M-EARTS system that the aircraft had been cleared for approach. The effect of this entry is to cause the aircraft data block to show "APC" in the assigned altitude field, lower the aircraft's effective assigned altitude to the adapted MSAW altitude for its current position, and also to reduce the sensitivity of the MSAW general terrain monitoring algorithm to rapid descent rates. FAA publication NAS-MD-678 states:

"If a period is entered, the assigned/block altitude is removed (if any), the characters 'APC' (to indicate that the aircraft is cleared for approach) are displayed in field 2 of the full data block and in the readout area whenever the flight plan is subsequently displayed there, and the MSAW polygon altitude considered to be a block altitude lower limit for general terrain monitoring purposes. Subsequent entry of either an assigned or block altitude will override this function."

The effect of this entry was to delay the CERAP aural and visual MSAW alert by 23 seconds because of the effective change in the aircraft's assigned altitude and changes to MSAW logic intended to reduce nuisance alarms generated by aircraft descending rapidly on IFR approaches. Instead of activating when the third consecutive predicted general terrain monitoring alert occurred at 1734:02, the alert occurred when the system predicted that the aircraft could no longer level off at 1,900 feet (the adapted MSAW altitude for its position) minus a 200 foot buffer without exceeding 2Gs of vertical acceleration. This occurred as PAL110 descended through 1,700 feet. Once the aircraft descended below 1,700 feet, the alert changed from predicted to current (meaning that the aircraft was actually below the minimum safe altitude) and remained a current alert until the aircraft began to climb on its go-around. The alert terminated at 1735:47. The CERAP controller did not attempt to make any transmissions to PAL110 or contact Agana FCT about the alert.

The tower RCW had been having intermittent communication problems since the December typhoon, and although it was displaying targets, it was not certified for ATC use at the time of this incident.

The flashing "MSAW" alert was sent to the RCW display at the same time that it appeared on the CERAP display, because the content of the RCW is a "quick look" (image of) the CERAP's displayed data. The aural alert was not sent to the tower until 1735:40. The delay in sending the aural alert to the tower was the result of local M-EARTS adaptation, which inhibited tower alerts for aircraft operating more than five miles away from the airport reference point. This is done to minimize the number of nuisance alerts sent to the tower about aircraft that are not operating under tower control. CDR indicates that the alert was sent on the first sweep after the aircraft passed the five mile boundary, but by that time PAL110 had already struck the wires.

The ILS runway 6L approach may be executed with or without an operational glideslope. When the glideslope is out of service, the procedure provides stepdown fixes at IKOVY DME fix (12.1 nm, minimum altitude 2,600 feet), GUQQY outer marker (6.7 nm, minimum altitude 1,440 feet), and the BOLFY DME fix (5.1 nm, minimum altitude 840 feet). Even though the controller had incorrectly told the crew that the ILS 6L DME was out of service at the time of the approach clearance, distance information from the aircraft's global positioning system navigation equipment should have enabled the crew to identify the stepdown fixes, thereby allowing them to descend to 840 feet, the BOLFY minimums. The published chart states that the BOLFY minimums are 560 feet, but

this altitude was amended by Notice to Airmen 2/6587 to read 840 feet.

Previous Safety Board Recommendations

After a 1997 accident involving Korean Airlines flight 801, which was also on approach to runway 6L at GUM, the Safety Board issued recommendation A-00-8 asking the FAA to, "Consider designating Guam International Airport as a special airport requiring special pilot qualifications."

On April 4, 2000, the Administrator of the FAA responded, "The FAA is currently revising Advisory Circular (AC) 121.445-1D, Pilot In-Command Qualifications for Special Areas/Routes and Airports. The revision includes a process for determining special airports. The process begins with an assessment of the airport in question by an initiator. The assessment is then reviewed and analyzed by the FAA's Flight Standards Air Transportation Division, which makes the determination relative to the qualification status. If the airport meets the qualifications, it is added to Appendix 1 of the AC. An assessment of the Guam International Airport's qualifications for a special airport will be made once the AC is issued. I will keep the Board informed of the FAA's progress on this safety recommendation." The recommendation was classified "Open - Acceptable Action" by the Safety Board. No further responses have been received, and the FAA's progress on this recommendation is currently unknown.

The National Transportation Safety Board determines the probable cause(s) of this incident as follows.
The pilot's initiation of a premature descent that was both below the nominal glideslope and steeper than normal. Contributing to the incident was the air traffic controller's failure to respond to the MSAW warning and issue a safety alert as required by FAA order.