

# AIRCRAFT ACCIDENT REPORT

PAN AMERICAN WORLD AIRWAYS, INC.

BOEING 727, N317PA

NEAR BERLIN, GERMANY

NOVEMBER 15, 1966

NATIONAL TRANSPORTATION SAFETY BOARD

DEPARTMENT OF TRANSPORTATION

WASHINGTON D.C. 20591

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SYNOPSIS

A Pan American World Airways, Inc., Boeing 727, N317PA, operating as Flight 708, crashed in the East Zone of Germany approximately 9.7 miles west-southwest of Tegel Airport, Berlin, Germany, on November 15, 1966, at approximately 0142 G.m.t. The three crewmembers, who were the only occupants of the aircraft, received fatal injuries. The aircraft was destroyed by impact and fire.

Flight 708 was a regularly scheduled cargo flight operating on an Instrument Flight Rules clearance from Frankfurt, Germany, to Tegel Airport. The flight progressed in a routine manner to the Berlin area, at which time Berlin Control proceeded to vector the aircraft for an instrument approach to Tegel Airport. At 0141:30 Berlin Control advised the flight they were 6-1/2 miles from the outer marker and cleared the flight for an Instrument Landing System (ILS) approach to Runway 8R. The crew's acknowledgment of this clearance was the last radio transmission made by the flight. Just after completion of this transmission, the target of the aircraft disappeared from the radar scope.

Surface weather observations made at Tegel Airport at the time of the accident indicated that the visibility was 2.6 kilometers (1.56 miles) in snow, the cloud coverage was 3/8 at 500 feet and overcast at 600 feet, and the temperature was -1°C.

The Safety Board determines that the probable cause of this accident was the descent of the flight below its altitude clearance limit, but the Board has been unable to determine the cause of such descent.

1. INVESTIGATION

1.1 History of Flight

Pan American World Airways, Inc., Flight 708 of November 15, 1966, utilizing Boeing 727, N317PA, was a regularly scheduled cargo flight from Frankfurt, Germany, to Tegel Airport, which is located in the French Sector of Berlin, Germany. Flight 708 normally lands at Tempelhof Airport in Berlin. However, because of resurfacing of the runways at Tempelhof, Pan American had been operating in and out of Tegel Airport since the evening of November 13th.

Prior to departure, the captain was observed in the left pilot's seat in the cockpit while the first officer was in the right seat.

The flight was cleared to Tegel at the requested cruising altitude of flight level (FL) nine zero. <sup>1/</sup> After departure from Frankfurt at 0104, <sup>2/</sup> the flight proceeded in accordance with its clearance and at 0118 reported to Frankfurt Air Traffic Control passing Mansbach at FL nine zero. Control of the flight was then transferred to Berlin Control, and at 0131 Flight 708 was cleared direct to the Tegel VOR via Havel, to maintain FL nine zero. The flight was also given the Tegel weather and altimeter setting. Flight 708 acknowledged this clearance and requested a repeat of the altimeter setting (1015 mb.), which was provided by Berlin Control and acknowledged by the flight.

At 0133:50 Berlin Control cleared the flight to "descend and maintain flight level three zero, your convenience."

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<sup>1/</sup> 9,000 feet. Flight level terminology is used as reported.

<sup>2/</sup> All times used herein are Greenwich mean time (G.m.t.) based on the 24-hour clock. Local times can be obtained by adding one hour to G.m.t.

At 0135:55 Flight 708 reported leaving FL nine zero. This was acknowledged by Berlin Control, which again provided the flight with the altimeter setting of 1015 mb. Flight 708 acknowledged and read back this setting.

At 0138:38 Berlin Control cleared Flight 708 to "turn left heading zero three zero, descend and maintain two thousand."

At 0140:35 Berlin Control advised Flight 708 that they were "one two" (twelve) miles southwest of Tegel.

A subsequent transmission at 0141:30 advised the flight they were six and one-half miles from outer marker and cleared them to "turn right heading zero six zero, cleared ILS runway eight right approach." The crew acknowledged this clearance at 0141:38 with the following transmission: " 'ger zero six zero cleared ILS seven oh eight." This acknowledgment was the last radio transmission from Flight 708.

Just after completion of the last transmission by Flight 708, the secondary radar target of the aircraft disappeared from the radar scope. The primary target lingered in a stationary position for an additional 30 to 60 seconds before also fading out. <sup>3/</sup> The controller made several attempts to contact the flight but was unsuccessful. Neither Tegel nor Tempelhof towers had any contact with the aircraft.

There were no known eyewitnesses to the accident. However, a police official who was on duty at the control point of the line of demarcation

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<sup>3/</sup> Primary radar targets are reflections from the aircraft surfaces, while secondary targets are electronic returns from a radar transponder aboard the aircraft.

noticed a detonation type noise, similar to an explosion heard from a distance, coming from a direction southwest of the Soviet occupation zone between 0130 and 0145.

Approximately 10 hours after the aircraft disappeared from the radar scope, the Soviet representative at the Berlin Air Safety Center confirmed the crash. The impact site, which was within the East Zone of Germany, was located at a point 9.7 miles on the 251° radial of the Tegel VOR.<sup>4/</sup> The geographic coordinates of this point are 52°30'02" north latitude and 13°02'28" east longitude. The accident occurred at nighttime beneath an overcast.

#### 1.2 Injuries to Persons

All three crewmembers were fatally injured in the crash. There were no passengers aboard the aircraft.

#### 1.3 Damage to Aircraft

The aircraft was destroyed by impact and fire.

#### 1.4 Other Damage

Nonadmittance to the accident site precluded a determination of damage sustained by objects other than the aircraft.

#### 1.5 Crew Information

An examination of company and Federal Aviation Administration (FAA) airman records of the flight personnel aboard Flight 708 revealed that all crewmembers were properly qualified and certificated for the operation involved. Detailed information in this regard is set forth in Appendix A.

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<sup>4/</sup> Tegel VOR is located on the airport.

The three crewmembers had rest periods ranging from 22 to 29 hours prior to reporting for duty at Tegel Airport late in the afternoon of November 14th and, prior to Flight 708, had conducted 5 flights into and out of Tegel Airport in N317PA.<sup>5/</sup>

A Pan American pilot, who had a brief conversation with the captain of Flight 708 prior to its departure from Frankfurt, noticed nothing unusual with respect to the captain's physical or mental behavior. This same pilot did not talk with the other members of the crew since they were asleep in the crew room.

Post-mortem pathological and toxicological examinations of the three crewmembers disclosed no evidence of any inflight incapacitation.

#### 1.6 Aircraft Information

Pertinent information and statistics concerning the aircraft, its powerplants, weight and balance, and fuel are set forth in Appendix B.

A Pan American captain, who was the last pilot to fly N317PA prior to the captain of Flight 708, indicated that the aircraft was airworthy when he completed his flight at Tegel Airport on the afternoon of November 14.

Another Pan American pilot, who had a brief conversation with the captain of Flight 708 prior to its departure from Frankfurt, reported that the latter gave no indication that he had experienced any problems with the aircraft or its instrumentation.

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<sup>5/</sup> These flights, which ranged from 37 to 53 minutes in duration, were operated between Tegel, on the one hand, and Frankfurt, Hamburg or Cologne.

An examination of the maintenance log sheets of N317PA covering the period from October 9, 1966, to November 15, 1966, revealed that all discrepancies listed thereon had received corrective action.

1.7 Meteorological Information

Surface weather observations made at Berlin-Tegel Airport at 0120 and 0150 (i.e., 22 minutes prior to and 8 minutes after the accident) were as follows: visibility 2.6 kilometers <sup>6/</sup> in snow; 3/8 cloud coverage at 500 feet and overcast at 600 feet; temperature -1°C; surface wind 3 knots from 180 degrees; and altimeter setting 1015 mb.

A weather radar set located in Berlin was being observed up until 0048 when the equipment became inoperative. A radar report issued at 0000 stated that a large area of snowfall was moving over Berlin to the east, giving the city light to moderate precipitation. A second report, issued at 0100 but based on an observation made just before the radar became inoperative, indicated that weak precipitation echoes were crossing the Berlin City area from the west causing only insignificant snowfall.

A Pan American pilot who flew through the frontal weather west of Berlin six times on his various arrivals at and departures from Berlin between the hours of 1240 and 2000 on November 14th described the weather, in part, as follows: The main base of the clouds was at 8,000 feet with tops at 9,500 feet. Light turbulence was encountered. Engine and wing anti-ice was used throughout the day when the temperature envelope and

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6/ To convert kilometers to miles, multiply by .6.

precipitation/clouds indicated a need therefor, although no ice was observed to accumulate on the windshield wiper structure. <sup>7/</sup>

The aerodrome forecasts for Berlin-Tempelhof and Berlin-Tegel issued at 2045 on November 14 for the period 2200-0700 were in part as follows:

Berlin-Tempelhof: Wind 200 degrees at 5 knots, visibility 0.5 km in fog, ceiling 200 feet obscuration; gradually becoming, between 2300-0200, visibility 0.8 km in snow, ceiling 200 feet overcast.

Berlin-Tegel: Wind 200 degrees at 5 knots, visibility 1.2 km, ceiling overcast at 300 feet; gradually becoming, between 2300-0200, visibility 0.8 km in snow, overcast 200 feet.

Prior to departure from Frankfurt, the captain of Flight 708 was provided with a weather folder which included forecasts for the route to be flown. In addition, a Pan American dispatcher called the flight at 0130, while en route, and gave them the 0120 Berlin-Tegel weather.

#### 1.8 Aids to Navigation

Navigational aids at Tegel Airport include a VOR installation and an Instrument Landing System (ILS), the latter being the system utilized on the instrument approach for which Flight 708 had been cleared by Berlin Control just prior to impact. The aircraft was under radar observation by surveillance radar located at Tempelhof Air Base until the target of the aircraft disappeared from the scope.

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<sup>7/</sup> Apart from Flight 708, and the preceding Berlin to Frankfurt flight (No. 709) operated by the same crew in the late evening of November 14, there were no reported aircraft operating in the Berlin area between the hours of approximately 2100 on November 14th and about 0600 on November 15th.

A flight check of navigational aids in the area concerned was made on November 23, 1966, and all were found to be operating within prescribed tolerances. The radar antenna location and type of radar were such that a usable target could be observed down to a height of 100 feet and a weak target as low as 50 feet above the terrain at the crash site.

There were no reported discrepancies of ground or airborne navigational equipment during the flight.

#### 1.9 Communications

Persons familiar with the voices of the crewmembers identified the first officer as having made all transmissions to air traffic control. However, the captain was identified as having made the transmissions concerning the weather information supplied en route by the Pan American dispatcher. There was no evidence of an emergency or unusual situation in any transmission from the aircraft, nor were there any reported discrepancies in the air-to-ground communications during the handling of the flight.

#### 1.10 Aerodrome and Ground Facilities

Not involved in this accident.

#### 1.11 Flight Recorders

The aircraft was equipped with a flight recorder unit located in the electronic rack shelf aft of the nose gear wheelwell. In addition, a cockpit voice recorder unit was installed in the aft cargo compartment just aft of the cargo door. However, neither of these recorders was among the wreckage which was returned (see Wreckage section).

1.12 Wreckage

Subsequent to notification of the accident, the Chief, U.S. Military Liaison Mission, Potsdam, established liaison with Soviet authorities and requested that access to the crash site be granted to investigative personnel and other U.S. officials. These requests were denied, however, with the consequence that an on-scene investigation could not be accomplished.

Two days after the accident, Soviet authorities released the bodies of the three crewmembers and returned part of the wreckage which was later determined to amount to 50 percent or less of the total aircraft. Documentation of the returned wreckage disclosed that the following major items were among the missing components:

1. Flight recorder unit with recording tape.
2. Cockpit voice recorder unit.
3. Cut-out section of vertical fin and horizontal stabilizer, including stabilizer jackscrew, feel computer and box beam components.
4. Major parts of No. 1 engine.
5. Main portion of flight control systems including all power units.
6. Internal components of Sperry SP-50 automatic pilot (except one aileron surface servo).
7. Major portion of air conditioning system components.
8. Cockpit instrumentation including navigation and communication equipment together with flight engineer's panel.

9. Pilot and copilot seats.
10. Cockpit pedestal.
11. Both main landing gears and wheels.
12. The left main landing gear support beam.

Since the structures phase of the investigation was conducted without the opportunity of visiting the crash site, vital information concerning ground markings and wreckage distribution was not available. Information received secondhand indicated that the aircraft impacted in a clear area the surface of which was distinguished by a series of knolls or rises up to about 50 feet in height. It was further reported that the path of the wreckage was about 400 yards long and oriented along a magnetic heading of approximately 030°.

In order to elicit the maximum intelligence from the available structure, the returned wreckage was assembled on a hangar floor in the contour of the aircraft as each piece was identified. Examination of the resultant two-dimensional mockup disclosed that fragmentation of the structure was quite severe and consistent with an aircraft striking the ground with high impact forces. However, numerous pieces of fuselage skin with relatively little distortion were found separated from the attached frames and stringers, the skin having been forced outward over the rivet heads or having popped the rivet heads. No indication of fatigue cracking was found in any of the fractures.

Only a relatively small percentage of the systems components was included in the wreckage which was returned. Portions of the main landing gear and nose gear assemblies were available for examination. The actuating cylinders of these components were found in the retracted position, indicating that all three landing gears were in the extended position. The available evidence also indicated that the tail skid was retracted. In addition, measurements taken between the drive housing stop and the traveling nut stop on four wing flap jackscrew assemblies indicated that the flap setting was between 8 degrees and 10 degrees.

Disassembly and inspection of available parts from the No. 2 and No. 3 engines disclosed no evidence of powerplant failure, malfunction or operational distress. Examination to the extent possible also indicated that the reversers on these two engines were in the forward thrust position. Available material from the No. 1 engine was insufficient to permit the extraction of useful information.

Damage to the pylon leading edge and mounting structure indicated that the two side-mounted engines separated from their mounting supports in a forward, downward direction. The No. 2 or center engine also separated in a downward direction, as indicated by the absence of damage to the fuselage area immediately above this engine and by the evidence that the three engine mount bolts failed in tension overload.

#### 1.13 Fire

The returned wreckage had sustained severe fire damage, with the greatest concentration being from the nose section of the fuselage to approximately fuselage station 1000. However, there was very little fire

damage in the area of the center fuel tank, below floor level. There was no pattern or continuity of fire damage, although this observation is somewhat qualified by the presence of numerous gaps in the reassembled fuselage wreckage. In some instances, pieces which were not fire damaged mated with others which exhibited charring or exposure to heat.

#### 1.14 Survival Aspects

Circumstances of the investigation precluded knowledge pertaining to any evacuation or rescue activity. However, from all indications the accident was nonsurvivable.

#### 1.15 Tests and Research

Following the initial structure examination at Berlin, selected pieces of the aircraft structure were shipped to Washington, D. C., for further study. These pieces consisted primarily of shell structure, skin pieces separated from frames and stringers, representative pieces of internal wreckage, and a miscellaneous collection of debris. This material was minutely examined by representatives of the Federal Bureau of Investigation for physical damage or foreign residues indicative of an explosion. No such evidence was found.

## 2. ANALYSIS AND CONCLUSIONS

### 2.1 Analysis

The aircraft had been maintained in accordance with applicable regulations and, from all indications, was airworthy at the time Flight 708 departed from Frankfurt. The gross weight and c.g. of the aircraft were computed to have been within limits both at the time of takeoff and at the time of the accident. The flight crewmembers were properly certificated

for the operation involved and there was no sign that any of them became incapacitated during the flight. Examination of the available wreckage disclosed no indication of a malfunction or failure of the aircraft power-plants, structure or systems.

Fire damage and sooting did not follow any specific pattern, as would be expected if an inflight fire had occurred. Rather, the evidence was more indicative of post-impact fire. In addition, the possibility of sabotage was rendered even more remote by the fact that the special examination of certain metal parts disclosed no evidence of physical damage or foreign residues compatible with an inflight explosion.

Based on the examination of structural components of the wings and fuselage, it was evident that the aircraft struck the ground in a generally level attitude. The wing tips sustained comparatively light ground contact, and the lower aft fuselage sections did not exhibit the impact or scratch marks which would be expected if the aircraft had impacted in a nose high attitude.

Both main landing gears and the nose gear were extended at impact. It appears that the nose gear separated from the structure after the aircraft was on the ground, probably due to striking a mound which caused an immediate aft load and failure of the strut assembly. The nose section of the aircraft sustained extensive damage, which is consistent with the severe injuries received by the crewmembers. Following separation of the nose gear, the aircraft apparently continued to slide on the underside of the nose and both main gears. This attitude would have held the aft fuselage

off the ground, explaining the lack of underside damage to that section of the aircraft. The main gears apparently stayed on the aircraft until it slowed down and the weight increased on the gears, causing the wheels to sink into the ground and the gears eventually to fail aft and slightly to the right.

Comparative jackscrew measurements disclosed that the flap setting was between 8 and 10 degrees. The fact that there is no flap handle quadrant setting or detent for this position, coupled with the retracted position of the tail skid and the extended position of the gear, indicates that the flaps were in transit toward the down position at the time of impact. <sup>8/</sup>

The secondary radar target of the aircraft disappeared from the radar scope just after completion of the transmission from Flight 708 acknowledging their approach clearance. This transmission commenced at 0141:38 and ended at approximately 0141:41. Assuming that the secondary target did not appear on the radar scope at any time subsequent to the completion of the foregoing transmission, the latest point in time that secondary target loss could have occurred was 0141:45. <sup>9/</sup>

Flight checks conducted subsequent to the accident indicated that the surveillance radar, which had been utilized to track Flight 708, could detect a target down to 50 feet above the terrain at the crash site.

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<sup>8/</sup> The tail skid will automatically extend when the landing gears are extended and the flaps are lowered through 15 degrees. Conversely, the skid will retract when the gears reach the retracted position.

<sup>9/</sup> The antenna utilized on surveillance radar has a scan rate of 15 r.p.m. and thus completes one sweep every 4 seconds.

Accordingly, the disappearance of the secondary radar target of the flight from the radar scope would have occurred when the aircraft descended through a height 50 feet above the ground. <sup>10/</sup> Assuming a rate of descent of 1,500 feet per minute, which represents the average descent rate of Flight 708 from the time it departed the cruising altitude of 9,000 feet until impacting approximately 6 minutes later, it would have taken the aircraft 2 seconds to descend the final 50 feet to the surface. Adding these 2 seconds to the above calculated time of secondary target disappearance would place the time of impact at 0141:47.

The conclusion that impact occurred at 0141:47, or within seconds thereof, is further substantiated by an analysis of the remaining evidence bearing on this matter. The flight was given a radar fix at 0141:30 which placed it 6.5 miles from the outer marker. Starting at the geographic point of impact, and measuring back along the projected flightpath of 030° <sup>11/</sup> until reaching a point 6.5 miles from the outer marker, the location of the radar fix was established as being approximately one mile from the impact site. Using the above-calculated time of impact of 0141:47 would mean that the aircraft covered this distance in 17 seconds, or at a ground speed of 212 knots. In view of the existing tail wind at 2,000 feet of approximately 10 knots, this ground speed would convert to a true air speed and an indicated air speed of about 202 knots. Such a figure is consistent with

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<sup>10/</sup> The continued appearance on the radar scope of the primary target, after the secondary target had disappeared, was probably a reflection of the aircraft debris blown into the air by the explosion at impact.

<sup>11/</sup> The flight was on an assigned heading of 030° until just prior to impact. In addition, the wreckage distribution indicated that the aircraft was on this heading at impact.

the aircraft speed which would be expected in view of the fact that the flaps were being lowered through the 8-10 degrees position at impact. <sup>12/</sup>

In addition, the fact that the aircraft impacted on a heading of 030 degrees indicates that the crew did not have time to effect a turn to 060 degrees, the heading assigned to the flight some 12 seconds prior to impact.

The above calculations indicate that the crew of Flight 708 completed their final transmission, which contained no indication of any difficulty, only 6 seconds prior to impact. This would seem to rule out the possibility that the aircraft had levelled off at the assigned altitude and then, subsequent to the transmission, dove to the surface. It is extremely unlikely that the aircraft could have descended to the surface from 2,000 feet, or even from 1,153 feet, <sup>13/</sup> in 6 seconds and then impacted in a level altitude. Rather, it is much more conceivable that the flight had already descended through the assigned altitude at the time the transmission was completed and thereafter continued such descent until it struck the ground.

It is recognized that the time of impact calculated above is based in part on factors whose value cannot be determined with precision but can only be deduced from the available evidence. On the other hand, even if it is assumed that the time of impact cannot be determined with a substantial degree of certainty, there is other evidence, apart from the close proximity in time of the final crew transmission to impact, which indicates that the

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<sup>12/</sup> The maximum speed for lowering flaps to 5 degrees is 215 knots, while the maximum speed for lowering them to 15 degrees is 205 knots.

<sup>13/</sup> Prior to receiving approach clearance, the flight had been cleared to descend to 2,000 feet. When the flight was cleared for an ILS approach, its minimum assigned altitude was in effect lowered to the outer marker minimum crossing altitude of 1,153 feet.

aircraft continued its descent through the altitude clearance limit, as if in the process of making a normal let-down to the final approach, until colliding with the surface. Thus, the fact that the flaps were being lowered through 8-10 degrees indicates that the crew was preparing for the final approach. In addition, the level attitude of the aircraft at impact is not only consistent with a normal descent, but indicates that the crew remained unaware of their proximity to the ground, since otherwise they would probably have rotated their aircraft in order to soften the force of impact.

The reasons underlying the descent of the flight through its assigned altitude cannot be explained. As noted previously, there was no indication of a malfunction or failure of powerplants, structure or systems, nor was there any evidence of an inflight fire or explosion. With respect to the weather encountered during the flight, the aircraft would have been in and out of, or between, layers of altocumulus and/or stratocumulus clouds while cruising at 9,000 feet. <sup>14/</sup> During the early portion of the descent, the flight would have been in and out of cloud layers and probably encountered light snow. When reaching the lower levels, the aircraft probably was subjected to light to moderate rime icing, and may have encountered light freezing drizzle. The freezing level was at the surface in the Berlin area.

The weather conditions were therefore conducive to icing, and it is possible that problems with airframe or engine icing were experienced during the latter portion of the descent. On the other hand, the aircraft

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<sup>14/</sup> Both at altitude and during descent, the aircraft would have encountered only light turbulence, in view of the stratus type of clouds.

was equipped with systems to prevent or remove ice accretion and there is no reason to assume that the crew, which should have been aware that the flight was operating in an environment conducive to icing, had not activated these systems. Furthermore, there was no indication of any icing difficulty in the transmissions from the crew, and it is inconceivable that icing could have developed into a serious problem during the few seconds between the last crew transmission and impact.

If the crew remained unaware of their descent through the assigned altitude, as the available evidence indicates, a problem with respect to the aircraft altimetry may have existed. The aircraft was equipped with 4 altimeters, two of which were the drum-pointer pressure type while the other two were <sup>15/</sup> low range radio altimeters. It is highly improbable that the crew had set the incorrect barometric pressure in the pressure altimeters in light of their several acknowledgments of this setting as provided by Berlin Control during the later phases of the flight. Moreover, the cockpit checklist specifically prescribes that the pressure altimeters shall be set and cross-checked during descent. <sup>16/</sup> The checklist also provides that, prior to descent, the radio altimeter shall be tested and the "bug" set. When the aircraft passes through the altitude at which the "bug" is set, both a visual and an aural signal are generated. The Pan American check pilot who gave the captain of Flight 708 his initial equipment

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<sup>15/</sup> The pressure altimeters provide the crew with the altitude of the aircraft above sea level, if the correct barometric pressure has been set into the instrument. The radio altimeters provide the absolute altitude of the aircraft above the terrain over which it is being flown.

<sup>16/</sup> It should also be noted that the aircraft anti-icing system extends to the static ports which serve the flight instruments, including the pressure altimeters.

qualification and route checks imparted to the captain the procedure of setting the "bug" on 2,000 feet as a reminder during descent.

Apart from the checklist provisions concerning altitude, the Pan American B-727 operating manual prescribes that the pilot-in-command shall assure that all deck crewmembers are aware of the altitude to which the flight is cleared to descend. This manual also provides that during descent from en route flight the pilot not flying will call out 1,000 feet above the assigned altitude.

In view of the available instrumentation, as well as the comprehensive procedures prescribed by the checklists and manual, it is difficult to envision how the pilots could have been unaware that the aircraft had descended through the assigned attitude. The lack of opportunity to examine critical aircraft components which might have shed light on this matter, or to have the benefit of flight recorder and cockpit voice recorder information, precludes any further knowledge concerning the circumstances leading to the crash. Accordingly, the Board is unable to determine the reason why the flight descended below its altitude clearance limit.

## 2.2 Conclusions

### (a) Findings

1. The aircraft was airworthy, and its gross weight and center of gravity were within limits.
2. The flight crewmembers were properly certificated and qualified for the operation involved.

3. There was no indication that the pilots became incapacitated during the flight.
4. The wreckage returned constituted less than 50 percent of the total aircraft. Among the significant components missing were the flight recorder and cockpit voice recorder.
5. Examination of the returned wreckage disclosed no evidence of a mechanical failure or malfunction of the aircraft structure, systems or powerplants.
6. There was no evidence of an inflight fire or explosion.
7. The landing gears were extended at impact, while the flaps were extended 8-10 degrees and were in transit to the down position.
8. The aircraft impacted in a generally level attitude.
9. The aircraft was cleared to make an Instrument Landing System approach to Runway 8R at Tegel Airport. Just after acknowledging the clearance, the aircraft crashed.
10. The weather conditions at the time and in the general area of the crash were: visibility 1.56 miles in snow; overcast at 600 feet; and temperature of -1°C.
11. The available evidence is insufficient to permit a determination as to why the flight descended through its altitude clearance limit.

(b) Probable Cause

The Safety Board determines that the probable cause of this accident was the descent of the flight below its altitude clearance limit, but the Board has been unable to determine the cause of such descent.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOSEPH J. O'CONNELL, Jr.  
Chairman

/s/ OSCAR M. LAUREL  
Member

/s/ JOHN H. REED  
Member

/s/ LOUIS M. THAYER  
Member

/s/ FRANCIS H. McADAMS  
Member

APPENDIX A

Crew Information

Captain Walter T. Reavis, age 41, was the holder of Airline Transport Pilot Certificate No. 126164. He held type ratings in the Douglas DC-6/7, Boeing 377, Boeing 707/720 and Boeing 727 aircraft with commercial privileges in airplane multiengine land. His first-class medical certificate was dated October 25, 1966, and required him to wear glasses for near vision.

Duty time since last rest period . . . . approximately 9 hrs. and 52 min.

Total pilot time . . . . . 14,212 hours

Total time flight training in Boeing 727

equipment (including rating check) . . . 34 hours and 10 minutes

Total time in Boeing 727 equipment

(including training time) prior to

Flight 708 . . . . . 58 hours and 55 minutes

Satisfactorily completed ground training

in Boeing 727 . . . . . September 20, 1966

Satisfactorily passed type rating check

in B-727 . . . . . October 30, 1966

Satisfactorily passed System Route

Check in B-727 equipment . . . . . November 8, 1966

Last proficiency check - satisfactorily

passed as pilot-in-command DC-6 equipment. . April 27, 1966

Last line check - satisfactorily passed

in DC-6 equipment . . . . . June 23, 1966

Captain Reavis had been flying within Pan American's Internal German System since December 1963.

First Officer Raymond B. Foppe, age 42, was holder of Airline Transport Pilot Certificate No. 74031-41. He held type ratings in the Douglas DC-4, DC-6/7, and Boeing 377 aircraft with commercial privileges in airplane single and multiengine land and sea. His first-class medical certificate was dated July 25, 1966, and required him to wear glasses to correct defective distant vision.

Duty time since last rest period . . . . approximately 9 hrs. and 52 min.

Total pilot time . . . . . 17,542 hours

Total time flight training in Boeing 727

equipment . . . . . 32 hrs. and 01 min. (includes both initial [20 hrs. and 01 min.] and subsequent training)

Satisfactorily completed ground training

in B-727 . . . . . February 25, 1966

Unsatisfactory on type rating check in

B-727 (however, considered satisfactory

to continue flying as First Officer). . . . . September 26, 1966

Additional training flight in B-727

(upon completion of this flight FAA-

approved check airman rated subject

unsatisfactory for type rating check

but satisfactory to continue flying as

a First Officer). . . . . October 11, 1966

Total time as copilot in B-727 . . . . 412 hours and 01 minutes

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Last proficiency check - satisfactorily  
passed as pilot-in-command DC-6  
equipment . . . . . November 30, 1965

Last proficiency check - satisfactorily  
passed as second-in-command B-727  
equipment . . . . . April 15, 1966

Last line check - satisfactorily  
passed as pilot-in-command DC-6  
equipment . . . . . December 2, 1965

First Officer Foppe had been flying within Pan American's Internal German System since June 1963.

Flight Engineer John W. Charlton, age 34, was the holder of Flight Engineer Certificate No. 1695185 and Airline Transport Pilot Certificate (ATR) No. 1450567. His Flight Engineer Certificate indicated he held ratings in turbojet-powered aircraft and his ATR indicated a rating in Lockheed B-34. He also had commercial privileges in airplane single and multiengine land with an instrument rating. His first-class medical certificate was dated September 25, 1966, and contained no limitations.

Duty time since last rest period . . . . approximately 10 hrs. and 22 min.

Total pilot time . . . . . 4,700 hours

Total flight training as Flight  
Engineer on B-727 prior to taking  
practical exam (flight check) . . . . . 17 hours

Satisfactorily passed oral examination  
for Flight Engineer certificate . . . . . July 8, 1966

Satisfactorily passed practical  
examination for Flight Engineer

Certificate . . . . . July 12, 1966

Satisfactorily passed line check

B-727 . . . . . August 15, 1966

Total time as Flight Engineer

in B-727 equipment . . . . . 253 hours and 58 minutes

Flight Engineer Charlton was permanently based in Miami, Florida, as a B-727 Flight Engineer. He had been in Berlin since September 29, 1966, in order to augment the Berlin base complement while Berlin Flight Engineers received their B-727 training in Miami.

APPENDIX B

Aircraft Information

The aircraft was a Boeing 727-21, registration N317PA, manufactured by the Boeing Company. The aircraft, serial number 18995, was delivered to the owner on January 19, 1966, and was put into service February 15, 1966. The total airframe time was 1,804:21 hours.

The powerplants were three Pratt & Whitney JT8-D1 turbo fans. The engines had never been overhauled. Engines No. 653564 and No. 653408 had been in the engine overhaul shop for a No. 5 bearing failure. The other engine, No. 653851, had been installed on N317PA since new.

<u>Engines S/N</u>	<u>Position</u>	<u>T.T.</u>	<u>T. S. O.</u>
P-653408B	No. 1	560:51	New
P-653564B	No. 2	753:14	New
P-653851B	No. 3	248:38	New

The re-computed takeoff weight of N317PA was 134,270 pounds and the estimated weight at the time of the accident was 126,270 pounds. Maximum allowable takeoff weight was 145,500 pounds. The center of gravity (c.g.) limits for the flight were 15 percent mean aerodynamic chord (MAC) forward and 36 percent MAC aft. The aircraft's c.g. was computed to have been within these limits both at the time of takeoff and at the time of the accident.

The aircraft had been refueled at Frankfurt and departed the ramp with a total of 31,500 pounds of Kero-A1 fuel.