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File No. 1-0062

CIVIL AERONAUTICS BOARD
ACCIDENT INVESTIGATION REPORT

Adopted: October 29, 1952

Released: October 31, 1952

PAN AMERICAN WORLD AIRWAYS, INC. - NEAR RIO DE JANEIRO, BRAZIL,
JULY 27, 1952

The Accident

The main cabin door of Pan American World Airways' Boeing 377, N 1030V, opened suddenly during pressurized flight at about 1446 GMT, ^{1/} July 27, 1952. Out-rushing air blew overboard a woman passenger who had been in seat No. 33, closest to the door. The aircraft was at an altitude of about 12,000 feet and was pressurized to a differential of 4.1 pounds per square inch. At the time the aircraft was over ocean outbound about 18 minutes from Rio de Janeiro, Brazil, at about Latitude 23° 30' S and Longitude 43° 40' W.

History of the Flight

This flight, designated by PAMA as Flight No. 201 of July 26, 1952, originated at New York International Airport (Idlewild). Its destination was Buenos Aires, Argentina, South America, with stops scheduled at Port of Spain, Trinidad, B.W.I.; Rio de Janeiro, Brazil; and Montevideo, Uruguay.

Crew changes on Flight No. 201 were made at Port of Spain and Rio de Janeiro.

From Idlewild to Port of Spain the flight was routine, with no reported difficulty in the functioning of the main cabin door except for the purser's later statement, "I found the door handle to be quite difficult to open or close."

1/ Greenwich Mean Time. Rio de Janeiro time was 1146.

The same type of routine operation was experienced on the second leg of the flight, from Port of Spain to Rio de Janeiro, again with no reported difficulty in the functioning of the main cabin door except that the purser on this leg later stated, "The only thing noticed was a slight difficulty in locking the door which is not uncommon on the B-377." Neither purser, however, considered the door handle difficulty of sufficient importance to report. The aircraft landed uneventfully at Rio de Janeiro and was serviced and loaded for the next portion of the flight.

The crew from Rio de Janeiro consisted of Captain G. L. Fly, First Officer R. A. Sylvester, Flight Engineer J. D. Knight, Radio Officer C. E. Donaldson, Purser G. A. Oliva, Stewardess L. Hill, and Stewards R. Garcia and M. A. Dominguez. There were 19 passengers. The aircraft was so loaded that its center of gravity was within prescribed limits, and its total weight was 56,660 kilos (124,935 pounds) as compared with its maximum allowable take-off weight of 60,191 kilos (132,721 pounds). The flight plan was according to instrument flight rules at an altitude of 6,000 meters, or approximately 20,000 feet.

After the aircraft was loaded, the main cabin door was closed and supposedly locked by ground personnel and the position of the inside handle checked by the purser, as was routine practice. During the cockpit check, prior to starting the engines, a cockpit warning light remained on indicating that one or more of the cabin doors (two cargo, one galley and the main cabin) was not locked. Accordingly, the flight engineer inspected the two cargo doors and the main cabin door. (The galley door was inspected by ground personnel and pronounced locked, via interphone.) The flight engineer noticed that the handle of the main cabin door was not in the horizontal (locked)

position. He opened the door, closed it, and turned the handle as far as it would go toward the horizontal (locked) position. He estimated that the handle was within about 25° of the locked position. The flight engineer testified that he used a flashlight to check the positions of the four bolt mechanisms and the pressure lock visible through their respective inspection windows on the inside of the door. All seemed normal. He then reported to the captain that all doors were locked. The engines were started, and the aircraft left the ramp and took off at 1428. During this time the door warning light remained on.

A climb was started, as was cabin pressurization. At an altitude of about 12,000 feet and with a cabin pressure differential of 4.1 pounds per square inch, corresponding to a cabin altitude of about 2,000 feet, the purser heard a loud hissing noise at the cabin door. He went to the flight deck and stated to the captain, "We should depressurize because I think the door is open."

The captain ordered the flight engineer to inspect the door. (The door warning light was still on.) The first officer assumed the station of the flight engineer who went aft with the purser. Both inspected the door while the captain stopped the aircraft's climb. The flight engineer did not make a visual inspection through the door windows but placed his hand along the top edge of the door, whereupon the noise decreased. He then instructed the purser to place wet towels in that area to reduce the air leak and the noise. At this time the door handle was still not in the locked position, the flight engineer estimating that it was still about 25° from being in the horizontal position and the purser estimating it to be only about 19° from the vertical, or fully unlocked position.

The purser then went aft in the cabin to procure towels. The flight engineer returned to his station and reported to the captain that the door seal

was leaking but everything seemed normal. The captain elected to continue. The door warning light was still on.

Within a minute or two, at 1446, the cabin door blew open. As stated, a woman passenger in seat No. 33, nearest the door, went through it. None of the other occupants was injured although many of them experienced a temporary ear discomfort as would occur following a rapid depressurization. The depressurization, of an explosive violence, caused damage throughout the cabin, blowing loose ceiling panels and many sections of soundproofing and upholstery and tearing off the door of the ladies' lavatory. Fog, caused by condensation at the lower pressure, temporarily filled the cabin.

The aircraft was immediately turned back to Rio de Janeiro where it landed uneventfully at 1513, forty-five minutes after taking off. During the entire flight the weather was good, with little or no turbulence. The door opened while the aircraft was on course for Montevideo and about seven minutes after passing abeam of Santa Cruz.

Upon notification of this accident, the Brazilian Government immediately instituted an intensive air, sea and shore search for the body of the missing passenger. This search was futile.

Investigation

When the flight returned to Rio de Janeiro, local authorities immediately placed the aircraft under guard. Passengers were deplaned, questioned and permitted to leave on a subsequent flight.

An accident investigator of the Civil Aeronautics Board, at that time on temporary duty at Rio de Janeiro, took part in the investigation at the invitation of the Director of Civil aviation for Brazil.

As the main cabin door, its locking mechanism and the manner of its opening will be discussed at some length, it is appropriate here to describe that door and its associated safety devices.

The door opens outward and is hung on two hinges at its forward edge. It has both an external and an internal locking handle. The external handle is approximately nine inches long and is mounted at its center on the locking shaft. The internal handle is a lever about nine inches long mounted at one end on the same locking shaft. Normally, these two handles remain parallel. The door is completely unlocked when the handles are approximately vertical with the internal handle upward. It is fully locked when the handles are approximately horizontal, i.e., when the internal handle is turned counter-clockwise to a horizontal position.

The outside of the door is marked with two curved arrows showing the directions to turn the door handle, "to unlock" and "to lock." The inside of the door has a single arrow curved clockwise, marked "turn handle - opens out."

Rotation of the door handle shaft actuates a mechanism that extends or retracts 13 locking bolts, commonly called bayonets, placed around the edge of the door. There are two of these bolts on both the top and the bottom of the door edge, five on the forward edge and four on the aft edge. These bolts are extremely hard and are polished. Their full travel from the unlock to the lock position is approximately 1-3/8 inches. The outer approximate halves of all 13 bolts are tapered in both width and thickness.

Around the door frame are 13 receptacles which receive the bolts. Each is capped with a striker plate with an orifice into which the fully extended bolt fits snugly.

The inside of the door is fitted with five clear plastic windows. One, located on the lower rear, allows visual inspection of the door's pressure lock. The other four, two at the top and two at the bottom of the door, allow visual inspection of the positions of the mechanism actuating the four bolts (bayonets) located immediately adjacent to the bases of the bolts.

The Pan American B-377 operations manual, carried aboard the aircraft, describes completely the locking mechanisms of the various exterior doors of the aircraft and their safety devices.^{2/} A description of the main entrance door locking mechanism is quoted as follows:

1. Pressure Lock: To prevent anyone from inadvertently opening the door when the cabin is pressurized, the pressure lock acts to prevent movement of the lower cable system. The lock is energized continuously when cabin pressure differential exceeds 2" H₂O. Engagement of the pressure lock may be checked through the square window on the lower aft portion of the door.
2. Latch Dog Lock: This lock prevents damage to 13 latch dogs by locking all dogs in the retracted position when the door is opened and thus prevents slamming door closed on the open latch dogs. This lock is automatically operated by a small striker plate in the upper forward portion of the door.
3. Vibration Lock: To prevent the door latching dogs from working loose due to vibration, the vibration lock automatically engages a locking pin in the door handle sprocket when the door handle is turned into the locked position. During the first 30 degrees of unlatching, the rotation of the door handle acts to disengage the vibration lock pin from the door handle sprocket.

^{2/} Pan Am B-377 operations manual, aircraft description of exterior doors, item 87:011 (1) and (2), published August 14, 1951.

4. Anti-Rotation Latch: This is a spring catch type anti-rotation latch installed under the lining of the door handle shaft. It serves to prevent rotation of handle toward the unlocked position due to vibration, serving the same purpose as the vibration lock.
5. Bungee Cord: In event of failure of the vibration lock the bungee cord applies sufficient tension to the door handle to maintain it in the locked position and thus prevent the locking mechanism from working loose due to vibration.

TO CHECK MAIN CABIN DOOR PROPERLY LOCKED

- Handle Position . . . Handle should be horizontal, and against internal stop. If handle is not horizontal when it is against stop, write up for Maintenance action.
- Bungee Cord Cord should be attached from rear end of handle to the lower portion of the door.
- Pressure Lock When pressure differential exceeds 2" H₂O, dogs should be in position to prevent cable from being moved sufficiently to actuate door latches. The locking dogs are viewed through square window in aft lower portion of door.
- Door Latches Door Latches may be viewed through the four circular windows, two at the top and two at the bottom of the door. Latch mechanisms should be in locked position.

WARNING

1. In event of main entrance door air leakage, the area in front of the door should not be used for food service cleaning purposes.

2. In event of main entrance door air leakage, do not touch the door handle. Any attempt to adjust handle during pressurized flight can only lead to further opening of the door.

There is installed in the B-377 aircraft a door warning system. It is designed to alert the crew to any malfunction of the main entrance cabin door, forward cargo door, rear cargo door and the galley loading door by means of a warning light in the cockpit. At the main cabin door there are two door-closed micro-switches installed in the door frame, one for the upper cable system and the other for the lower cable system, and one door-locked warning switch under the door lining, actuated by the vibration lock. These micro-switches are installed to cover not only the complete traveling action of the locking door bayonets, or bolts, but also to cover the complete rotation of the door handle to insure that the vibration latch and the anti-rotation latch are completely secure. These switches are so located that they can be readily inspected at all times.

The B-377 operations manual "Aircraft Description Exterior Doors" also includes instructions when the door warning light comes on in the cockpit. These instructions, in part, are as follows:

"If the warning light remains illuminated after all doors are closed and locked, the following should be checked O.K. prior to takeoff:

- | | |
|------------------------|---|
| Main entrance door . . | 1. Four latches fully closed (check thru 4 windows) |
| | 2. Door handle in locked position |
| | 3. Bungee cord attached" |

Examination of the cabin main entrance door was made at Rio de Janeiro. Damage to the door was confined to downward distortion of both hinges, a cracked lower hinge and three rivets missing from the lower hinge. The forward

edge of the aluminum metal window frame in the door was distorted rearward, and a small section of upholstering fabric at the center rear edge was missing. A deep indentation and slight displacement of the rubber door seal near the door's upper rear corner was found and there was a small indentation of the rubber seal near the door's lower rear corner.

Damage to the door frame was confined to a slight depression of the frame metal near the upper rear corner. The rubber seal across the top of the frame was missing. The remainder of the frame's rubber seal appeared to be somewhat deteriorated.

The mating indentations in the door and its frame were of such size and nature that they were obviously caused by the loosened and wedged door frame seal.^{3/}

No evidence of failure or malfunctioning of the main entrance door locking mechanism was found. All rigging adjustments that could be checked were found to be within acceptable tolerance. This included the micro-switch actuator adjustments, the bayonet extensions, and all other checks except the cable tension check, the pressure switch pressure check and the anti-vibration lock plunger clearance check.

The pressure switch secondary lock was actuated by connecting a rubber tube to it and blowing through the tube. This properly locked the mechanism and made it possible to measure the clearance which was within the tolerance specified by the CAA approved company maintenance manual.

No tensiometer was available with which to measure the bayonet lock actuating cable tension. The upper cable appeared to be adjusted approximately to the required tension of 30 to 40 pounds but the lower cable appeared to retain only about half of that tension. There appeared to be some abnormal

^{3/} See Attachment "A"

play in the actuating mechanism during operation of the handle but it did not affect the proper locking of the door during tests.

It was not possible to close the main entrance door until the hinges were disconnected. When this was done the door was closed, the aircraft's electrical power system was actuated and the door was locked. During this test the door warning light actuated properly and the door handle moved fully to its horizontal, locked position. The door was then unlocked and the flight engineer involved, while standing in the cabin, moved the locking handle as far to the left as he remembered moving it just prior to the flight involved.

This position was at a point midway between the unlocked and locked positions which was at an angle of about 45° rearward from vertical. The flight engineer then continued the leftward movement of the handle until it was fully in the horizontal position. During this latter test, the door moved noticeably inboard, as is normal.

All 13 bayonet wells in the door frame lock plates were examined for foreign matter. A small amount of sediment was found in each of the two lower wells and in the aft lower well, a small clothing type safety pin and the head of a small dural rivet were also found. No evidence of distortion or fresh scoring was found on either of these objects. The wells measured $1\frac{1}{2}$ " deep and the bayonet extension of the aft lower bayonet measured $1-7/16$ ", the allowable extension being $1-3/8$ to $1\frac{1}{2}$ inches.

The reclining back of seat No. 33, located adjacent to the left cabin wall just forward of the main entrance door (occupied by the missing passenger) was found collapsed rearward with its lower structure broken, the headrest missing and the upholstery at the upper outboard corner torn. The seat belt was intact and unbuckled. The inboard arm rests of three aisle seats (Nos. 10,

15 and 25) located along the aisle between the lavatory and the main entrance door were also damaged.

No repairs were made to N 1030V at Rio de Janeiro, and the aircraft was ferried to Miami on July 31, 1952, where it was met by a Board investigator. Security was established over the aircraft and its log books and the investigation was continued on that date. Physical findings of the preceding investigation were confirmed at Miami. Examination of the main cabin door and door frame revealed some minor distortions and a somewhat deteriorated door frame sponge rubber seal. (On July 1, 1952, 26 days before the accident, a new seal had been installed in the door frame.) The lower door hinge which was distorted had been removed at Rio de Janeiro so that the door could be closed for the ferry flight.

This door was opened, closed and locked numerous times to determine if the locking mechanism or any of its safety devices were malfunctioning. None was found. The door warning light system was also checked several times; no evidence of malfunctioning was found.

After repair of the door hinge and sealing arrangement and the proper adjusting of the tension of the lower cable at Miami, the door was re-installed in N 1030V. Flight tests were then conducted which disclosed air leakage around the door. Recheck of the sealing arrangement revealed that air was leaking between two sheet metal members, part of the door frame. This admitted air to the space behind the door frame seal. Air leaking into this space would tend to loosen the bond which holds the door frame seal. It was determined that the metal screws holding the door frame trim angle were loose, and tightening them stopped the leak.

Board investigators reviewed all maintenance records applicable to the main cabin door of N 1030V for a 30-day period prior to the accident. These records disclosed three instances of door leakage due to deterioration of the rubber seal. In addition, the company submitted to the Board a B-377 door warning summary of instances of trouble and corrective action taken on all of its Boeings for the six months period. During this period there were 28 reported instances of trouble involving the aircraft's four exterior doors, including faulty door frame seals and leakage around the main cabin door. A majority of these instances, however, indicated trouble in the door warning light system. There have been many instances of false warnings to the crew in the cockpit, but in each case when the light came on, it was the duty of the flight engineer to check the locking mechanisms of the exterior doors. Because of these rather frequent false warnings, it became practice to ignore the warning light, after a check had been made.

The flight engineer testified that he had received three weeks training on the B-377 at the Boeing factory during February 1949. This course included a brief familiarization with the general locking mechanism of the aircraft's exterior doors. Later he was given the usual flight training course of about 50 hours. One of his overall duties was checking these doors if the door warning light came on in the cockpit. The flight engineer had approximately 2,607 hours on the B-377.

The captain testified that he attended the company's school for B-377 familiarization at New York for approximately six weeks in 1950. The course included discussion and inspection of the doors, their locking mechanism and their warning devices.

Analysis

As explained, there was no malfunctioning of the door or any of its locking mechanisms or safety devices, and it is thus clear that the accident was caused by the crew's failure to recognize the hazard of an incompletely locked cabin door, due to jamming by a loosened door frame seal. None of the previously mentioned safety locking devices can function unless the latching mechanism and the door handle are in the fully closed position.

The crew should have been aware of the danger because of three fully independent warnings of imminent trouble. First was the warning light that remained on. Second was the noise of pressurized air escaping around the top of the door. And third, and possibly the most important, was the fact that the door handle never was in a position to more than partially extend the locking bolts (bayonets).

The first of these three warnings, the light, was plain and continuous. The second, the escaping air, was brought to the flight crew's attention by the purser. The third, the door handle's position, should in itself have been enough to indicate to the flight engineer what was due to happen. In fact, the flight engineer's act of attempting to force further the door handle during pressurized flight could well have precipitated the blow-out. The company's operating manual plainly states that in the event of door leakage the door handle shall not be touched because any attempt to adjust it during pressurized flight can only lead to further opening of the door. The flight engineer was aware of this specification but ignored it. Furthermore, when he first checked the door handle on the ground and found, after opening and reclosing the door, that the handle would still not go to its

locked (horizontal) position, he could readily have learned whether the locking mechanism was working properly by reopening the door and turning the door handle to the closed position while observing the travel of the locking bolts. This he did not do.

The flight practice of ignoring a door warning light, despite frequent false warnings, is certainly subject to criticism. In this case the warning light was a true warning.

The deep indentation in the door's upper rear corner and slight displacement of the adjacent portion of the door's seal mated exactly with the slight depression in the door frame. In other words, when the door was closed, the two depressions abutted as if they had both been caused by the wedging of the same object.

These two depressions are marked on Attachment A. Their positions relative to the missing portion of the door seal suggested strongly that it was a loosened and sagging door frame seal that had jammed at that point.

Accordingly, tests were conducted with a similar obstruction placed in the same position. It was found that under this condition, the door handle could be rotated only to approximately the same position from the horizontal as was described by the flight engineer.

Both pursers on the two previous legs of this flight testified as to difficulty in fully closing the door. This might well, and probably does, mean that the door frame seal was becoming loose several flight hours before the accident but not, of course, to the extent necessary to prevent full locking of the door.

As previously described, N 1030V was test flown after all repairs had been made to the cabin door and its frame. Leakage still occurred and it was

found that this was caused by the loose metal screws behind the door frame lining. This condition caused the eventual loosening of the door frame seal. These loose screws had not been discovered during the door and frame repairs and probably had been loose for an appreciable period of time.

Thus, because the condition that allowed this leakage had been progressive, it is highly probable that the seal sagged from the frame after the aircraft's door was opened following the landing at Rio de Janeiro. No company employee reported a sagging seal, but its position, from the extreme top of the door frame, could allow a slight sag to remain unnoticed.

The most probable reason for the door opening during flight is as follows. The door frame seal became loosened along the top of the frame during the flight from Port of Spain to Rio de Janeiro. But, as the door remained closed, it was held in its proper position. It sagged when the door was opened, and this sagging remained unnoticed while the aircraft was made ready for the next leg of the flight. Upon closing the door the sagging seal jammed, creating the marks shown on Attachment A, and preventing the door from being fully closed. Although there is a marked difference of opinion between the flight engineer and purser as to how far the door handle was turned, it is self evident that it was turned only far enough to engage the tapered ends of the bolts in their receptacles. Cabin pressure exerted an increasing force on the door. This force reached a magnitude sufficient, under normal vibration conditions in flight, to expel the tapered ends of the bolts from their receptacles and back into the door edge, whereupon the door opened violently under the impetus of a force of several tons. Outgoing air carried away the sagging portion of the frame seal also as shown on Attachment A.

As one result of this accident, the carrier is installing indicators on the B-377 four latching mechanisms that are now visible through the corner

windows of the cabin door. These indicators, extending to the windows, will be conspicuously colored -- red for open, green for locked. Pending this installation the latching mechanisms themselves have been painted conspicuously to allow their positions to be more readily determined. The moving cap portion of the pressure switch has been marked for alignment. These marks are visible through the pressure switch window.

Also, the carrier is in the process of changing the warning light system on its B-377s. This change will involve placing a warning light at each of the four exterior doors. The single cockpit warning light will remain to indicate that any of the four doors are improperly locked, and the individual door lights will allow immediate isolation of the trouble.

All of the carrier's B-377s were immediately inspected for loose door frame trim screws and the condition of door frame seals, and this inspection will be continuous as directed by a service bulletin issued by the company to all its stations. 4/

A few days after this accident the company, following conferences with the Civil Aeronautics Administration, issued all personnel concerned a directive to follow all procedures published and in effect at the time of the accident, applicable to the main cabin door of the B-377. These included:

1. No take-off permitted if door warning light is on unless cause of warning is definitely established as warning system malfunction.
2. No take-off permitted unless bayonet locks are observed to be in fully extended position and door handle is in full locked position.

4/ All other U. S. operators of B-377 equipment were likewise alerted.

3. Main door secure inspection to be made before take-off and again after pressurized by pilot or engineer personnel properly safeguarded to determine that door handle bayonets and pressure locks are properly engaged.

The same directive carried these additional items which were not in effect at the time of the accident:

4. If door warning comes on or air leak is noted at main entrance door in pressurized flight, the following action is required:
 - (a) Move passengers from two left-hand seats just forward of main entrance door and have one flight crew member guard area at all times at safe distance and conduct any desirable investigation with proper safeguards from safe distance.
 - (b) If door handle or bayonets not in place, as soon as conditions permit descend to safe altitude, depressurize, and properly engage door locks. Pressurized flight may be resumed if lock can be engaged.
5. Use guard rope in main door area at all times.
6. Thorough maintenance investigation any flight item on main door warning system at next station to insure maximum dependability of warning system; also strict adherence to established door rigging and inspection procedures at routine services.

On September 15, 1952, the company issued an Operations Information Bulletin for insertion in all B-377 operations manuals. It included the above directives and the following:

"RESPONSIBILITY FOR DOOR INSPECTION:

1. When there is one flight engineer aboard, the Captain shall be responsible to assign a qualified crew member to make the after pressurization check covered in Item (4) above. 5/

5/ For the purposes of this report "Item 4 above" is in substance items 3 and 4 above.

2. The flight engineer shall be responsible for all ground checks of all hatches for security. Where there are two flight engineers on board, the flight engineer shall be responsible for all air inspections and checks of all hatches for condition and security. Where there is one flight engineer on board, the flight engineer shall be responsible for all air checks of all hatches for security after inspection by a qualified pilot has initiated a report of any abnormal condition or malfunctioning of any door engaging mechanism. The procedure outlined in the first section of this memorandum must be followed for all these inspections and checks."

Although the flight engineer had been given a brief indoctrination of the B-377 exterior doors and their locking devices at the Boeing factory, apparently no continuing program of familiarization of such devices had been instituted by the company for either the flight crew or the cabin attendants. However, such a course has now been established and is in effect for all pertinent crew members.

The captain's formal schooling in connection with the doors had been more than two years before the accident, and there is no record of his having received any refamiliarization on the subject.

Of course, the B-377 operations manual which is required to be aboard the aircraft and is available to all flight crew members contains full information relative to doors and their operation.

Pan American World Airways temporarily suspended both Captain Fly and Flight Engineer Knight until the investigation of this accident was completed. The flight engineer was later discharged by the company, and the captain returned to flight status in his former capacity.

The Civil Aeronautics Administration took the following action as a result of this accident:

1. Admonished the company by letter to make all B-377 cabin attendants familiar with the locking of the cabin door sufficiently to allow them to recognize a hazardous condition, and to make flight crew members familiar with door mechanisms and safety devices.
2. Reprimanded the captain by letter for continuing the flight with a pressurized cabin without taking further precautionary measures and ignoring danger warnings, but not for wilful disregard for the safety of the flight. A copy of this letter has been placed in the captain's airman certificate file, CAA, Washington, D. C.
3. The Miami office of the CAA recommended to the Administrator, Washington, D. C., that the airman certificate of the flight engineer be suspended for three months subject to its being renewed upon his passing a written, oral and practical examination administered by an authorized agent of the CAA.

Findings

On the basis of all available evidence the Board finds that:

1. The carrier, the aircraft and the crew were properly certificated.
2. When the flight reached an altitude of 12,000 feet, the cabin pressure differential was 4.1 psi.
3. The main cabin door blew open in flight because it was not fully locked.
4. This unsafe condition was not recognized by the flight engineer.
5. The captain failed to evaluate properly the warnings and continued flight under pressurized conditions.
6. A passenger seated nearest the door was blown through it and lost at sea; none of the other occupants was injured.
7. Considerable damage occurred throughout the interior of the cabin.
8. Following the decompression the flight at once descended and returned to Rio de Janeiro.

9. The door locking mechanism and all its associated safety devices were inspected and found to be functioning normally.

10. The door frame seal loosened and sagged sufficiently to jam and prevent fully locking the door prior to take-off, resulting in a substantial air leak during pressurized flight.

11. Later tests revealed an air leakage due to loose metal screws in the door frame trim angle.

12. This leakage eventually deteriorated the bond between the door frame seal and liner.

13. The company did not maintain an adequate training program relative to exterior door mechanisms and safety devices on the B-377, so that hazardous conditions could be avoided.

Probable Cause

The Board determines that the probable causes of this accident were,
(a) the flight engineer's failure to recognize an unsafe condition of the cabin door despite three completely separate warnings of that condition; and
(b) the captain's action in continuing flight while pressurized despite the several warnings that the main cabin door was not properly locked.

BY THE CIVIL AERONAUTICS BOARD:

/s/ DONALD W. NYROP

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

/s/ CHAN GURNEY

S U P P L E M E N T A L D A T A

Special Investigation

The Civil Aeronautics Board was notified of this accident at 1600 GMT, July 27, 1952, at Rio de Janeiro, Brazil, and an investigation was immediately initiated in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. In connection with the investigation, depositions were taken and other documents including photographs were made a part of the record at Washington, D. C.; Miami, Florida; and at Jamaica, Long Island, New York, in lieu of a public hearing.

Air Carrier

Pan American World Airways, Inc., is a New York corporation, having its main offices at 135 East 42nd Street, New York City, and operates as an air carrier under a certificate of public convenience and necessity and an air carrier operating certificate issued pursuant to the Civil Aeronautics Act of 1938, as amended. These certificates authorize the carrier to engage in air transportation with respect to persons and property between various points in the United States and foreign countries, including Rio de Janeiro, Brazil, South America,

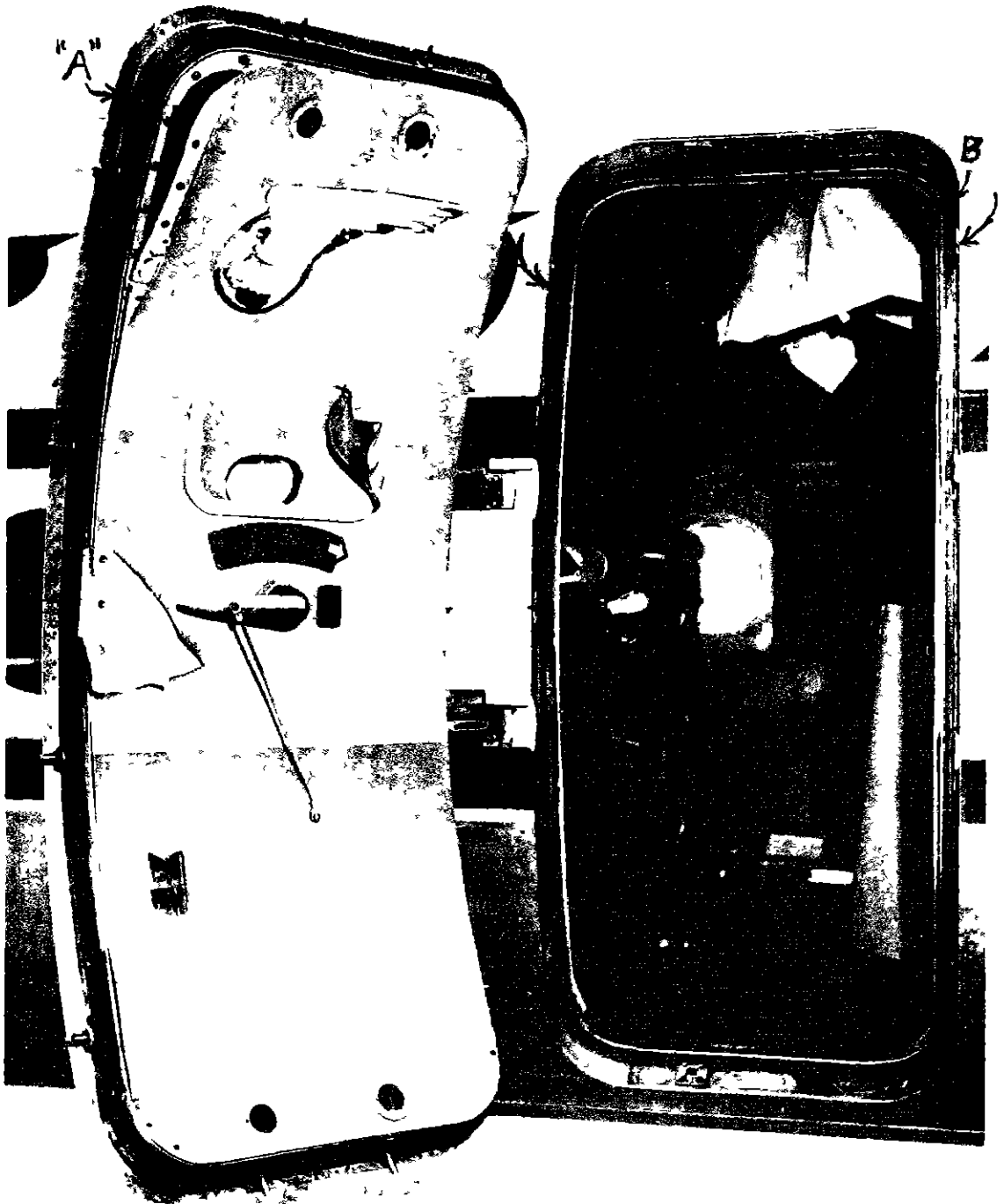
Flight Personnel

Captain George Lafayette Fly, age 42, was employed by Pan American World Airways on October 2, 1939. He was the holder of a valid airman certificate with an airline transport rating for single and multi-engine land and sea aircraft, 0-6600 horsepower. Captain Fly had a total of 10,729 flying hours, of which 1,574 hours were in B-377 aircraft. He had received his last CAA physical examination on May 28, 1952.

Flight Engineer J. D. Knight, age 38, was employed by Pan American World Airways on March 1, 1942. He was the holder of a valid airman certificate for a flight engineer, and an aircraft mechanic and engine mechanic ratings. Mr. Knight had a total of 7,744 flying hours, of which 2,607 hours were in B-377 aircraft. His last CAA physical examination was on June 6, 1952.

The Aircraft

N 1030V, a Boeing B-377 Stratocruiser, was owned and operated by Pan American World Airways and was currently certificated by the Civil Aeronautics Administration. It had a total of 7,885 flying hours and was equipped with Pratt & Whitney R-4360, TSB3-G engines and Hamilton Standard 24263 propellers.



ATTACHMENT "A" - Exhibit 4B-1

1. Near Rio de Janeiro, Brazil, 7/27/52

PAWA B-377 N 1030V

Showing door as found (except upholstery along top of door which was pulled loose by investigators). NOTE: Indentation of door and door seal at "A". Frame seal missing between arrows. Slight indentation of frame at "B".

Note that inside door handle is horizontal (locked position) and that all locking bolts are fully extended, demonstrating that the locking mechanism was functioning normally.