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AIRCRAFT ACCIDENT REPORT

OVERSEAS NATIONAL AIRWAYS, INC.
DOUGLAS DC-9, N935F
OPERATING AS ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ FLIGHT 980
NEAR ST. CROIX, VIRGIN ISLANDS
MAY 2, 1970

Adopted: March 31, 1971

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591

REPORT NUMBER: NTSB-AAR-71-8

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15. Supplementary Notes

16. Abstract: Overseas National Airways pperating as Antilliaanse Luchtvaart Maatschappij, Flight 980 (ALM), was ditched near St. Croix. Forty persons, including 35 passengers and five crewmembers survived. Twenty-three persons, including two infants and the stewardess, did not survive. The aircraft sank in **5,000** feet of water and was not recovered.

The flight departed Kennedy International Airport, **N.Y.**, nonstop for St. Maarten, Netherlands Antilles. After and ADF and three circling approaches in poor weather, during which a landing could not be made, the flight departed for St. Croix. Enroute to St. Croix in a low-fuel state, the aircraft was descended to the water in anticipation of a ditching. When fuel exhaustion was reached, the engines flamed out and the aircraft was ditched.

The National Transportation Safety Board determines that the probable cause of this accident was fuel exhaustion which resulted from continued, unsuccessful attempts to land at St. Maarten until insufficient fuel remained to reach an alternate airport. A contributing factor was the reduced visibility in the approach zone because of rain showers, a condition not reported to the flight.

The Board **also** finds that the probability of survival would have been increased substantially in this accident if there had been better crew coordination prior to and during the ditching.

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NATIONAL TRANSPORTATION SAFETY BOARD
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AIRCRAFT ACCIDENT REPORT

Adopted: March 31, 1971

OVERSEAS NATIONAL AIRWAYS, INC., DC.9, N935F OPERATING AS ANTILLIAANSE LUCHT VAART MAATSCHAPPIJ FLIGHT 980 NEAR ST. CROIX, VIRGIN ISLANDS MAY 2,1970

SYNOPSIS

An Overseas National Airways, Inc. (ONA), DC-9, N935F, operating as Antilliaanse Luchtvaart Maatschappij Flight 980 (ALM 980), was ditched approximately 30 miles east-northeast of St. Croix, Virgin Islands, at 1549 e.s.t., on May 2, 1970. Forty persons, including 35 passengers and five crewmembers, survived, The remaining 23 persons on board, including two infants and a stewardess, did not survive. The aircraft sank in water more than 5,000 feet deep, and was not recovered.

The flight, from John F. Kennedy International Airport, New York, to Juliana Airport, St. Maarten, was being under terms of a lease agreement, utilizing an ONA aircraft and flightcrew, and an ALM cabin crew. ALM 980 established radio contact with Juliana Tower and received clearance for an Automatic Direction Finding (ADF) approach to Runway 09. The weather was reported as scattered clouds at 800 feet, estimated ceiling 1,000 feet broken, 5,000 feet overcast, and visibility 2 to 3 miles. The crew sighted the runway too late to land successfully on this approach, and attempted two left turn, visual circling approaches. The first circling approach was abandoned because of poor alignment with the runway again, and on the second one the captain was unable to maintain the proper descent profile without reducing power and increasing the sink rate beyond acceptable limits. The captain executed a missed approach, made a low altitude return to the St. Maarten Radio Beacon (Rbn), and was given clearance to St. Thomas at an assigned altitude of 4,000 feet. The fuel gauges were reported to have been acting erratically during the climb, but momentarily stabilized at 850 pounds of fuel remaining. A higher altitude was requested and a course adjustment was made for St. Croix, which was closer. Although the captain doubted the accuracy of the fuel gauge reading, he decided to descend in order to establish visual contact with the water. He also advised the purser that they were low on fuel, and to prepare the cabin for ditching. The purser made this announcement, and no other warning was given to the passengers prior to impact.

The ditching site was confirmed on radar with the assistance of a Pan American World Airways flight that diverted for that purpose. Other fixed-wing aircraft orbited the area until the U.S. Coast Guard, Navy, and Marine Corps helicopters began picking up survivors. Weather in the area during the rescue operation was estimated to be 400 to 500 feet overcast and visibility as low as three-eighths of a mile in rain.

The National Transportation Safety Board determines that the probable cause of this accident was fuel exhaustion which resulted from

continued, unsuccessful attempts to land at St. Maarten until insufficient fuel remained to reach an alternate airport. A contributing factor was the reduced visibility in the approach zone because of rain showers, a condition not reported to the flight.

The Board also finds that the probability of survival would have been increased substantially in this accident if there had been better crew coordination prior to and during the ditching

The Board has recommended that actions be taken to improve passenger safety through adequate warning, proper briefing, standardized seatbelts, and more accessible stowage of lifevests for emergencies. Additionally, the Board recommended priority action in the establishment of a VHF communications link between San Juan and St. Maarten.

Finally, the Board recommends that the FAA reassess the standards pertaining to certification of flotation equipment used aboard aircraft.

1. INVESTIGATION

1.1 History of the Flight

Antilliaanse Luchtvaart Maatschappij Flight 980 (ALM 980), operated pursuant to a lease agreement with Overseas National Airways, Inc. (ONA), between John F. Kennedy International Airport (JFK), New York, and Juliana Airport, St. Maarten, Netherlands Antilles. ONA furnished a DC-9, N935F, and flightcrew, and ALM provided the cabin attendants.

N935F arrived at JFK at 0747[1] on May 2, 1970. There were no maintenance writeups on the aircraft; two previously recorded carryover items were corrected and signed off. However, the captain testified that the public address system from the cockpit to the cabin was discovered to be inoperative, prior to departure from JFK.

After the aircraft was taxied to the International terminal, the total fuel on board was 7,800 pounds. When a fuel truck arrived, 3,139 gallons were pumped from the underground hydrant system, and the aircraft fuel gauges--both at the right wing fueling station and in the cockpit--indicated 28,900 pounds of fuel on board. The fueling operation was completed at approximately 1015.

The captain computed the fuel required for this flight by using a cruise mach of 0.78 and an altitude of 29,000 feet for the first half of the flight, and long range cruise for the remainder. The computed fuel burnoff was rounded off to 21,000 pounds. The reserve fuel requirement predicated on the Federal Aviation Regulations (FAR) was 6,400 pounds, computed as follows:

En route Reserve (10 percent)	2,100 pounds
Fuel to Alternate (St. Thomas]	2,100 pounds
Hold fuel at 1,500 feet (30 minutes)	2,200 pounds
Total fuel reserve per FAR 121.645	6,400 pounds

However, bulletins received by the captain on the morning of the flight established a new company requirement for fuel planning purposes. The minimum estimated fuel on arrival at destination (EFA) for a nonstop flight to St, Maarten was established as 7,000 pounds. This meant that unless the fuel reserve requirements were computed to be 7,000 pounds or more, a nonstop flight should not be planned. The captain's computed EFA in this case was over 7,000 pounds; consequently he used this higher reserve fuel figure to arrive at the 4:34 hours' endurance figure in his flight plan. He noted during preflight that the 28,900 pounds of fuel on board exceeded the planned requirements by 900 pounds.

The flightcrew for ALM 980 had filed an Instrument Flight Rules (IFR) flight plan to St. Maarten requesting Flight Level 290 (FL 290), and indicated a time en route of 3 hours 26 minutes. The selected alternate was St. Thomas, Virgin Islands, and the computed time to fuel exhaustion was 4 hours 34 minutes. The airways routing was via Control 1147 to Tuna Intersection, Blue 23 to Roy Intersection, Amber 23 to Guava Intersection, and direct to St. Maarten.

The flight left the terminal at 1102 and departed on Runway 13R at 1114. At the time power was applied for takeoff, the fuel totalizer

[1] All times herein are eastern daylight, based on the 24-hour clock, unless otherwise noted.

read 28,450 pounds. The departure and climb to FL 290 were normal, and a crusise mach of 0.78 was established. Slightly north of Landry Intersection, approximately 600 miles southeast of New York, the cruise mach was reduced to 0.76. In the vicinity of Ginny Intersection, approximately 929 miles south of New York, the turbulence penetration speed was selected and some minor deviations were made due to weather. ALM 980 passed Ginny Intersection at 1325 and approximately 11 minutes later requested and received clearance to descend to FL 270 (Flight Level) where 0.74 cruise mach was used. After passing Grant Intersection, approximately 1,145 miles south of New York, the flight was cleared to descend to FL 250 due to turbulence and the cruise mach was adjusted to 0.72. At 1424, the flight passed Guava Intersection, approximately 211 miles north of St. Maarten, with 8,600 pounds of fuel on board. The captain estimated that they would arrive at St. Maarten at 1500 with 6,000 pounds of fuel.

Shortly after ALM 980 was given a final descent clearance to 10,000 feet, San Juan Air Route Traffic Control Center (ARTCC) advised that the St. Maarten weather was below landing minimums. The captain requested a repeat of that information and then asked for clearance to San Juan at FL 210. At 1445:50, the flight diverted for San Juan. However, during the next 5 minutes, Juliana Tower advised the flight that the weather had improved to an estimated ceiling of 1,000 feet broken, 5,000 feet overcast and 4 to 5 miles visibility in rain. With these weather conditions, flight below 1,000 feet presumably could be accomplished by visual reference to the ground. The flight was given a new clearance to St. Maarten at 1451, with permission to descend to 10,000 feet at pilot's discretion. The captain noted at this point that 5,800 pounds of fuel remained, and estimated that they could arrive at the ramp at St. Maarten at 1505 with 4,400 pounds of fuel. ALM 980 was cleared to descend to 6,000 feet, and subsequently cleared for an approach to Juliana Airport at approximately 1500.

At approximately 1508, the flight reported level at 2.500 feet and the tower controller advised that the weather was 800 feet scattered, estimated ceiling 1,000 feet broken, 5,000 feet overcast, visibility 2 to 3 miles. The crew commenced the approach at 1515, and they were cleared to make any turns desired in case of a missed approach. On this approach the crew did not sight the runway in sufficient time to align the aircraft for a landing, and a left turn was made to reposition the aircraft, by visual reference to the ground, for another landing attempt at approximately 1519. This attempt was also unsuccessful because of poor alignment with the runway. During both of these approaches, the aircraft had been flown with 25" flaps, landing gear down, and 140 knots airspeed. After the second landing attempt was aborted, the captain selected full flaps and maintained 128 to 130 knots airspeed for the third approach. On this occasion, he was successful in aligning the aircraft with the runway, but he was too high and close in to maintain the proper descent profile without reducing power below acceptable limits. The captain stated that during the approaches a moderate rain shower was in the area where he was turning on a base leg, but generally visual contact with the field was maintained. The weather remained relatively unchanged throughout this period.

The first officer computed the bug speed for the landing approach to be 118 knots. He later attempted to revise it to 115 knots during the subsequent landing attempts, but the captain instructed him to leave it at 118 knots. He stated that the weather reported by the tower was consistently 1,000 feet overcast and 3 miles visibility.

Witnesses at St. Maarten, who observed the approaches of ALM 980, varied greatly in their estimates of the visibility, ranging from 2 miles to as low as onequarter mile to one-half mile. There was general agreement that visibility was better at the field than in the approach areas to the north and west.

Following the third unsuccessful attempt to land, the captain returned to the St. Maarten Rbn and elected to divert to St. Thomas. The flight was cleared to St. Thomas via direct route at 4,000 feet by the Juliana Tower and, at 1531,

ALM 980 was instructed to contact San Juan ARTCC. The captain testified that during the climb to 4,000 feet the fuel gauges and totalizer were erratic, but the totalizer indication stabilized momentarily at 850 pounds while the aircraft was level at 4,000 feet. The copilot recalled hearing, or seeing the figure of 850 pounds. He stated, "During the missed approach procedure the captain and the navigator were discussing the fuel remaining. I noticed the fuel totalizer tumbling, at which time I took notice of the fuel burn indicators, on the right indicator only 13,156 pounds was burned. I do not remember the exact indication of the left indicator, although I believe the indication was similar to the right one."

The navigator testified, "The only time I saw 850 pounds was this one time, initially. The numbers that seem to stand out 'after this bobbing around was 1,350-1,400 pounds. I also was receiving higher readings in the 2,000 range."

The captain stated that fuel cross-checks had been made en route, and no discrepancies had been noted until after the departure from St. Maarten. His last recollection of fuel quantity was 3,800 pounds, which he testified he had observed when the aircraft was on the downwind leg of the third landing attempt. He testified that after the reading of 850 pounds was observed, "My navigator and I were discussing it, and I told him that there is no way that we could possibly at this particular time—no way in my judgment have less than 2,000 pounds of fuel on board this aircraft. The gauges had to be giving out some sort of erroneous reading."

Radio contact with San Juan ARTCC was established at 1531:15. The flight was advised that a higher altitude would be assigned. Although there were no intervening requests for higher altitude, the controller called their attention to conflicting traffic at 12 o'clock, 10 miles, at 1532:40. Approximately 1 minute later, he asked what altitude they were requesting. At 1533:40, the flight advised, "Anything you've got higher, I'm a little short on fuel and I gotta get up." The flight was cleared to FL 120, and during the climb requested clearance to St. Croix, which was 11 miles closer. The captain indicated that he used reduced power and airspeed in the climb in an effort to consume less fuel. At 1538:38, in response to a request to descend, the flight was cleared to 5,000 feet. Concerning this request to descend, the captain testified, "By the time I had gotten to 7,000 feet in the climb, and the navigator and I were trying to analyze the situation, and also deciding on closer fields, et cetera, I decided that there was no way for me to decide whether the gauge was accurate or inaccurate. I had to believe it. If at this time I did in fact have this low fuel, I would best get back on the water and try to find a place to ditch the aircraft." Less than 1 minute later, the captain reported to the San Juan controller, "Okay there's a possibility I may have to ditch this aircraft, I am now descending to the water." He also called the purser forward and told him to prepare the cabin for ditching. During the next several minutes, the crew inquired about their position and the availability of assistance, and they were apprised of the rescue efforts which were already in progress. At 1547:40, they stated, "Nine eighty roger.. .ah.. . we're ditching." The radar target was lost at 1548:40.

The captain leveled off momentarily at 500 feet and positioned the aircraft over an established "swell system." He then descended in 100-foot increments, pausing momentarily to improve his depth perception. At approximately 20 feet, he lowered 15° flaps and allowed the airspeed to decrease from the previously maintained value of 145 to 150 knots.

When the low fuel pressure lights flickered, he selected full flaps. Shortly after this, the engines flamed out, and he flew the aircraft onto the water at approximately 90 knots while maintaining the aircraft body angle at 5° to 6° noseup.

The ditching occurred during daylight hours at approximately 17°53' N. latitude and 69°14' W. longitude. The captain stated that just prior to impact, he flashed the seatbelt and "no smoking" signs. Since radar contact with the flight was lost at 1548:40, ditching is presumed to have been at approximately 1549.

1.2 Injuries to Persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal	**1**	**22**	0
Nonfatal	**2**	**35**	0
None	**3**	0	

1.3 Damage to Aircraft

The aircraft remained essentially intact, but after floating for approximately 10 minutes, it sank in more than **5,000** feet of water and was not recovered.

1.4 Other Damage

None.

1.5 Crew Inforamtion

The crew was qualified for the flight. (See Appendix B for details.)

1.6 Aircraft Information

The aircraft was properly certificated and had been maintained in accordance with existing regulations. The weight and center of gravity were within prescribed limits. N935F was fueled with aviation kerosene at JFK. (See Appendix C for details.)

1.7 Meteorological Information

The captain of ALM **980** was provided the standard Weather Bureau documentation for the route of flight at JFK. The aviation terminal forecast for St. Maarten, issued at **0545** by the forcecast office at San Juan, valid for the **24-hour** period beginning at 0800 **was** as follows:

Wind 110°, 10 knots, visibility *6* miles, haze, **2/8** cumulus, bases at **2,500** feet, **5/8** altocumulus, bases at **10,000** feet, **6/8** cirrostratus, bases at **30,000** feet, temporarily wind direction variable, speed **15** knots, visibility **5** miles, showers, *6/8* cumulus, bases at **1,500** feet, 20 percent probability wind direction variable, speed **25** knots, visibility 1½ miles, thunderstorm, **2/8** cumulonimbus, bases at **500** feet, **6/8** cumulus, bases at **1,500** feet, no amendments **2300-1200.**

An in-flight weather advisory, AIRMET Alfa I, issued at **0840** and valid **0900-1300** indicated, in part: Over Puerto Rico, the Virgin Islands, the northern Leeward Islands and adjacent waters and northwestward along Amber **17,** ceilings and visibility locally below **1,000** feet and **2** miles in scattered to locally numerous showers and thunderstorms. Continuing past **1300.**

Winds-aloft observations were in part as follows:

Height (feet m.s.l.)	*Direction (° true)*	*Velocity (knots)*
	San Juan (1916)	
20,000	**230**	**30**
25,000	**255**	**46**
30,000	**235**	**41**
	St. Maarten (0800)	
4,000	**130**	**19**
6,000	**140**	**21**
8,000	**145**	**18**
12,000	**170**	**29**
16,000	**205**	**32**

The surface weather observations at St. Maarten were as follows for the times listed:

1400 - **1,000** feet broken, **5,000** feet overcast, visibility **6** miles, rain showers, wind 110°, **14** knots, gusts **22** knots, temperature **25" C.,** dew point 23° C.

1500 - 800 feet scattered, estimated **1,000** feet broken, **5,000** feet overcast, visibility **5** miles, rain showers, rain showers all quadrants, altimeter setting **29.90.**

1600 - 800 scattered variable broken, estimated **1,000** feet broken, **5,000** feet overcast, visibility **3** miles, rain showers all quadrants, altimeter setting **29.90.**

1.8 Aids to Navigation

The Juliana Airport is served by a nondirectional radio beacon (Rbn) located approximately 2,500 feet south of the west end of Runway 9-27. The approved instrument approach to the airport requires the pilot to cross the Rbn at 2,500 feet and proceed outbound on a bearing of 285° while decending to 1,500 feet. The procedure turn must be executed south of this bearing at 1,500 feet. The pilot may then descend to the published minimum altitude on the inbound bearing of 105°. The weather minimums for this approach are 600 feet ceiling and 2 miles visibility.

There were no reported malfunctions of the Rbn during the time ALM 980 was using the facility.

1.9 Communication

Radio communications between the flight and various facilities were normal, except that San Juan ARTCC was unable to receive transmissions on 121.5 **MHz.** Interfacility communications between San Juan ARTCC and Juliana Tower were weak, and at times unintelligible which reduced the effectiveness of the controllers involved. They testified that the problem varies unpredictably between transmitters and receivers at both facilities.

1.10 Aerodrome and Ground Facilities

The Juliana Airport is located on a narrow neck of land on the southwest coast of the island of St. Maarten. The airport elevation is 13 feet. Runway 9-27, the only runway, is 5,249 feet long and 148 feet wide, with an asphalt and concrete surface. The runway is equipped with white omnidirectional lights, and a Visual Approach Slope Indicator (VASI) light system for Runway 9, set for a glide slope of 2.5°. Both systems are of variable intensity, and they were operating during the approaches of ALM 980. There is very little land extending beyond either end of the runway; however, the hills on the main body of the island rise to elevations in excess of 1,000 feet approximately 2 miles east of the runway. These hills are used as checkpoints for estimating the ceiling and visibility. There are no fixed reference points visible in the Caribbean Sea to the south and west.

1.11 Flight Recorders

The aircraft was equipped with a flight data recorder and a cockpit voice recorder, but neither was recovered.

1.12 Wreckage

The aircraft's major components remained intact at impact, but the wreckage sank in approximately 5,000 feet of water. Recovery of the wreckage from this depth was not feasible.

1.13 Fire

There was no fire.

1.14 Survival Aspects

Approximately 10 minutes prior to the ditching, the captain instructed the purser to advise the passengers to don their lifevests and prepare for a ditching. The purser understood this to be a precautionary measure and assumed that further instructions would be given if a ditching were necessary. The steward and stewardess demonstrated how to put on the lifevest as the purser made the announcement over the cabin public address (PA) system. (The cockpit microphone for the PA system was inoperative, and as a result no direct instructions were given from the cockpit.) Then all three cabin attendants assisted individual passengers as necessary. Some could not remove the lifevests from the pouch under the seat, and others were unable to don the vest properly. The navigator was sent back to the cabin to assist with preparations for ditching, and he helped the purser move the 25-man raft from the forward coat closet, on the left side of the aircraft, to the galley area directly opposite on the right side. The steward was also in the galley area securing the galley equipment

when the navigator suddenly was aware that impact was imminent, and shouted for everyone to sit down. The steward sat down on the raft, Cing aft, and the navigator and purser sat in the aft-facing jumpseat on the forward cabin bulkhead. They were unable to fasten their seatbelts prior to impact. Several passengers and the stewardess were still standing, and at least five others did not have their seatbelts fastened at impact. The reactions of passengers ranged from those who used pillows in various "crash positions" to those who looked out the window, assuming that the aircraft was completing an overwater approach to the runway at St. Croix.

Following impact, the purser and the navigator attempted to open the forward main passenger loading door, but found it to be jammed and inoperable. These two crewmembers then moved to the galley area where a third crewman, the steward, had already opened the galley exit door and at least one passenger had made her escape through the galley door. The three crewmen attempted to free the raft from the galley equipment which had spilled to the galley floor. They had just been joined by the first officer in this effort when the raft inadvertently inflated. The inflated raft pinned the first officer to the galley bulkhead, and prevented the other crewmembers from entering the main cabin area. The first officer did not recall how the liferaft became inflated or how he became free from the position in which it pinned him. These four crewmembers exited through the galley door. The captain was aware of the difficulties in the galley area, and entered the water through the cockpit window. He swam to the left overwing exits, opened them from the outside, and assisted two passengers out of the aircraft. The captain then glanced through the cabin for additional passengers but saw none. Most of the passengers exited through the aft right overwing exit, which was opened by a passenger who was seated next to it.

The navigator found an emergency escape slide floating in the water and, with the help of a female passenger, inflated it. The first officer, who had no lifevest, climbed on top of the slide and assumed command of the main group of survivors who gathered around the slide. Belts and ties were used to provide additional handholds for the people.

Although none of the five 25-man rafts on board the aircraft was deployed, several rafts were air-dropped at the ditching site. The U.S. Coast Guard HU-16, an amphibian aircraft, dropped two rafts but both fell too far away to be reached. In addition, a Skyvan dropped two rafts in the area. The captain swam to one raft and the navigator reached the other, but neither was able to maneuver his raft back to the main group.

Recovery of the survivors by helicopter began approximately 1% hours after the ditching, and the last survivor, the first officer, was picked up about 1 hour later. In summary, **11** survivors were picked up by the two **U.S.** Coast Guard HH-52A helicopters, 26 survivors were rescued by a **U.S.** Navy SH-3A helicopter, and the remaining three survivors were picked up by a U.S. Marine Corps CH-46 helicopter.

1.15 Tests and Research

The Douglas Aircraft Company (DACO) computed a fuel consumption study for ALM 980. The parameters for the study were based on maneuvers, airspeeds, and power settings described by the captain during interviews by the operations group on three separate occasions. A flight profile was then constructed by integrating these data with information from the FAA recorded transcripts of communications. (See Appendix D.) The integration resulted in one adjustment in the profile. A "hold" of 3 minutes and 7 seconds was imposed at 10,000 feet to make the study coincide with the altitude reported by the crew.

The study assumed a +5° C. variation from standard day temperature for the en route phase, standard day temperature in the traffic pattern at St. Maarten, and did not include any fuel burned during operation of the auxiliary power unit (APU) prior to takeoff. The fuel charts used for the study made allowance for a higher consumption rate than the standard DC-9-30 series aircraft. This was the result of a

fuel audit by the Douglas Aircraft Company on ONA aircraft and was due to jet assisted takeoff fairings installed on those aircraft.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

There were no malfunctions of the aircraft's systems, powerplants, or airframe. A nonstop flight from JFK, New York, to St. Maarten with a continuation to an alternate (St. Thomas or St. Croix) was within the limits of endurance of the aircraft. The captain and first officer were qualified for the flight.

The cause of this accident lies in the area of flight operations and, specifically, fuel management. The captain's fuel computations indicated that 28,000 pounds of fuel would be required to make the flight and meet the company's minimum EFA of 7,000 pounds at St. Maarten. Prior to the beginning of the operation, the aircraft was loaded with 28,900 pounds of fuel, or 900 pounds in excess of the planned requirement. On his flight plan, the captain entered 3 hours 26 minutes for the time of the flight, and he listed the fuel on board to be enough for 4 hours 34 minutes of flight time.

The captain testified that the en route fuel burnoff of 21,000 pounds was predicated on a 0.78 mach cruise for the fiist half of the route, and long range cruise (LRC) for the last half, both at 29,000 feet. The flight was not flown as planned. The 0.78 mach cruise was abandoned 170 nautical miles prior to the midpoint. Power settings well above those required by LRC were maintained for the remainder of the flight. The last third of the flight was flown at altitudes ranging from 27,000 feet to sea level. All procedures used were conducive to higher rates of fuel consumption than those originally planned.

While the fuel management procedures that were used are demonstrably incompatible with the flight plan procedures, a detailed discussion of the en route procedures is somewhat academic, since the total estimated time to fuel exhaustion of 4 hours 34 minutes compares with remarkable accuracy to the actual fuel exhaustion time of 4 hours 35 minutes. It is, therefore, to the last 1 hour of flight that attention must be directed. Of particular interest are the events which followed the captain's initial decision to divert to San Juan, after being advised that St. Maarten weather conditions had gone below the approved minimums. If the flight had proceeded to San Juan, the accident obviously would not have happened. Of interest, then, are the reasons for altering this decision, and the return to the course for St. Maarten. First, there is the obligation of a flightcrew to deliver passengers to a planned destination, if it can be accomplished safely. In this regard, the revised weather information furnished to the crew by the Juliana Tower Controller, which advised that current conditions were well above minimums, and showed an improving trend, undoubtedly influenced the captain's judgment and was the basis for his considering the attempt to reach the original destination. The governing factor would be the amount of fuel necessary to proceed to St. Maarten, execute an approach, and if necessary, to proceed to the alternate destination, The decision to continue the flight to St. Maarten was made at approximately 1451. At that time, the aircraft had been airborne for 3 hours 37 minutes, or 11 minutes longer than the originally planned flight time of 3 hours 26 minutes.

The captain testified that the fuel reading at 1451 was 5,800 pounds remaining. An ETA for St. Maarten of 1505 had been computed. Based on this time, the captain believed that the flight would be on the ramp at St. Maarten with 4,400 pounds remaining, provided an ADF approach was necessary. These computations were based on an 800-pound fuel burnoff in the descent from 21,000 feet, and allowed 600 pounds for an ADF approach and landing. If a straight-in VFR approach could be executed, the captain estimated the flight would be on the ground with 5,000 pounds of fuel remaining. On this basis, the aircraft would arrive at St. Maarten within the prescribed fuel limits. Time remaining to fuel exhaustion, based upon the original flight plan estimate, was then 57 minutes. At 1451:10,

the flight started descent from 21,000 feet for the intended approach to St. Maarten. However, the flight did not arrive over the St. Maarten Rbn until 1515, 10 minutes beyond the captain's revised estimate. Approximately all the extra 10 minutes were flown at 2,500 feet, at 210 Knots Indicated Airspeed (KIAS). The average fuel consumption in this flight regime would be about 80 pounds per minute (lbs./min.), or 800 pounds for the 10-minute period.

Considering the 800 pounds of fuel burned during the 14-minute descent from 21,000 to 2,500 feet and the 800 pounds required to fly the extra 10 minutes at 2,500 feet, it can be deduced that the flight arrived over the Rbn with about 4,200 pounds remaining. Thus, the remaining fuel would be approximately 100 pounds below the FAA-prescribed alternate fuel requirement. Time to fuel exhaustion would be 33 minutes, based upon the original flight plan estimate. At this point, the captain should have recognized that fuel margins had reached critical limits, and that a timely deviation to the alternate was necessary if there was any significant delay in landing.

The first approach was initiated and, at 1518:30, the field was in sight. The aircraft was not in position from which a landing could be made, and the landing attempt was abandoned. Twenty-nine minutes then remained to the fuel exhaustion time predicted on the flight plan. After the landing was not completed, the captain began a series of close-in, low-altitude, left-hand circles in successive attempts at landing that lasted for approximately 11 more minutes. In all, three circles were made during which the captain attempted unsuccessfully to place the aircraft in a proper landing approach position. During this period, the aircraft was in a landing configuration at high-power settings which were conducive to a high rate of fuel consumption.

The Safety Board notes that the captain testified that he was able to keep the field in sight during the circling attempts at landing. The question then arises as to why an ADF and two essentially VFR approaches were missed, although they should not have posed great difficulties if the reported 2 miles' visibility in the approach zone had actually existed.

The Safety Board believes that the rain shower, reported by the captain to be located at the point where the turn on the base leg was accomplished, had reduced the visibility to the point that forced the approach to be conducted too close to the airport to attempt to keep the runway in sight. The captain must have concluded that the visibility conditions over the water on the final approach flihtpath precluded a successful landing at St. Maarten, or the diversion to St. Thomas, late as it was, would not have been commenced. Accordingly, the Board concludes that the visibility in the most essential area of the approach was far below the announced values derived from visibility markers in other quadrants.

The captain testified that he read 3,800 pounds remaining on the fuel totalizer when the aircraft was on the downwind leg of the second circling approach. As previously stated, the flight arrived over the Rbn with 4,200 pounds and, according to the captain's own estimate, would burn approximately 600 pounds during the approach and landing. It is more logical to assume that the reading of 3,800 pounds was taken sometime between the time of completion of the ADF approach and the start of the first left-hand circling approach, and not later.

The best estimates resulting from the DACO and the Safety Board study of fuel consumed during this flight indicate that approximately 1,400 pounds were consumed during the 11-minute period ending when the flight completed the third circle and again headed for the Rbn. Therefore, the fuel remaining at this time (about 1530) was calculated to be 2,200 pounds. This amount was essentially confirmed by the reading of the fuel flow indicators observed by the copilot. Twenty-one hundred pounds was the amount of planned fuel considered necessary for the flight from destination (St. Maarten) to alternate (St. Thomas), a distance of 109 nautical miles. Theoretically, a successful flight could be made to the alternate, St. Thomas or St. Croix, provided precise procedures were followed. Data obtained from DACO performance charts indicate this possibility. While these calculations indicate that the

aircraft may have been capable of reaching St. Thomas or St. Croix with the remaining fuel, they are based upon zero wind conditions, and do not take into account other variables that could affect the precise flight track and profile required. If the captain had elected to continue to climb on course to St. Thomas, or St. Croix, he would have opened the possibility of fuel exhaustion at altitude. The result would have been a powerless glide through an overcast to the water with little or no opportunity to set the aircraft up for a ditching. Such a ditching might not have been so successful as the one being discussed here.

With respect to any confusion resulting from erratic fuel gauges after the flight departed from the St. Maarten Rbn at **1530,** the Board notes that no one recalled how much fuel remained immediately prior to the time the fuel quantity gauges and totalizer began spinning. The first officer did note at some point during this period that the right fuel flow digital indicator showed that **13,156** pounds had been burned, and that the left indicator had a similar reading. This led him to conclude that there was still 2,500 pounds of fuel on board.

The validity of his estimate may be examined as follows:

Fuel on board at JFK	**28,900** pounds
Fuel used according to digital counters	**26,312** pounds
Difference	**2,588** pounds

When the approximately 250 pounds of fuel used by the auxiliary power unit, and which is not recorded on the fuel-used counters, is subtracted, the fuel remaining would be **2,238** pounds, or within **38** pounds of the amount arrived at by the Board's calculations. These figures compare with the **2,114** pounds which the DACO study projects would have remained at the initiation of the climb from the St. Maarten Rbn.

The captain stated that the 850-pound reading was taken at about the time ALM **980** established contact with San Juan ARTCC at **1531:15,** or about **1** minute 15 seconds after departure from St. Maarten Rbn. The Board believes that the 850-pound reading was a result of normal erratic behavior of the totalizer, due to a combination of the low fuel state, aircraft attitude, and the effects of turbulence, and not the result of a previously undetected malfunction which suddenly corrected itself at this point in time. This is confirmed by the navigator's testimony of several subsequent momentary readings, ranging from **1,300** pounds to 2,000 pounds, and by the fact that the aircraft engines continued to operate for at least 17 minutes after the 850-pound reading was observed.

The time that the aircraft was able to remain airborne after departure from St. Maarten is within **2** minutes of the time available as projected by both the DACO and Safety Board studies, and is consistent with the fuel consumed against time over other segments of the flightpath.

The Board notes that the captain did not ask for a specific altitude when he advised Juliana Tower of the decision to divert to St. Thomas, nor was there any mention of the low fuel condition when contact was made with San Juan ARTCC. Consequently, the controller waited for the flight to pass conflicting traffic before he issued a clearance to climb to FL **120.** Even after the delayed initiation of the climb, the captain did not use full power. Rather, he used a low power and low airspeed climb which was much less efficient in terms of distance than a full power climb would have been. Thus, any opportunity to reach St. Thomas or St. Croix was diminished.

When the captain requested a climb from **4,000** feet to any higher altitude, at **1533:40,** he was even then committed to land either at St. Maarten or somewhere in the water. Shortly after initiating the descent, he made the first reference to San Juan ARTCC of the possibility that the aircraft might have to be ditched. At approximately this time, he also advised the purser that they might have to ditch. If the seatbelt and no-smoking *signs* were flashed as the captain testified, there was no prior cockpit-cabin coordination conveying the significance of such an act, and it was not observed. This

omission undoubtedly affected the survival prospects of the passengers during and after the ditching.

There is no doubt that the ditching was accomplished under extremely adverse conditions. The captain demonstrated exceptional airmanship in the control of the aircraft, and the first officer and navigator greatly minimized the loss of life while awaiting rescue in the water. The effectiveness of three cabin attendants was reduced because of their lack of knowledge of what was happening, and the short preparation time available to them.

2.2 Conclusion

(a) Findings

1. The aircraft was properly certificated and airworthy.

2. The crewmembers were properly certificated.

3. The aircraft was capable of flying the trip nonstop.

4. The crew should have been well aware that their arrival at St. Maarten would be with approximately 4,300 pounds of fuel, their planned diversion fuel requirement.

5. Visibility in the approach zone of Runway 9 was less than that at the airport, but there were no satisfactory reference points to accurately indicate the visibility.

6. The captain attempted one ADF approach, two additional landing approaches, and a missed approach departure procedure in the St. Maarten area. In so doing, he used up the fuel necessary for diversion to an alternate airport.

7. There were no malfunctions of the fuel indicating system. The erratic action of the gauges during the climbout from St. Maarten resulted from the low fuel state, turbulence, and relatively high nose-attitude.

8. Notwithstanding any instrument indications of fuel quantity, the captain should have realized that he was at or near minimum fuel for successful diversion to his alternate, and should have employed the most efficient means of reaching that alternate. This included the use of emergency authority.

9. The cabin attendants did not fully appreciate the gravity of the situation. They were not given signals to warn that ditching was imminent and to brace for impact, which then could have been relayed to the passengers.

10. The preoccupation of the navigator, purser, steward, and the first officer, with the liferaft in the galley area, followed by the raft's inflation, precluded the four crewmen from assisting others in the cabin. The inflation of the raft also denied passengers the use of the galley door for possible egress.

(b) Probable Cause

The Board determines that the probable cause of this accident was fuel exhaustion which resulted from continued, unsuccessful attempts to land at St. Maarten until insufficient fuel remained to reach an alternate airport. A contributing factor was the reduced visibility in the approach zone because of rain showers, a condition not reported to the flight.

The Board also finds that the probability of survival would have been increased substantially in this accident if there had been better crew coordination prior to and during the ditching.

3. RECOMMENDATIONS

As a result of this investigation the Safety Board recommended that the Federal Aviation Administration take the following actions:

(a) Require that the item "warn passengers" be inserted as one of the last items on the emergency landing or ditching checklists of all carriers, yet sufficiently advanced on the list to insure adequate time for passengers to brace for a crash. (See Appendix E.)

(b) Require that no flight involving the briefing of passengers regarding emergency procedures be dispatched without an operable public address system. The system should be functioning so that the flightcrew can speak to the passengers and a cabin attendant can speak to the passengers from at least one cabin station. (See Appendix F.)

(c) Take necessary steps to eliminate, within a reasonable time, the use of fabric-to-metal type seatbelts and require the metal-to-metal type of seatbelt with a standardized activating device. (See Appendix *G.)*

(d) Reexamine the methods for storage of lifevests aboard aircraft to eliminate any obstructions to expeditious access in the event of an emergency requiring their use. (See Appendix H.)

(e) Initiate action to install a VHF communications link between San Juan ARTCC and Juliana Tower. This action was scheduled for fiscal year 1972, and is being considered for priority action prior to that time if possible. (See Appendix I.)

The Safety Board further recommends that:

The FAA reassess the standards set forth in FAR, parts 37.122 and 37.178 pertaining to the certification of liferafts and lifevests, with a view toward eliminating the deficiencies in such equipment as evidenced by the investigative record of this accident. Research and development should be undertaken, as necessary, to accomplish this reassessment and improvement of standards.

The evidence stablished in this investigation indicates that additional deficiencies in survival procedures and survival equipment may exist. Because of this evidence, the Safety Board has in progress the writing of a special report concerning the study of passenger survival in this and other accidents. It is anticipated that this study will yield further recommendations concerning passenger survival.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

INVESTIGATION AND HEARING

1. Investigation

The Board received notification of the accident at approximately 1800 on May 2, 1970, from the Federal Aviation Administration. Investigators were dispatched to St. Croix, and working groups were established for Operations, Air Traffic Control, Weather, and Human Factors. Although there was no group activity in the area of airworthiness, investigators examined all the wreckage that was recovered and reviewed the maintenance records of the aircraft. The Federal Aviation Administration, Overseas National Airways, Inc., Antilliaanse Luchtvaart Maatschappij, Douglas Aircraft Company, *Air* Line Pilots Association, and the Netherlands Antilles Government all participated in the investigation as interested parties. The on-scene investigation was completed on May 9, 1970.

2. Hearing

A public hearing was held at San Juan, Puerto Rico, on July 7 to 11, 1970. Parties to the Investigation included the Federal Aviation Administration, Overseas National Airways, Inc., Antilliaanse Luchtvaart Maatchappij, Douglas Aircraft Company, and Air Line Pilots Association. The Netherlands Antilles Government was represented by official observers.

3. Preliminary Reports

A preliminary report of the investigation was released on June 29, 1970, and a summary of testimony taken at the public hearing was released on August 17, 1970.

Crew Information

Captain Balsey D. DeWitt, aged 37, held airline transport pilot certificate No. 1315809 with ratings in airplane single- and multiengine land, Vickers Viscount, B-707/720, DC-6/7, DC-9, and commercial privileges in the DC-4. He had accumulated approximately 12,000 total flying hours, including 1,700 hours in the DC-9. He completed his last proficiency check on April 8, 1970, and his FAA first-class medical certificate was issued January 30, 1970, with no limitations. Captain DeWitt attended DC-9 recurrent training on August 28, 1969, including instructions in ditching and evacuation procedures.

First Officer Harry E. Evans II, aged 25, held airline transport pilot certificate No. 1541660 with ratings in airplane single- and multiengine land. He did not have type ratings in any specific aircraft. He had accumulated **3,500** total flying hours, including 600 hours in the DC-9. He completed his last proficiency check on April 17, 1970, and attended DC-9 recurrent training on April 15, 1970. Ditching and evacuation procedures were included in this course. His FAA first-class medical certificate was issued December 18, 1969, with no limitations.

Navigator Hugh H. Hart, aged 35, held flight navigator certificate No. 1478586. He had accumulated approximately 7,000 total flying hours, including 17 hours in the DC-9. His last flight check was accomplished on August 3, 1969, in a DC-8. His FAA second-class medical certificate was issued September 23, 1969, with no limitations. He received recurrent training in the DC-8 on August 29, 1969, but his records do not indicate that he received any training in the DC-9.

All flight crewmembers had been on duty 6 hours 48 minutes, with rest periods of 24 hours preceding this period of duty.

The cabin attendants were employees of ALM, and received a special course in the differences between the ONA and ALM equipment on January 7,1970. The regular recurrent emergency training was as follows:

Purser Wilford J. Spencer	August 29,1969
Steward Tobias Cordeiro	August 13,1969
Stewardess Margaret Abraham	August 28,1969

Aircraft Information

N935F, a McDonnell Douglas DC-9-33F, S/N 47407, was delivered to ONA on March 7, 1969. It had been flown a total of 2,505 hours prior to the accident flight. The last major inspection, accomplished at 800-hour intervals, was completed on March 17, 1970. Pratt & Whitney JT8D-9 engines were installed as follows:

Position	Serial *No.*	Time Since Overhaul	Total Time
1	P666818D		2,505
2	P666809D		2,505

The aircraft weighed 103,322 pounds at takeoff, and the center of gravity was 15.3 percent **MAC.** Both values are within the allowable limits.

D A M FUEL CONSUMPTION STUDY

Overseas National Airways, Inc.
DC-9, N935F, ALM Flight 980
Near St. Croix, Virgin Islands
May 2,1970

	SEGMENT	ALTITUDE	SPEED	ΔTIME	TIME[a]	ΔFUEL	FUEL REM	WEIGHT	NOTES
	START TAXI	0		0	150200		28,900	104,222	
	START TAKEOFF	0		12:00	1514:00	450	28.450	103,772	
1	200 KIAS @ 1000'	1,000'	200	1:30	1515:30	400	28,050	103,372	Assumed Time
2	200 KIAS @ 2000'	2,000'	200	0:22	1515:52	84	27,966	103,288	
3	250 KIAS @ 2000'	2,000'	250	0:13	151605	56	27.910	103,232	
4	4000'	4,000'	250	0:45	1516:50	165	27,745	102,067	Out of 4000' 1519:15
5	14,000'	14.000.	290	4:54	1521:44	957	26,788	101,110	Out of 14,000' 1524:35
6	TOP OF CLIMB	29,000'	.72M	1245	1534:29	1,880	24,908	100,230	FL 290 NOW 1538:40
7	ACCELERATION	29,000'	.78M	1:25	1535:54	175	24,733	100,055	
8	TUNA	29,000'	.78M	1:06	1537:00	120	24,613	99.935	
9	ROY	29.000'	.78M	26:W	160300	2,820	21.793	97.115	
10	ROY -- .76M	29,000'	.78M	35:00	1638:00	3,720	18,073	93,395	
11	LANDRY	29.000'	.76M	5:00	1643:00	490	17.583	92,905	
12	GINNY	29,000'	.76M	42:00	1725:00	4,090	13.493	88.815	
13	GINNY - 1737:00	29,000'	.76M	12:00	1737:00	1.160	12,333	87,655	
14	DECEL & DESCENT	27,000'	.74M	3:15	1740:15	302	12,031	87,353	RPT @ 280 @ 1743
15	GRANT	27,000'	.74M	21:45	1802:00	2,135	9,896	85,218	Assume STD+5° Day
16	DECEL & DESCENT	25,000'	.72M	4:24	180624	168	9,728	85,050	
17	GUAVA	25,000'	.72M	17:36	1824:00	1,742	7,986	83,308	Tot. Vic. Guava = 8600
18	GUAVA - 1842	25,000'	.72M	18:00	1842:00	1.785	6,201	81,523	
19	DESCENT	21,000'	320	0:57	1842:57	15	6,186	81,508	
20	HOLD @ 21,000'	21,000'	300	8:13	1851:10	931	5,255	80,577	Tot. Read 58001b.
21	DESCENT TO 10,000.	10,000'	3201250	342	1854:52	76	5,179	80,501	
22	HOLD AT 10,000'	10.000'	250	3:07	1857:55	267	4.912	80,234	
23	DESCENT TO 2500' & DECEL	2,500'	210	4:18	1902:13	116	4,796	80,118	
24	HOLD AT 2500'	2.500.	210	5:47	1908:00	467	4,329	79651	Level at 2500' @ 1908:00
25	HOLD AT 2500'	2,500'	210	7:00	1915:00	566	3,763	79,085	
26	TURN O/BD, PROC. TURN, DESCENT(X)	600.	210	3:30	1918:30	229	3,534	78,856	
27	MANEUVERS TU PT.Y	600'	140	6:27	1925:03	757	2,777	78,099	Tot. Read 3800 Ib.
28	MANEUVERS TO PT.Z	600'	157.5	5:00	193003	663	2.114	77,436	Tot. 850-1250-1850
29	TURN TO 290' & CLIMB TO 4000'	4.000'	250	1:18	1931:21	285	1.829	77.151	Tot. 850
30	HOLD @ 4000'	4.000'	250	3:14	1934:35	282	1.547	76,869	
31	LOW POWER CLIMB TO 7200'	7,200'	250	4:00	1938:35	399	1.148	76,470	
32	DESCENT (FLT. IDLE)	1,200'	190	4:50	1943:25	133	1,015	76,337	
33	DESCENT (FLT. IDLE)	SL	190	1:02	1944:27	32	983	76,305	
34	HOLD NEAR SL			4:33	1949:00	564	419	75.741	* 1/4 Min @ 500'. 400', 300', 200', and 100' @ 170 KIAS. Remainder @ Full Flap at AV. HT. of 50' 140 KTS.

[a] Times listed herein are Greenwich mean time, based on the 24-hour clock

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

September 10, 1970

OFFICE OF
THE CHAIRMAN

COPY

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D.C. 20590

Dear Mr. Shaffer:

Our investigation of the Overseas National Airways **DC-9-33F** ditching near the island of St. Croix on May **2,** 1970, appears to indicate that no warning of impending impact was received in the cabin prior to the crash.

Although the flightcrew did read and execute the company's emergency landing or ditching checklist prior to impact, this checklist did not contain an instruction to warn the passengers. The amplified checklist contained in the aircraft flight manual sets forth this requirement as one of the captain's preimpact duties. The timing and sequence of the warning are further elaborated upon in the emergency procedures section of the company's operations manual. We have examined the emergency checklists of several other air carri-. ers and found that the requirement to warn the passengers does not appear on this checklist, though it is discussed in the emergency procedures section of their flight manuals.

The preparation and bracing of the passengers to accept decelerative forces is, in the Board's opinion, an integral part of configuring the aircraft for a ditching or emergency landing. As such, it should not be left to memory, but should be placed on the emergency checklist for these procedures.

Therefore, we recommend that:

The item "Warn Passengers" be inserted into the emergency landing or ditching checklists of all carriers, and that it be one of the last items prior to impact, yet sufficiently advanced to insure adequate time to permit the passengers to brace for a crash.

Sincerely yours,

/s/ John H. Reed
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

C
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28 SEP 1970

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D.C. 20591

Dear **Mr.** Chairman:

This is in reply to your letter of 10 September 1970 containing a suggestion that the item "Warn Passengers" be inserted on the emergency ditching checklists of all air carriers.

We agree that while the emergency procedures sections of the major air carriers' operations manuals are comprehensive in regard to an anticipated ditching, a preimpact warning to the passengers is not among the items on the checklist.

We will, therefore, initiate a bulletin to our principal operations inspectors requiring them to see that each of their assigned air carriers includes the item "Warn Passengers" on their preditching checklists.

Sincerely,

/s/ K. M. Smith
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

October 29, 1970

COPY

OFFICE OF CHAIRMAN

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D.C. 20590

Dear Mr. Shaffer:

A public hearing was held in San Juan, P. R., on July 7, 1970, in conjunction with the Overseas National Airways DC-9, (ALM Flight 980), ditching near St. Croix on May 2,1970. At the hearing, the flight captain testified that his public address system microphone was inoperative and therefore he could not use the system to give the passengers a "brace for impact" warning prior to striking the water. Instead, he said, he turned the seatbelt sign on and off as an alternate means of alerting the passengers and cabin crew for impact. This proved to be ineffective as this alternate signal was not known to be a "brace for impact signal" by either the cabin crew or passengers. The surviving passengers report receiving no warning of impact. Twenty-three persons lost their lives in this accident, including a stewardess who was reported to be standing in the aisle assisting passengers at the time of impact. The Board believes there would have been fewer lives lost if the passengers and cabin attendants had received adequate warning in time to strap themselves into their seats and prepare for the impact.

Federal Air Regulations Section 121.571 and 121.572 require on all flights the oral briefing of passengers concerning, among other things, the location and operation of emergency equipment and emergency exits. It is difficult to see how such an oral briefing can be adequately given in large presentday aircraft without the aid of a properly functioning public address system.

Although the public address system appears to be a necessity in providing the required passenger briefing, it is not a required item on the ONA DC-9 minimum equipment list (MEL). The Board is not aware of any air carrier aircraft in which the public address system is an item of required minimum equipment. Under these conditions, a passenger-carrying aircraft can be dispatched without adequate means of providing the routine emergency information to the passengers. In addition, with an inoperative system, important instructive messages in time of emergency can be relayed only with difficulty.

The Board, therefore, recommends that:

> The Federal Aviation Administration take the necessary steps to insure that no flight now requiring the briefing of passengers regarding emergency procedures

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

OFFICE OF THE CHAIRMAN

COPY

October 29, 1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D.C. 20590

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The Board, therefore, recommends that:

The Federal Aviation Administration take the necessary steps to insure that no flight now requiring the briefing of passengers regarding emergency procedures

be dispatched without an operable public address system. The system should be functioning so that the flight deck crew can speak to the passengers and a cabin attendant can speak to the passengers from at least one cabin station.

In accordance with established procedures, this letter will be placed in our public docket at the end of the five working-day period commencing the day after the date of this letter. It is understood, therefore, that there will be no public dissemination of this letter until that time.

Sincerely yours,

/s/ John H. Reed
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF THE ADMINISTRATOR

C O P Y

5 NOV 1970

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, **D.C.** 20591

Dear **Mr.** Chairman:

This is in reply to your letter of 29 October 1970 in which the Board recommends that:

> "The Federal Aviation Administration take the necessary steps to insure that no flight now requiring the briefing of passengers regarding emergency procedures be dispatched without an operable public address system. The system should be functioning so that the flight deck crew can speak to the passengers and a cabin attendant can speak to the passengers from at least one cabin station."

We will consider the Board's recommendation as a petition for rule making and will therefore issue a notice of proposed rule making on public address systems in the very near future.

Sincerely,

/s/ J. H. Shaffer
Administrator

APPENDIX G

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANS ——ATION
WASHINGTON, D.C. 20591

OFFICE OF
THE CHAIRMAN

C
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Y

September 14,1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D.C. 20590

Dear **Mr.** Shaffer:

During the recent investigation of the ditching of the DC-9, ALM Flight 980, on May **2,** 1970, near St. Croix, Virgin Islands, a deficiency in the function of passenger seatbelts was found. The seatbelts were of the metal-to-fabric type utilizing a serrated cam in the belt buckle as the latching mechanism. At least six passengers were thrown from their seats, although they had their seatbelts fastened. The suspected deficiency is that the fabric belt slipped through the buckle.

In 1964, the Federal Aviation Administration conducted a survey of this type of belt on recommendation from the Civil Aeronautics Board, and found that four percent of the belts were defective. At that time, FAA issued a directive which recommended to their field personnel that they put special emphasis on checking the adequacy of this type of belt. Since that time, the same deficiencies were noted in the accident involving United **Air** Lines at Norfolk, Virginia, in 1967, and in an in-flight turbulence incident involving a United Caravelle in 1965. In the latter incident, one of the four injured passengers died three days later.

Failure of such seatbelts to lock effectively under loading has been attributed to wear of the cam serrations. It is also thought by many that with acceleration conditions, flailing of the loose belt end may activate the cam and cause unwanted release of the belt. The demonstrated inadequacy of this seatbelt locking mechanism leads the Board to the conclusion that there is a serious question as to the reliability of this safety device.

Review of accident records over the last ten years reveals no indication of failure in the metal-to-metal type of seatbelt.

In view of the above, the Board recommends:

That the FAA take the necessary steps to eliminate, within a reasonable time, the use of fabric-to-metal type of seatbelts in aircraft of U. S. registry and require the metal-to-metal type of seatbelt with a standardized activating device

Sincerely yours,

/s/ John H. Reed
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

APPENDIX G

WASHINGTON, D.C. 20590

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OFFICE OF
THE **ADMINISTRATOR**

21 OCT 1970

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D.C. 20591

Dear **Mr.** Chairman:

This is in regard to your letter of 14 September 1970 concerning the finding that possible latching deficiencies existed in the metal-to-fabric type seat belt buckle assemblies in the Douglas DC-9 involved in a ditching on **2** May 1970 near St. Croix, Virgin Islands, in which the proper ditching procedures were not followed.

As noted in your letter, we have emphasized to field inspection personnel and operators the importance of maintaining the seat belt webbing material and latch serrations in proper condition so that the serrated cam would grip the fabric securely and not permit the web-**big** to slip through the buckle when latched. Service experience since that time has not indicated a need for replacement of this type of belt.

In order to assure a high level of safety belt integrity, in 1969 we initiated a project to renew and update our technical standard orders for various equipment items, including the eat belt Technical Standard Order C-22e. All of the evidence from the ditching investiation and the other cases **in** 1965 and 1967, which you cited, will be of value in **our** curent assessment to revise **our** standards. We would appreciate receiving any additional inbrmation concerning specific seat belt buckle deficiencies that you may have found in lour investigation of the DC-9 ditching at St. Croix. We are particularly interested in information where fabric belts have failed in past instances.

We appreciate your interest in this matter and your recommendations will be considered *I* our project.

incerely,

/ K. M. Smith
Acting Administrator

In accordance with established procedures, this letter will be placed in our public docket at the end of the five working-day period commencing the day after the date of this letter. It is understood, therefore, that there will be no public dissemination of this letter until that time.

Sincerely yours,

/s/ John H. Reed
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

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OFFICE OF
THE ADMINISTRATOR

2 DEC 1970

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D.C. 20591

Dear *Mr.* Chairman:

This will acknowledge your 13November 1970 letter providing additional information on fabric-to-metal seat belt buckle deficiencies, in response to our **21** October 1970 request.

We have the following comments on the incident involving release of a belt buckle during acrobatic flight maneuvers by a Board Investigator in a Champion Model 7ECA airplane.

The manufacturer issued a service letter in February 1968 which recommended that metal. to-metal belt locking means be used in Model 7 airplanes when performing acrobatic flights. The FAA also amended the aircraft specification for the applicable airplanes to provide the same information. The owner of the airplane in which your investigator had the incident should have been aware of the manufacturer's service letter since distribution included all owners of record, all Champion distributors, and various FAA offices. However, since it is evident that the manufacturer has not been successful in getting metal-to-metal type buckles into Model 7ECA aircraft and since fabric-to-metal buckles may be installed in acrobatic aircraft other than the acrobatic Model 7 aircraft, we are taking the following actions:

(1) Proposing mandatory replacement of fabric-to-metal belt assemblies with metal-to-metal units on acrobatic Model 7 series airplanes.

(2) We are considering a project to revise our operating rules pertaining to acrobatic flight, in Federal Aviation Regulations 91, to provide for the improved locking means as a general requirement.

Sincerely,

/s/ J. H. Shaffer
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

OFFICE OF
THE CHAIRMAN

COPY

September 14, 1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D.C. 20590

Dear Mr. Shaffer:

During the recent investigation of the ditching of the DC-9, owned by Overseas National Airways and operated as ALM Flight 980, on May 2, 1970, near St. Croix, Virgin Islands, comments from survivors indicated that many passengers experienced difficulties in removing the lifevest from beneath their seats. The difficulty appeared to be in the release of a strap and snap fastener holding the lifevest pocket closed. A few passengers were unable to remove the lifevests from beneath their seats because of this difficulty. At least two had to get on their hands and knees to effect removal. Other passengers commented on the time consumed by these unnecessary activities. The Board feels that any activity to be performed by a passenger in an emergency should be made as simple as possible, with unimpeded access to the lifevest. The pocket should therefore be left open.

In view of the above, the Board recommends that the Federal Aviation Administration take the necessary steps to:

> Re-examine the methods utilized aboard aircraft for holding lifevests with a view towards eliminating any obstructions to expeditious access in the event of an emergency requiring their use.

Our Bureau of Aviation Safety staff is at your disposal for any further information which you may desire.

Sincerely yours,

/s/ John H. Reed
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON; D.C. 20590

OFFICE OF
THE ADMINISTRATOR

COPY

27 SEP 1970

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D.C. 20591

Dear Mr. Chairman:

This is in *reply to your* letter of *14* September 1970 regarding the DC-9 ditching near St. Croix on 2 May 1970 and the problem of lifevest stowage.

The Federal Aviation Administration is reassessing lifevest installations in light of the information obtained from the DG9 ditching accident concerning passengers who had difficulty in retrieving lifevests from beneath their seats. Where deficiencies are found in any installations, appropriate corrective action will be taken. We appreciate the information and views on the matter which you have provided. If additional information is needed, we will accept your offer of assistance and contact staff members of your Bureau of Aviation Safety.

Sincerely,

/s/ K. M. Smith
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

OFFICE OF
THE CHAIRMAN

COPY

July 7, 1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Department of Transportation
Washington, D.C. 20590

Dear Mr. Shaffer:

The Board's investigation of the Overseas National Airlines DC-9, N935F (ALM 980), ditching accident in the Caribbean on May 2, 1970, has revealed evidence of an unsatisfactory condition of the ATC communications circuit between San Juan Center and Juliana Tower, Philipsburg, St. Maarten, Netherlands Antilles.

Our investigators found the unsatisfactory condition while they were reviewing the records of the San Juan ARTCC pertaining to air traffic services provided the DC-9. The tape recording of voice communications between the San Juan Center (D3 sector controller) and Juliana Tower contains transmissions from Juliana Tower that were extremely weak, unintelligible at times, and not recorded on other occasions. The investigators interviewed the controllers involved and reviewed the transcripts of recorded conversation. They found that the High Frequency (HF) radio communications system (frequency 5122 KHz), used for interfacility communications, was not reliable on several occasions. At times, the two controllers were unable to communicate effectively with each other. Exchange of vital control information was a problem.

Fortunately, this particular communication problem had no direct relationship to causal areas of the accident under investigation. However, it does point to the need for a better communications system between San Juan Center and Juliana Tower. The inadequacies of the existing system make it a potential hazard to the safe, orderly exercise of air traffic control which is the responsibility of the San Juan Center.

The Board has learned that authorities from the Netherlands Antilles Government have recently indicated to your Atlanta Region their desire to establish a VHF communications link between San Juan and Juliana Tower at an early date, if FAA would agree. We understand also that the Atlanta Region recognizes the need for the installation of the VHF communications link between the facilities but does not have funds approved for this needed improvement. In view of the responsibility of the United States for the exercise of air traffic control at Juliana Airport, the Board recommends that:

FAA initiate action to install the VHF link communications system between San Juan Center and Juliana Tower. Such action should result in more reliable interfacility voice communications, so vital to the safe conduct of air traffic control in the area.

Sincerely yours,

/s/ John H. Reed
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

APPENDIX I

WASHINGTON, D.C. 20590

C
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OFFICE OF
THE ADMINISTRATOR

20 JUL 1970

Honorable John H. Reed, Chairman
National Transportation Safety Board
Department of Transportation
Washington, D.C. 20591

Dear Mr. Chairman:

This is in reply to your letter of 7 July 1970 wherein you recommended that the FAA initiate action to install a VHF link communications system between the San Juan, Puerto Rico, Air Route Traffic Control Center and the Juliana Tower, Philipsburg, St. Maarten, Netherlands Antilles.

As indicated in your letter, we have recognized the need for improving the communications capability between these two facilities. Our budgetary planning for Fiscal Year 1972 contains a request to provide VHF communications link service between San Juan Center and Juliana Tower.

To the extent that our fiscal resources and national priorities will permit, we will continue to evaluate the possibility of initiating action before FY 1972.

Sincerely,

/s/ J. H. Shaffer
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

OFFICE OF
THE CHAIRMAN

COPY

September 15, 1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D.C. 20590

Dear Mr. Shaffer:

The National Transportation Safety Board acknowledges your letter of July 20, 1970, in response to our recommendation that the Federal Aviation Administration initiate action to install a VHF link communications system between San Juan Center and Juliana Tower.

As safety is our primary consideration, we appreciate your recognition of the need for improving the capability of those communications by including this request in your budgetary planning for Fiscal Year 1972. We are pleased that FAA will continue to evaluate the possibility of initiating action to provide the necessary equipment before FY 1972.

We hope that FAA can install the subject communications system before FY 1972, and the Board would appreciate being informed when this is done.

Sincerely yours,

/s/ John H. Reed
Chairman

GPO 910-284