



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 25, 2022

Group Chairman's Factual Report

SURVIVAL FACTORS

DCA21FA174

A. ACCIDENT

Location: Honolulu, Hawaii
Date: July 2, 2021
Time: 0145 Hawaii standard time (HST)
1145 coordinated universal time (UTC)
Airplane: Boeing 737-200, N810TA, Rhoades Aviation Inc, dba TransAir Flight 810

B. SURVIVAL FACTORS GROUP

Group Chairman Amanda Taylor
National Transportation Safety Board
Washington, DC

Group Member Angela Cruz
The Boeing Company
Seattle, WA

C. DETAILS OF THE INVESTIGATION

A survival factors investigator was assigned to this case on July 13, 2021, to document the search and rescue aspects of this accident as well as the seats and restraint systems. Air traffic control (ATC) audio transcripts, the U.S. Coast Guard Joint Rescue Coordination Center (JRCC) situation report, and the airport fire incident report were reviewed to create a timeline of the search and rescue. In addition, the investigator collected various electronic records. On-scene documentation of the cockpit seats and restraints was conducted by the group member from Boeing with oversight from the NTSB investigator in charge after the accident airplane was recovered in October 2021.

D. FACTUAL INFORMATION

1.0 Airplane Configuration

The airplane was equipped with two pilot seats, both occupied, located in the cockpit and two observer seats, both unoccupied. The left observer seat was located directly behind the captain and the center line (CL) observer seat was stowed in the compartment just aft of the P-6 panel aft of the first officer seat.

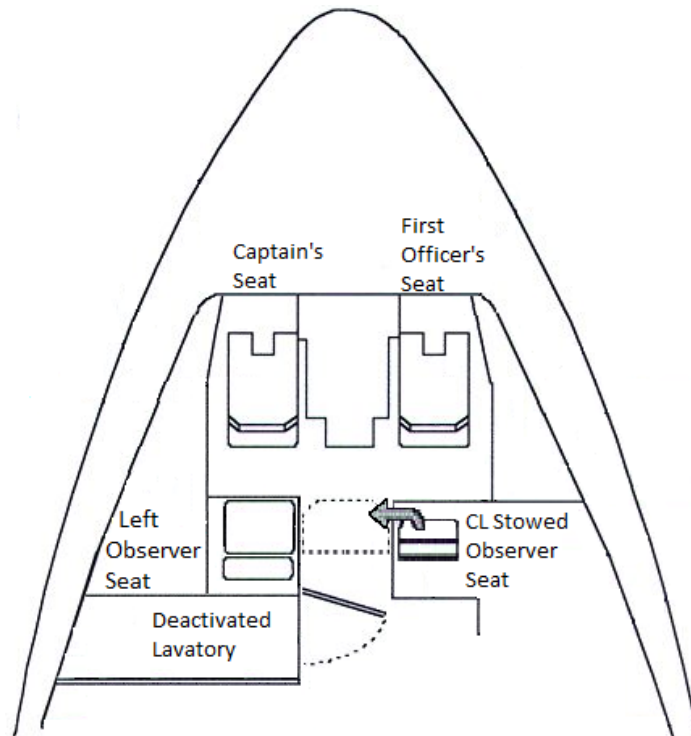


Figure 1 Cockpit layout of N810TA.



Figure 2 The forward section of the accident airplane N810TA.

2.0 Overall Cockpit

The overall floor structure of the cockpit was intact, though there was some buckling in the floor around the cockpit door. The captain cockpit window was fully open and unbroken. While the forward section of the airplane was being rigged for recovery, the first officer cockpit window was partially opened, and unbroken, but was subsequently pushed to the fully open position by the remote operated vehicle (ROV) when routing the cable through the cockpit and out the captain cockpit window. Escape ropes were stowed in their compartments. There was some minor damage to the overhead switches on the right side of the upper control panel. It was

noted that the recovery cable was routed through both cockpit windows by the ROV and may have caused this damage.

3.0 737-200 Cargo Airplanes Operating in the US

The NTSB sent a request for information to the FAA to determine the number of 737-200 and variants flying in the national air space. There was a total of fourteen. Six of those were registered as operating under part 129¹, meaning they are registered with the US, but are not operated in the US.

4.0 Seats

The two pilot seats installed in the cockpit were manufactured by IPECO, with the captain seated on the left and the first officer on the right side. After initial examination in place, the seats were removed from the airplane by TransAir mechanics to document the bottom of the seat and the floor structure below them. After on-scene documentation was completed, the seats were shipped to the NTSB materials laboratory in Washington DC for further examination. For complete details see the Materials Laboratory Factual Report.

4.1 Captain Seat



Figure 3 Captain seat in cockpit after recovery.

¹ 14 CFR Part 129 Operations – Foreign Air Carriers and Foreign Operators of U.S. Registered Aircraft Engaged in Common Carriage.

After recovery the captain seat was intact, secured to the seat tracks which were fastened to a boxed structure that attached to the floor, and was positioned approximately 2.25 inches from the aft stops of the seat tracks. There was no damage to the seat cushions or deformation of the seatpan. The seat was designed to comply with TSO-39b². There was a data tag that read:

P/N 3A090-0019-02-1
S/N 150(illegible)
Issue 1
model: 01096-0001
TSO-C39b

The seat cushions were removed, and no part numbers were identified on the seatpan cushions. The seatback cushion had a data tag with handwritten numbers on a fabric label that read:

P/N 0A 070 0511OH BS4 manufacturing date: 06/04/1990
Batch number: I20078 / 328227
TSO-C72b.

Measurements were taken from the seat to different cockpit structures after recovery to document the occupiable volume. The measurements were taken with cushions in place and with cushions removed.

Measurement Dimension	Measurement Description	With Cushions (inches)	Without Cushions (inches)
A	Seatpan seatback intersection to overhead structure	40.5	43
B	Seatpan seatback intersection to forward overhead structure	36	39
C	Seatpan seatback intersection to top of instrument panel	32.5	35.25
D	Seatpan back intersection to control column	29	30.5
E	Center of seatback to control column	34	35.5
F	Center of seatback to instrument panel	39	40.5

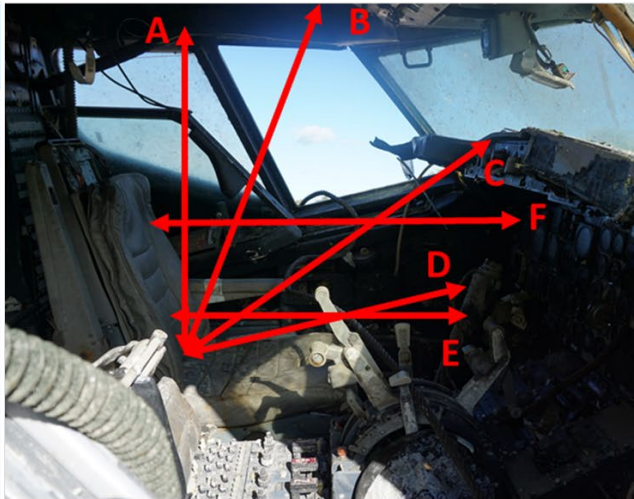


Figure 4 Measurements of the captain seat in the airplane.

After removal from the airplane, it was noted the bungees underneath the seat remained intact as well as the threaded rod and spring which adjusted the seat angle. There was no damage to the boxed seat structure or features below the seatpan.

² Issued 04/17/1987 and superseded by TSO-39c in 02/13/2004.

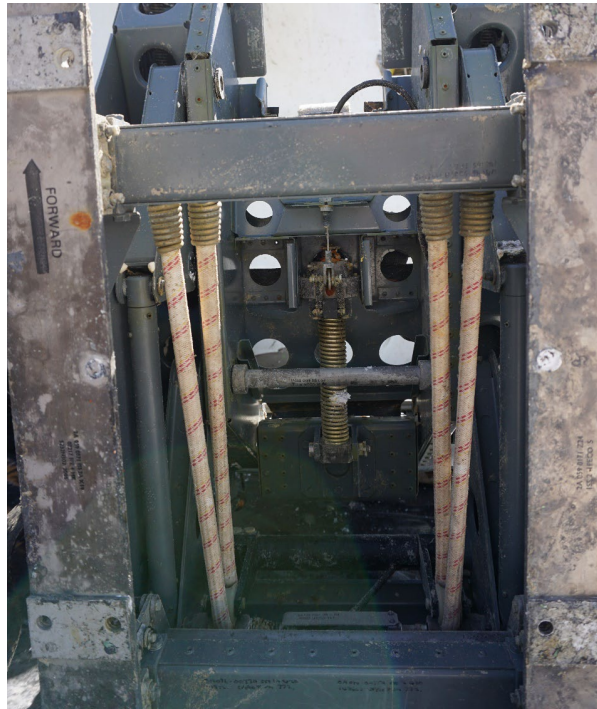


Figure 5 View of captain seat from the bottom after removal from the airplane.

4.2 First Officer Seat



Figure 6 First officer seat in cockpit after recovery.

After recovery the first officer seat was intact, secured to the seat tracks which were fastened to a boxed structure that attached to the floor, and was in its farthest aft position on the tracks. The seatback was rotated forward and was stuck in that

position. A measurement from the top of the seatback in the folded forward position to the instrument panel was approximately 22". The seatback was pulled upright by investigators with considerable force; however the seatback could not remain that way without support.

There was no damage to the seat cushions or deformation of the seatpan noted after removal of the cushions. The seat was designed to comply with TSO-39a³. There was a data tag that read:

P/N 05 0004 01
S/N 4620
Issue 1
model: 0A 059 0008
TSO-C39a

The seatback cushion was glued to the structure and was unable to be removed. The seatpan cushion was removed and there were no part numbers on either cushion.

Measurements were taken from the seat to different cockpit structures after recovery to document the occupiable volume. The measurements were taken with cushions in place and with seatpan cushion removed, additionally the seat back was held in the vertical position. The seatback cushion was measured at 3" thick.

Measurement Dimension	Measurement description	With Cushions (inches)	Without Cushions (inches)
A	Seatpan seatback intersection to overhead structure	48	49.5
B	Seatpan seatback intersection to forward overhead structure	41.25	43.5
C	Seatpan seatback intersection to glare shield or shelf in front	38	40
D	Seatpan seatback intersection to control column	37.25	42.5
E	Center of seatback to control column	34	34*
F	Center of seatback to instrument panel	39	39*

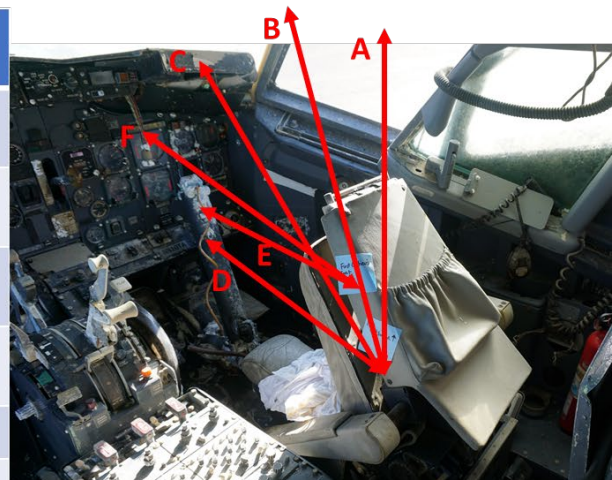


Figure 7 Measurements of first officer seat in the airplane.

The seat was removed with the seat tracks still attached because the rollers were seized to the seat tracks. After removal from the airplane, it was noted that there was damage to the stowage compartment below the seat. The left bungee was broken, and half was missing, the right is connected, however the elastic was broken

³ Issued 02/24/1972 and superseded by TSO-39b in 04/17/1987.

in multiple places. The threaded rod and spring, which adjusted the seat angle, was fractured at the forward end. The rod and spring were removed from the seat.



Figure 8 View of first officer seat from the bottom after removal from the airplane.



Figure 9 First officer seat as viewed from the front looking back, showing damage to stowage compartment.

5.0 Restraint Systems

Pilot seats were both equipped with a 5-point restraint with a central rotary buckle, and inertia reels manufactured by Pacific Scientific. Corrosion on the buckles and tangs was likely due to submersion in seawater. The seatbelts did not become detached from their anchors on the seat, and both sets of restraints were unbuckled. The information printed on the fabric labels sewn onto the seatbelt webbing was indecipherable, or there were no labels present.

5.1 Captain Restraint System

The captain seat upper torso restraint consisted of two belts that routed over the top of the seat into two separate inertia reels. The seatbelts were all intact, however fraying was noted along the sides of the torso belts. Corrosion on the back of the buckle allowed only the manufacturer to be identified.

The inertia reel lock lever position was set to lock. When the upper torso webbing was pulled, the inboard inertial reel allowed webbing to pay out, and the outboard reel did not. Upper torso restraint measurements were taken from where the seatbelt came through the top of the seatback to the tang prior to the seatback cover being removed. The inboard upper restraint was adjusted to a length of 4.25". The outboard upper restraint was adjusted to a length of 4". The inboard lapbelt was adjusted to a length of 20.5". The outboard lapbelt was adjusted to a length of 21.5". The crotch strap was 11". The patent number for both upper restraint inertia reels were 5312066 with a manufacturing date of 04/08 and the part numbers were:

Inboard: 1117032-03

Outboard: FA1117032-03



Figure 10 Captain inertia reels after removal of seatback cover.

5.2 First Officer Restraint System

The first officer seat upper torso restraint consisted of two belts that routed over the top of the seat where they combined to an inverted yoke that went down to a single inertia reel. All portions of the restraint webbing were undamaged. The information on the buckle read:

Code Ident No: 45402
Patent# 2699.732 / 2921.353

The inertia reel lock lever was in the unlocked position. When the upper torso webbing was pulled, the restraints did not move. Upper torso restraint measurements were taken from where the seatbelt came through the top of the seatback to the tang prior to the seatback cover being removed. The inboard upper restraint was adjusted to a length of 10.5". The outboard upper restraint was adjusted to a length of 10.25". The inboard lapbelt was adjusted to a length of 21.5". The outboard lapbelt was adjusted to a length of 21". The crotch strap was 11.625". No part marking information could be identified on the inertia reel parts.



Figure 11 First officer inertia reel after removal of seatback cover.

6.0 Rudder Pedals

The rudder pedals were examined, and the right rudder pedals were positioned farther forward than the left. After the debris from around the control column was removed, the rudder pedals appeared in good condition. There was no discernable difference in wear or damage between positions. However, the first officer's right pedal was pushed farther forward than the captain's.

7.0 Cockpit and Forward Cabin Doors

The airplane was equipped with two Type I forward exits (door 1L and 1R), two Type III overwing window exits, and one right side aft door (3R). Neither of the forward cabin doors aft of the cockpit were used for evacuation. The 1L and 1R cabin doors were opened after recovery and operated normally. The floor between both cabin doors, beneath the lavatory, galley, and aft of the cockpit door had collapsed. The cockpit door was initially closed. Refer to the Structures Group Chairman's Factual Report for details on the door and structural damage observed.

8.0 Emergency Equipment

Emergency equipment was located throughout the cockpit and cargo compartment. The aft pockets on the both the captain and first officer seats were empty. A life vest and an oxygen mask were on the floor just outboard of the captain seat. A portable oxygen bottle and mask were wedged between the first officer seat and the outboard structure. A fire extinguisher was in its cradle aft of the first officer seat, and goggles were in the stowage compartment just inboard from the opened right cockpit window.

The crash axe was in its stowage pouch near the floor by the left observer seat, a flashlight was still located in its stowage container, another life vest located on the upper shelf, and the stowage compartment under the shelf was empty. A third oxygen mask was lying on the left observer seat bottom structure. The seat cushion for the left observer seat was between the captain seat and the outboard structure. The box below the left observer's seat was full of binders, and no first aid kit was found.

In the closet compartment just above the stowed center line observer seat, a fourth oxygen mask was found. The galley compartments were opened, and no other emergency equipment were within its compartments. There were no evacuation slides installed in the airplane.

9.0 Summary of Evacuation and Rescue

The flight crew reported that the airplane hit the water and came to a stop quickly. It was dark and quiet inside. Both the captain and first officer (FO) had their restraints on including the shoulder harnesses. During the impact the FO described his upper torso moving forward and the captain also remembered the FO moving forward. The FO further described his right shoulder rolling forward, downward and to the left causing his body to twist so he was facing to the left. His head moved downward (with his face turned to the left) and the top of his head struck something in front of him.

The captain looked out his left side window and saw water halfway up the window. They could feel the airplane sinking. The captain opened his window and water began rushing into the cockpit. He tried to get out but could not because his restraints were still buckled. He released his restraints and egressed the airplane out his window. He had no problems releasing the restraint or opening the window. The captain left everything behind and did not reach for any type of flotation device. He stated he was more focused on getting out of the sinking airplane. The captain recalled seeing the FO get out of the airplane before him. The FO opened his

window and had no problem turning the rotary buckle to release the restraints and egressed through his window.

Once in the water the captain decided to swim to the left side of the airplane to find something to hold onto because there were waves crashing over him. He found nothing so he swam over to the tail section which was floating. He went into it to see if there was something to float on but found nothing. He went to the vertical fin where and used the automatic direction finder antenna to hoist himself up. The tail was slowly sinking so he stayed on the right side where he found a handhold. The waves knocked him off a few times and each time he swam back to the tail climbed back up and held onto it. Some waves were tall enough he would have to duck his head under, so they would go over the top of him. After doing that a few times he remembered seeing a helicopter come overhead. It did a few passes and the last thing he remembered was a wave coming over him, knocking him off the tail then the tail no longer being there. He struggled swimming in the water with his boots on, he tried to remove them but was unable to. His next memory was waking up in the hospital.

Once out of the cockpit the FO was able to see that the airplane had broken into two pieces, and he chose to stay with the nose section where he was already. He saw the captain swim over to the tail section but then lost sight of him. However, they were able to call each other's names and hear a reply so they both knew they were still above the water. The FO then remembered the nose starting to sink. About that time, he noticed one of the big wooden pallets nearby. He climbed up on that and could still see the tail section, with the captain standing on top.

After a "long time," the FO remembered hearing a helicopter and saw it make three big circles around them. On the fourth pass the helicopter crew saw him and put their spotlight on him. He signaled toward the tail where the captain was because he was concerned about the tail section sinking. The FO recollected the helicopter then dropping a diver in the water who came to him and stayed there while the helicopter went over to the tail. A boat from the fire department met the pallet, picked up the FO and took him back to the fire boat dock. He stated that the ride took a long time because the waves were high. Someone in the boat bandaged his head to stop the bleeding. When they got to the boat dock the FO was transported to the hospital via ambulance.

10.0 Search and Rescue (SAR)

10.1 HNL Aircraft Rescue and Fire Fighting (ARFF)

The HNL emergency plan stated there were approximately 30 million passengers embarking or disembarking an aircraft and over 400,000 take-offs and

landings occurring yearly. Additionally, other operations such as flight training, air tours, private aircraft, and the Honolulu Police Department were based at HNL. With the primary arrival and departure routes occurring over water, the potential for aircraft incidents to occur immediately off and adjacent to the airport in ocean and lagoon areas prompted the need under 14 CFR Part 139.325 for the airport emergency plan to incorporate ARFF capabilities to also respond to marine incidents.

To support any marine SAR efforts the HNL ARFF has three rescue boats housed at the two stations on the airport (see figure 3).

ARFF Station 1:

Titan 249X T-TOP, 32 ft., twin inboard 250 power engines. Dispense flotation devices and pick-up survivors.

ARFF Station 2:

SEA ARK, 32 ft., twin inboard engines. Dispense flotation devices and pick-up survivors. May serve as a flotation platform or an on-scene command post

AVON RHI, 13 ft., single outboard engine. Primarily for dispensing flotation devices and picking up survivors.



Figure 12 Google earth view of Honolulu Airport fire station locations.

The HNL ARFF had two documents that served as guidance for personnel in the event of a water landing. The *Marine Incident Standard Operating Guideline* (SOG) dated December 7, 2012, and section 9 of HNL's Airport Emergency Plan (AEP) titled *Water Rescue Situations* dated June 13, 1997 (see attachments 1 and 2).

The AEP noted that a water incident at HNL could involve six different jurisdictional entities and that understanding who was in charge and the setup of an incident command post was critical.

Section 3.2 of the SOG described the response procedures. Upon notification from the HNL tower that an aircraft was in the water ARFF would gather as much information as possible to determine the exact location and number of passengers involved and pass that information to the United State Coast Guard (USCG). The AEP stated that a Unified Command (UC) was to be formed in response to an air/ sea disaster to establish a common set of incident objectives and strategies. The USCG assumed management of the on-scene water SAR operations, and the HNL ARFF acted as the coordinator of the shore-side support and rescue.

10.2 USCG Procedures

The USCG 14th district's boundaries of responsibility stretch from the Hawaiian Islands across most of the Central and Western Pacific Ocean. It included the Joint Rescue Coordination Center (JRCC) Honolulu which was responsible for coordinating aviation and maritime SAR for over 14 million square nautical miles of the Pacific Ocean and was staffed by both military and civilians⁴.

The USCG addendum to the U.S. National Search and Rescue Supplement established policy, guidelines, procedures, and general information for USCG use in SAR operations⁵. To meet their SAR response standard, USCG units with a SAR readiness responsibility were required to maintain a suitable SAR resource ready to proceed within 30 minutes of notification of a distress.⁶

10.3 Honolulu Control Facility Procedures

The Honolulu Control Facility (HCF) was an air traffic control facility operated by the Federal Aviation Administration (FAA). It was a terminal radar control facility that used radar and nonradar capabilities to provide approach control services to airplane arriving, departing, or transitioning airspace over the Pacific Ocean surrounding the Hawaiian Islands. HCF consisted of a tower with air traffic controllers and a watch desk on the ground floor in the same building.

⁴ International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual.

⁵ U.S. Coast Guard Addendum (COMDTINST M16130.2) to the United States National SAR Supplement (NSS) to

⁶ This readiness requirement may be adjusted by district commanders, and by unit commanders when this authority is delegated, based on resource constraints, crew fatigue limits, environmental considerations, or other factors.

In the event of an emergency, HCF utilized a primary crash circuit also called a "crash phone." The crash phone included a dedicated telephone line that allowed for direct and timely communication of information from air traffic control to the primary responders. In the tower there were two phones; the primary was in the front-line manager area and the secondary was at the local assist position.

An HCF control sheet dated April 22, 2016, notified all tower personnel that the Hawaii Department of Transportation (HDOT) had upgraded their phone system (attachment 3). This upgrade had affected the HCF air traffic control tower's crash phone circuit, which caused the crash phones to go out of service intermittently. To track the outages, HCF management requested the air traffic controllers to conduct line checks "occasionally" from each phone to ensure they were functional. If both crash phones were out of service and an emergency notification was received from an airplane, tower personnel were instructed to call the Honolulu airport ramp control, which would then disseminate the information out to the HNL ARFF and then the USCG JRCC.

In a subsequent control sheet dated September 11, 2020, HCF notified all personnel that the current phone line connecting the tower to the airport was at least 30 years old, had been identified as unreliable and needed replacement (see attachment 4). HDOT's aviation division had contracted to upgrade to fiber optic cable in early 2022 during a runway 8L widening project.

11.0 SAR Summary

On July 2, 2021, about 0135, the captain of Transair⁷ flight 810 (RDS810) reported to HCF they had lost an engine and that they were going to run a checklist at an altitude of 2000 feet staying around 15 miles from the airport. About 0138 HCF called HNL ARFF to notify them an aircraft declared an emergency but had no additional details to provide. HNL ARFF reported they would stage trucks near runway 4R which the controller had cleared in preparation for RDS810's return. About 0139 RDS810 radioed HCF that they were heading straight for the airport and requested ARFF support on arrival.

About 0142 RDS810 notified HCF they had lost engine one and that engine two was "running very hot and likely lose it as well." They again requested ARFF but added that they were low on speed and asked HCF to notify the USCG. About 0145 the USCG JRCC received initial notification from HCF that there was a downed airplane two nautical miles south of HNL. Two minutes later the first emergency

⁷ Rhoades Inc doing business as Transair and from here forth the company will be referred to as Transair

locator transmitter⁸ alert was received by JRCC with a location of 21°16'7"N, - 158°01'9"W, 2 nautical miles southeast of Kalaeloa Airport.

About 0147 JRCC notified HNL ARFF who estimated that it would be 20 minutes before their 32-foot rescue boat 1 could arrive on scene. About 0148 JRCC contacted USCG Air Station Barbers Point to request an MH-65 Dolphin. HNL ARFF launched the rescue boat about 0200. USCG 6544 took off about 0218 from Air Station Barbers Point. The station was approximately 2.8 miles northwest of the SARST coordinates.

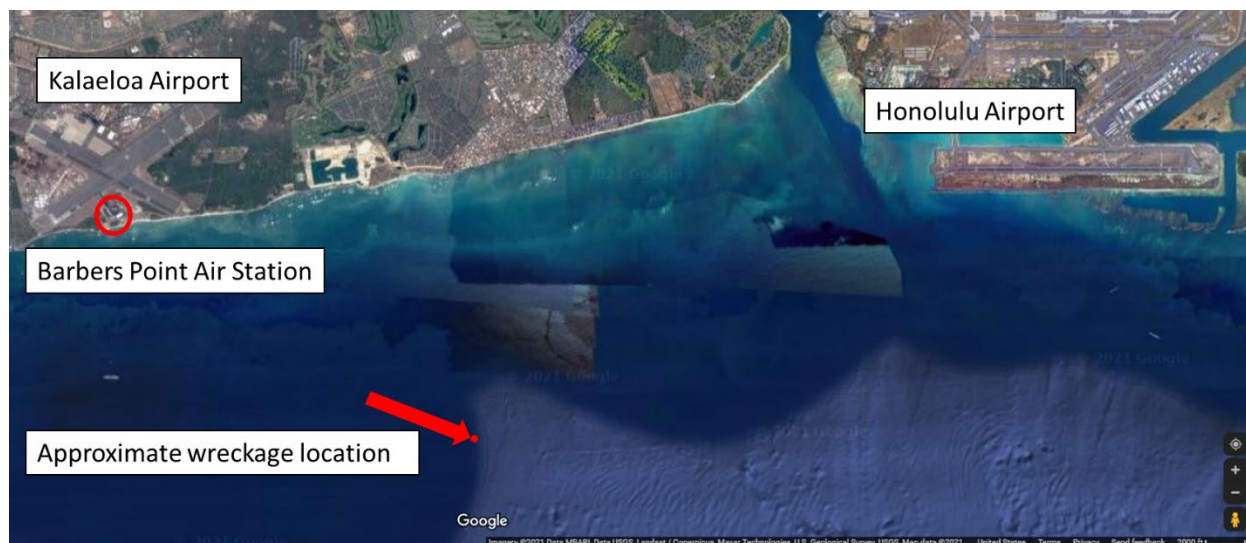


Figure 13 Google earth view of wreckage, airports and USCG station location.

About 0230 USCG 6544 located both survivors in the water floating near the ELT coordinates. About 0240 HNL ARFF rescue boat 1 arrived on scene, delayed by the high surf and low visibility. According to the SAR report, a rescue swimmer deployed from the helicopter and assisted the captain who was located on the airplane's tail. They were hoisted back to the helicopter together and then the rescue swimmer re-entered the water to assess the condition of the first officer. After evaluation the swimmer elected to swim the first officer on the floating debris to the HNL ARFF rescue boat about 0251. USCG 6544 departed the scene about 0259 and arrived at Queens Medical Center with the captain about 0305.

About 0302 the ARFF rescue boat was enroute to airport fire station 2, with an approximate time of arrival of twenty-five to thirty minutes. At 0320 the boat reported an additional twenty minutes estimated time of arrival due to high surf and low visibility. The first officer was eventually transferred to an ambulance waiting at station 2 about 0406 for transport to Queens Medical Center.

⁸ The accident airplane was equipped with a Kannad 406AF ELT (P/N S1821502-02) that transmitted on 406 MHz.

A more detailed timeline of events was constructed from the HCF watch desk phone audio, ATC phone audio, ATC audio transcripts, the USCG JRCC situation report, and the Hawaii Department of Transportation Airports Division Fire Incident Report (ARFF). and is attachment 5 of this report.

E. LIST OF ATTACHMENTS

Attachment 1: HNL ARFF Marine Incident Standard Operating Guideline (SOG)
Attachment 2: HNL ARFF Airport Emergency Plan Section 9: Water Rescue Situations
Attachment 3: Honolulu Control Facility control sheet "HNL Crash Phone" 04/22/2016
Attachment 4: Honolulu Control Facility control sheet "Crash Phone emergency back-up procedures" 09/11/2020
Attachment 5: Timeline of Events

Submitted by:

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