National Transportation Safety Board
Aviation Accident Final Report

Location:	KAMUELA, HI	**Accident Number:**	LAX96FA103
Date & Time:	01/29/1996, 0435 HST	**Registration:**	N999CR
Aircraft:	Cessna 402B	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal, 2 Serious
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

The aircraft departed at night from runway 4R on a flight to transport mail. The pilot-in-command (PIC) was in the left seat, a pilot-rated cargo loader was in the right seat, and another cargo loader was aboard the aircraft, but was not in a seat. During takeoff, the aircraft entered a turn and flew into gradually rising terrain. The initial impact point was about 15 feet higher than the runway elevation and about 0.3 miles abeam the departure end of the runway. Investigation revealed that the company allowed pilot-rated cargo loaders to fly the aircraft from the right seat during positioning and ferry flight segments (to build multiengine flight time) as part of their compensation. There was evidence that at the time of the accident, the aircraft was being piloted on this flight from the copilot's position. The right side of the instrument panel was equipped with only EGT gauges (no flight instruments on the copilot's side). There were cloud layers in the vicinity, no moon illumination, and no visible ground lighting in the direction of flight. No preimpact mechanical malfunction or failure was identified during the investigation. Except at the pilot and copilot positions, the airplane had no other seat and/or restraint system. The operator stated that the pilot was not authorized to carry company personnel or passengers without the required seating.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: failure of the copilot (pilot-rated cargo loader, who was flying the aircraft) to establish and maintain a positive rate of climb after taking off at night; and inadequate supervision by the pilot-in-command (PIC), by failing to ensure that proper altitude was obtained and maintained during the departure. Factors relating to the accident were: darkness; the lack of visual cues; and the resultant visual illusion, which the copilot failed to recognize during the night departure. Also, the lack of a restraint system (seat belt and/or shoulder harness) for the passenger was a possible related factor.

Findings

Occurrence #1: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. (F) LIGHT CONDITION - DARK NIGHT
2. (F) VISUAL/AURAL PERCEPTION - FLIGHTCREW
3. FLIGHT/NAV INSTRUMENTS - OTHER
4. (C) PROPER CLIMB RATE - NOT MAINTAINED - COPILOT/SECOND PILOT
5. (F) VISUAL ILLUSION - COPILOT/SECOND PILOT
6. (C) SUPERVISION - INADEQUATE - PILOT IN COMMAND
7. TERRAIN CONDITION - RISING
8. (C) PROPER ALTITUDE - NOT OBTAINED/MAINTAINED - PILOT IN COMMAND
9. (F) SEAT BELT - NOT AVAILABLE - PASSENGER

Factual Information

HISTORY OF FLIGHT

On January 29, 1996, at 0435 hours Hawaiian standard time, a Cessna 402B, N999CR, collided with gradually rising terrain while on takeoff from the Wiamea-Kohala Airport, Kamuela, Hawaii. The aircraft was destroyed. The certificated airline transport pilot sustained fatal injuries, and two onboard cargo loaders received serious injuries. The aircraft was being operated as a contract mail flight by Trans Executive Airlines of Hawaii under 14 CFR Part 135 when the accident occurred. The flight originated in Honolulu, Hawaii, at 0200. The flight departed Kamuela on the return leg of the flight at 0430. Visual meteorological conditions prevailed at the time and no flight plan had been filed.

A worker at the Waimea-Kohala airport reported that about 0530 on the morning of the accident he heard a knock on his door. When he opened the door he saw one of the cargo loaders (hereafter referred to as cargo loader No. 2) who told him that he had just been involved in an aircraft accident. The cargo loader told the worker that he heard a sound he did not recognize and the next thing he remembered was being outside the aircraft. He looked around, saw the airport beacon, and began walking toward it. He estimated that it took him between 45 minutes to 1 hour to reach the airport, which involved climbing over two fences.

One of the police officers who first responded to the scene told the Safety Board that the night was very dark with a clear sky and calm winds. From his vantage point at the accident site, he was unable to see any ground lights toward the south or east.

On the date of the accident police officers interviewed cargo loader No. 2, who had been in the cargo compartment. During the interview, he reportedly told officers that when they left Waimea his friend (cargo loader No. 1) was flying the aircraft, while the pilot acted as the copilot. He later told FAA inspectors who spoke with him on April 24, 1996, that he did not recall who was flying the aircraft. (The Hawaii Police Department report is appended to the report.)

After several attempts by the Safety Board and the Honolulu FSDO to contact cargo loader No. 1, on April 23, 1996, he responded to the FSDO inspector by letter, in which he admitted performing copilot duties, but denied flying the aircraft. According to FAA inspectors, he stated that he remembered something abnormal happened with one of the engines because it was sputtering. He said he looked at the engine gauges and they were not right.

PERSONNEL INFORMATION

The operator reported the pilot-in-command for the Part 135 flight was current and qualified in the aircraft with about 1,250 hours in the Cessna 402. He had previously flown this regularly scheduled mail flight to and from the airport. The operator stated that the pilot was not authorized to carry company personnel or passengers without required seating. He was, however, permitted to allow rated employees to fly the aircraft on Part 91 positioning and ferry segments. He explained that he did not pay the cargo loaders, but rather allowed them to build multiengine flight time on these flights as compensation.

Cargo loader No. 1 held a commercial pilot certificate, with multiengine and instrument ratings. A pilot's logbook found in the aircraft wreckage bore his name. A review of that logbook revealed that he had logged pilot-in-command time on 47 company flights from

December 23, 1995, through January 22, 1996. The logbook also showed that 23 of those flights were flown over the same route as was being flown at the time of the accident.

AIRCRAFT INFORMATION

A review of the aircraft, engine, and propeller logbooks was conducted by the Safety Board, FAA airworthiness inspectors, and manufacturers' representatives. No discrepancies related to airworthiness were identified. (Extracts of aircraft maintenance records are appended to this report.)

The aircraft had been manufactured and delivered with auxiliary and winglocker fuel tanks in addition to the main fuel tip tanks. However, both the auxiliary and winglocker fuel tanks had been removed from the aircraft, resulting in a total fuel capacity of 102 gallons.

The aircraft was configured for an all cargo flight with seating limited to the pilot and copilot.

WRECKAGE AND IMPACT INFORMATION

The aircraft crashed on open rolling terrain about .3 miles south of runway 04 at 19 degrees 59.55 minutes north latitude and 155 degrees 39.55 minutes west longitude. The first evidence of ground contact was east, abeam the departure end of runway 04. At this location, ground scars and debris identified as components from the right wing, were near a protruding 5-foot rock formation. The rock formation exhibited an impact mark about 1 foot from its top, which, at that point, was about 2,686 feet msl. The debris included portions of the right tip tank, including the fuel boost pump and the right outboard aileron hinge bracket. The initial ground scar and debris path were along a 148-degree bearing.

There was no evidence of subsequent ground contact for about 128 feet until a second ground scar was located. Sixteen perpendicular slash marks were noted along this scar, and measured on average about 24.25 inches apart. The second ground scar was along a 160-degree bearing.

The final ground scars were about .5 miles south of the airport and .7 miles from the initial impact point along a 264-degree bearing. The terrain at this point had risen to an elevation of about 2,711 feet msl. These ground scars were located on the ascending side of a grassy knoll. The initial portion of the scar revealed five additional perpendicular slashes, averaging about 26 inches between slashes. During the impact sequence the left engine and propeller separated from the left wing. The aircraft continued up and over its crest for an additional 207 feet. The aircraft came to rest on a 072-degree bearing. The relative bearing between the second and final ground scars was 218 degrees.

A ground speed was computed for the first three propeller slashes in the first series of 17 marks using 2,450 rpm. A similar computation was made for the first three propeller slashes in the last series of five marks also using 2,450 rpm. (The theoretical formula and the actual computations are appended to this report.)

An on-site examination was conducted by the Safety Board investigator in coordination with an FAA airworthiness inspector. The aircraft was later re-examined by representatives from the aircraft and engine manufacturers under the supervision of an FAA airworthiness inspector.

All flight control surfaces and load bearing structures were located between the initial point of impact and the final position of the aircraft. Control continuity was not established due to the extent of damage to the airframe, flight control surfaces, and the numerous breaks in the control cables, rods, cranks, and pulleys. No evidence was found of preimpact control binding

or chaffing associated with any of the control linkages.

There was an approximate 90 percent empennage separation near FS 213. The nose section of the aircraft was crushed aft to about FS 167. Both wings exhibited leading edge damage as well as buckling, bending, and structural separation. There was impact damage on the top of the vertical stabilizer along with an aft and downward collapse of the forward cabin area. The horizontal stabilizer and elevators exhibited impact damage and were found separated from the empennage.

The landing gear was found in the up and locked position while the wing flaps were in the full up position. The flap motor showed five links extending from the top of the chain drive sprocket to a point where the chain transitions to a cable. The flap control handle and indicator also indicated less than the flaps full up position. The aircraft representative was able to quantify the preimpact trim position of the rudder as neutral and the aileron trim as 0 degrees, with the tab neutral. The flap position and elevator trim setting were considered unreliable due to structural damage, control separation, and possible movement during the impact sequence.

Both main fuel tip tanks were destroyed during the impact sequence. The forward bulkhead of the right tank had ruptured and was separated from the tank. The left main tip tank was also separated and exhibited evidence of distortion. The fuel valves for both tanks were found in the "open" position. The fuel sector switch for the left tank was found on "main" while the switch for the right tank had been destroyed.

Both engines separated from their mounts and both propellers separated from their respective crank flanges. Both engines were examined by the engine manufacturer under the direct supervision of an FAA airworthiness inspector. Valve train continuity was established to the accessory section through the hand rotation of the crank flange and observing the rotation at the aft end. Hand rotation established thumb compression in all six cylinders of both engines. The right vacuum pump was removed and hand rotated, establishing the pump's mechanical continuity. Both engine fuel pumps were removed, examined, and found to be mechanically intact. The engine fuel screens were removed and examined. Both fuel control units' fuel screens were also examined. The left engine fuel manifold was disassembled and that screen examined. There was no evidence of foreign substances found on any of the screens.

As each engine was hand rotated, a spark was obtained from at least one of the magnetos. The top spark plugs were removed from both engines and examined. There was no evidence of oil, carbon, or lead fouling on any plug. According to the Champion check-a-plug chart, there was no unserviceable erosion on any of the plugs' massive electrodes.

Both propellers were recovered and examined. The left propeller was found on the feather stop while the right prop was found in mid-range. All three blades on the left hub exhibited torsional twisting and some bending near the blade root. The three blades on the right hub exhibited torsional twisting, bends, and curling opposite the direction of rotation. Both prop spinners were crushed and torn away.

The pilot's control wheel had no visible signs of distortion; however, the copilot's control wheel exhibited a bent control grip. The right side of the instrument panel was equipped with only EGT gauges. The throttle quadrant exhibited evidence of impact damage along with some aft displacement.

The pilot's and copilot's seats had separated from their seat tracks. There was no evidence of

enlargement or elongation of the lower track holes, nor was there evidence of slippage marks from the upper track seat pins.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was conducted on the pilot by the Hawaii Department of Health. Toxicological samples were obtained and screened locally for drugs and alcohol with negative results. The pilot-in-command had a carboxyhemoglobin (COHg) concentration of 3.4 percent. The principal operations inspector (POI) for the operator reported that the pilot's former coworkers informed him that the pilot was a smoker. The Civil Aero Medical Institute (CAMI) reported that this level of COHg is common in the general population and has no measurable effect on physiological performance. (The coroner's toxicological findings are appended to this report.)

The pilot rated cargo loader in the right seat, was reported by the police department as having received a fractured thumb.

After a review of the conditions surrounding this accident, researchers at CAMI formed an opinion regarding a precipitating event. They stated that because of the circumstances present in this accident mirror what they term a "dark night takeoff accident," there is a likelihood that the pilot experienced these effects. For this to occur the pilot will have limited outside visual cues but will not be flying the aircraft with reference to instruments. The aircraft may then enter an undetected descent while flying straight ahead or in a coordinated turn. The perception of a descent is masked by the fact that the aircraft is accelerating which allows the pilot to continue until ultimately experiencing controlled flight into terrain. This perception will persist unless detected and corrected by the pilot through reference to the air speed indicator, vertical speed indicator, or altimeter.

This form of disorientation is called somatogravic illusion, which is a product of a prolonged turn at night with few outside visual cues so that there is no visual perception of a descent. If the flying pilot fails to maintain sufficient back pressure on the yoke, this combined with the reduced lift coefficient due to the bank angle will result in a gradual loss of altitude.

They completed their assessment by relating experiences in which the pilots became aware of the condition but were unable to fully recover from the psycho-physiological affects for up to 20 to 30 seconds. (A CAMI provided reference "Dark night Takeoffs and the False Climb Illusion" is appended to this report.)

SURVIVAL ASPECTS

Shoulder harnesses were available at the pilot's and copilot's position, however, their use is unknown. Other than the seats at the pilot's and copilot's positions, there were no other seats and/or restraint systems onboard or available.

ADDITIONAL INFORMATION

One mail sack belonging to the U.S. Postal Service and tagged "DIS Honolulu 8967 3rd class letters Kamuela, HI" was found onboard the aircraft.

The aircraft was recovered to a covered area on the ramp of the Waimea-Kohala airport by Mauna Kea Helicopters. The wreckage was released to a representative of the registered owner on February 8, 1996.

Pilot Information

Certificate:	Airline Transport; Flight Instructor	**Age:**	29, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane Single-engine; Instrument Airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	08/31/1995
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	3434 hours (Total, all aircraft), 1250 hours (Total, this make and model), 3350 hours (Pilot In Command, all aircraft), 250 hours (Last 90 days, all aircraft), 72 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N999CR
Model/Series:	402B 402B	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	402B0616
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	01/22/1996, AAIP	**Certified Max Gross Wt.:**	6300 lbs
Time Since Last Inspection:	49 Hours	**Engines:**	2 Reciprocating
Airframe Total Time:	19764 Hours	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	TISO-520-E
Registered Owner:	TRANS EXECUTIVE AIR OF HAWAII	**Rated Power:**	300 hp
Operator:	TRANS EXECUTIVE AIR OF HAWAII	**Operating Certificate(s) Held:**	On-demand Air Taxi (135)
Operator Does Business As:	TRANS AIR	**Operator Designator Code:**	TXHA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Night/Dark
Observation Facility, Elevation:	ITO, 38 ft msl	**Distance from Accident Site:**	44 Nautical Miles
Observation Time:	0450 HST	**Direction from Accident Site:**	104°
Lowest Cloud Condition:	Scattered / 5000 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	Broken / 9000 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	310°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	20°C / 18°C
Precipitation and Obscuration:			
Departure Point:	, HI (MUE)	**Type of Flight Plan Filed:**	None
Destination:	HONOLULU, HI (HNL)	**Type of Clearance:**	None
Departure Time:	0430 HST	**Type of Airspace:**	Class E

Airport Information

Airport:	WAIMEA-KOHALA (MUE)	**Runway Surface Type:**	Asphalt
Airport Elevation:	2671 ft	**Runway Surface Condition:**	Dry
Runway Used:	4R	**IFR Approach:**	
Runway Length/Width:	5190 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 2 Serious	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	ROBERT R CRISPIN	**Report Date:**	04/29/1997
Additional Participating Persons:	DARCY REED; HONOLULU, HI EMILE J LOHMAN; WICHITA, KS GEORGE M HOLLINGSWORTH; RESTON, VA		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		