

C I V I L A E R O N A U T I C S B O A R D
AIRCRAFT ACCIDENT REPORT

Adopted: March 6, 1963

Released: March 8, 1963

FEDERAL AVIATION AGENCY, CONSTELLATION L-749A, N 116A,
CANTON ISLAND, PHOENIX GROUP, PACIFIC OCEAN
APRIL 26, 1962

SYNOPSIS

A Lockheed Constellation, Model L-749A, N 116A, owned by the United States Government and operated by the Federal Aviation Agency, crashed following a local training flight at Topham Field, Canton Island, April 26, 1962, at 1213 local time. All four FAA crew members were fatally injured. One of the two passengers, not an FAA employee, was also fatally injured. The other, an FAA physician, was seriously injured. The aircraft was destroyed.

The purpose of the flight was to train the copilot in various maneuvers and flight configurations prior to being tested for an Airline Transport Pilot Rating, and to train a flight maintenance technician as a flight engineer.

The probable cause of the accident was loss of control during an attempted go-around following initial touchdown, as the result of an undetected reversal of No. 4 propeller.

Investigation

A Lockheed Constellation, Model L-749A, N 116A, owned by the United States Government and operated by the Federal Aviation Agency, crashed following a local training flight at Topham Field, Canton Island, April 26, 1962, at 1213 local time. ^{1/} All four FAA crew members were fatally injured. One of the two passengers, not an FAA employee, was also fatally injured. The other, an FAA physician, was seriously injured. The aircraft was destroyed.

The last flight of FAA Constellation N 116A prior to the accident was on the 25th of April. That flight was from Honolulu, Hawaii, to Canton Island, and was operated as FAA Logistic Flight 62-53 carrying passengers and freight. Before departure from Honolulu there was a brief delay caused by the changing of the rear spark plug of No. 15 cylinder of No. 4 engine. Otherwise the flight was routine, and of about eight hours duration, with arrival at Topham Field, Canton Island, at 1855, April 25. The crew consisted of Pilot-in-Command, Julius J. Terranova, Copilot Herbert G. Fielding, Flight Engineer Harry E. Johnson, Navigator Robert R. Rassmussen, and Flight Maintenance Technician Paul L. Garriott. Flight Engineer Lloyd Z. Young was deadheading.

A local training flight at Canton Island on April 26 had been authorized by FAA's Chief of Aircraft Operations for the Pacific Region. For this flight the crew consisted of Captain Julius J. Terranova, a designated check pilot, Copilot Herbert G. Fielding, Flight Engineer Lloyd Z. Young, and Flight Maintenance Technician Paul L. Garriott, Jr. There were two passengers, Dr. John B. Miller, FAA Resident Physician of Canton Island, and Areti Tabonga, an employee

^{1/} All times herein are local (165th meridian) based on the 24-hour clock.

of the Standard Oil Company at Canton Island. The purpose of the flight was to train Copilot Fielding for his Airline Transport Pilot Certificate flight test and also to train Flight Maintenance Technician Garriott as a flight engineer.

Flight Engineer Young, assisted by Mr. Johnson, the flight engineer on the previous day's flight, preflighted the aircraft and supervised the refueling. At 0855 Captain Terranova filed a local VFR (Visual Flight Rules) flight plan with the IFSS (International Flight Service Station) at Canton, estimating the flight time as about four hours. Crew and passengers then boarded the aircraft, with Copilot Fielding occupying the left pilot seat, Captain Terranova the right pilot seat, Mr. Garriott the flight engineer's station, and Flight Engineer Young standing adjacent to Mr. Garriott. Dr. Miller sat in the observer's seat behind the left pilot seat, and Mr. Tabonga was in the first seat on the left side of the passenger compartment. During the investigation no weight and balance figures could be found; however, Flight Engineer Johnson later estimated the aircraft's gross weight at 88,156 pounds. The maximum allowable for takeoff was 107,000 pounds.

The engines were started with Mr. Johnson acting as fireguard, and at 0900 the flight contacted Canton IFSS advising it would be taxiing to the runway in about 10 minutes.

After run-up, the aircraft took off from runway 9 reporting off at 0914 to Canton IFSS. As observed from the ground by Flight Engineer Johnson, and others, the aircraft stayed in the airport traffic pattern and made several approaches and landings with various flap configurations, some employing

propeller reversing after touchdown. The first landing was to a full stop and appeared to be with 80 percent flap. The aircraft was then taxied back and immediately taken off again. The next approach appeared to be with full flaps. A go-around was started some 300 feet over the threshold and the aircraft was flown level over the runway with flaps down. On the next landing which was to a full stop, the final approach appeared long, flat, and fast. The next takeoff was with flaps up. The aircraft left the traffic pattern and was climbed to altitude for the purpose of conducting emergency procedures training.

Surviving passenger Dr. Miller indicated that these procedures included the feathering, and simulated feathering, of propellers and the simulation of hydraulic and electrical system failures. During this period the crew of N 116A contacted Canton IFSS several times. At 1042 they advised being 10 miles west at 5,000 feet. At 1108 they reported over Canton at 6,500 feet and stated that operations were normal. At 1142 they reported four miles out, requested traffic information, and advised their intention of making a pass over the airport. Shortly thereafter the aircraft passed over the airport from north to south at an altitude of about 500 feet and then continued out over water where it circled several times. The aircraft was then climbed to traffic pattern altitude and entered a left downwind leg. At this time, according to Dr. Miller, Flight Engineer Young took over the engineer's panel and Mr. Garriott stood behind Young. Mr. Tabonga stood in the doorway of the flight deck.

At 1210, N 116A contacted Canton IFSS and requested the current altimeter setting, which was given as 29.86. N 116A acknowledged. This was the

last radio contact with the aircraft; during none of the radio contacts had any mechanical difficulty been mentioned. N 116A was observed to make an approach for landing.

Following touchdown the aircraft rolled 239 feet on the right main landing gear with the right wing continuing to drop. The aircraft then lifted off in a nose-high and right-wing-down attitude, and the right wing tip struck the ground at the right edge of the runway. This crushed the right wing tip as well as the outboard portion of the wing and the right aileron. The aircraft at the time was banked sharply to the right and the nose was high. With the angle of bank increasing, the turn continued with the right wing scraping and being abraded by coral. An 18-inch high coral ridge was struck, causing further breakup of the wing. The angle of bank continued to steepen, the aircraft cartwheeled coming to rest 220 feet off shore in water about three feet deep. All engines broke free. There was no fire either before or after impact.

The weather at the time of the accident was: scattered clouds at 2,000 feet; visibility more than 15 miles; temperature 86 degrees F; dewpoint 73 degrees F; wind east-northeast 6 knots; altimeter 29.86.

The first identifiable tire marks on the runway were 650 feet past the threshold of runway 9. This runway is 6,000 feet long and 150 feet wide. The touchdown was on the two right main wheels only, indicating a right wing low attitude. According to the marks the outboard right tire touched before the inboard right tire. This touchdown was 20 feet to the right of the centerline of the runway, indicating the centerline of the fuselage was six feet to the right of the centerline of the runway. This mark was solid for 17 feet, then very light, with intermittent markings for the next 95 feet. At this point a solid mark made by the outboard tire of the right

landing gear started 29 feet to the right of the runway centerline and ended 127 feet down the runway, 38 feet from the centerline of the runway. The average heading of this mark was 097 degrees, or 7 degrees from the runway heading. The aircraft became airborne at this point and there were no further tire marks.

Two hundred thirty-six feet from the last tire mark and 24 feet off the right edge of the runway, the wing tip first scraped the coral terrain as evidenced by impact marks. Four feet from this first impact the right wing struck a taxiway light located 18 feet from the right edge of the runway. At this point the right wing tip and a portion of the right wing outer panel failed upward, leaving skid marks about seven feet wide across a taxiway and adjacent terrain for 475 feet. Here the right wing tip struck a crushed coral ridge 18 inches in height and approximately 170 feet from the right edge of the runway. The average heading of the skid mark as it crossed the taxiway was 102 degrees. Sixty-six feet from the coral ridge, a second ridge one foot high was contacted. The average heading of the skid mark between these two ridges was 127 degrees. Numerous small pieces of de-icer boot material were found along the path between these ridges. Beyond the second ridge were found a wing leading edge former with a small portion of skin attached, a 20-inch section of leading edge skin with stringer attached, and a fuel tank vent from No. 3A tank. These items were 37, 60, and 146 feet, respectively, along the flightpath from the second ridge.

A trail of fragmented parts and debris led to the edge of the water and to the main wreckage, some 220 feet off shore. This main wreckage consisted

of a large portion of the fuselage and sizable portions of both wings. These parts were on a heading of 50 degrees and were resting on a coral shelf. The empennage was broken from the fuselage and was found 40 feet aft of the fuselage break on a heading of 35 degrees.

A total of 16 persons on the ground saw or heard various phases of the final approach, touchdown, and crash. A number of their statements indicate that the final approach was higher and steeper than usual, with flaps extended 100 percent. One, a weather observer, stated in effect that the aircraft touched down on both main landing gears some 300 feet past the runway threshold. Another, Flight Engineer Johnson, observed the right wing to be slightly down and the nose to be down just before touchdown which he thought was farther down the runway. Some witnesses heard a pronounced increase in engine noise when the aircraft swerved from the runway.

Much of the forward portion of the aircraft was literally ground away by sharp coral. However, the airframe proper, its control systems, other aircraft systems, the instrumentation, the engines, and the propellers were examined. There was no evidence of failure of the airframe nor of the control systems. Readings of instruments, engine controls, and tab settings, which could be obtained yielded nothing that could be directly related to the accident. The flap handle was in the "up" position. The flap control mechanism indicated the flaps were in transit upward at approximately 60 percent at time of impact.

The cockpit aileron and rudder boost control levers as well as their related control valves were found in the "off" position.

The maintenance records of the aircraft indicated proper and current maintenance.

The engine examination, which included complete disassembly, was conducted under Board supervision at Los Angeles where complete facilities were available. There was no sign of operational distress in any of the four engines, nor did the maintenance histories of the engines suggest any items that could logically be linked to this accident.

Examination of the four propellers indicated that the blade angles at the time of impact were 15 degrees positive, 15 degrees positive, 23 degrees positive, and 20 degrees negative for Nos. 1, 2, 3, and 4, respectively. The low pitch stop is at 15 degrees positive and the reverse pitch stop is at 20 degrees negative. Functional tests and disassembly of the pitch changing mechanism of the four propellers did not reveal any irregularities. Functional tests of the four governors were satisfactory. Two of the governors were checked for engine r.p.m. settings with 2,260 and 2,300 indicated. The above work was accomplished at Honolulu. Subsequently, the No. 4 governor was again functionally tested and disassembled at Los Angeles. The test was satisfactory. The only discrepancy found during examination following disassembly was scoring and pitting on the low pressure relief valve. Propeller repair specialists described the extent of this scoring and pitting as "Excessive," considering the relatively low operational time of 352 hours since the last overhaul. The cause of the scoring and pitting could not be established.

The No. 4 governor had been overhauled and all applicable Service Bulletins and Airworthiness Directives complied with in June of 1960. The governor was retained in stock as a spare unit until July 1961, at which time it was again disassembled, inspected, latest modifications incorporated, reassembled and functional.

tested. The low pressure relief valve was not replaced and reportedly was in good condition at this time.

Autopsies were performed on the bodies of the crew members. Only one significant fact was revealed. Flight Engineer Young had recently ingested a significant amount of a barbiturate. His tissues contained therapeutic quantities of an unidentified barbiturate -- with physical properties similar to butabarbital -- which would be compatible with his having taken a 100 milligram dose of a medium or long-acting barbiturate three times a day for a prolonged period. This same tissue level could have been achieved in other ways, such as taking four or five 100 milligram tablets a few hours before death; or five to ten tablets 10 hours before death.

The Administrator had elected to conduct flight operations of this aircraft in accordance with Parts 20, 43, and 60 of the Civil Air Regulations except for certain special deviations. Section 43.45 of Part 43 of the Civil Air Regulations prohibits any person from serving as a crew member in civil aircraft while using any drug which affects his faculties in a manner contrary to safety. However, a deviation from this provision is found in the Administrator's Manual of Procedures which governs the operation of this flight in that it proscribes the use of barbiturates by crew members within twelve hours prior to flight.

Interview of Survivor Under Narcosynthesis

The sequence of events prior to and during the accident was established largely through details provided by the survivor, Dr. Miller. He was seriously injured and was initially able to recall only the general activities, operations, procedures, and maneuvers prior to the final touchdown of N 116A. He was unable, at first, to recall details prior to and immediately after the accident other than that the touchdown was normal, the aircraft gradually veered to the right, and the Pilot-in-Command, Captain Terranova, shouted "..... frozen!"; and reached

far to the left from his right seat, across the pedestal, to some undetermined control. The copilot in the left seat had both hands on the control wheel, according to Dr. Miller.

Dr. Miller, a Government physician, was eager to help in the investigation of this accident. At the suggestion of a Board investigator he agreed to be questioned while under the influence of sodium amytal, a drug used to prompt memory recall. The method, or technique, is known as narcosynthesis and is sometimes used by physicians to help patients release suppressed information.

Accordingly, on May 11, 1962, Dr. Miller voluntarily submitted to a medically supervised interview under narcosynthesis, with a Board investigator present. Lt. Colonel Paul Yessler, M.C., U.S.A., Chief, Neuropsychiatric Division, at Tripler Army Hospital, Honolulu, administered the drug. At this time, Dr. Miller recalled many of the details of the flight including the words which Captain Terranova shouted as the aircraft veered to the right on landing: "Controls frozen!", and "Ailerons frozen!". Dr. Miller also remembered that at approximately the same time, Captain Terranova reached for the aileron and rudder boost control levers and pulled them to the "off" position. On May 12, 1962, a tape recording of the interview was played back for Dr. Miller, at which time recall of these details was verified. This was the first use of narcosynthesis interview technique by the Board in connection with the investigation of an aircraft accident.

Analysis

Aircraft and powerplant maintenance, and the state of the weather cannot demonstrably be linked to the cause of this accident. Investigation of the

airframe, systems, and powerplants revealed the following three items which cannot be accepted as normal and will be specifically considered in this analysis; namely,

- (1) No. 4 propeller in reverse pitch (-20 degrees).
- (2) No. 4 propeller governor low pitch relief valve pitted and scored.
- (3) Aileron and rudder boost off.

Otherwise, no evidence of a suspect nature was disclosed by the investigation of the airframe, systems, and powerplants.

The landing culminating in the accident was to have apparently been the last for the day. Maneuvers, and their sequences, which were being practiced prior to the final landing, are not known precisely. However, according to the survivor they included a considerable number and variety of simulated emergency conditions, including a feathered propeller or propellers in conjunction with other simulated difficulties. The use of propeller reversing during landings was established.

The reportedly higher and steeper than usual final approach with flaps extended 100 percent is not considered unusual, especially during the conduct of a training flight. The approach configuration and path are not considered pertinent to the probable cause of the accident or indicative of difficulties being encountered.

Discussion of the initial touchdown of the aircraft on the right main landing gear and its subsequent attitude and path of travel cannot be divorced from considerations of the No. 4 propeller which was found in full reverse pitch. Apparently, the approach was essentially normal until just prior to

touchdown. The propeller operating during approach with an ineffective low pitch stop constitutes a very logical cause for the landing events as described. As power and airspeed are progressively reduced, propeller pitch decreases to maintain the selected r.p.m. until the low pitch stop is reached. Normally, any further reduction in airspeed and/or power is reflected by a reduction in r.p.m. In the event the low pitch stop is ineffective, blade angle is further reduced and at least initially, the selected r.p.m. is maintained. This situation would be most readily evident to the crew by an r.p.m. decrease on three tachometers and one, No. 4, would remain at the selected reading. Change in thrust as sensed by the pilot at the controls would be relatively minor and probably would go unnoticed during the phase under discussion. As the airspeed and/or power was further reduced and probably at the time power was reduced to start the flare, energy input to the propeller would decrease such that the selected r.p.m. would not be maintained and the propeller blade angle would abruptly decrease with an appreciable r.p.m. decrease, and would move into the reverse pitch regime and continue to full reverse. As the propeller moved toward full reverse, the reverse pitch indicating light located on the pilot's panel would come on. This light comes on about 5 degrees before full reverse pitch is reached. Accompanying this blade angle change would be an abrupt and very substantial increase in drag and some reduction of right wing lift. It is concluded this is what occurred because it is not only compatible with the touchdown attitude but with the physical evidence as well.

Information as to specific power and specific airspeed at any particular time along the final approach path is lacking. However, to provide some appreciation of the parameters involved, the airspeeds, r.p.m. and powers, which result in the propeller governing at the 15-degree low pitch stop, are listed as follows:

<u>Revolutions per Minute</u>	<u>Indicated Air Speed</u>	<u>Brake Horsepower</u>
2300	140	147
2300	130	294
2300	120	426
2300	110	528
2300	100	646
2300	90	720

A reduction of IAS and/or BHP, with r.p.m. remaining constant, causes the propeller blades to go below 15-degree blade angle if the low pitch stop is ineffective. The reportedly steep descent on final approach is compatible with low BHP.

After contact with the runway by only the right gear for 239 feet, during which an application of power was heard, the aircraft lifted off, and while turning to the right, the right wing tip contacted the ground. The right turn continued with the right wing dragging. Indications are that the wing flaps were in transit toward the retracted position which, in conjunction with the application of power, leads to the conclusion a go-around was being attempted. The only logical explanation for this uncontrollable maneuver, compatible with the physical evidence, is that with Nos. 1, 2, and 3 propellers in forward thrust and No. 4 propeller in reverse thrust, full power was applied during an appreciable period following the initial touchdown.

The possibility that early use and/or misuse of the throttles may have precipitated the accident has been considered. One such possibility considered is that reverse thrust may have been applied before the aircraft was firmly on all landing gears, then because of control difficulty, forward thrust was applied with No. 4 failing to respond. Such an occurrence has been discounted because the short time involved precluded normal reversing and unreversing of the four propellers. Furthermore, the throttle arrangement on this aircraft make inadvertent application of reverse thrust most unlikely.

An ineffective low pitch stop is considered the most likely cause of the premature reversal of the No. 4 propeller. The timing and sequence of events following initial touchdown are precisely what would be predicted in this event.

As for an explanation, there are several possibilities. A false electrical reversing signal would immediately initiate a reversal and would be expected to be random timewise. Special precautions taken to protect the reversing solenoid circuit from false signals have been very effective. This is considered to be the most unlikely of the several possible causes of the unwanted reversal that have been considered. Timing of the reversal, as previously discussed, is considered to be very pertinent to this conclusion. Either a governor low pressure relief valve seized in the closed position or a low pitch stop lever assembly servo valve stuck in the open position would render the low pitch stop levers ineffective. Normal propeller response to airspeed and power with either of these malfunctions present would result in

propeller response as previously discussed. A propeller feathering and unfeathering in flight would provide the positioning for either of these valves which, in the event of sticking, would precipitate the events which are believed to have culminated in the accident. Although No. 4 was not specifically mentioned, the survivor did state simulated emergencies including feathering and unfeathering of propellers were accomplished during the training flight. The physical condition of the low pressure relief valve, as found, makes it the most likely cause of the unselected reversal. That the fault was not revealed by functional tests is not a compelling reason for eliminating these two possibilities. It is not unusual for a hydraulic component malfunction to fail to recur when the unit is subsequently checked on a test facility. This is especially apt to be true if the initial trouble had been caused by contamination in the oil, for, under test, clear oil is used and the original contaminant may be displaced immediately.

The Board believes that the accident had its inception when No. 4 propeller was in reverse pitch, unknown to the crew, during the final approach, and that upon touchdown, directional and attitude control loss was followed by application of power for a go-around causing high yawing forces, quickly swerving and banking the aircraft into the ground.

As previously mentioned, a reverse pitch indicating light is located on the pilot's panel which would actuate five degrees prior to the propeller travel to full reverse. In addition, this condition could have been detected by the difference in the r.p.m. between the engines by any of the three flight crew members.

It cannot be stated that the flight engineer's failure to detect the r.p.m. change was the result of his use of barbiturates.

It is obvious by Captain Terranova's action, i.e., pulling the aileron rudder boost control "off" and shouting "controls frozen, ailerons frozen," that his reaction to the directional and attitude control difficulty following touchdown was, in fact, to correct a control malfunction - not a propeller reversal problem. This action further compounded the control difficulties. A jammed aileron because of damage from contact of the right wing with the ground logically accounts for such a diagnosis, although erroneous, by the captain.

Probable Cause

The Board finds that the probable cause of the accident was loss of control during an attempted go-around following initial touchdown, as the result of an undetected reversal of No. 4 propeller.

BY THE CIVIL AERONAUTICS BOARD:

/s/ ALAN S. BOYD
Chairman

/s/ ROBERT T. MURPHY
Vice Chairman

/s/ CHAN GURNEY
Member

/s/ G. JOSEPH MINETTI
Member

/s/ WHITNEY GILLILLAND
Member

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

Investigation

The Civil Aeronautics Board was notified of the accident immediately after occurrence. An investigation was started at once in accordance with the provisions of Title VII of the Federal Aviation Act of 1958.

Operator

The Federal Aviation Agency, Pacific Region, operated Constellation N 116A which was owned by the United States Government.

Flight Personnel

Captain Julius J. Terranova, age 38, was employed by the Federal Aviation Agency on May 23, 1959. He possessed an FAA Airline Transport Pilot Certificate, No. 238865, and ratings in L-749 and DC-4 type aircraft. He had a total of 5,867 hours, of which 3,911 were in Constellation type aircraft. His last proficiency check was on September 6, 1961, and his last en route check was on February 11, 1962. His last first-class medical examination was taken in February 1962, with no limitations. On August 7, 1961, Captain Terranova was appointed check pilot on L-749 and DC-4 type aircraft.

Copilot Herbert G. Fielding, age 45, was employed by the Federal Aviation Agency on February 8, 1960. He possessed FAA commercial certificate No. 429746, with multiengine and instrument ratings. He had a total of 8,353 hours, of which 524 were in the Lockheed L-749A. His last first-class medical examination was passed on April 19, 1962, with no limitations.

Flight Engineer Lloyd Z. Young, age 45, was employed by the Federal Aviation Agency on March 7, 1959. He possessed Flight Engineer Certificate No. 1196651, and Airframe and Powerplant Mechanic Certificate No. 161034. He had a total of over 6,000 hours in Constellation aircraft. His last second-class medical examination was passed October 1961.

Student Flight Engineer Paul L. Garriott, Jr., age 32, was employed by the Federal Aviation Agency as a Flight Maintenance Technician on July 10, 1961. He possessed Airframe and Powerplant Certificate No. 1372514. His last second-class medical examination was passed in June 1961.

The Aircraft

The aircraft was originally purchased from Lockheed Aircraft Corp., by Eastern Air Lines on February 10, 1949, as model No. L-749A-79, S/N 2611. It was leased by the United States Government from EAL, and certificated August 23, 1960. The United States Government purchased the aircraft June 30, 1961. The aircraft was utilized for logistics purposes and was operated in the FAA's Pacific Region out of Honolulu, Hawaii. It had been flown a total of 1,189.8 hours by the FAA. The aircraft had a total of 41,481.6 hours and 3,968.4 hours since the last Block III overhaul which was accomplished by Eastern Air Lines.

FAA maintenance records indicate that the last preflight check (daily) was performed on N 116A, 11.0 hours prior to April 25, 1962. A total of 80.5 hours had been flown since its last numbered check (No. 11), which was completed on March 29, 1962. FAA maintenance system numbered checks are performed every 120 hours.

The engines were Curtiss-Wright model No. 749C18-BD1, with operational times since overhaul of 91.9 hours, 38.9 hours, 999.6 hours, and 474.3 hours for Nos. 1, 2, 3, and 4, respectively.

The propellers were Hamilton Standard model No. 43E60-343, blade type 6903B-0. Their operational times since overhaul were 263.9 hours, 2,065.1 hours, 91.9 hours, and 2,065.1 hours for Nos. 1, 2, 3, and 4, respectively.