

## CIVIL AERONAUTICS BOARD

**ACCIDENT INVESTIGATION REPORT**

Adopted: January 10, 1958

Released: January 15, 1958

FLYING TIGER LINE, INC., DOUGLAS DC-6A, N 34953,  
NEAR NEW YORK INTERNATIONAL AIRPORT, N. Y.,  
JUNE 21, 1957

The Accident

At 1051<sup>1/</sup> on June 21, 1957, a Douglas DC-6A, N 34953, leased and operated by Flying Tiger Line, Inc., made a forced landing, following loss of power on all engines, on a sandbar in Jamaica Bay two miles southwest of its takeoff from New York International Airport. The five flight crew members were uninjured; two of the four company employee-passengers incurred minor injuries. The aircraft received substantial damage from the wheels-up landing and salt water immersion.

History of the Flight

The flight, designated as 8516-21, originated at New York International Airport (Idlewild) and was a ferry flight to Dover, Delaware. From there the flight was to transport MATS (Military Air Transport Service) freight to Chateau Roux, France. An en route stop and crew change was scheduled at Gander, Newfoundland. An IFR clearance to Dover had been given by ARTC as follows: To the Woolf intersection via the 150-degree radial of Idlewild VOR and Victor Airway 16, maintain 3,000 feet. The flight crew consisted of Captain Gregory P. Thomas, Copilot William H. Seamans, Flight Engineer B. J. Palamar, and Stewardesses Russon and Johnson.

The takeoff from runway 31R was started at approximately 1048. While climbing at an indicated airspeed of 135 knots, gear up and flaps at the 20-degree takeoff position approximately over the northwest end of runway 31R, a substantial power loss on No. 3 engine occurred followed immediately by a similar loss on Nos. 1, 2, and 4 engines. Idlewild local control was advised that the aircraft was making an emergency landing. The aircraft was observed to make a descending left turn and to land wheels up on a sandbar in Jamaica Bay southwest of the airport. It came to rest on the fuselage bottom, level laterally and longitudinally.

The gross weight of the aircraft at the time of takeoff was 74,977 pounds, which is under the allowable gross takeoff weight of 100,000 pounds (autofeathering inoperative). The load was distributed in compliance with c. g. limits.

The 1051 Idlewild weather was high, thin scattered clouds; visibility more than 15 miles; temperature 74; dewpoint 48; wind north-northeast 6 knots; altimeter 30.06.

---

<sup>1/</sup> All times herein are eastern daylight and based on the 24-hour clock.

## Investigation

After the power loss occurred the flight was cleared by Idlewild tower to land on any runway. The aircraft passed near the approach end of runway 13R but its altitude was so low that a further left turn to the runway could not be made. According to testimony of the captain, it was necessary to go straight ahead with the small amount of power remaining and he was unable to maintain altitude at an airspeed of 105 knots. The landing, with gear up and flaps fully extended, was made on a heading of approximately 200 degrees magnetic off the east shore of an island in Jamaica Bay.

Statements of the flight crew indicated that a normal engine rump had been made at 30 inches of manifold pressure and all pressures and temperatures were normal. In accordance with the Flying Tiger operations manual, a wet takeoff was made using 2,800 r. p. m., 59.5 inches of manifold pressure, and 240 BMEP. After breaking ground and reaching an altitude of about 140 feet over the end of runway 31R, the BMEP of No. 3 engine dropped to 105, followed by a similar drop on the other three engines. A reduction of manifold pressure to 50 inches did not correct the difficulty and it was returned to 59-1/2 inches. The continuing loss of power, drop of airspeed to 105 knots, and low altitude precipitated the forced landing.

Because of the nearly simultaneous loss of power on all four engines, initial investigation was directed to the aircraft's fuel supply. Board investigators immediately obtained samples of gasoline and ADI (antidetonant injection) fluid from the aircraft. Samples were also obtained at the supply source of the Flying Tiger Line. The samples of gasoline were analyzed and found to be the correct octane rating (108-135) and uncontaminated. Laboratory analysis of the samples taken from the ADI tanks of the aircraft revealed 55 percent of 50/50 methanol-water contaminated with 45 percent of ethylene glycol. The 50/50 methanol-water is the correct ADI fluid while ethylene glycol is a fluid used to eliminate ice accretion on the exterior surfaces of aircraft.

Investigation disclosed that N 34953 had arrived from an overseas trip the evening of June 20 and that the aircraft was serviced the morning of June 21. Fuel was added to the four main tanks only. The aircraft's four ADI tanks were filled by a mechanic using a portable cart holding a 55-gallon drum marked "ADI." Samples taken from this cart disclosed the fluid to be entirely ethylene glycol.

Investigation further disclosed that the ADI servicing cart had been replenished, the late afternoon of June 19, from a fenced drum-storage area outside of the Flying Tiger hangar on New York International Airport. It was found that there were drums containing various liquids intermingled in this storage area. Among these liquids were both ADI fluid and ethylene glycol. All of the drums were marked on one end as to the contents. However, the method of filling the portable cart was to insert a hand pump at a side bung in the drum where there were no markings. A deposition taken from the uncertified mechanic who had serviced the cart on June 19 indicated that he had mistakenly filled the cart from a drum of ethylene glycol. This mechanic also indicated to Board investigators the drum used to fill the ADI cart. The stenciling on the end of this drum, while dirty and blurred, was distinguishable as indicating the contents to be ethylene glycol. The mechanic stated that he had previously serviced the ADI cart but that he had never had occasion to draw other fluids at the outdoor source of supply.

An examination of all engines at the sandbar disclosed no evidence of structural failure or malfunction. All four engines were subsequently shipped to the Flying Tiger base at Burbank, California. Under supervision of Board personnel a cylinder from each row of the No. 1 engine was removed for examination. No evidence of operational failure was found. The articulating assemblies, master rod, and main bearings were intact and adequately lubricated. Rotation of the propeller shaft revealed normal gear train action throughout the entire engine. A concentricity check was made on the propeller shaft and found to be within limits.

After reassembly the No. 1 engine of N 34953 was installed on an engine test stand for the purpose of checking its performance under dry power as well as wet power with a similarly contaminated ADI mixture as was found on the subject flight. New spark plugs were installed because of salt water corrosion and fouling of the original plugs. Nothing else was required.

The engine was then started and operated at idle power until temperatures and pressures stabilized. The engine was operated at 1,000, 2,100, 2,300, and 2,600 r. p. m. at dry power, at which times pressures and temperatures were normal. During these runs the ignition analyzer indicated normal ignition patterns on all cylinders. The engine was then operated without water injection (ADI) at takeoff power (2,800 r. p. m.; 60 inches manifold pressure) and a torque meter pressure of 132 pounds was recorded. This is equivalent to 238 BMEP or 2,350 horsepower. Temperatures and pressure were within normal limits.

The ADI tank was then serviced with a mixture of 55 percent of 50/50 methanol-water and 45 percent of ethylene glycol. The ADI system was checked and found to function normally at 2,400 r. p. m. and 45 inches manifold pressure. However, at this time the ADI fluid was not permitted to enter the cylinders. Power was then advanced to wet takeoff figures (2,800 r. p. m. and 62 inches manifold pressure) and a torque pressure of 132 pounds (equivalent to 238 BMEP) was recorded. The contaminated mixture was then allowed to flow and approximately 40 seconds later the color of the exhaust flame changed from whitish-blue to deep orange; the torque pressure dropped immediately to 70 pounds and the cylinder head temperatures rose rapidly to the top limit of the instrument (plus 300 degrees centigrade). The maximum allowable cylinder head temperature at takeoff is 260 degrees centigrade. The ignition analyzer indicated a progressive fouling of the spark plugs in all cylinders. A drop in torque pressure from 132 pounds to 70 pounds (equivalent - 238 BMEP to 127 BMEP) would be a drop in horsepower from approximately 2,350 to 1,225.

After the full power test the engine was operated at dry power for 45 seconds but the torque pressure did not improve appreciably. Cylinder head temperatures remained above the maximum limits.

After the salvaging of the aircraft and the installation of four other powerplants, a test flight reflected full and normal operation of the aircraft's fuel and water injection systems.

It was noted during the investigation that the usual air carrier standards in the storing, marking, and servicing of various aircraft fluids were not in effect at the Flying Tiger Idlewild hangar. The assigning of personnel to fill the ADI servicing cart was entirely haphazard.

## Analysis

Based on the evidence disclosed during the investigation of this accident, the Board has conclusively proved that the engine power loss was the result of contaminated ADI fluid in the engines. Tests duplicating the situation showed that the continuing and increasing power loss experienced during the flight precluded continued flight. In this regard, the Board believes the pilots met the serious situation ably and did all that was possible under the conditions. In fact, the pilots are to be commended for their action in avoiding populated areas and making the landing on an isolated sand bar.

Had the engines been run up on the pretakeoff check approximately 40 inches of manifold pressure, ADI fluid would have started to flow and its effect would probably have been detected by the crew. However, it is normal procedure to check magnetos at atmospheric pressure (approximately 30 inches) and complete the runup at about this manifold pressure to preclude a rise in cylinder head temperature.

The Board is of the opinion that the mechanic mistakenly filled the ADI cart with ethylene glycol. The mechanic should have been able to read the markings on the drum and, before filling the ADI cart, he should have made certain as to the contents of the drum used.

It is apparent that a serious lack of managerial supervision was also involved. The drums should have had additional markings indicating the contents placed at the side bung by FTL maintenance. It is further evident that a separation of the drums in a more orderly manner would have assisted in preventing the mistake that occurred. Finally, it is the Board's opinion that there was a definite lack of instruction for the mechanics servicing the ADI cart.

Subsequent to this accident, the supplier took steps to stencil the initials "ADI" above the side bung on drums that are equipped with a side bung. In addition, the air carrier has revised its maintenance manual instructing its personnel to segregate ADI fluids from other fluids and to discharge a slight amount of fluid over their hand before servicing an aircraft to determine if the fluid is contaminated.

## Findings

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

1. The carrier, the aircraft and the crew were currently certificated.
2. The gross load of the aircraft was under the allowable gross weight.
3. A wet takeoff (i. e., the ADI switches were actuated) was made in accordance with FTL operations manual.
4. The fluid in the aircraft's ADI tanks consisted of 55 percent methanol-water (correct ADI fluid) and 45 percent ethylene glycol.
5. The use of this mixture for takeoff caused a nearly immediate loss of power in all engines and precipitated the forced landing.

6. The ADI fluid service cart used to service N 34953 was mistakenly filled, by a mechanic, with ethylene glycol.

7. The cart was serviced at a common uncovered storage area where drums containing glycol, ADI fluid, and other liquids were intermingled.

Probable Cause

The Board determines that the probable cause of this accident was the loss of power on all engines immediately after a wet takeoff due to (A) contamination of ADI fluid resulting from (B) mechanic's mistake in replenishing ADI supply cart with ethylene glycol (de-icing fluid), and (C) inadequate supervision of storage facilities.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE

/s/ CHAN GURNEY

/s/ HARMAR D. DENNY

/s/ G. JOSEPH MINETTI

/s/ LOUIS J. HECTOR

## S U P P L E M E N T A L   D A T A

### Investigation

Personnel of the New York office of the Civil Aeronautics Board heard and observed the takeoff of N 34953 over their building. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Depositions, ordered by the Board, were taken at New York International Airport on July 10 and 17, 1957.

### Air Carrier

Flying Tiger Line, Inc., is a Delaware corporation with its principal offices at Burbank, California. The corporation operates as an air carrier under a certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. These certificates authorize the carrier to engage in air transportation between various points in the United States and foreign countries. The subject flight was under a military contract Air Force 33/600/34320.

### Flight Personnel

Captain Gregory P. Thomas, age 43, was employed as a pilot by Flying Tiger Line in 1950. He held an airman certificate with airline transport rating and type ratings on DC-3, DC-4, DC-6, DC-7, C-46, and Constellation aircraft. He had, according to company records, a total of 13,000 pilot hours, of which 300 were acquired in DC-6 aircraft. His last six-months' proficiency check was on February 10, 1957.

Copilot William H. Seamans, age 42, was employed by Flying Tiger Line in 1952. He held an airman certificate with airline transport rating and type ratings on DC-4 and C-46 aircraft. He had, according to company records, a total pilot time of 14,000 hours, of which 80 hours were acquired in DC-6 aircraft. His last six-months' proficiency check was on June 7, 1957.

Flight Engineer B. J. Palamar, age 30, was employed by Flying Tiger Line in 1956. He held an airman certificate with rating of flight engineer and had a total flying time, according to company records, of 750 hours, of which 500 were acquired in DC-6 aircraft. His last flight engineer proficiency check was on March 28, 1957.

### The Aircraft

Douglas DC-6A, N 34953, serial number 44677, was manufactured November 18, 1954. It was owned by the Main-Elford Corporation and leased to Flying Tiger Line, Inc. Total time on the aircraft was 9,922 hours, with 38 hours since maintenance operations No. 5. The aircraft was equipped with four Pratt and Whitney CB-17 engines and four Hamilton Standard model 43E60-375 propellers, blade model 6895E-8. Total time on the four engines was between 5,843 and 9,102 hours, and between 271 and 1,020 hours since last overhaul. Total time on the four propellers was between 661 and 15,479 hours, and 459 and 2,462 hours since last overhaul or new.