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: September 10, 1963 Released: September 13, 1963

THE FLYING TIGER LINE INC., LOCKHEED 1049H, N 6923C, DITCHING IN THE NORTH ATLANTIC SEPTEMBER 23, 1962

SYNOPSIS

On September 23, 1962, at 2200 Greenwich Mean Time, a Flying Tiger Line Inc., Lockheed Constellation model 1049H, N 6923C, on a Military Air Transport Service passenger contract flight from McGuire Air Force Base, New Jersey, to Frankfurt, Germany, was ditched at sea approximately 560 nautical miles west of Shannon, Ireland. Forty-eight of the 76 souls on board survived.

Approximately three hours after departing Gander, Newfoundland, a fire developed in the No. 3 engine. This engine was shut down and its propeller feathered. A few minutes later the propeller of No. 1 engine oversped when the flight engineer inadvertently closed the No. 1 engine firewall shutoff valve. This engine was also shut down and the propeller feathered. At this time the captain altered course to proceed to Shannon. After flying approximately one hour, the No. 2 engine developed serious trouble and the aircraft subsequently was ditched.

The Board determines the probable cause of this accident was the failure of two of the aircraft's four engines, and improper action of the flight engineer, which disabled a third engine, thereby necessitating a ditching at sea.

Investigation

Operations

The Flying Tiger Line, Inc., Flight No. 8816-23-923 (FT 923), was a Military Air Transport Service contract Flight No. BRAF 019/23 from McGuire AFB, New Jersey, to Rhein Main Airport, Frankfurt, West Germany, with a scheduled flight crew change and refueling stop at Gander, Newfoundland.

Prior to departure from Newark to pick up passengers at McGuire AFB, preliminary flight planning for the Atlantic crossing was accomplished by Flying Tiger Line dispatch personnel and the flight plan was checked by the navigator. The weather information utilized emanated from the U. S. Weather Bureau via teletype and facsimile.

The aircraft departed McGuire AFB at 1145. 1/ Upon departure the stewardesses briefed the passengers on over-water emergency procedures. Between McGuire and Gander the navigator calculated his Equal Time Point (ETP) and the Point of No Return (PNR) for the Gander-Frankfurt leg and plac these on the appropriate navigational chart. These calculations were based upon the weather information and weather charts provided by U. S. Air Force personnel at McGuire AFB. The weather charts used included the 500 and 700 millibar prognostic charts. The flight to Gander was stated to have been routine.

The crew from Gander to Frankfurt consisted of Captain John D. Murray, Copilot Robert W. Parker, Flight Engineer James E. Garrett, Jr., Navigator Samuel T. Nicholson, Stewardesses Elizabeth A. Sims, Carol Ann Gould, Ruth Mudd, and Jacqueline L. Brotman. There were 68 passengers on board the airplane.

Captain Murray said that at Gander he met and talked to the incoming crew and discussed with the navigator the fuel requirements for that leg of the flight. On the basis of the weather information he had received at McGuire AFB, the navigator recommended that the fuel load be increased by 800 pounds. The captain further stated that as the aircraft was relatively light he ordered the fuel load increased by 3,000 pounds and had the additional fuel placed in the No. 5 tank. The captain also reviewed a folder of forecast weather information provided by the Canadian Meteorological Service. He checked and signed the weight and balance manifest which had been prepared by the first officer and, although certain errors were made during the preparation of this manifest, the gross takeoff weight of the aircraft was well below the authorized limitations and the load was properly distributed. The captain said there were no entries of any significance in the aircraft's logbook.

A preflight inspection of the aircraft was made by the flight engineer, and servicing of the aircraft with fuel and oil was accomplished Following fueling operations at Gander, the fuel sumps are normally drained by Seaboar World Airlines mechanics usually upon instruction from The Flying Tiger Line Maintenance Representative stationed at Gander. However, in this instance the Maintenance Representative stated that to his knowledge the fuel sumps were not drained.

The flight departed from Gander at 1709 with 68 passengers and the crew of 8 aboard. Captain Murray occupied the left pilot seat, and Copilot Parke the right pilot seat.

The flight was given an instrument clearance to Frankfurt-Rhein Main Airport to maintain flight level 110. 2/ The en route flying time was estimated as 9 hours and 22 minutes.

The takeoff and climbout were described as normal.

At 1805, a report from FT 923 indicated it was at 51°00' north latitude, 50°00' west longitude, flight level 110, in clouds, OAT 3/ -18°c., wind 275°, 45 knots, and experiencing light icing.

At 1849, another radio transmission from FT 923 indicated it was then at 52°10' north latitude, 45°00' west longitude, flight level 110, in clouds, OAT -15°c., and wind 265°, 25 knots, and experiencing light icing.

At 1851, the flight requested, and Gander Area Control Center (ACC) approved, a climb to flight level 130. FT 923 acknowledged leaving flight level 110 at 1853, and at 1900 reported reaching flight level 130.

At 1932, a report from the flight indicated the aircraft was then at a position of 52°50' north latitude, 40°00' west longitude, at flight level 130, in clouds, OAT -18°c., and wind 275°, 20 knots. At this new altitude the flight again encountered light icing and the captain, after reviewing the meteorological forecast folder and discussing the situation with the crew requested flight level 210.

At 1951, Gander ACC cleared FT 923 to climb to and maintain flight level 210. At 2010, the flight acknowledged reaching flight level 210.

2/ When the altimeter is set at the Standard Sea Level Pressure of 29.92 the altitude read is expressed in flight levels, i.e., FL 110 is representative of 11,000 feet.

3/ OAT - Outside Air Temperature.

Within a few minutes after reaching this altitude, and, according to the navigator, approximately eight minutes past the precomputed ETP, a fire warning occurred on the No. 3 engine and this propeller was feathered. While in the process of engine shutdown, Stewardess Sims came to the cockpit and reported a fire in the No. 3 engine. Captain Murray then instructed the flight engineer to check the engines visually. The engine check was accomplished from the passenger compartment.

At 2019, the copilot called Gander Radio, reported the failure of No. 3 engine, and requested permission to descend to flight level 90, the highest altitude which could be maintained in 3-engine configuration at the computed aircraft weight. Gander ACC approved descent to flight level 90 and asked if the flight needed escort. The flight replied "stand by." According to the captain, about six or seven minutes after the No. 3 engine fire warning and shutdown and shortly after the flight engineer returned to the cockpit from examining the fire in the No. 3 engine, the No. 1 engine oversped. The No. 1 engine was shut down and its propeller feathered immediately. Subsequent attempts to restart this engine were unsuccessful. Maximum Except Takeoff (METO) power was then established on engines Nos. 2 and 4 in order to maintain a minimum rate of descent.

The flight engineer checked the aircraft performance charts and determined that the 2-engine configuration at the computed weight of the aircraft precluded flight above flight level 50.

At approximately 2025, the copilot called Gander Radio and reported Nos. 1 and 3 propellers feathered, requested flight level 50 and an escort.

Gander ACC asked FT 923 if it was returning to Gander or proceeding to Shannon. The flight replied, "proceeding to Shannon." The change in altitu was approved. The captain testified that fuel was not dumped because he believed that there would be an insufficient safety margin if this was done.

The flight called Shannon at 2039 for weather conditions at Keflavik, Iceland, and was informed that at 2000 hours surface winds were 240 degrees at 42 knots, with gusts to 58 knots, visibility 8 kilometers (5 miles), rain stratocumulus clouds at 1,800 feet. Captain Murray stated that in his opini these weather conditions eliminated the use of Keflavik as an emergency fiel

At this point the flight engineer read the procedures for ditching contained in the operations manual and computed the ditching airspeed. He next reviewed the ditching stations and procedures prescribed for the copilo and navigator. The senior stewardess was called to the cockpit and briefed on the procedure to be followed in the cabin. The captain stated that on several occasions thereafter he flipped the public address system switch to inform the passengers of events, but the senior stewardess was "doing such a fine job of briefing them," he decided not to interfere. During this time the copilot was in radio contact with Shannon and Gander, and these transmissions were monitored and recorded by Prestwick Oceanic Radio.

At 2045, FT 923 requested sea conditions from Gander Radio. These were later given to Riddle 18H, a DC-7 eastbound flight, to be relayed to FT 923 as: wind from 260 degrees at 28 knots; primary swells from 260 degrees true, 8 to 12 feet high; secondary swells from 300 degrees true, 8 feet high. Captain Murray's testimony verified that Riddle 18H did relay this message.

Two minutes later FT 923 was asked by Gander if it intended to ditch. The flight advised, "do not intend to ditch." At 2050, Gander requested Riddle 18H to alter course and intercept FT 923.

At 2054, FT 923 reported its position as 54°05' north latitude, 30°30' west longitude, and at 2058 gave its Estimated Time of Arrival (ETA) for Shannon as 0200.

At 2103, the flight reported its position as 54°10' north latitude, 29°10' west longitude. Shannon at this time declared an alert. Also at this time Prestwick requested MATS 33246, a westbound flight, to change course to intercept FT 923.

At 2106, MATS 33246 made radio contact with FT 923. Following this, many messages were then relayed through MATS 33246 and through Riddle 18H.

At approximately 2115, a fire warning on the No. 2 engine occurred. Captain Murray reduced power; the fire warning light went out and the alarm bell stopped ringing. He then reapplied power to approximately one or two inches of manifold pressure less than METO power. At this time he had the passengers don their lifevests and altered course for Ocean Station Vessel Juliett, which was 480 nautical miles away near position 52°30' north latitu and 19°54' west longitude. Again a fire warning for No. 2 engine was experienced, power was further reduced, and the warning stopped. Power was then increased to slightly less than the previous power setting and the copilot called Shannon to inform them that the flight would be unable to maintain flight level 50.

Captain Murray stated that upon encountering trouble on No. 2 engine, all attempts to restart engine No. 1 were discontinued.

Upon reaching flight level 30, altitude was maintained at approximatel 150 knots IAS, with METO power on No. 4 engine and reduced power on No. 2 engine.

Between 2120 and 2124, MATS 33246 and Riddle 18H gave estimated times of arrival over FT 923 as 2200 and 2155, respectively.

At 2142 the position of FT 923 was reported as 54°10' north latitude, and 25°30' west longitude.

At 2154, MATS 33246 was in visual contact with Flight 923. Riddle 18H was in visual contact with FT 923 at 2157. At approximately this time the No. 2 engine failed; however, its propeller was not feathered. The captain then turned on the public address system and said: "Ladies and gentlemen, this is the captain speaking. We are going to ditch." A ditching heading of 265 degrees magnetic was then decided upon and MATS 33246 was alerted to stand by. The captain received a radio altimeter reading of 3,100 feet fro the navigator, and changed his altimeter to coincide with that reading. Directional control of the aircraft was difficult with METO power on the No. 4 engine, and the aircraft was turned to the left in order to obtain th heading of 265 degrees.

Captain Murray stated that half way through the turn to ditching heading, after failure of No. 2 engine, "the controls froze." He attributed this to a loss of hydraulic pressure, and started to disengage the hydrauli control boost. However, the flight engineer suggested the use of the hydra crossover switch, which was then actuated, restoring hydraulic pressure to

control boost system, after which the controls responded normally. As the aircraft was lined up on a heading of 265 degrees, the captain reduced power on the No. 4 engine so that directional control could be maintained.

Flaps were used throughout the approach to the water -- with the selection of first, 60 percent, then 80 percent, and finally 100 percent.

The pilot of Riddle 18H flying over the scene at the time of the ditching indicated that there were scattered clouds in the area, bases near 2,000 feet, tops near 3,000 feet, weather good, and no moon.

Captain Murray stated that depth perception and visibility were excelle during the final descent; there was a considerable distance between waves, possibly 200 feet. Just prior to impact he used the landing lights, and cut the power on the No. 4 engine to land just past the top of a swell. However, just before impact the nose of the aircraft was brought up to parallel the face of the approaching swell and ditching was accomplished intc

Preparation and Ditching

After the second engine failure, the senior stewardess was called to the flight deck and briefed on the ditching procedures. Upon her return to the cabin, she briefed the other stewardesses by reading the ditching drill from the manual. She also announced over the loudspeaker system that they would conduct a ditching drill, at the same time assuring the passengers that the aircraft could proceed to Shannon on two engines. She then called attention to a ditching folder inside the pocket behind each seat. The three remaining stewardesses circulated among the cabin passengers and assisted in explaining the ditching procedure.

There were differences between the instructions given by the Stewardes and the instructions contained in the ditching folder regarding the correct position to be assumed for ditching. These differences resulted in some confusion, as evidenced by passenger statements. Most passengers were advi to put a blanket and pillow on their laps, to lay their heads on these, and clasp their hands and arms around their legs. Others were briefed to cross both arms, place their hands on the seatback ahead of them and to rest thei heads on their crossed arms. Some passengers did not understand either of these instructions and assumed still different positions.

All of the passengers donned lifejackets and were instructed not to inflate them until they were outside the aircraft. The captain stated that it had been necessary for the copilot to tie his lifejacket on him since he could not divert his attention from the controls. None of the lifejackets were equipped with lights.

Sometime before ditching, two soldier passengers, at the direction of the crew, removed the emergency liferaft stowed in the crew compartment and placed it in front of the left rear main exit door where it was tied down. The door between the crew compartment and the main cabin was removed and stowed in the left forward coat closet. The stewardesses requested the passengers to remove dentures, pens, pencils, glasses, and other sharp objec from their persons and to place them in the pockets of the seatbacks. Passengers were asked if they had any knives or flashlights and those collected

were then distributed to certain passengers who had been given special duti such as opening emergency exits and launching liferafts. According to the passengers, most of the stewardesses did not have knives or flashlights, as required. Miss Gould, the surviving stewardess, obtained a flashlight from a passenger but lost it before reaching the liferaft. Passengers' shoe and boots were also collected and these were stowed in the forward lavatory.

Prior to ditching, the stewardesses assumed strategic seat positions near emergency exits. Two stewardesses occupied seats in rows beside the over-the-wing exits on the left side and one stewardess occupied a seat in the row opposite the aft over-the-wing exit on the right side. The senior stewardess occupied the right rear seat opposite the main cabin door.

Just prior to ditching, the navigator went into the cabin and removed the tiedown strap from the liferaft. He then seated himself in an aisle seat which was in the last row on the left side just forward of the main cabin door.

The cabin lights had been turned down so that the passengers might accustom their eyes to darkness. Approximately five minutes prior to contact with the water the captain had announced the decision to ditch. Howeve no final signal to "brace" for water contact was given, as outlined in the Flying Tiger ditching pamphlet and required in their operations manual. As a result, several passengers and stewardesses were seated in an upright position at the time of impact.

After initial impact, there were no skips or subsequent impacts. At impact, the captain said his head went forward and struck the instrument

panel. He also recalled that the copilot got out of his seat and called, "You all right John?", and that he answered, "Yes." Then Captain Murray said, "I got up and followed the copilot and the flight engineer out of the cockpit into the main cabin compartment." Upon reaching the cabin he remembered his flashlight, and went back into the cockpit and got it. The captain said that he had another flashlight in his kit but that there wasn time to get it. Upon his return from the cockpit he said he observed the cabin to be clear of all persons. He said, however, that he noticed some seats piled up in the rear of the cabin on the right side, but blood in his eyes from a 2 1/2-inch cut on his forehead prevented good vision. Captain Murray then left the aircraft through the forward left emergency over-the-wing exit and inflated his lifejacket.

Survivors stated there was only one deceleration during water contact and it was described as severe.

The triple seats on the right side of the cabin compartment from the aft over-the-wing exit back to the most rearward row failed at impact. As a result of the pileup of these seats, some passengers experienced considerable difficulty in extricating themselves.

The navigator stated that he had some difficulty in opening the main cabin door. Wing exits were opened easily with the exception of the aft over-the-wing exit on the right side, which was opened after moving a faile seat which had partially blocked this exit. Immediately after opening the main cabin door, the navigator pushed out the liferaft. Since the lanyard provided for the liferaft's retention was not tied to the aircraft nor was

it held by the navigator when he launched the raft, it drifted away requirin him to jump into the water to retrieve and inflate it.

Passengers who evacuated through the left over-the-wing exit said they believed the left wing had separated from the aircraft during the ditching because when they left the cabin they stepped into the water instead of onto the wing. The surviving stewardess stated that she felt the jagged metal at the wing root and that the left wing was missing. One survivor stated that he stood on the right wing after evacuating the cabin, some recalled observing the right wing while exiting the aircraft, but other survivors sta they saw no right wing.

During the evacuation of the aircraft some of the survivors said they could see clearly, and others said they could hardly see at all; however, by following other people they were able to find an exit. When the last passengers left the aircraft the water inside was at least waist deep. A passenger who indicated that he was the last one to leave said that he did not see anyone remaining in the aircraft. However, he added it was possible that some of the broken seats may have concealed someone.

In addition to the 25-man liferaft stowed in the crew compartment, the aircraft carried four 25-man liferafts which were stowed in four compartment two in each wing aft of the rear spar. A cable control, actuated by a handl located inside the jamb of the aft over-the-wing exits, sequentially unlatch the wing compartments' cover doors and opens the valves to the CO_2 cylinder of each raft on that side of the aircraft. As each raft inflates, it ejects

itself automatically from the compartment. The stowed rafts in the left wing can also be released by actuating a lever in the cockpit. In addition to these releases there is a release mechanism on each wing liferaft compartment.

The captain was asked the location in the cockpit of the release handle which actuates the liferafts stowed in the left wing compartments. He was not aware that there was such a handle in the cockpit.

None of the liferafts stowed in the wings was seen by the survivors during the evacuation; however, all rafts were later recovered. There was no evidence that these rafts were used by any of the non-survivors.

The survivors stated that they alternately swam and tread water until they eventually found the raft. Some survivors saw a light, but it could not be established whether they saw the automatically actuated lights on the raft or the flashlight carried by the captain. A total of 51 persons includi the captain, navigator and Stewardess Gould swam to the raft and boarded it. As this number exceeded the capacity of the raft by over 100 percent, the crowded conditions restricted movement. Therefore, the position in which man boarded the raft was essentially the position in which they had to remain until rescued. Under the existing circumstances the raft took on water over the sides, and although bailing was almost continuous throughout the entire time on the raft, it was necessary for some survivors to hold the heads of others out of the water. Aircraft were overhead continuously from the time of ditching until rescue approximately six hours later by the merchant ship Celerina. Three passengers on the raft died, either on the raft or shortly after being rescued.

The captain stated that he did not know whether the flight engineer had closed the ditching valve as required in the company's ditching procedures. He further stated that the aft over-the-wing exits had not been removed because of insufficient time after the decision to ditch had been made. Removal of the exits is also required by the company manual.

When asked why he chose the ditching heading of 265 degrees magnetic, he said that he had been advised by Gander Radio that the primary swells were from 260 degrees and the winds were from 265 degrees at 30 knots. Directions given in forecasts such as these are true headings and magnetic variation must be taken into account. The magnetic variation in the locale of the ditching is in excess of 20 degrees.

Captain Murray testified that the sea was covered with white caps, but the primary swells were quite apparent and appeared to be 15 to 20 feet high. He stated that he was familiar with the ditching procedures in The Flying Tiger Line manual, and was aware of the stipulation therein "Never land into the face of a swell (or within 45 degrees of it)." However, he stated that he did not agree with the ditching procedures in the manual concerning the direction of landing with respect to swell movement, and because of the distance between swells elected to land into the face of one.

Powerplants

All powerplants operated normally until shortly after the climb to flight level 210. The first difficulty the captain reported was a No. 3 engine fire warning. This engine was shut down immediately, propeller feathered, and one bank of fire extinguishment discharged. The shutdown procedure was carried out by the flight engineer upon order by the captain t

"feather No. 3 and standby to discharge." Fire extinguisher discharge was performed subsequently upon command by the captain. The immediate action items to be accomplished in the event of an engine fire, as noted in The Flying Tiger Line model 1049H Abbreviated Emergency Procedures, are:

1. Throttle - Closed
2. Feather Button - Push
3. Mixture - Off
4. Emergency Shutoff Lever - Full Off Position
5. Engine Fire Extinguisher Selector Switch - Set
6. Fire Extinguisher Discharge Switch (at Pilot's Order) - Discharge

The captain testified that during the time an emergency was being combated involving an engine fire the flight engineer would actually perform these functions and report to him when the propeller was feathered. However, he did not know the order in which these items had been performed nor could he state with certainty that all were performed. These items are expected to be known by the captain and flight engineer and executed promptly without reference to an emergency checklist. He testified repeatedly that he never was aware of nor was he advised when No. 3 emergency shutoff lever was pulle and stated that he would not have such knowledge until the "cleanup." The fire warning went out when the extinguishment was released. The engineer, a ordered by the captain, checked this engine visually from a cabin window and reported a residual fire burning in No. 3 power recovery turbine stack (PRT) He believed it would go out, and this must have occurred since there was no further difficulty with this engine. Later, when considering restarting No. 3 engine, the flight engineer reported this engine's oil was deplete Loss of No. 3 engine oil had not been reported previously and the captain could not tell when the oil was lost or the rate of depletion. Passengers

in the cabin were not able to furnish much information regarding this engine and many did not know when it was stopped. There was mention of "sparks" emanating from No. 3 engine; however, no extensive flames were reported.

About six to seven minutes after the No. 3 engine fire warning and about coincidental with the flight engineer's return to the cockpit after observing this engine from the passenger cabin and the report of his observations, the No. 1 engine oversped without warning, reportedly peaking at 3300 r.p.m. The captain pulled all throttles back, pulled the nose of the aircraft up to slow down and ordered No. 1 propeller feathered. The flight engineer feathered No. 1 propeller and rotation was observed by the captain to have stopped. Captain Murray testified that he was not aware of any abnormal indication from the No. 1 engine prior to the overspeed. He further testified that he looked back and saw the flight engineer returning the No. 1 emergency shutoff lever to the "on" position. The flight engineer this time stated "I am sorry John, I goofed." The flight engineer was standing when this occurred. The emergency shutoff lever is a control in the cockpit that is used, as the name implies, when shutting down an engine because of failure or fire. This control, when moved from the normally "on" position to the "off" position, progressively stops the flow of the following fluids to the engine:

1st detent - All on, normal position
2nd detent - Hydraulic oil off
3rd detent - Blast air, fuel and hydraulic oil off
4th detent - Engine oil, blast air, fuel and hydraulic oil off

There are four such controls, one for each engine, located about midship, overhead and just to the rear of the captain's position. The captain testified when he first observed the No. 1 emergency shutoff control being moved by the flight engineer it was between the 2nd and 3rd detents in transit toward the "on" position. Concurrently, he observed the No. 3 emergency shutoff control in the "off" position. He did not know when either of these valves had been moved from their normal "on" position to the "off" position. Subsequent to shutdown of the No. 1 engine, the checklist was used to secure both Nos. 3 and 1 engines.

A restart of these engines was considered shortly after No. 1 was shut down. Because of the loss of oil, a restart of No. 3 was not attempte Repeated attempts to restart No. 1 were made, once using the starter, the remainder by unfeathering the propeller which in effect develops appreciabl torque. Except for about 5 to 10 degrees of rotation on the initial unfeathering attempt, it was not possible to rotate the engine and a restart could not be accomplished.

Surviving passengers confirmed the approximate timing of the No. 1 engine overspeed relative to the No. 3 engine shutdown. The consensus was that the overspeed occurred soon after a crew member was observed looking out the cabin window at the No. 3 engine. Likewise, the unfeathering of the non-rotating No. 1 propeller was observed by at least one surviving passenger.

Interruption of oil to the type engine involved is reflected by incipi damage to certain bearings within seconds, minor damage in 20 to 30 seconds

and gross damage after 1 to 2 minutes. Oil to the propeller governor is interrupted almost simultaneously with the interruption to the engine.

Oil must be supplied to the propeller continuously to maintain a controlled engine r.p.m. Interruption of oil supply to the governor is followed by a decreasing quantity available to control the propeller blade angle which is the prime control of engine r.p.m. Leakages inherent in the governo engine, and propeller oil circuit account for this loss. Calculations based on nominal leakages indicate that an overspeed from 2400 r.p.m. to 3300 r.p.m would occur in about 40 seconds. Actual service experience upon which to base an elapsed time to a 3300 r.p.m. overspeed is lacking. There are variables not considered in the calculation which would increase the rate of onset of overspeed. The 3300 r.p.m. reported as maximum is compatible with a properly functioning pitch lock, a device incorporated in the propeller mechanism to prevent damaging overspeeds.

When asked to give the sequence of operations used by him following an engine overspeed, the captain did not recite the sequence recommended by the company in its checklist for the subject type aircraft.

The captain stated he had received company ground school instruction on the operation of the propeller pitch lock mechanism; however, he was unable to recall any of the details of such instruction or the operation of the device.

Following the stopping of Nos. 3 and 1 engines, a minimum rate of descent utilizing METO power from the remaining two engines was established.

Approximately one hour after No. 1 engine was shut down, the fire warni for No. 2 engine came on. Power was reduced, the fire warning ceased, and operation was continued with the manifold pressure reduced about two inches below METO. Approximately 20 minutes and again 40 minutes after the initial warning, the fire warning repeated a second and third time; in each instance this warning ceased when a reduction in power was made. Subsequently, for the fourth time the No. 2 engine fire warning came on and could not be silen Shortly thereafter the No. 2 engine failed, accompanied according to the captain, by noise, vibration, and a thud. The propeller was not feathered because the captain believed that the windmilling action would provide for engine rotation and thus keep the hydraulic pump operating. Failure of No. engine had occurred at 3,000 feet altitude and the ditching followed a few minutes later.

The captain testified that to his knowledge, excluding the fire warning all No. 2 engine instrument indications and the ignition analyzer checks were normal until the failure occurred. He said that he did not order anyor to, nor to his knowledge did any operating crew member, visually check No. 2 engine at any time after the first fire warning came on. He further stated that no stewardess came forward with any information regarding No. 2 engine.

Surviving passengers, one an experienced pilot, furnished information regarding No. 2 engine which complements, in part, the captain's testimony. At intervals, which in general agree with the estimated times of the fire warnings, they observed bursts of sparks coming from No. 2 engine and trail- ing over and aft of the wing and one of the passengers said at each occurre

he heard the fire warning bell. Many heard the fire warning bell which persisted at the final failure and interpreted it as a "ditching bell." The consensus of the passengers who observed the sparks was that they came from the left side cowl area and from across the top of the engine. The final burst was described as more prolonged and accompanied by considerable fire which came from the left side of the engine and trailed back over the top of the wing. One passenger reported directing the attention of a steward to the sparks and said that the stewardess immediately proceeded forward to the cockpit.

The flight engineer had extensive experience in this type aircraft prior to employment with The Flying Tiger Line. The emergency procedures used by his previous employer with respect to engine fire or failure differed in sequence from those of The Flying Tiger Line. In particular, the operation of the firewall shutoff lever was placed in the cleanup portion on the check-list by the other carrier, while Flying Tiger placed it in the initial or immediate action portion.

Maintenance Records

All maintenance accomplished at Gander was under the supervision of a company representative but was done under contract by Seaboard World Airlines personnel. It was reported there were no discrepancies noted on the log of FT 923 for the Newark, McGuire AFB, Gander leg of the flight, and no maintenance was performed at Gander.

A comprehensive review of the maintenance records pertaining to this aircraft was made. These records indicated compliance with all applicable

Airworthiness Directives. All prescribed items listed in both the last No. 2 operation and terminal check had been signed off as having been properly executed and inspected.

Weather

The 0000 surface weather chart of September 24, 1962, showed a deep low-pressure area centered over Iceland. A well-defined trough of low pressure extended from the low southwestward to near the southern tip of Greenland, then southward passing through a point approximately 250 miles east of Gander. A frontal system associated with the low over Iceland extended southward from the Norwegian Sea, with a cold front passing across the northern tip of Scotland, thence southwestward off the western Irish coast approximately 150 miles west of Shannon, or about 250 miles east of Ocean Station Vessel Juliett.

The 500 mb. chart for 0000 of September 24, 1962, showed a deep low-pressure area centered just north of Iceland. A trough of low pressure extended southwestward to near the southern tip of Greenland thence southward over the Atlantic through a point approximately 150 miles east of Gand

The following surface weather observations (including the state of the sea) were available from Ocean Station Vessel Juliett at the times indicate

2100/23 position, 52°30'N, 19°54'W, partly cloudy (4/10 cloud cover), bases of cumulus and stratocumulus 2,000 ft. and 3,500 ft., scattered cirrus, visibility 12-1/2 miles, air temperature 55°F, sea temperature 58°F, dewpoint 41°F, pressure 1021.2 mb., wind northwest 15 kts., pressure rising, past weather partly cloudy. Waves from west-northwest, period 5-7 seconds, 8 ft. high waves from west-southwest, period 7-9 seconds, 13 ft. high.

0000/24 position 52°36'N, 20°30'W, partly cloudy (4/10 cloud cover), stratocumulus bases 3,500 ft., visibility 12-1/2 miles, air temperature 54°F, sea temperature 57°, dewpoint 35°F, pressure 1022.0 mb., wind west-northwest 10 kts., pressure rising, past weather partly cloudy, ship's course last 3 hrs. averaged northwest 10-12 kts. Waves from west-northwest, period 5-7 seconds, 6 1/2 ft. high and waves from west-southwest, period 7-9 seconds, 14 ft. high.

A partial report from Ocean Station Vessel Charlie, whose position was near 52°48'N, 34°36'W, at 2100 on September 23, 1962, was as follows:

> Overcast, cumulus, slight showers, visibility 6 7/8 miles, air temperature 48°F, sea temperature 53°F, dewpoint 34°F, pressure 1018.6 mb., pressure falling then rising last 3 hours.

The 0000 rawinsonde 4/ observation of September 24, 1962, at Ocean Station Vessel Juliett, showed essentially, conditionally unstable air to the base of a 2°C temperature inversion near 4,000 feet. The top of the inversion was near 5,000 feet with a 1,000-foot stable layer above. The lapse rate was approximately moist adiabatic from 6,000 to near 11,000 feet, virtually isothermal from 11,000 to near 13,000 feet, with stable air indicated above that point to above 21,000 feet. The freezing level was near 8,000 feet. The wind at 5,090 feet was shown as 310°, 13 kts; at 10,640 feet as 290°, 23 kts.; at 18,600 feet as 240°, 49 kts.; and at 24,016 feet as 240°, 58 kts.

In accordance with international agreements, meteorological documentation for the Gander-Frankfurt portion of the flight was provided at Gander by the Canadian Meteorological Service. A flight folder for FT 923 was furnished to Seaboard World Airlines which handled the dispatching of FT 923

4/An upper air observation which includes temperature, moisture, wind direction and velocity.

The captain stated that he reviewed this flight folder prior to departure. The folder contained the following:

One page of terminal forecasts including Shannon, Frankfurt, Gander, Keflavik, Reykjavik, Halifax, Prestwick, London, Dublin, Orly, Brussels Santa Maria.

A prognostic chart of significant weather.

A surface prognostic chart.

A 700 mb. prognostic chart.

A 500 mb. prognostic chart.

Analysis

Following departure from Gander the flight proceeded routinely on cours to Frankfurt until the fire warning in the No. 3 engine occurred shortly aft the aircraft reached flight level 210 at 2010. According to the navigator the flight was then eight minutes past the ETP which had been precomputed pr to arrival at Gander. Based upon this information the decision was made to continue the flight to Shannon rather than return to Gander. However, the precomputed ETP was not checked against the actual conditions encountered en route. Based upon the information developed in the course of this investiga tion, the ETP utilized was in error in excess of one hour. Since the error was in favor of continuing flight toward Shannon, however, which was prefera under the circumstances, it is not considered a causal or contributing facto in the sequence of events which ultimately led to the ditching.

It was not possible to establish a concise time period between the No. engine fire and the No. 1 engine overspeed. Testimony by the navigator and the captain was vague and incomplete as to time and sequence of events in th

cockpit as well as to statements made by the other crew members during and after the No. 3 engine fire and the No. 1 engine overspeed. It was Captain Murray's opinion that approximately six or seven minutes transpired between the time of the initial fire warning and the subsequent completion of the entire emergency checklist for the No. 3 engine. This is normally accomplish after the immediate action items have been completed, and encompasses all items on the checklist. According to the captain this normally takes one to one and one-half minutes. In this instance, however, the normal procedure was interrupted immediately after discharge of the fire bottle when the stewardess entered the cockpit and reported fire in the No. 3 engine. At this time the flight engineer was sent back to the passenger cabin in order to determine if fire still existed. This duty consumed an estimated two minutes and upon return to the cockpit the flight engineer gave a report of his observations to the captain. Shortly thereafter the overspeed in No. 1 propeller occurred and emergency action on this engine was accomplished. These events transpired in rapid sequence, resulting in a delay in completion the checklist items for engine No. 3.

The engine failures cannot be related to improper maintenance, overhaul, or contamination of fuel. Also, The Flying Tiger Line engine failure rate prior to the accident did not presage such an occurrence. The information available indicates the circumstances of the engine failures were unrelated and each will be treated separately.

The essential facts pertinent to the No. 3 engine, the first to fail, are: (1) fire warning with no other cockpit indication; (2) subsequent awaren

of loss of oil with no information regarding when or at what rate the loss occurred; (3) No. 3 PRT location exhaust stack fire; and (4) although not conclusive, some testimony indicating sparks trailing rearward. The circumstances suggest a No. 3 PRT failure involving both the oil seals and some turbine wheel rotational interference with possibly the former preceding and initiating the latter. Such a failure is not compatible with the reported, almost total, depletion of the No. 3 engine oil. The engine manufacturer advises oil would be lost at the rate of about one gallon/minute in the event the PRT oil seal was ineffective. Loss of approximately 40 gallons at this rate should be noted and reported by the flight engineer well in advance of almost total depletion. A piston failure which might result in a localized exhaust stack fire, as reported, and a relatively rapid loss of oil, would normally be reflected on engine instrumentation as well as probably a more violent engine failure than is indicated. Except for lack of an explanation for the undetected loss of oil, a No. 3 PRT failure is considered to be the most likely cause of the No. 3 engine fire warning.

The overspeed which prompted the stopping of the No. 1 engine is well documented and accepted without question. The only clue to account for the overspeed is the reported "reopening" of the No. 1 emergency shutoff valve control lever, as observed by the captain, with the assumption that it had been closed. It is concluded oil was turned off long enough, probably 30 to 60 seconds, to cause initial "oil starvation" damage and subsequent seizure of the engine and concurrently to starve the propeller of oil which is essential to maintaining r.p.m. control. Oil starvation for more than a minute is expected to cause gross engine damage with subsequent seizure at shutdown unl

As previously noted, the operation of the firewall shutoff valve is in the immediate action portion of The Flying Tiger Line checklist and Captain Murray testified that he would expect the flight engineer to accomp this operation without command from him. However, in view of the time elem between the failure of engines No. 3 and No. 1, it is unlikely that the No. firewall shutoff valve was actuated prior to the flight engineer's return to the cockpit after checking on the fire in the No. 3 engine. The delay i operating the firewall shutoff valve was probably due to the fact that the flight engineer had been hired by The Flying Tiger Line only a short while before this flight and had very limited experience with their procedures. T is in marked contrast to his substantial amount of experience with another carrier whose procedures refer to the operation of the firewall shutoff valv in the "cleanup" portion of the checklist. It appears likely that, with residual fire in the exhaust stacks of the No. 3 engine, and the pilot's decision not to discharge the second fire bottle, the action on the emergenc procedures was resumed upon the flight engineer's return to the cockpit. At this time the No. 1 firewall lever was mistakenly moved instead of No. 3. With the resulting overspeed of the No. 1 engine, the flight engineer appare recognized the mistake and was in the process of correcting it when observed by the captain.

The captain did not observe the tachometer reading but the copilot reported to the captain later that the maximum r.p.m. reached was 3300. Overs to this extent is not in itself damaging to the engine. It is believed the peller pitch lock functioned. The pitch lock is a relatively simple device incorporated in the propeller to limit overspeeds below engine-damaging valu

It functions without attention from the crew. A speed sensitive valve closes to trap oil being displaced as a result of a decreasing blade angle which in turn is permitting the overspeed to develop. After the pitch lock is effective, operation of the propeller in a "fixed pitch" position can be continued and any reduction of power and/or airspeed reduces the r.p.m. In this instance the continued operating capability of the engine is not known; however, with restoration of the emergency shutoff lever to the open position, further operation at slightly reduced power for some period was most likely.

From the captain's testimony it was evident that he was not fully aware of the safety features of the pitch lock system. Had he been aware of this feature he may not have feathered the engine immediately, thereby, retaining power on this engine. Furthermore, Flying Tiger Line operations personnel and the Federal Aviation Agency Air Carrier Operations Inspector assigned to the company demonstrated their lack of knowledge and appreciation for the features and applicability of the propeller pitch lock. Testimony indicated that scope and emphasis on training in this area was lacking. The Board strongly supports the view that crew training should encompass all features of all equipment that may be utilized to cope with emergencies in flight and thus enhance safety.

About one hour after No. 1 engine was stopped, the first of a series of No. 2 engine fire warnings came on. Until the fourth and last one, progressive reductions in power caused the warnings to cease. During this same period intermittent showers of sparks were observed emitting from the No. 2 engine. The last shower of sparks was more prolonged and culminated in an engine fire and violent failure. All instrument indications were norm until the final failure. All visual observations were reported by surviving passengers since no visual check was made of this engine by any of the operating crew. The reported circumstances of this powerplant malfunction and failure are unique and do not reflect an obvious cause. The series of fire warnings as described suggest an exhaust system leak becoming progressi more extensive. The showers of sparks are less readily explainable but conceivably were the result of exhaust flames contacting the aluminum cowl and/or the cylinder fins. Sparks that sometimes accompany a PRT failure usually are not intermittent as described and would not be expected to respo to repeated small reductions in power. The final failure and fire very like resulted from some kind of gross cylinder failure, probably initiated by repeated and progressive damage from a leaking exhaust assembly.

The captain testified that he did not feather the No. 2 propeller after the engine quit with a "thud" because he wanted the rotational speed of the windmilling engine to give him hydraulic pressure for the primary hydraulic

system. Nevertheless, during the turn to a pre-selected ditching heading the controls froze. The captain was in the process of disconnecting the boost when the flight engineer actuated the hydraulic crossover and restored boost pressure with the secondary hydraulic system. The controls then opera satisfactorily. While the Board recognizes the magnitude of the critical situation which confronted the captain, it is difficult to understand in vie of his training and experience why he would attempt to disconnect the hydrau boost instead of using the hydraulic crossover system.

The captain's choice of ditching heading, based on the wind and sea sta information, is not in accord with the procedures outlined in the approved Flying Tiger Manual or with the procedures recommended by the U. S. Coast Guard or Air Sea Rescue Manuals. The captain stated he chose a heading of 265 degrees magnetic to land into the wind. This was based on forecast information passed to him during his descent which indicated that the winds were approximately 28 knots from 260 degrees and the primary swell was from 260 degrees 8 to 12 feet in height.

Directions given in forecasts such as this are true headings and magnet variation must be taken into account. The magnetic variation in the locale of the ditching is in excess of 20 degrees and no allowance was made for thi by the captain when he selected his ditching heading. Therefore, the ditchi was not made parallel to the anticipated primary swell, as recommended, nor was it made into the forecast wind as the captain desired.

While Captain Murray elected to land into the face of a swell, on the basis of his opinion that the interval between swells offered a better ditch

situation than those specified in The Flying Tiger Line Manual, this procedure is not recommended because of the potential aircraft destruction. The procedure he used is, as a matter of fact, warned against in the manual Based upon witness testimony concerning the absence of the left wing, and the evidence of severe deceleration indicated by the failure of the aircraf seats, it is apparent that considerable impact force was encountered in the ditching. Failure of the left wing deprived the survivors of the liferafts stowed therein. Rafts on the right side were never seen by the survivors even though many exited through the right over-the-wing exits. However, these were later recovered and found inflated.

The reason for loss of the right wing stowed rafts is not clear from the testimony. The difficulty in opening the right rear over-the-wing exit may have contributed to the problem. Extended operation of this airplane at low temperatures could have increased the inflation time for these rafts materially, resulting in the rafts not inflating in time to be useful.

Details which are either necessary or desirable to be performed prior to ditching were not carried out. Differences in the instructions given to the passengers concerning the correct ditching position, failure of the captain to issue the instruction to "brace" prior to ditching, and failure to remove the aft over-the-wing exits prior to ditching indicate that prepar tions for the ditching were not completed. While it is not the Board's intention to criticize an individual who does all that is possible commensurat with the time available for action, it is obvious here that some of the prep tions which time and circumstances did permit were not carried out. Furthe

Performance and testimony by surviving crew members indicated a lack of or a low degree of proficiency having been gained from the training program designed to meet emergencies such as were encountered on this flight.

Under the circumstances of darkness, weather and high seas, which prevailed in the North Atlantic at the time of this ditching, the Board believes that the survival of 48 occupants of the aircraft was miraculous, however, had lights been provided on the lifejackets even more persons might have survived.

Probable Cause

The Board determines the probable cause of this accident was the failure of two of the aircraft's four engines, and improper action of the flight engineer, which disabled a third engine, thereby necessitating a ditching at sea.

Recommendations

In each aircraft accident the Civil Aeronautics Board reviews the factual data developed by its investigators to determine if improvements are needed which would enhance the survivability of a similar accident. This accident was no exception and certain items are considered to fall in this category. The unavailability of the wing liferafts leads the Board to question the advisability of their being externally stowed. Their unavailability can be attributed to the loss of the left wing and/or the increase in inflation time resulting from the decrease in the temperature of the CO_2 after prolonged flight at high altitude.

It was learned that the survivors had considerable difficulty in finding the only available liferaft and in locating the other survivors while in the water. Consideration should be given to improving the liferaft lighting systems so that in high seas, such as were encountered here, they could more easily be found. In addition, automatically actuated lights should be required on all lifejackets.

The testimony of many of the survivors casts doubt on the adequacy of the inflation means for the lifejackets installed on this airplane. Many had considerable trouble inflating their jackets since they could not find the CO_2 cartridge lanyard. There were also many reports of difficulty in swimming with the inflated jackets even though they had been previously checked for tightness by the stewardesses. Consideration should be given to improving the basic design of these jackets.

The above recommendations have been forwarded to the Administrator of the Federal Aviation Agency and are presently under active consideration.

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

Investigation and Hearing

The Civil Aeronautics Board was notified of this accident at 2320, September 23, 1962, through its Los Angeles Safety Investigation Office. The Washington Office personnel were immediately notified and an investigation was initiated and conducted in accordance with the provisions of Title V of the Federal Aviation Act of 1958. A public hearing was held by the Board on November 14, 1962, at 9:30 a.m. (local time) in the International Hotel, New York International Airport, Jamaica, Long Island, New York,

Air Carrier

The Flying Tiger Line Inc., is a scheduled air carrier incorporated in the State of Delaware with its principal business offices at Burbank, Califor It operates under a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board, and an air carrier operating certificate issued by the Federal Aviation Agency. These certificates author the company to transport cargo by air over numerous routes within the Contine limits of the United States. The subject flight was conducted under an exemp granted by the Civil Aeronautics Board which authorizes the carrier to engage in interstate, overseas, and foreign air transportation of persons and cargo pursuant to contracts with any department of the military establishment.

The Aircraft

N 6923C, a Lockheed 1049H/02-03 Super Constellation, serial No. 4827, was manufactured on February 20, 1958. The Flying Tiger Line Inc., purchase the aircraft from Lockheed on May 1, 1958, when the aircraft had 6.6 hours of

flight. It had a total of 15,800.7 flying hours. It was equipped with two Wright 988TC18-EA3 and two Wright 988TC18-EA6 engines, and four Hamilton Standard 43H60-363 propellers. Engine dataare as follows:

Position	Serial No.	Time Since Overhaul	Total Time
No. 1	706001	938.9	6,809.0
No. 2	706084	244.0	11,941.3
No. 3	708865	530.3	9,428.2
No. 4	708858	1,672.7	9,075.3

The Crew

Captain John D. Murray, age 44, had a total of 17,500 flying hours, of which 4,300 were in L-1049 type aircraft. He held a valid airman certificat No. 40975-40 with airline transport pilot privileges and ratings in airplane multiengine land, C-46, DC-3, DC-4, DC-6, DC-7, Lockheed Constellation, and Canadair CL-44D. Commercial privileges in airplane single-engine land and sea, rotorcraft and helicopters. His last proficiency check in L-1049H aircraft was on November 13, 1961.

His last FAA first-class physical examination was passed on June 16, 19 (limitation - reading glasses). He had flown 247.4 hours, 172.9 in L-1049s in the last 90 days; 72.6 hours, 41.2 in L-1049s in the last 30 days; and arrived in Gander at 0757 on September 22, 1962. He had 33 hours of rest prior to the flight.

First Officer Robert W. Parker, age 27, had a total of 2,430 flying hou of which 350 were in L-1049 type aircraft. He held a valid airman certifica No. 1421814 with commercial airplane single and multiengine land and instrument privileges. His initial check in L-1049H aircraft was on May 16,

his last FAA physical examination was passed on August 10, 1962. He had flown 184.3 hours in the last 90 days; 65.8 hours in the last 30 days; and arrived in Gander at 0757 on September 22, 1962. He had 33 hours of rest prior to the flight.

Flight Engineer James E. Garrett, Jr., age 30, had a total of 3,750 flying hours, of which 2,450 hours were in L-1049 type aircraft. He held a valid airman certificate No. 1341695 with commercial pilot privileges; flight engineer certificate No. 1390040; airman certificate No. 1302721 with airplane and powerplant ratings. His last proficiency check in L-1049H aircraft was July 25, 1962. His last FAA second-class physical was passed on November 28, 1961. He had flown 85.6 hours in the last 90 days; 83.2 hours in the last 30 days; and had 33 hours of rest before departure from Gander.

Navigator Samuel T. Nicholson, age 32, had a total of 7,500 flying hour of which 4,500 were in L-1049 type aircraft. He held a valid airman certificate No. 1370768 with navigator rating. His last FAA second-class physica was passed on June 9, 1962. He had flown 236.7 hours in the last 90 days; 74.3 hours in the last 30 days; and had 14 days, 19 hours' rest prior to departing Newark at 0900 on September 23, 1962.

Stewardess Elizabeth A. Sims, age 31, was hired on May 28, 1962. She had approximately six years' previous experience with other air carriers. She completed ground school on June 7, 1962, and her last wet ditching drill was in June 1962. She had flown 226 hours in the last 90 days; 48.3 hours in September; and had 10 days' rest prior to departing Newark at 0900 on September 23.

Stewardess Jacqueline L. Brotman, age 24, was hired on July 17, 1962. She had approximately three years' previous experience with other air carriers. She completed ground school on July 19, 1962, but her records indicated no wet ditching drill. She had flown 162.5 hours in the last 90 days; 43.1 hours in September; and had over three days' rest prior to departing Newark at 0900 on September 23.

Stewardess Ruth Mudd, age 24, was hired on August 6, 1962. She had three and one-half years of previous experience with MATS. She completed ground school on August 18, 1962, and her last wet ditching drill was in August 1962. She had flown 134.8 hours in the last 90 days; 69.5 hours in September; and had over two days' rest prior to departing Newark at 0900 on September 23.

Stewardess Carol Ann Gould, age 22, was hired on July 2, 1962. She had approximately six-months' previous experience with other air carriers. She completed ground school on July 6, 1962, and her last wet ditching drill was on July 5, 1962. Her last check ride was on July 14, 1962. She had flown 218 hours in the last 90 days; 60.3 hours in September; and had over six days' rest prior to departing Newark at 0900 on September 23.