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CIVIL AVIATION DEPARTMENT

BELIZE

CESSNA 402 N402BL

REPORT ON ACCIDENT AT

SAN PEDRO, AMBERGRIS CAY, BELIZE DISTRICT

ON 1 APRIL, 1991

Operator: Tropical Air Service Limited d.b.a. Tropic Air
San Pedro, Ambergris Cay, Belize

Aircraft: Type: Cessna 402B

Nationality: United States of America

Registration: N402BL

Place of Accident: In the sea East of San Pedro, Ambergris Cay, Belize District, Belize

Date of Accident: 1 April, 1991

Times in this report are local times.

SYNOPSIS

The accident was notified to the Air Traffic Control Tower, Philip Goldson International Airport, by Pilot [redacted] of Island Air's Cessna Aircraft V3-HNT at approximately 1510 on 1 April, 1991, Easter Monday. The Control Tower immediately informed the Chief Civil Aviation Officer at Cay Caulker by telephone. Investigation commenced immediately by telephone.

The aircraft was engaged on a local VFR flight from Philip Goldson International Airport to San Pedro, Ambergris Cay. This is normally a 15 minutes flight. There were one pilot and seven passengers on board. When the pilot reported six miles out on final approach he was asked to go around, by another Tropic Air aircraft on the ground, in order to give way for the other aircraft to take off because the aerodrome was congested. While circling at low altitude with wheels down and flaps down the aircraft crashed in the sea East of the island. All the occupants died.

Because the Civil Aviation Department does not have an Accident Investigation Branch and does not have the necessary expertise to conduct a thorough investigation The Chief Civil Aviation Officer requested the assistance of the Belize Defence Force, Air Wing. On 2 April, 1991, he sent a message to the National Transportation Safety Board of the United States of America, the State of both manufacture and registry, informing of the accident and requesting assistance. He also requested the assistance of the Surveyor from the United Kingdom Civil Aviation Authority, who provided airworthiness advisory service to Belize and who was resident in Kingston, Jamaica.

On 2 April,1991, a team comprising the Chief Civil Aviation Officer, a pilot and two aircraft maintenance engineers of the Belize Defence Force, visited the accident site to commence investigation. Assistance was provided by the Police on the island, who had taken responsibility the previous day for the recovery of the bodies and the salvaging of the luggage. We made arrangements for photographs to be taken of the wreckage under water. The BDF Officers went into the water to examine the wreckage. Photographs of the wreckage are shown in Appendix 1 to this report. The findings by the BDF Officers are given in Appendix 2.

On 3 April, 1991, the Minister of Energy & Communications appointed the Chief Civil Aviation Officer to be Inspector of Accident. On the same day our local team was joined by the CAA Surveyor, two Inspectors from the NTSB, one representative from Cessna Aircraft Company and one representative from Teledyne Continental Motors, who provided expert assistance.

With the assistance of the Police on the island eye witnesses were located and interviewed.

Because of lack of salvage equipment on the island the aircraft was not recovered until several days later. Salvage was supervised by the CAA Surveyor. Arrangements were made to refer the engines to Teledyne Continental Motors for dismantling and inspection. I commissioned the CAA Surveyor to oversee the inspection of the engines and propellers.

A report on the accident investigation submitted by the CAA Surveyor is given at Appendix 3.

The Surveyor's report on the Engine and propeller inspection is given at Appendix 4.

A report from Teledyne Continental Motors is given at Appendix 5.

A copy of the Load Sheet is given at Appendix 6.

A photograph of the island showing the Airstrip and the approximate location of the accident site is given at Appendix 7.

1 FACTUAL INFORMATION

1.1 History of the Flight

N402BL was a Cessna 402 aircraft leased and operated by Tropical Air Service Limited, d.b.a. Tropic Air, on local and international, scheduled and unscheduled commercial flights.

On 1 April, 1991, the pilot flew this aircraft from San Pedro Airstrip, Ambergris Cay, at 0700 to the Philip Goldson International Airport where he landed at 0715. He took on 73 gallons of fuel and departed at 0800 for Flores, Guatemala, a 55 minute flight. He returned from Flores and landed at Philip Goldson International Airport at 1015, and flew seven additional sectors between Belize City and San Pedro, each taking approximately 15 minutes. He had a rest period of approximately 1 hour 15 minutes at mid-day.

At 1421 he landed this aircraft at Philip Goldson International Airport completing his tenth sector for the day. The pilot remained in the aircraft on the apron while seven passengers and their luggage were boarded. After receiving clearance from the Air Traffic Control Tower, N402BL took off at 1436 on a flight to San Pedro. At 1443 he reported a position 14 miles out and was cleared by ATC to change to frequency 122.8 MHz, a local common broadcast (unicom) frequency. On approaching San Pedro the pilot broadcast his position on final approach for Runway 06, number two for landing. A Cessna 207, V3-HER was ahead and had broadcast its intention to land. A Tropic Air Twin Otter, call sign Tango Alfa, on the ground, requested that N402BL go around to allow Tango Alfa to take off because the ramp was full. N402BL acknowledged and was seen making a left turn with wheels down. No further communication was heard from N402BL. The aircraft was seen flying very low with wheels down and flaps down in a southerly direction and as it crossed the shoreline South of the airstrip the aircraft made a sharp left turn and crashed into the sea about 200 yards from the beach at approximately 1500 hours. The aircraft struck nose first then righted itself and sank in water about five feet deep. There was no fire.

Boats in the vicinity reached the accident site within a few minutes and reported that all occupants were dead inside the aircraft.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	7	0
Serious	0	0	0
None	0	0	0

1.3 Damage to aircraft

The aircraft sank in the sea about five feet deep and was destroyed. Both engines were detached from the aircraft. A section of the left wing broke off. (See Appendix 2)

1.4 Other damage

None

1.5 Personnel information

a) Pilot in command: [redacted]

Sex:	Male
Age:	27 years (date of birth - [redacted])
Nationality:	Citizen of Sri Lanka
Pilot Licence:	USA Commercial [redacted] issued by the Federal Aviation Administration on 22 June, 1988
Aircraft Ratings:	Single and Multi-engine land; Instrument Airplane
Last Medical Examination:	USA First Class, 23 October, 1990
Total Flying in last 28 days:	141 hours approximately, most of this time on N402BL. This was determined from company records.
Total experience:	Unknown. Pilot's Log Book could not be located.

b) There was no other crew.

1.6 Aircraft information

a) N402BL was a Twin-engine Cessna Model 402B aircraft.

Year of Manufacture:	1975
Aircraft Serial No.:	402B0827
Registration:	The aircraft was registered in the United States of America on 20 November, 1990, in the name of Alberta Aircraft Leasing Inc. of Las Vegas, Nevada.
Operator:	The aircraft was leased to and operated by Tropical Air Service Limited, d.b.a. Tropic Air, of San Pedro, Ambergris Cay, Belize.
Engines:	Teledyne Continental Motors, Model TSIO520E. Serial Numbers 166086-H and 183812-H.
Propellers:	McCauley, Model 3AF32C87-N, Serial Nos. 787285 and 861170.
Airworthiness:	A Certificate of Airworthiness in Normal Category was issued by the Federal Aviation Administration of the United States of America on 31 December, 1990. The aircraft was maintained in accordance with a Progressive Care Programme. The last inspection was completed on 24 March, 1991, at Hobbs time of 4153.4 hours. The next inspection was due at Hobbs time of 4218.8 hours. On 1 April, 1991, before commencing flight the reading was 4202.8 hours.

According to the US Inspectors the operation of the aircraft did not comply with applicable FAR Part 129. There was an outstanding Airworthiness Directive. The Progressive Care programme called for fifty hour interval inspections but a seventy-five hour basis was used. (See Appendix 3).

b) Performance: It was not possible to determine whether the aircraft was properly loaded or within the prescribed centre of gravity limits. The Passenger Manifest/Load Sheet was not completed properly. This showed only 130 lb. per adult male and 120 lb. per adult female passenger. This was inconsistent with company procedures which state 165 lb. per male and 140 lb. per adult female passenger. The luggage which was recovered and dried weighed 157 lbs. The gross weight at take-off was below the maximum permissible weight.

c) Fuel: The aircraft used Av Gas 100/130 Octane. Due to inconsistencies in the completion of the load sheets it was not possible to determine the amount of fuel prior to take-off on the last sector. The sector sheets do show the fuel on board.

1.7 Meteorological information

There is no Meteorological Station in San Pedro. According to eye witnesses at the time of the accident there were Visual Meteorological Conditions in sunlight with winds estimated at 10 knots from the NNW, and good visibility.

1.8 Aids to navigation

There is no navigation aid at San Pedro. The only visual ground aid was a Wind sock. The flight was conducted in accordance with Visual Flight Rules.

1.9 Communications

The only Aeronautical Telecommunications Facility in Belize is located at the Philip Goldson International Airport. A UNICOM system has been established in Belize so that aircraft on local flights outside of the Control Zone should broadcast their positions and intentions on 122.8 MHz.

The aircraft communicated with the Control Tower at Philip Goldson International Airport prior to departure and received take-off clearance. The aircraft took off at 1436 hours. At 1443 the aircraft reported its position 14 miles out and was cleared by ATC to change to 122.8 MHz. The aircraft was heard broadcasting its position and intention to land at San Pedro and was requested to go around by another Tropic Air aircraft on the ground. N4028L acknowledged. No further communication was heard from him.

1.10 Aerodrome information

San Pedro Airstrip has one runway, 06/24, 25 feet wide and 2300 feet long. The North East end has a paved area approximately 150 feet square which is used for parking, loading and unloading aircraft. This aerodrome is often overcrowded especially on weekends and holidays when airlines operate additional flights. The day of the accident was Easter Monday, an occasion when many local tourists travel to and from the island. During the approach of N402BL the aerodrome was congested.

At the request of another Tropic Air aircraft, N402BL went around in order for the other aircraft to take off and make room on the ground for N402BL. A Cessna C207 landed ahead of N402BL and exited the runway to a grass area on the right to make room for a Tropic Air Twin Otter to take off.

1.11 Flight recorder

No flight recorder was fitted or required to be fitted.

1.12 Wreckage and impact information

The aircraft crashed in the sea about five feet deep, approximately one mile south of the San Pedro Airstrip and 200 yards from the beach. Both engines were detached from the aircraft and one propeller separated from its engine. The outer left wing section broke off. The aircraft sank in the water. The wreckage area was estimated about 40 feet diameter, most of it forward and left of the fuselage. See Appendices 1 and 2.

1.13 Medical and pathological information

Post mortem examination conducted at the Belize City Hospital conclude that the occupants died from multiple head injuries, severe brain damage, multiple fractures and ruptured liver and spleen.

Specimen taken from the body of the pilot was referred to the National Transportation Safety Board of the United States of America for toxicology analysis. The tests detected no ethanol in the gastric contents and no drugs in the blood.

1.14 Fire

There was no fire.

1.15 Survival Aspects

Boats and divers arrived at the crash site within a few minutes of the accident and found the water dark with blood. All accupants were in the aircraft and strapped in their seats, but all were dead. The pilot seats as well as the seats in rows 1, and 2 were unattached due to substantial disruption of the floor. The seat assembly of both row 3 seats separated above the pedestal. The accident was not survivable.

1.16 Tests and research

The engines and propellers were referred to Teledyne Continental Motors for tear down and inspection. Unfortunately the engines had remained immersed in salt water for six days before they could be recovered and there was further delay in shipping to the USA. The tests were inconclusive and revealed no evidence of malfunction. See Appendix 4.

2 ANALYSIS

2.1 The aerodrome

The San Pedro Airstrip is small and has no suitable apron for aircraft to load and unload. At the time of the accident the aerodrome was overcrowded.

2.2 The pilot

The pilot had been working approximately twelve hours per day for a long time and had flown six to eight hours in eleven to twelve sectors per day. At the time of the accident he had flown 41 hours in excess of the maximum permitted by the company and by the Air Navigation Order in force in Belize.

2.3 The aircraft

a) The aircraft, registered in the USA, did not have a maintenance programme approved by the FAA. It was maintained to a Progressive Care Maintenance Programme established for another aircraft which required inspections at 50-hour intervals but a 75-hour interval was used.

b) The combined Passenger Manifest/Load Sheet was used only as a passenger manifest and did not show the seating arrangement of the passengers. The weights shown for passengers were far below the average used by the company for loading and Weight and balance purposes.

c) Neither the Load Sheet nor the Sector sheet was properly completed to show the amount or weight of fuel on the various sector flights.

2.4 The flight

The flight was conducted in Visual Meteorological Conditions. The pilot maintained communications in accordance with established procedures up to the time that he was requested to go around to allow another aircraft to take-off. He did not make any other position report. He did not report that he was making another approach for landing nor whether he was experiencing any difficulty.

Just prior to the accident the aircraft was seen on a right downwind leg flying very low, about 200 feet, and descending with wheels down. At about an altitude of 100 feet the aircraft pulled sharply nose up and banked steeply to the left and crashed into the sea.

3 CONCLUSIONS

3.1 Findings

a) The aircraft had a current certificate of airworthiness.

b) The established maintenance programme was not adhered to rigidly but there was no evidence of malfunction.

c) The load sheets and sector sheets did not show the weight or quantity of fuel. While it is not possible to determine the quantity of fuel prior to take-off, tests revealed no evidence of fuel starvation.

d) The engines were under power when the aircraft struck the water.

e) The load sheet and passenger manifest was not properly completed. It is not possible to determine whether the aircraft was flown within the Centre of Gravity limits.

f) The pilot had a valid pilot's licence and medical certificate.

g) The company's Operation Division failed to exercise proper control of the pilot's duty time and flying time.

h) The pilot had had very long duty hours and had flown excessive hours. He had exceeded the permissible maximum flying time by forty-one hours. He should not have begun this flight.

i) The aircraft radio was working up to the time that the aircraft arrived over the island and began to circle.

j) From the time the aircraft began to go around up to the time of the crash the pilot failed to report any further position or intention. He did not report any difficulty or emergency.

k) The aircraft was flying in a southerly direction extremely low and descending slowly with wheels down and gear down, about one mile south of the aerodrome. The aircraft suddenly pulled nose up then banked steeply to the left and crashed.

l) There were boats nearby so that help arrived very quickly.

m) All occupants died instantly.

n) The weather was VMC. (Visual Meteorological Conditions)

3.2 Probable Cause/s

There is no evidence which permits the investigation to determine with certainty the actual cause of the accident. It is considered a reasonable deduction that,

a) the pilot was unfit for flight due to fatigue;

b) he stalled the aircraft while flying very low down wind with landing gear down;

c) the aircraft was much too low to recover from the stall.

4 SAFETY RECOMMENDATIONS

It is recommended that:

a) until a new aerodrome can be constructed with improved facilities at San Pedro, temporary improvements are made at the existing airstrip to provide additional apron space for loading and off-loading aircraft;

b) Air Traffic Control service is provided at San Pedro as soon as possible;

c) the requirement for Air Operator's Certificate is implemented as soon as possible so that:

   i) all operators of public transport aircraft will be required to have and comply with approved Operations, Flight, Training and Maintenance Manuals;

   ii) proper load sheets will be completed prior to the commencement of all public transport flights;

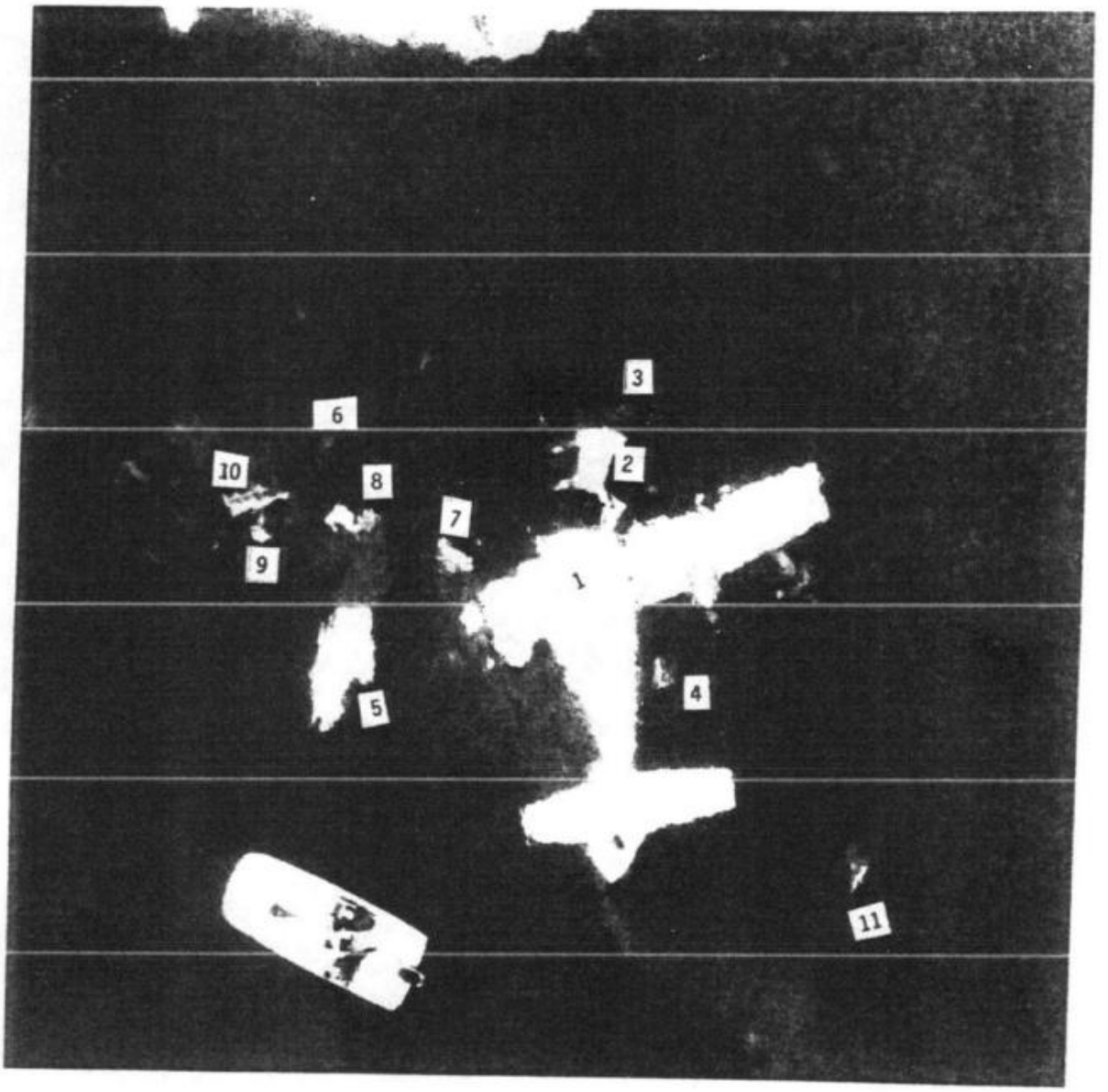
d) the Civil Aviation Department contracts the services of suitably qualified inspectors to do regular flight safety oversight of all aircraft operators.

[redacted]
Inspector of Accidents

Civil Aviation Department
Belize

December 1991

PHOTOGRAPH SHOWING AREA OF WRECKAGE IN THE WATER
(PICTURE TAKEN FROM THE AIR ON 2 APRIL, 1991)

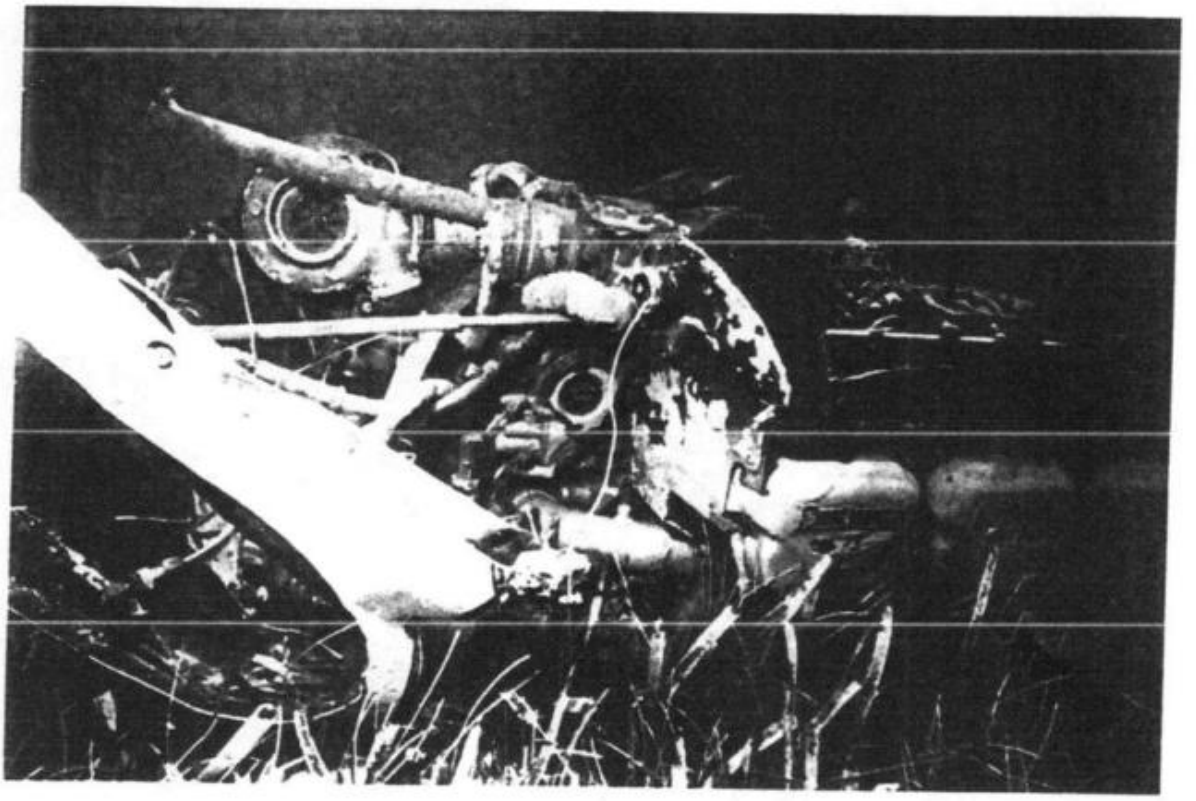


1. Fuselage
2. Nose - broken and twisted
3. Baggage compartment door
4. Section of skin from belly.
5. Section of Port wing separated from aircraft
6. Battery Box
7. Tip Tank - Port
8. Engine with propeller attached
9. Other engine without the propeller
10. Propeller separated from its engine
11. Starboard Tip Tank

(The boat is a Guard Boat)

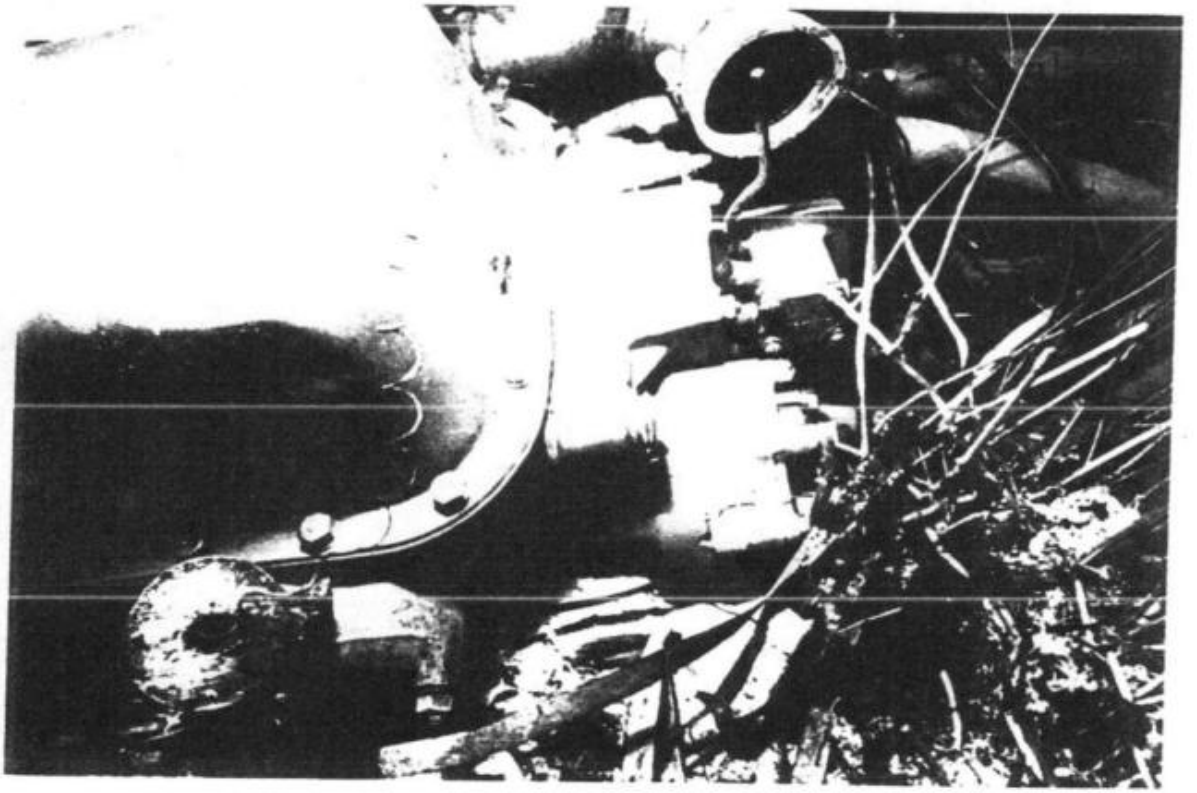
UNDERWATER PHOTOGRAPHS TAKEN ON 3 APRIL, 1991

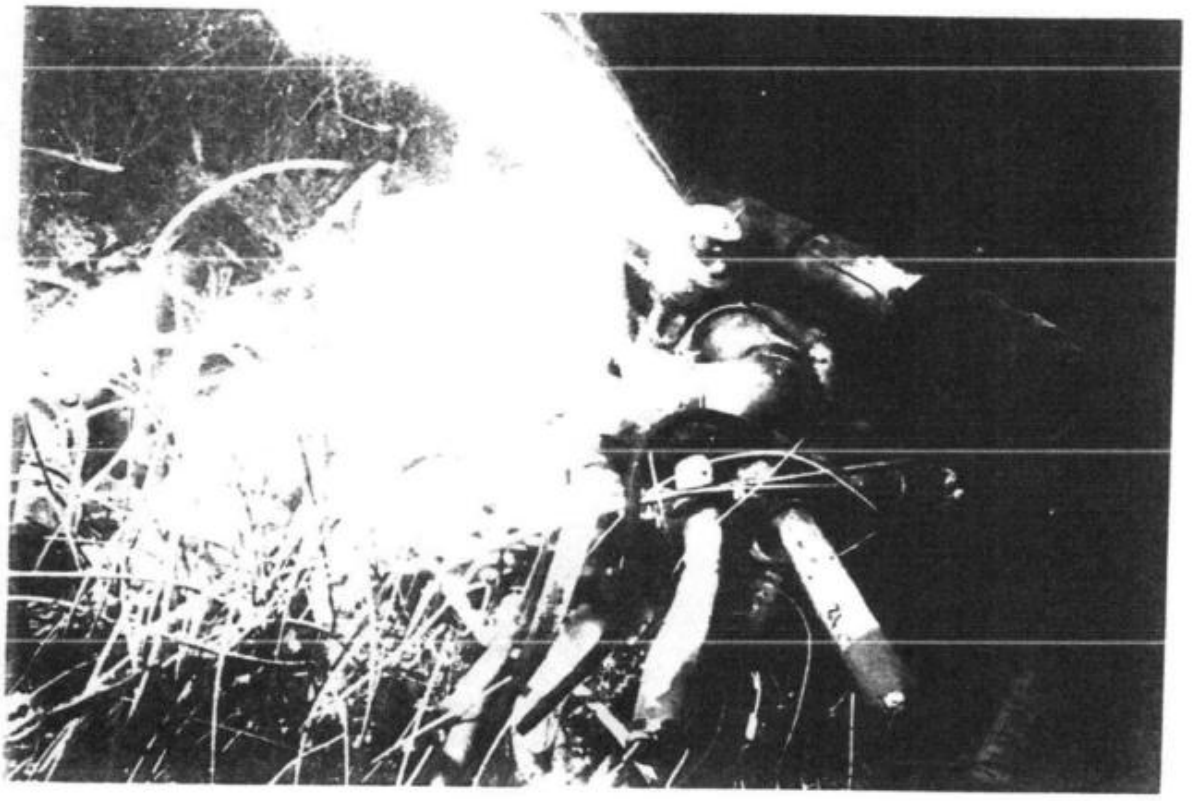
Engine without propeller



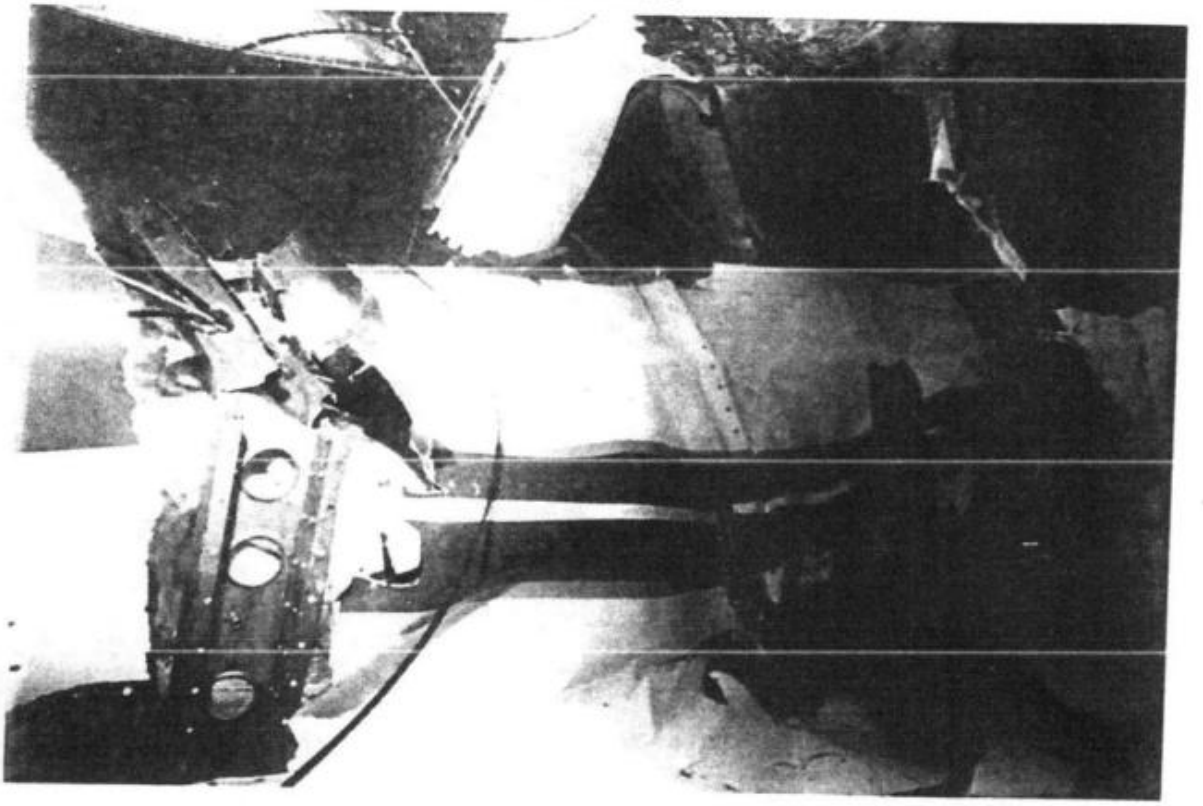
Propeller detached from above engine

Engine with Propeller attached

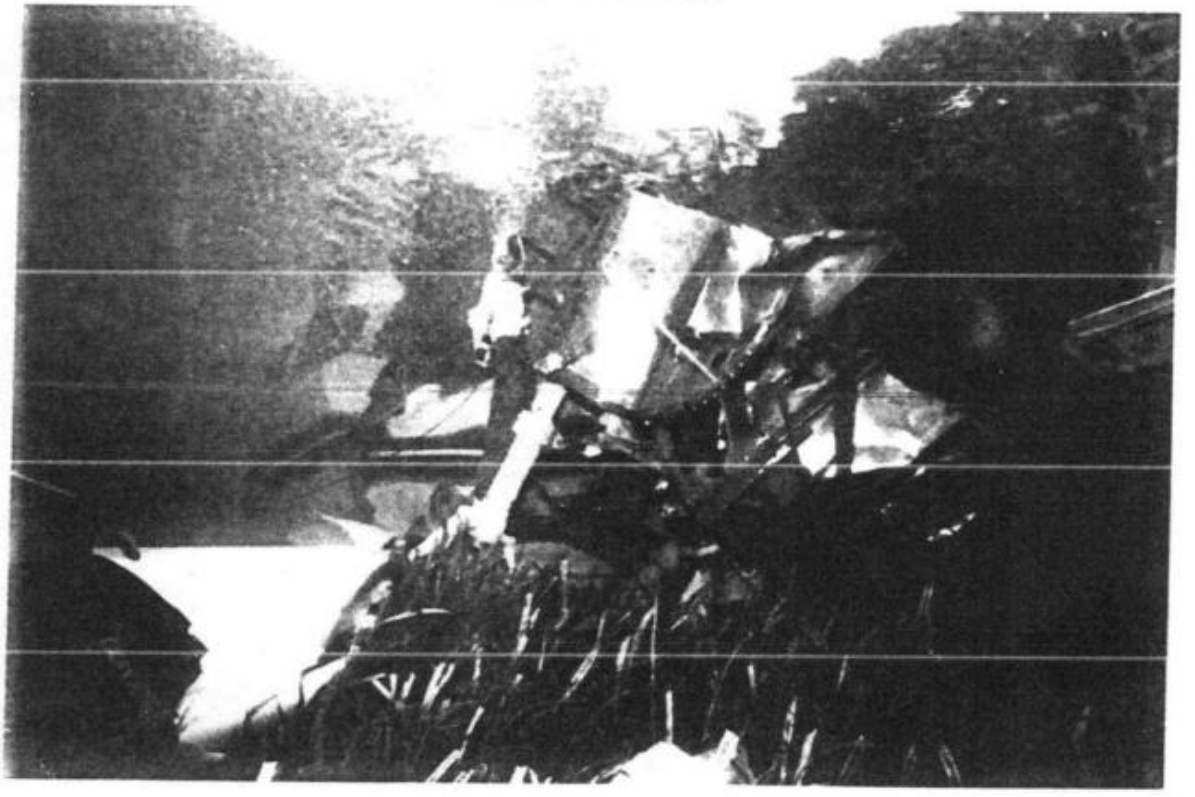




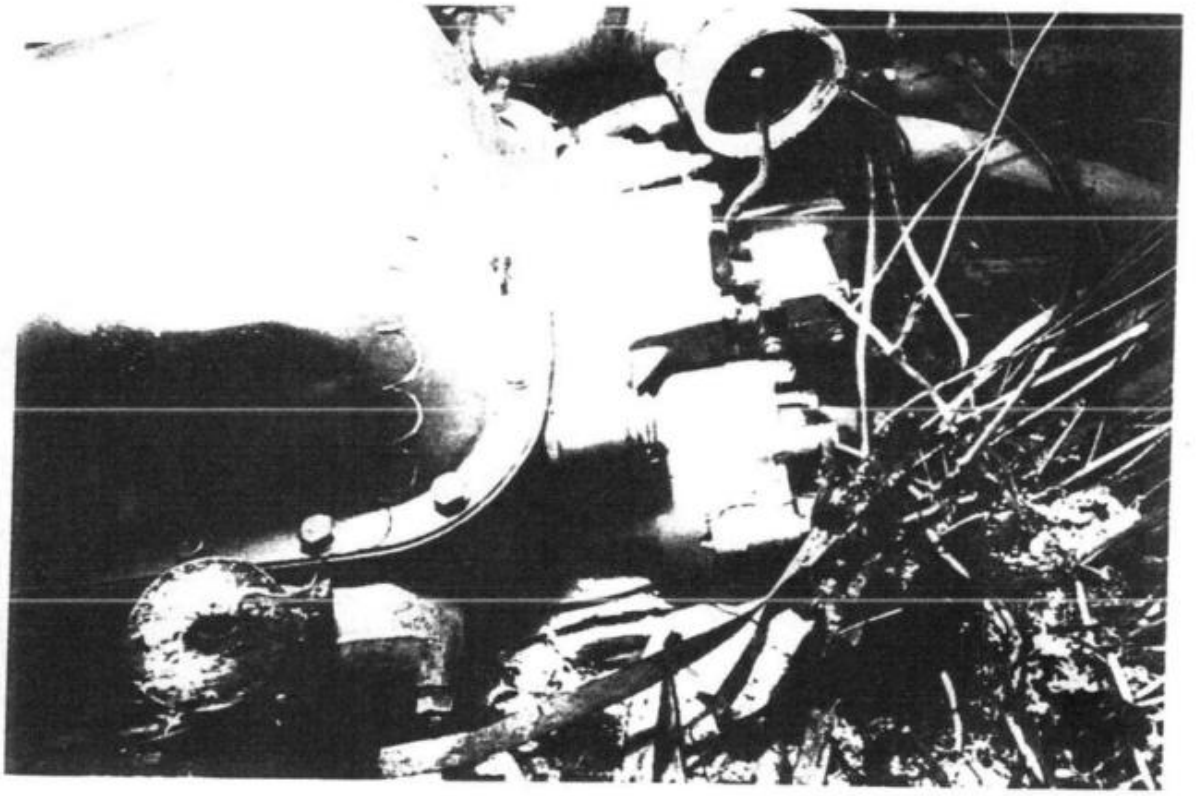
Aircraft Nose

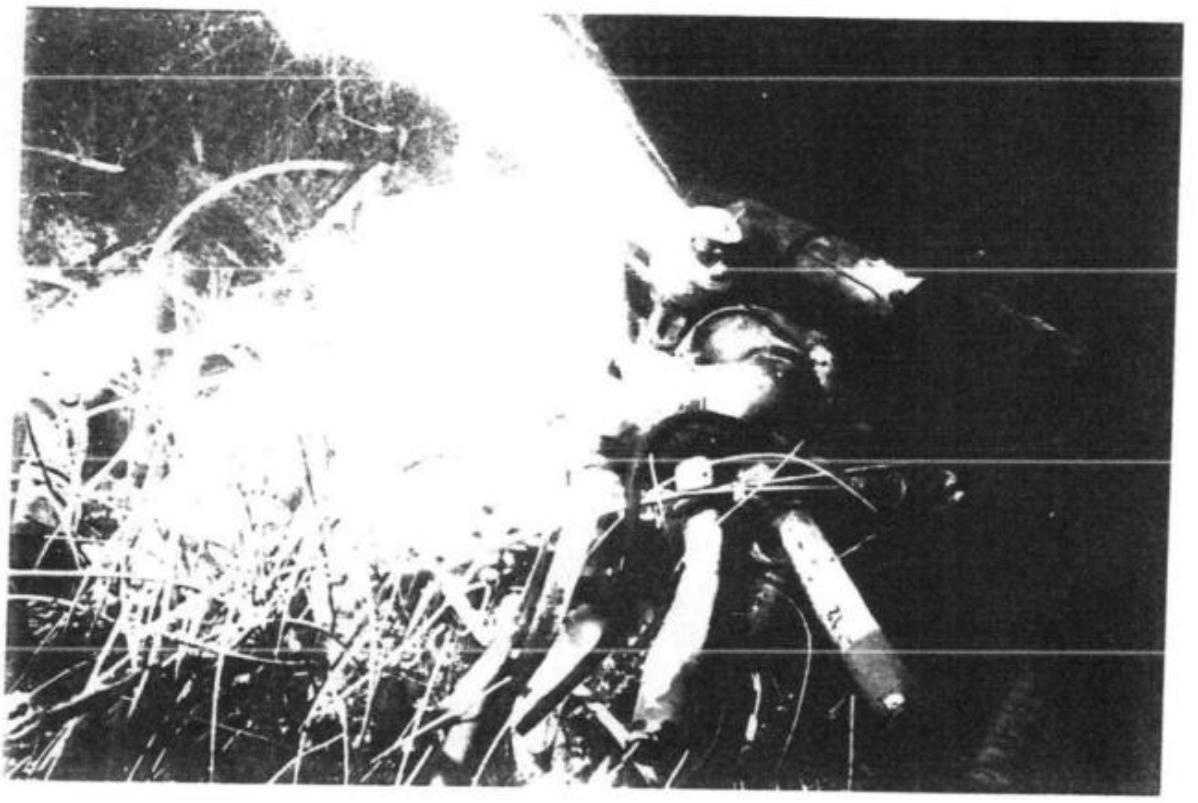


Nose Undercarriage

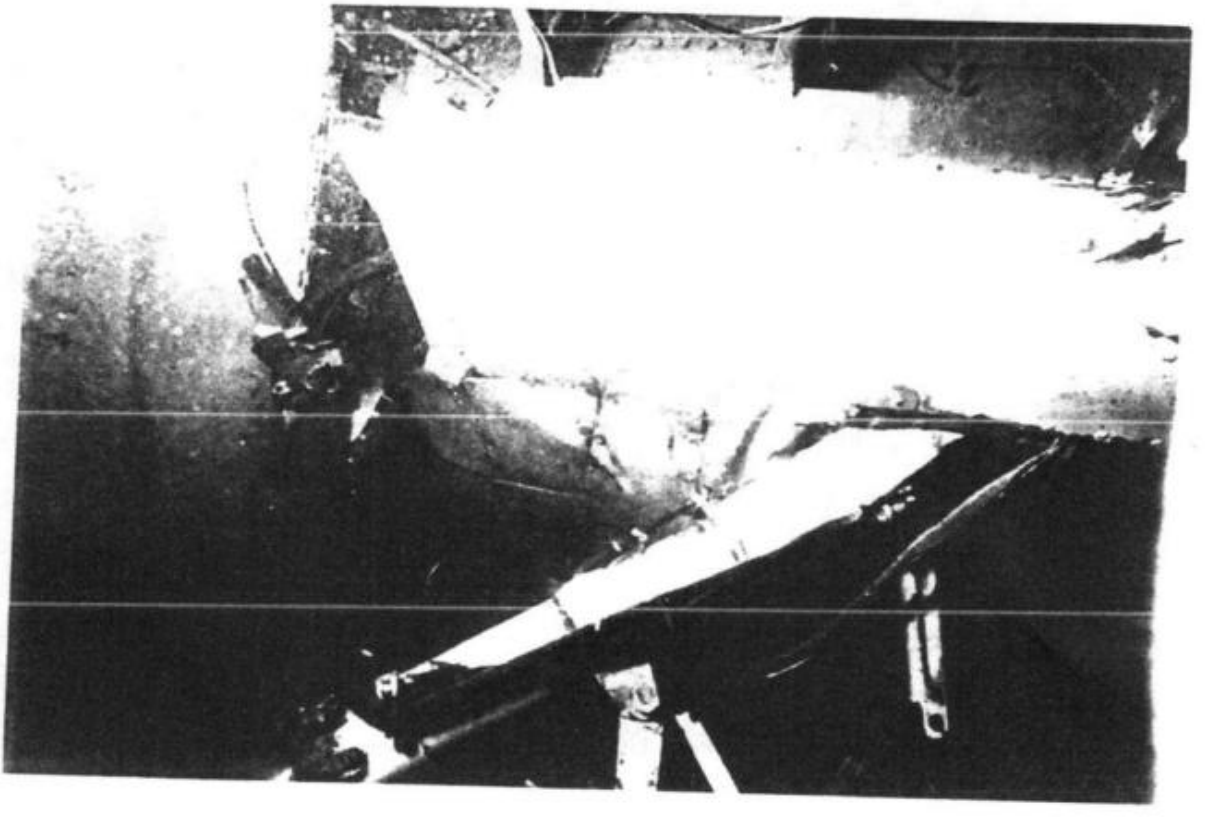


Engine with Propeller attached

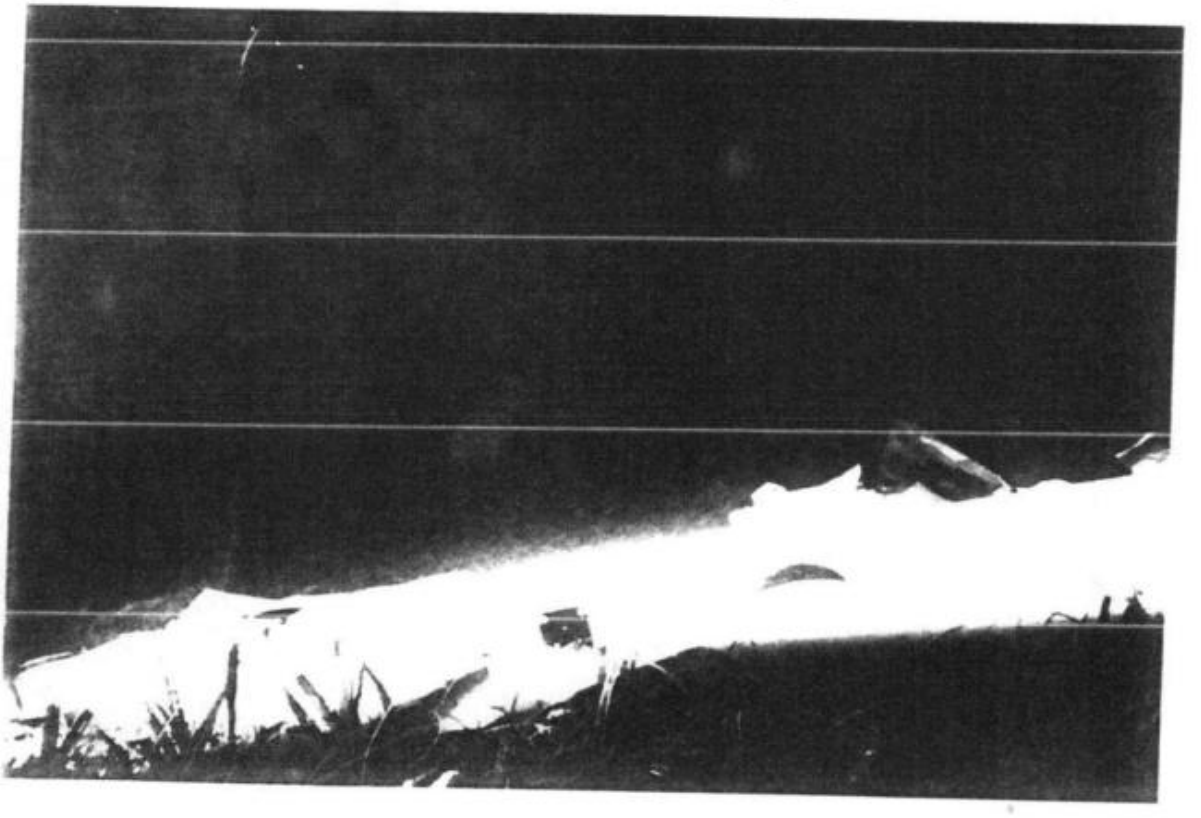




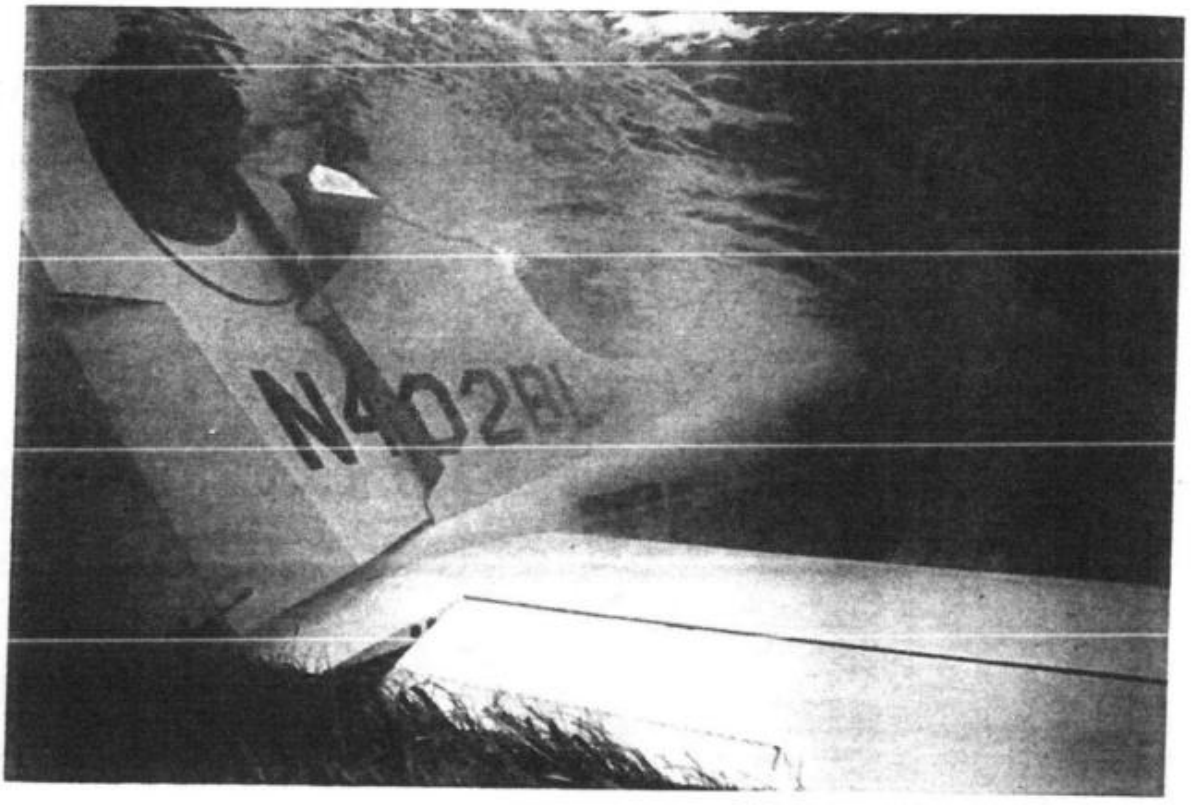
Starboard Undercarriage



Detached Section of Port Wing

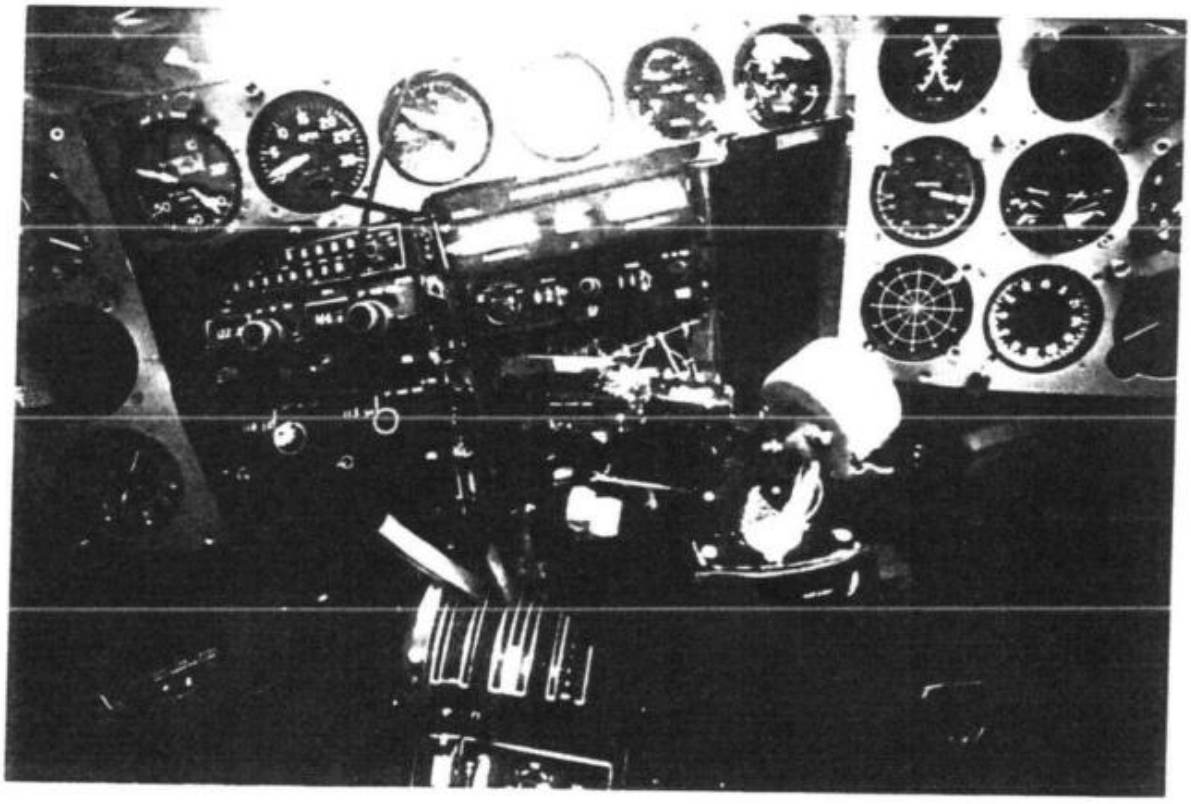


Aircraft Tail Section

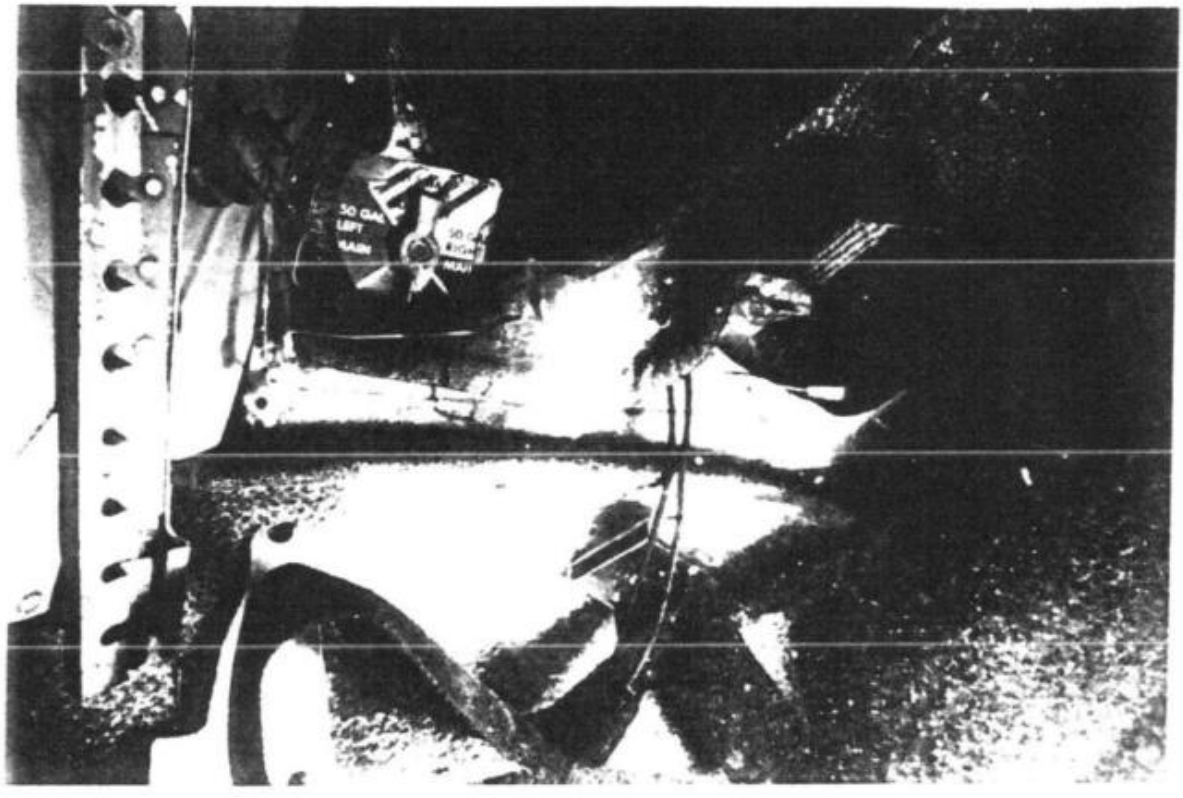


SECTION of Port Side of Fuselage

Instrument Panel



Fuel Cocks



DESCRIPTION OF WRECKAGE - N402BL

1. The aircraft fuselage is pointed 0200 mils (011.25°).
2. Both engines are lying due West of the aircraft.
3. The first engine is lying 23 ft. from the aircraft's nose upside down with the propeller still attached. The two visible propeller tips are just bent.
4. The second engine, Ser. No. 166 086H is lying 33 ft. from the aircraft's nose and is upright. The propeller is detached 11 ft from the engine which makes it 44 ft from the aircraft's nose. The two visible blades are bent into crescents.
5. Both propellers are embedded in indentations in the mud.
6. The centre of the port tip tank is 17 ft from the aircraft's nose.
7. The outer port wing section broke off and is parallel to 20 ft from the fuselage and inverted. The tip of this wing section is pointed in the same direction as the aircraft's nose.
8. Battery box with the battery complete was torn from the aircraft's nose and is 17 ft from the aircraft.
9. The flap lever is in the "up" position and the flaps appear to be flush.
10. The undercarriage is extended and the gear selector in the cockpit is broken off. The port main undercarriage is at an angle outwards from the fuselage with the side stay sheared. The starboard main undercarriage has been pushed through the wing and slightly forward along with a large portionof its mounting and other metal and is still vertical.
11. On the starboard side of the fuselage there is a large portion of shaped skin that is probably the fuselage to main plane underskin. This is 20 ft from the aircraft's nose.
12. The starboard tip tank is lying 35 ft from the aircraft's nose.
13. Two seats are lying outside the aircraft and all seatbelts are intact and unfastened. The pilot's seat was easily detached and removed in order to see the fuel cocks.
14. The fuel cock positions are: Port selector pointing aft and in the red sector; starboard selector pointing to starboard side, green sector. The starboard selector console is a bit compressed.
15. The instrument panel together with the power quadrant is twisted in a clockwise direction when the aircraft is viewed from the top. The fuselage is broken and detached on the port side and compressed and still attached on the starboard side.
16. Both yokes are broken but attached by wires to their respective column stems.
17. The altimeter settings are: Port altimeter - 30.02; Starboard altimeter - 29.92. The altimeter setting obtained from the Belize Weather Bureau for 011500 April 1991 local was 30.08.
18. The mixture levers are way forward with the port lever slightly more forward than the starboard one. The port RPM lever is halfway between the max and feathered positions and the starboard lever is slightly forward of halfway.
19. The starboard throttle lever is slightly forward of halfway. The port lever is slightly forward of the starboard one.
20. The power lever quadrant is positioned partly underneath the instrument panel.

(Prepared by BDF-Air Wing)

SUMMARY OF FINDINGS FROM ACCIDENT INVESTIGATION
CESSNA N402BL

1. INTRODUCTION

1.1 Cessna 402 N402BL was a U.S. registered aircraft operated by Tropicair Belize. On Monday, April 1, 1991, at approximately 15:00 hours the aircraft crashed, 300 yards off-shore San Pedro (Ambergris Cay) into shallow water killing all eight (8) occupants: pilot and seven (7) passengers.

1.2 An accident investigation team was set up as follows:-

L. Zaldivar (DCA) - Investigator In Charge

L.M. Arnot-Perret (CAA Jamaica) Advisor

Harold W (Bud) Donner - Assistant Manager, FAA Office of Accident Investigation

G. Scanavan - FAA Office of Accident Investigation

A.J. Guitz - Cessna

D. Carter - Teledyne Continental Motors

1.3 It has not been possible at this stage to identify a clearly defined cause for the accident, but the circumstances surrounding the accident give some considerable cause for misgivings concerning local operating standards.

1.4 FAR Part 129 should apply to the operation of this aircraft but the FAR had not been complied with.

2. MAINTENANCE

2.1 The maintenance management had demonstrated a lack of control and poor judgement. The deficiencies found on this aircraft could easily arise on other U.S. registered aircraft in the fleet. There appeared to be no effective liaison with Flight Operations. The aircraft should not have been released to service at the time of the accident since it was not maintained to comply with FAR and had an outstanding Airworthiness Directive.

2.2 The aircraft was being maintained to a maintenance programme directed to a different type of aircraft.

2.3 Notwithstanding item 1. the programme in use called for a fifty hour 'progressive care' programme, but a 75 hour basis was used.

2.4 The Maintenance Programme had not been approved by FAA.

2.5 A structural Airworthiness Directive AD 79-10-15 was called up at 11986.2 hours by the maintenance records, but it was not complied with. The aircraft should have been inspected on 24th March 1991, (the accident occured on 1st April). The Director ofMaintenance claimed that the N.D.T. inspector necessary, was not available (from a contracted N.D.T. organisation).

2.6 Non certified mechanics had frequently signed Airworthiness Releases for the aircraft.

2.7 There was no record of engine oil uplift for the day of the accident, nor the previous two (2) days.

2.8 There were entries for unserviceable components in the maintenance records, but the defects had not been cleared.

2.9 The Director of Maintenance had no knowledge of the whereabouts (or indeed, existence of) the Company's Engineering Manual, applicable to the FAR Part 129 operation.

3. FLIGHT OPERATIONS

3.1 The Chief Pilot and Director of Operations are not providing effective management control in order to secure a safe operation. There does not appear to have been effective liaison and co-ordination within Flight Operations Department nor externally with Maintenance and Traffic. Control of documentation by the pilots is unacceptably poor.

3.2 The pilot in command of the aircraft was [redacted] who held a locally validated U.S. CPL. In the 28 days prior to the accident, he had flown 141.5 hours; this is 41.5 hours in excess of the company's Operations Manual limit of 100 hours in 28 days. This total was calculated from aircraft log sector record pages, by the investigators.

3.3 Neither the Chief Pilot nor the Director of Operations monitor flight crew hours: this is in conflict with the duties laid down in the Ops Manual.

3.4 There is no 'total duty time' limitation in the Ops Manual. On the two (2) days prior to the accident, the pilot had been on duty for periods of approximately 12 and 13 hours. On the day of the accident he had been on duty approximately eight-and-a-half hours (comprising ten sectors).

3.5 Although the precise cause of the accident has yet to be determined, it is conceiveable that the pilot may easily have been fatigued and would consequently not have been in a fully fit condition. Any untoward occurence would have assumed far greater significance as the pilot's reaction time and mental processes may easily have been severely degraded.

3.6 In the company's examination on the C402B type, the pilot had incorrectly answered questions on the fuel system which would suggest that he had significant gaps in his knowledge of the fuel system operation: no corrective action was recorded.

3.7 It was apparent that the Ops Manual requirements for loading information had not been fully conveyed to traffic.

3.8 There was no record of fuel uplift on the day of the accident nor on the previous two (2) days for this aircraft (all flown by the same pilot). From the information available, it is possible that the main tanks (situated at the wing tip) were low on fuel at the time of the accident.

3.9 The hours recorded on the sector record page for the day of the accident did not match ATC transcripts, nor the ground refuellers records. The sectors recorded, however, all appeared to have been flown by the pilot concerned.

4. WEIGHT AND BAGGAGE/LOAD CONTROL

4.1 The control of weight and baggage by ground traffic services is wholly inadequate and results in flight manifests which appear to bear little relation to the actual weight and C of G conditions on each flight. From the information available, it is possible that the weight at take-off may have exceeded maximum take-off-weight authorised. It would not have been possible to determine C of G position for the flight in question.

4.2 The approximations used for passenger weight are not realistic (130 lbs male, 120 lbs female). An extra female weight was mistakenly included in the 'Passenger Manifest'.

4.3 The estimated total baggage figure of 200 lbs for seven (7) passengers, possibly including some small items of freight, was unrealistic in the circumstances prevailing.

SUMMARY OF FINDINGS FROM ACCIDENT INVESTIGATION
CESSNA N402BL

1. INTRODUCTION

1.1 Cessna 402 N402BL was a U.S. registered aircraft operated by Tropicair Belize. On Monday, April 1, 1991, at approximately 15:00 hours the aircraft crashed, 300 yards off-shore San Pedro (Ambergris Cay) into shallow water killing all eight (8) occupants: pilot and seven (7) passengers.

1.2 An accident investigation team was set up as follows:-

L. Zaldivar (DCA) - Investigator In Charge

L.M. Arnot-Perret (CAA Jamaica) Advisor

Harold W (Bud) Donner - Assistant Manager, FAA Office of Accident Investigation

G. Scanavan - FAA Office of Accident Investigation

A.J. Guitz - Cessna

D. Carter - Teledyne Continental Motors

1.3 It has not been possible at this stage to identify a clearly defined cause for the accident, but the circumstances surrounding the accident give some considerable cause for misgivings concerning local operating standards.

1.4 FAR Part 129 should apply to the operation of this aircraft but the FAR had not been complied with.

2. MAINTENANCE

2.1 The maintenance management had demonstrated a lack of control and poor judgement. The deficiencies found on this aircraft could easily arise on other U.S. registered aircraft in the fleet. There appeared to be no effective liaison with Flight Operations. The aircraft should not have been released to service at the time of the accident since it was not maintained to comply with FAR and had an outstanding Airworthiness Directive.

2.2 The aircraft was being maintained to a maintenance programme directed to a different type of aircraft.

2.3 Notwithstanding item 1. the programme in use called for a fifty hour 'progressive care' programme, but a 75 hour basis was used.

2.4 The Maintenance Programme had not been approved by FAA.

2.5 A structural Airworthiness Directive AD 79-10-15 was called up at 11986.2 hours by the maintenance records, but it was not complied with. The aircraft should have been inspected on 24th March 1991, (the accident occured on 1st April). The Director ofMaintenance claimed that the N.D.T. inspector necessary, was not available (from a contracted N.D.T. organisation).

2.6 Non certified mechanics had frequently signed Airworthiness Releases for the aircraft.

2.7 There was no record of engine oil uplift for the day of the accident, nor the previous two (2) days.

2.8 There were entries for unserviceable components in the maintenance records, but the defects had not been cleared.

2.9 The Director of Maintenance had no knowledge of the whereabouts (or indeed, existence of) the Company's Engineering Manual, applicable to the FAR Part 129 operation.

4.4 Although the manifest records an equal distribution of weight in the fore and baggage holds, little attempt was made to evenly distribute the weight.

4.5 Since there is no way of knowing how much fuel was in the auxiliary tanks at the time of departure, the fuel weight recorded was possibly completely incorrect.

4.6 Passenger seating allocation, important for C of G control, is not adequately controlled. Although the passenger manifest records passenger (and hence weight) distribution, the actual positioning of passengers was not accounted for on the flight in question. Photographic evidence would suggest that the two passengers in row 1 were not as recorded on the manifest.

5. TROPICAIR FLIGHT 80 - BELIZE TO SAN PEDRO

5.1 In the circumstances prevailing (see para 1,2,3,) the flight should not have been made: the aircraft was not properly maintained, the pilot could easily have been fatigued, the fuel state may have been low and the weight and C of G conditions were determinable. As a result of the foregoing, any untoward occurrence could easily have led to the pilot being severely overloaded and not being in a position to take appropriate and timely corrective action. At the time of the impact with undercarriage down and flaps up, the aircraft was in a very poor aerodynamic configuration.

5.2 The flight departed Belize International Airport at approximately 14:40 (local) for San Pedro, a distance of approximately 30 n.m. The pilot was advised by ATC (Belize) that the ramp at San Pedro might be overcrowded and was advised that he may have to divert to hold.

5.3 Due to the overcrowding on the ramp at San Pedro, the pilot diverted by flying parallel to the North of the runway in use (060). He then turned across the runway up-wind, parallel to the beach, just off-shore approximately 1/2 mile from the strip.

5.4 The aircraft was seen by a number of witnesses on the down-wind leg flying at low altitude (less than 200') and slowly desending. At this stage witnesses reported both engines functioning, undercarriage down, flaps up.

5.5 The aircraft reportedly desended to less than 100 ft and at a point approximately 1 mile from the end of the runway, it was seen heading for a hut on the end of a pier 60 yards from the beach. At this point, the aircraft pulled sharply nose up, banked left (away from the beach) and continued in a steep left bank, desending until it hit the water left wing first. At this time the aircraft had turned through 180 degrees. The water depth at this point was 5'.

5.5 Boats in the vicinity reached the aircraft within a few minuted. Witnesses report that the occupants were all dead and the bodies were substantially damaged, but not dismembered.

5.6 At no time in the course of the flight, did the pilot advise ATC or any other aircraft in the vicinity, that he was experiencing any difficulty.

5.7 A toxicity analysis was not carried out on the pilot after the crash, but ground personnel and ATC report that the pilot prior to take-off had behaved 'normally'.

6. AIRCRAFT WRECKAGE

6.1 Although the rear fuselage remained intact, the nose section forward of the cockpit door and the wing centre section were substantially unattached. The left wing outer panel separated as did both engines and one (the right hand) propeller. Disposition of the wreckage would suggest that all these components were attached at the moment of impact. The aircraft came to rest, right way up in 4-5 feet of water.

6.2 The left nose section was substantially damaged and the left outer wing panel unattached. It seems likely that the aircraft was in a very steep bank (possibly x >60 degrees) when the left outer wing hit the water and separated followed almost immediately by the left nose section impacting the water.

6.3 The left engine and propeller (attached) separated and continued in the line of flight for approximately 50 feet.

6.4 The right propeller separated from the right engine and the engine separated from its wing. Both finished to the left of the line of flight in a position consistent with the hypothesised crash sequence.

6.5 All controls were attached to the main structure and pitch and yaw trim were zero. The roll trim position could not easily be determined due to the separation of the left out wing panel and attendant movement of all control cables.

6.6 Both pilots seats were unattached, as were the seats in rows 1 and 2 due to the substantial disruption of the floor. The seat assembly in both row 3 seats separated above the pedestal which itself remained attached.

6.7 Mixture, Pitch and Throttle Controls were all 3/4 forward. Left Fuel was selected Off Right Fuel selected Main. The final position of these controls are not however, a reliable indication of their respective selection prior to impact due both to the likely sequence of events in the crash and the attempts subsequently to recover bodies.

6.8 The R.H.A.S.I. read 90kts, but the needle on the L.H. A.S.I. had detached.

6.9 Reading on other manometric instruments were very contradictory.

6.10 The flying control quadrants and rudder pedals had become substantially unattached but remained attached to their respective controls.

6.11 The left engine turbo-charger exhaust outlet elbow had a missing section 3x4 inches square, and the bulkhead and components showed signs of local heating distress.

6.12 There was no external evidence to suggest that the engines were not running at the moment of impact. Both engines have been sent for strip-down, examination.

6.12 The interior bulkheads in the wing tip (main) tanks showed no sign of'hydraulicing' (buckling) which would be expected in a crash of this nature if there was substantial fuel in the tip tanks.

6.13 A substantial amount of fuel drained from the auxiliary tanks when the wreckage was moved from the water.

[redacted]

/dm

CRASH OF CESSNA 402, N402BL
ENGINE AND PROPELLER INSPECTION

1 INTRODUCTION

1.1 On May 7, 1991, the recovered engines and propellers from the above referenced aircraft were dismantled and inspected by representatives from Teledyne Continental Motors and McCauley Aircraft Accessories.

I.B. Charnock - Air Safety Investigation (T.C.M.)

Thomas M. Knopp - Senior Project Engineer (McCauley)

Witnessed by:-

L.M. Arnot-Perret - C.A.A. representing DCA Belize

A.J. Guitz - Air Safety Investigator Analyst (Cessna)

2. GENERAL

2.1 As a result of six (6) days of immersion in sea-water, followed by more than one (1) month awaiting shipment and inspection, the engines and accessories were suffering from corrosion which made accurate assessment of their operating condition difficult to assess fully: it was not possible for example, to hand turn the engine or driven accessories.

2.2 With the exception of the propellers, which were separated from the engines for ease of transportation, all of the major engine components and accessories for both engines were attached.

2.3 There were no external indications on either the propellers or the engines, of any significant structural or component failures which would have indicated a total or partial loss of engine or propeller pre-crash power disruption.

2.4 During the crash, both engines had separated from the aircraft so it was not possible to determine the integrity of attachment of engine/propeller controls and fuel supplies just prior to the crash.

3. PROPELLER S/N 787285. MODEL: McCAULEY 3AF32C87-N.

3.1 This propeller had detached from its engine during the crash, when the attach studs had pulled out of the hub by stripping the internal threads.

3.2 The spinner had deformed at impact and was formed around the propeller hub and counterweight assembly. The relative position suggested that this propeller was not in a feathered position at the moment of impact.

3.3 Blades 2 and 3 were below fine pitch but become detached from the pitch change mechanism. Internal witness marks indicated that at the mement of impact, the pitch change mechanisms were attached correctly. Blade 1 remained attached to the pitch change mechanism,

3.4 Each of the blades was bent rearwards approximately 30 degrees beyond blade station (BS) 18.

3.5 The propeller fine pitch latch was engaged and the piston rod protrusion was correct for this position.

4 PROPELLER S/N 861170 MODEL: McCAULEY 3AF32C87-N

4.1 This propeller has remained attached to its engine throughout the crash sequence.

4.2 The propeller spinner deformation indicated that the counterweights were not in the feather position.

4.3 All three (3) blades remained attached to the pitch change mechanism. Blade 1 was severely bent rearwards (approximately 80 degrees) whilst blades 2 and 3 had similar deformation to the other propeller.

4.4 The pitch change mechanism was latched in the fine pitch position.

5 ENGINE S/N 183812-H, MODEL: CONTINENTAL TS10 520E8

5.1 The sump was removed from the engine: very little oil was contained therein. The crankshaft, big end assemblies, bearings and gears revealed no evidence of failure.

5.2 All externally driven components were removed from the engine. Only the alternator was free to turn, all others being siezed. The start motor adaptor gear housing had cracked, all other attachments appeared normal however.

5.3 The turbo-charger was seized but showed no indication of pre-crash failure.

5.4 The fuel pump and distribution valve both evinced a strong smell of fuel and neither showed any sign of pre-crash failure.

5.5 The inlet and exhaust manifolds were correctly attached. Disassembly revealed very large crystalline deposits in each of the exhaust ports, some of them as much as 20 m.m. in size.

5.6 The cylinder assemblies were all correctly attached. Each of the pistons was correctly assembled and none showed unusual colouration nor evidence of damage. Without the cylinders, the crankshaft rotated freely.

5.7 There was no evidence of any previous failure in the valve mechanisms.

6. ENGINE S/N 166086-4, MODEL: CONTINENTAL TS10-520E-8

6.1 The sump had been considerably flattened, probably during the crash.

6.2 In other respects, the engine was in a similar undamaged condition to S/N 183812 with the exceptions listed in the following paragraphs.

6.3 The start adaptor casing was not cracked.

6.4 The cystalline deposit in the exhaust manifold was considerably less and only noticeable in the region of No. 3 port.

6.5 A large portion of metal was missing from the tailpipe of the supercharger.

7. CONCLUSIONS

7.1 Due to the seized and corroded nature of the rotating components, it was not possible to determine fully, the operating condition of each, immediately prior to the crash.

7.2 All component drives for both engines were intact and gave no indication of pre-crash failure.

7.3 The main engine running gear for both engines showed no sign of pre-crash failure.

7.4 The propeller had latched into the fine pitch position immediately before impact. Neither propeller had been feathered.

7.5 The propeller pitch change mechanisms had been functioning correctly just prior to the crash.

7.6 It was not possible to determine the precise power condition of the engines and propellers immediately prior to the crash.

8. HYPOTHESIS

8.1 The crystal growth in the exhaust ports arose due to immersion of the hot exhaust in cool water which caused boiling of the water locally. The subsequent rapid cooling permitted salt crystal growth after the water evaporated.

8.2 The lesser xrystalline growth in the manifold of engine S/N 166087 would indicate that this exhuast was cooler than that of engine S/N 183812. It is possible then, that the cooler engine was producing less power.

8.3 The missing metal from the tailpipe of the supercharger on engine S/N 166086 implied a possible pre-crash incipient failure or weakening.

L.M. Arnot-Perrett

/dm

TELEDYNE CONTINENTAL MOTORS
Aircraft Products Division

QA

Quality Assurance Analytical Inspection Report

DATE: May 8, 1991

DISTRIBUTION: J. B. Charnock

SUBJECT: TSIO520E Engines.
Serial Nos. 166086-H and 183812-H

The above engines were from Cessna 402. N402BL.

Both were received at TCM unprotected and resting on forklift pallets. Propellers for each engine were atop the engines.

Shipping documents indicate both engines were shipped to Mobile, AL (Godwin Shipping) via Twin Air, New Orleans, LA (waybill 019188).

Aircraft engine receivers A63724 and A63725 were prepared to document S/N 183812-H and S/N 166086-H respectively. Engine logs were not with this shipment.

Inspection commenced 5-07-91 with the following participants:

L. M. Arnot-Perrett	Airworthiness Surveyor Civil Aviation Authority of the United Kingdom
A. J. Gultz	Air Safety Investigator Analyst Cessna Aircraft Company
Tom Knopp	McCauley Propeller Co. Vandalia, Ohio
Wayne Edmonds	McCauley Propeller Co. Vandalia, Ohio
Hugh B. Gordon	Product Analyst Teledyne Continental Motors
Gerald Bourg	Analytical Inspector Teledyne Continental Motors

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Aircraft Products Division

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Quality Assurance Analytical Inspection Report

Page Two - Serial Nos. 166086-H and 183812-H

ENGINE 183812-H

This engine was received resting on a fork lift pallet. The engine nacelle structure below and aft of the engine had separated from the aircraft. This structure was returned atop the engine. A propeller was returend atop this structure. Its spinner was collapsed rearward. All three blades were bent rearward. Blade bending was within that section spanned by the deicer boot. All studs had pulled from this propeller hub- to identify this propeller as being from engine 166086-H.

The engine was returned resting on its oil sump. The sump was dented upward but appeared to be otherwise intact.

The left front baffling had been forced rearward around/into the propeller governor. This governor was intact. The intake balance tube had been forced rearward.

All four engine mount brackets were still in position. Attachment bolts had pulled brackets to strip out the helicoil inserts. The left rear bolt had pulled out of the airframe bracket. This bolt remained in position. The right front bolt had broken away flush with the mount bracket surface.

No. 2 intake tube had broken loose at its attachment flange. No. 1 intake tube had broken away at its transition to the riser structure.

The air throttle body was attached to engine rear by its fuel pressure sensor hose. deck reference hose and fuel outlet hose to the manifold valve.

The throttle and mixture control arms were bent. The mixture control arm was no longer operable. The main fuel inlet fitting had broken away flush with the throttle body.

The tach generator body had broken away from its position on the oil pump rear. The generator body was returned as a loose item.

The turbosupercharger oil return fitting had broken away flush with the scavenge pump body.

All top and bottom spark plug wires had been disconnected from their sparkplugs.

Quality Assurance Analytical Inspection Report

The turbosupercharger was intact but shaft rotation was no longer possible. The wastegate valve was in full open position. The tailpipe was distorted and had separated from the turbine housing.

Shaft rotation was stiff on both magnetos. Salt water had attacked the electrodes and combustion deposits on nearly all sparkplugs. Those not damaged offered no evidence of carbon or lead fouling.

Salt water entry had left white deposits in the exhaust manifolds. Nos. 1, 5, 4 and 6 cylinder exhaust ports were plugged with white crystalline deposits.

Mud/silt had entered Nos. 1, 3, 2 and 6 cylinders. Piston rings on all pistons were rusted. The pistons and pins all exhibited salt water damages.

Residual combustion deposits in No. 4 and 5 cylinders appeared to be normal in coloration.

Cylinder overhead valve train components were intact and appeared to be functional.

There were no indications of crankshaft main bearing distress. Water entry had rusted the connecting rods, camshaft and hydraulic lifters.

The crankshaft exhibited several bending overload fractures within the rear propeller flange fillet.

All six connecting rods moved without restriction. All four counterweights moved without restriction.

Shaft rotation was still satisfactory on the propeller governor, starter motor and starter adapter. Shaft seizure was noted on the fuel pump, vacuum pump, turbosupercharger and alternator. Drive trains were undamaged. The turbosupercharger exhibited no evidence of blade damage.

The oil pump and scavenge pumps appeared to be functional. There were no indications of any metallic debris in the oil sump.

Visible through the broken fuel inlet fitting the fuel control inlet screen was corroded.

At the request of Mr. Arnot-Perrott the accessory items were not further explored.

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ENGINE 166086-H

This engine was returned on a forklift pallet. The propeller from S/N 183812-H was strapped to the engine top.

The engine was still attached to the nacelle engine mount structure and still attached to all components within the nacelle. The nacelle structure had released at the firewall.

The starter motor had broken away from its position on the starter adapter.

The propeller had pulled off the propeller flange leaving the propeller hub studs and nuts in the flange.

No. 6 valve cover was punctured. The oil sump was dented upward/balance tube distorted rearward.

The nacelle structure had bent upward just behind the engine. Both exhaust manifold sections were buckled at the rear cylinders.

Saltwater had flooded the exhaust manifold and entered Nos. 1, 3, 4 and 6 cylinders. Combustion deposits in these cylinders were destroyed. Deposits in No. 2 cylinder and on the piston indicate no fuel abnormalities, however, these and deposits in No. 6 showed some moisture attack.

Cylinder overhead valve train components were intact and appeared to be functional. All open valves moved to the closed position on cylinder removal.

The crankshaft main bearings exhibited nominal operational signatures. Water had rusted the connecting rods, camshaft and lifters. Connecting rods and counterweights all moved normally.

Shaft rotation was still nominal on the magnetos, propeller governor and starter adapter.

Shaft lockup was noted on the fuel pump, vacuum pump, alternator and turbosupercharger. Drive train components on the three former items were intact.

On the fuel pump its main fuel inlet fitting had broken away flush with the pump body. The aneroid housing had broken loose. It still remained attached to the aneroid.

The sparkplug electrodes had received varying water damage. There were no indications of carbon or lead fouling.

Propeller inspections were performed by McCauley personnel Tom Knopp and Wayne Edmonds. Their findings were reportedly that both propellers exhibited very similar damage signatures/power settings.

Following these examinations the engine residuals were placed in storage to await disposition instructions from Mr. Arnot-Perrett.

Hugh B Gordon
Hugh B. Gordon.
Product Analyst

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