FINAL REPORT

AIRCRAFT ACCIDENT INVESTIGATION REPORT

GENERAL INFORMATION

Report / File. No:	-	**AAIIU: 3/1/33**
Registered Owner / Operator	-	**RORAIMA AIRWAYS INC**
Aircraft Model / Type	-	**BN-2A-III-2 TRISLANDER**
Nationality	-	**GUYANESE**
Registration	-	**8R-GRE**
Place of Accident / Region	-	**HAAGS BOSCH SANITARY LANDFILL, EAST BANK DEMERARA, REGION 4, GUYANA** **COORDINATES: 6.7645° N, 58.1494° W**
Aircraft Manufacturer	-	**FAIREY BRITTEN-NORMAN**
Date of Accident	-	**14 AUGUST 2021**
Time of Accident	-	**15:29 UTC (11:29 GST)**

REPORT / FILE #: GAAIU 3.1.33

This investigation was conducted in accordance with the methodology and requirements of ICAO Annex 13, therefore, it is not intended to apportion blame, or to assess individual or collective liability. Its sole objective is to draw lessons from the occurrence which may help to prevent future accidents. Consequently, the use of this Report for any purpose other than for the prevention of future accidents could lead to erroneous conclusions.

Note: All times in this Report are Coordinated Universal Time (UTC) unless otherwise stated. UTC is four hours ahead of Guyana Standard Time (GST). (UTC = GST +4).

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ACRONYMS / ABBREVIATIONS / TERMS AND THEIR MEANING AS USED IN THIS REPORT

TERMS	MEANING
AAIB	Aircraft Accident Investigation Board (UK)
ACCREP	Accredited Representative
AMO	Approved Maintenance Organisation
AOC	Air Operator Certificate
BN	Britten-Norman (Manufacturer of the Trislander)
CAA	Civil Aviation Authority
CVR	Cockpit Voice Recorder
EASA	European Union Aviation Safety Agency
FDR	Flight Data Recorder
GAAIIU	Guyana Aircraft Accident & Incident Investigation Unit
GARs	Guyana Aviation Requirements
GCAA	Guyana Civil Aviation Authority
GPHC	Georgetown Public Hospital Corporation
ICAO	International Civil Aviation Organisation
IIC	Investigator-In-Charge
LH	Left Hand (Port)
LHS	Left Hand Side (Port Side)
MLG	Main Landing Gear
MSL	Mean Sea Level
NLG	Nose Landing Gear
PIC	Pilot-In-Command / Commander
RAI	Roraima Airways Incorporation
RH	Right Hand (Starboard)
RHS	Right Hand Side (Starboard Side)
SYEC	ICAO Designator for Eugene F. Correia International Airport
SYIB	ICAO Designator for Imbaimadai Aerodrome
UK	United Kingdom

SYNOPSIS (SUMMARY OF EVENTS)

Roraima Airways Inc, the owner / operator of the aircraft, notified the Guyana Civil Aviation Authority (GCAA) via telephone at approximately 15:45 UTC (11:45 GST) on the 14 August 2021 and the investigation began that same day.

On 14 August 2021 at approximately 14:20 UTC (10:20 hrs GST), the Roraima Airways Inc aircraft, a Britten-Norman BN-2A-III-2 Trislander, bearing Nationality & Registration Marks 8R-GRE departed the Imbaimadai Aerodrome (SYIB), Region 7, Guyana, to perform a regular commercial passenger / cargo flight schedule to the Eugene F. Correia International Airport (SYEC) in Region 4, Guyana, with two (2) crew members (01 Commander, and 02 Observer Pilot), three (3) passengers, and cargo of approximately 281 lbs. At approximately 15:29 UTC (11:29 hrs GST), the aircraft suffered total engine failures.

The Commander reported that the order of failure was, first the tail (rear) engine lost power and became inoperative, then the port engine power failed, the engine then "coughed" and momentarily regained power and then became inoperative. Almost immediately after the port engine failed, the starboard engine lost power and became inoperative. The eventuality was total loss of power of all three (3) engines. The Commander reported that he realised that he could not make it to the destination airport. At the time, he had no other choice but to seek out a place to land the aircraft.

The aircraft was ditched (force landed, Commander's words) into the swampy area of the Haags Bosch Sanitary Landfill in Region 4, Guyana, approximately seven (7) nautical miles from its intended arrival aerodrome SYEC. The aircraft suffered some structural damages to the nose section. The crew had no injuries; however, one (1) passenger (female adult) had a gash over her left eye, the male adult passenger was diagnosed with a bleeding liver at the hospital, and the third passenger (a child under two (2) years old) had no injury.

The Haags Bosch Sanitary Landfill is a controlled area for the disposal of waste material (garbage) by burying it. The area where the aircraft landed had garbage and tall grass and was under water of approximately three (3) feet high.

The initial investigation identified the following contributary and consequential factors:

a. The accident occurred because of total engine failures due to fuel starvation and the pilot's decision to land the aircraft in the landfill. The fuel starvation was due to all the fuel in the main tanks being depleted (used up).

b. The Commander did not check to ensure that the main fuel tanks had enough fuel for the flight before departure SYIB. He also did not transfer fuel from the tip tanks (which had fuel in it) to the main tanks to ensure that there was enough fuel to sustain the flight schedule.

(Note: Fuel from the tip tanks cannot be fed directly to the engines, the engines are fed fuel from the main tanks only. Therefore, if there is insufficient fuel in the main tanks for the flight schedule, and there is no other means to replenish the main tanks, then the fuel from the tip tanks should be transferred to the main tanks before commencement of the

flight schedule.) In any case, the fuel in the main tanks must be sufficient to sustain the flight schedule and this must be ascertain before flight.

c. The Commander ditched the aircraft in the swampy area of a sanitary landfill, and in his opinion, this was the best option he had at the time (his words). The impact caused damages to the nose section of the aircraft.

d. Eight (8) safety recommendations were made during the course of the investigation. ***(Refer to Item 4 below).***

1. FACTUAL INFORMATION

1.1 HISTORY OF FLIGHT

1.1.1 FLIGHT DATA /AERODROME INFORMATION

a.	Flight Number	-	**ROR738**
b.	Aircraft Registration	-	**8R-GRE**
c.	Type of Operation	-	**COMMERCIAL PASSENGER / CARGO**
d.	Last Point of Departure	-	**SYIB**
e.	Date / Time of Departure	-	**14 AUGUST 2021 / 14:20 UTC (10:20 GST)**
f.	Point of Intended Landing	-	**SYEC**
g.	Coordinate / Accident Site	-	**6.7645° N, 58.1494° W**
h.	Aerodrome Orientation	-	**NOT APPLICABLE**
i.	Aerodrome Length	-	**NOT APPLICABLE**
j.	Aerodrome Width	-	**NOT APPLICABLE**
k.	Aerodrome Elevation	-	**NOT APPLICABLE**

The aircraft was operated by a single Pilot (Commander); however, an Observer Pilot was on board and occupied the First Officer's seat. On 14 August 2021, the aircraft departed Imbaimadai Aerodrome (SYIB) at approximately 14:20 UTC (10:20 GST) for the Eugene F. Correia International Airport (SYEC) but was "force landed" (Commander's decision, his words) at the Haags Bosch Sanitary Landfill after the aircraft experienced total engine failures.

There were five (5) souls on board (01 Commander, 02 Observer Pilot, 03 Female Adult, 04 Male Adult and 05 Child under two (2) years old). Also, on board was two hundred and eighty-one (281) pounds of cargo. There were no dangerous goods on board. The aircraft suffered structural damages to the nose section and the nose landing gear.

At approximately seven (7) nm from destination airport the aircraft tail (rear) engine lost power and became inoperative. The Commander then secured the engine. The Commander then switched on the fuel transfer pumps (his words). Shortly thereafter, the port engine lost power, then "coughed" and regained power momentarily but subsequently lost power again, and shortly after that the starboard engine also lost power. The aircraft had a total engine failure (loss of propulsive force from all three (3) engines).

The aircraft was losing altitude and the Commander decided to force land the aircraft into the swampy sanitary landfill that was in the vicinity. The tall grass and water may have cushioned the impact and the aircraft suffered little structural damages, mostly in the nose section.

After landing, the Commander did not switch off the fuel transfer pumps or electrical power. He went and attended to a female adult passenger who had a gash over her left eye and who was paranoid and screaming. After tending to the passenger, the Commander then went back to the flight deck and turned off the transfer pumps and electrical power (Commander's words). Thus, when Inspectors of the GCAA and Accident Investigators examined the fuel tanks, they found that all the tanks had some quantity of fuel in it:

a. Starboard Main Tank had 25 imperial gallons of fuel.
b. Starboard Tip Tank had 3 imperial gallons of fuel.
c. Port Main Tank had 8 imperial gallons of fuel.
d. Port Tip Tank had 11 imperial gallons of fuel.

Inspectors and Investigators observed RAI maintenance staff as they conducted fuel flow checks on all three (3) engines as per the approved Trislander maintenance manual and found the checks to be satisfactory.

At the initial interview, the Commander did not indicate that there was insufficient fuel in the main tanks to support the flight schedule. He did not indicate whether he checked the main tanks fuel quantity gauges or did he use a calibrated dipstick (in accordance with RAI Operations Manual) to ascertain the quantity of fuel in the fuel tanks.

The Commander could not remember if he transferred fuel from tip tanks to main tanks at the departure aerodrome (SYIB) before he commenced the flight schedule.

Fuel was not transferred from the tip tanks to the main tanks at departure aerodrome (SYIB) the transfer pumps were activated after the tail (rear) engine failed.

1.2 INJURIES TO PERSON

INJURIES	CREW	PASSENGERS	OTHER	TOTAL
FATAL	-	-	-	-
SERIOUS	-	-	-	-
MINOR / NONE	-	2	-	2
TOTAL	-	2	-	

There were no fatalities. Neither the Commander nor the Observer Pilot had any injuries.

The female adult passenger had a gash (cut) over her left eye. The Observer Pilot initially rendered first aid to the passenger and the Commander took over and bandaged the injury. The passenger was taken to the Georgetown Public Hospital Corporation (GPHC) where she was examined, and her injury treated before she was discharged. The male adult passenger was taken to the GPHC where he was examined and diagnosed with slight bleeding of the liver. He was admitted to the hospital and treated, and after three (3) days of observation, he was discharged. The infant passenger was taken to the GPHC where she was examined and found to be without injury. She was not admitted to the hospital.

It must be noted that after the main fuel tanks were replenished the engines started without any difficulty.

1.3 DAMAGE TO AIRCRAFT

The damage to the aircraft was confined to the nose section. The aircraft was removed from the crash site and repositioned to an asphalted road in the vicinity of the crash site. Temporary repairs were done to the nose section and aircraft was flown from the road to RAI Base at SYEC.

1.3.1 OBSERVATIONS AT THE ACCIDENT SITE

At the accident site the aircraft was inspected, and the following were observed:

a. The port aileron had a slight bend at the outer trailing edge.
b. The nose landing gear (NLG) was bent backwards.
c. The fuel tanks were inspected, and fuel quantity checked using a calibrated dipstick:
    i. Starboard Main Tank had 25 imperial gallons of fuel.
    ii. Starboard Tip Tank had 3 imperial gallons of fuel.
    iii. Port Main Tank had 8 imperial gallons of fuel.
    iv. Port Tip Tank had 11 imperial gallons of fuel.
d. Fuel flow checks were done on all three engines and found satisfactory.

1.3.2 OBSERVATIONS AFTER AIRCRAFT WAS REPOSITIONED ON THE ROAD

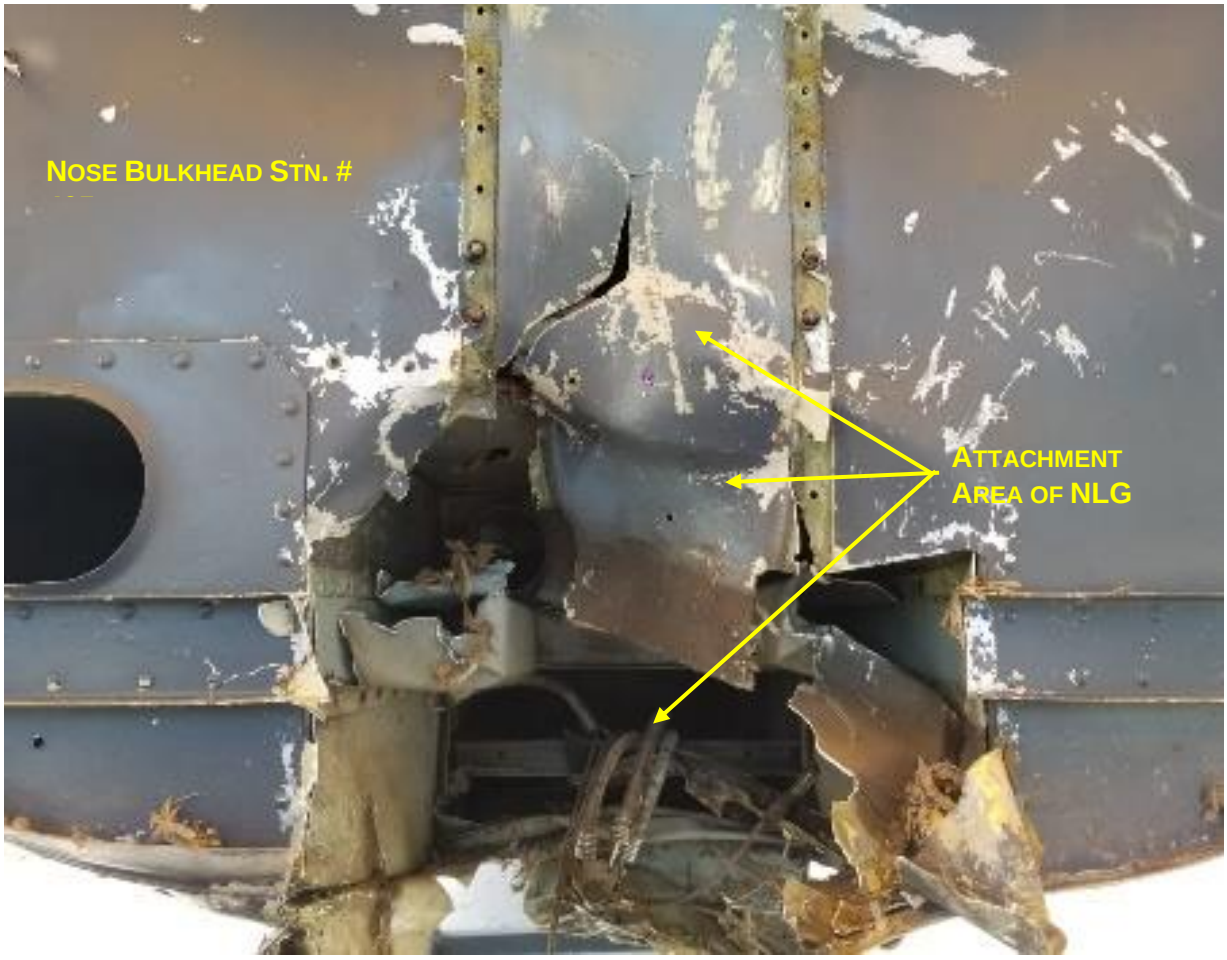
The aircraft was removed from the crash site and repositioned on a nearby road where further inspections were carried out and the following were observed:

a. The nose bulkhead at Stn. # 405, attachment area for the NLG, had major structural damages.
b. The keel members attached to the bulkhead had major structural damages.
c. The nose cargo bay had structural damages.
d. The nose section bottom skin had major structural damages.
e. Heavy landing inspections / checks were carried out and found satisfactory.

f. Wheel alignment inspections / checks were carried out and found satisfactory.

g. Aircraft structure (in general) was inspected and found satisfactory, except for the damages mentioned above.

PICTURES BELOW SHOWING NOSE AREA DAMAGES


NOSE BULKHEAD STN. #
ATTACHMENT AREA OF NLG


NOSE BULKHEAD STN. #
ATTACHMENT AREA OF NLG

1.4 Other Damage

There was no other damage.

1.5 Personnel Information - Commander

a.	Commander	-	**Male, Aged 45 Years**
a.	Date of Birth	-	**2 May 1976**
b.	Licence	-	**Commercial Pilot's Licence Issued 12 November 2017; Class Ratings - Single & Multi Engine Land Issued 9 February 2015**
c.	Instrument Rating	-	**Valid To 30 April 2022**
d.	Aircraft Proficiency Check	-	**Valid To 31 October 2021**
e.	Medical Certificate	-	**Class 1, Valid To 31 December 2021; Class 2, Valid To 30 June 2022**
f.	Flying Experience		
	Total All Types	-	**7,842 Hours**
	Total On Type	-	**4,000 Hours**
	Total Last 30 Days	-	**91:32 Hours**
	Total Last 24 Hours	-	**2:26 Hours**
g.	Previous Rest Period		
	Off Duty	-	**17 Hours**
	On Duty	-	**9 Hours**

1.6 Aircraft Information

1.6.1 General

The aircraft is a Fairey Britten-Norman BN2A MK III-2 Trislander, built in 1979. It carried the manufacturer's serial number 1042 and is operated and maintained by Roraima Airways Inc, the holder of a GCAA certificated / approved Air Operator Certificate (AOC) and Approved Maintenance Organisation (AMO). At the time of the accident, the aircraft accumulated (since new) 18,041 hours and 28,560 landings.

The aircraft is fitted with three (3) Lycoming O-540-E4C5 piston engines and each engine is equipped with a two-bladed constant-speed Hartzell propeller, designated HC-C2YK-2CUF. At the time of the accident, each of the three (3) engines accumulated 1,078:17 hours since new.

There are four (4) fuel tanks on the aircraft, (i) port tip tank, (ii) port main tank, (iii) starboard tip tank and, (iv) starboard main tank. Each tip tank has a capacity of 27.5 imperial gallons and each main tank has a capacity of 65 imperial gallons. Total accumulative fuel capacity for all four (4) tanks is 185 imperial gallons.

The engines are fed fuel from the main tanks only (i.e., fuel cannot be fed to the engines via the tip tanks). When the fuel quantity in the main tanks is 40 imperial gallons or below, the manufacturer recommends that fuel can be transferred from the tip tanks to the main tanks, this will avoid overfilling the main tanks and spilling fuel through the vents.

There are two (2) fuel transfer pumps, one (1) for the port tanks and the other for the starboard tanks. It is recommended that the fuel for the journey be checked, and if required, fuel from the tip tanks can be transferred to the main tanks while the aircraft is on the ground. This will ensure that there is sufficient fuel in the main tanks for the flight schedule. The rate of fuel transfer via the pumps is less than the engine consumption rate (fuel burn rate). This means that the engines consume fuel at a higher rate than the pumps can transfer. Thus, the reason why it is recommended that the fuel transfer be done on the ground when the engines are not running.

At the accident site the fuel transfer pumps were checked and found to be operating satisfactory. Fuel flow checks were carried out on all three (3) engines in accordance with the manufacturer's maintenance manual and found satisfactory.

The aircraft was registered in Guyana on 10 November 2016 and issued with a Certificate of Registration (C of R) No. 326. The aircraft was initially issued with a Certificate of Airworthiness (C of A) on 6 December 2016, C of A No. 275. On 10 December 2020, its C of A was renewed by the GCAA, and this was valid until 9 December 2021. A Certificate of Release to Service (CRS) was issued by the operator's GARs Part 6 Approved Maintenance Organisation (AMO) on 12 August 2021 and was valid until 10 December 2021.

1.6.2 ENGINES

ENGINE MANUFACTURER		LYCOMING
ENGINE TYPE	-	**O-540-E4C5**
ENGINE - STARBOARD		
SERIAL NUMBER	-	**RL-26067-40E**
TOTAL TIME	-	**1,078:17 HRS**
ENGINE - PORT	-	
SERIAL NUMBER	-	**RL-26040-40E**
TOTAL TIME	-	**1,078:17 HRS**
ENGINE - TAIL/REAR	-	
SERIAL NUMBER	-	**L-22382-40A**
TOTAL TIME	-	**1,078:17 HRS**

1.7 METEOROLOGICAL INFORMATION

Weather was not relevant to this accident, however, at the time of the accident the ceiling and visibility was unlimited (CAVU).

1.8 AIDS TO NAVIGATION

The performance of navigational aids was not relevant to this accident.

1.9 COMMUNICATIONS

There were no communication issues relevant to this accident.

1.10 AERODROME INFORMATION

Aerodrome information was not relevant to this accident.

1.11 FLIGHT RECORDERS

Flight recorders, including Cockpit Voice Recorders and Flight Data Recorders were not fitted or required to be fitted to this class of aircraft.

1.12 WRECKAGE AND IMPACT INFORMATION

1.12.1 GENERAL

Aircraft had minimal damage, except for the nose area. See Item / Para 1.3.

1.12.2 ENGINEERING INVESTIGATION

The aircraft was type certificated in accordance with British Civil Airworthiness Requirements (BCAR) Section "K", which is applicable to smaller public transport aircraft with a maximum weight of less than 5,700 kg.

Fuel samples from each fuel tank sump and gascolator were taken and checked for water, sediments, and other contaminants, and found satisfactory. Fuel flow checks were carried out on each engine and found satisfactory. Fuel quantity in each fuel tanks were checked using a calibrated dipstick. The results of each check are as follows:

a. Starboard Main Tank had 25 imperial gallons of fuel.
b. Starboard Tip Tank had 3 imperial gallons of fuel.
c. Port Main Tank had 8 imperial gallons of fuel.
d. Port Tip Tank had 11 imperial gallons of fuel.
e. Starboard Carburettor drained and approximately ¼ pint of fuel was collected.
f. Port Carburettor drained and approximately ¼ pint of fuel was collected.
g. Rear Carburettor drained and found empty.
h. Starboard Engine fuel flow check was done, result was 1 minute 13 seconds per gallon.
i. Port Engine fuel flow check was done, result was 2 minutes 48 seconds per gallon.
j. Rear Engine fuel flow check was done, result was 1 minute 26 seconds per gallon.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

One passenger was given first aid by the Commander and Observer Pilot. The passenger was airlifted via helicopter and was treated at a hospital and discharged after treatment. Another passenger was diagnosed with slight bleeding of the liver after he was examined at a hospital. He was admitted to the hospital, treated, placed under observation, and was discharged after three (3) days. No other person was reported to have suffered any injury or had to be treated at a hospital or was hospitalised.

1.14 FIRE

There was no fire.

1.15 SURVIVAL ASPECTS

Search and Rescue (SAR) was immediately activated, and the military, police and fire service were contacted. The military immediately provided a helicopter to rescue the crew and passengers and airlifted them to proximity of a hospital. Both pilots administered first aid to an injured passenger. Injured passengers were treated at a hospital. One passenger was hospitalised and placed under observation and discharged after three (3 Days)

1.16 TESTS AND RESEARCH

Investigators / Inspectors tried to find out why all three (3) engines failed but could not find any plausible reason since the fuel in the tanks were water and contaminant free, the fuel flow checks were satisfactory, and there was fuel in the main tanks.

It was deduced that for all three (3) engines to fail, the common thing would be fuel starvation. However, the reason for the fuel starvation was undetermined at the time. However, it was surmised that the Commander ***may not*** have transferred fuel from the tip tanks to the main tanks in a timely manner and the main tanks may have become depleted of fuel, thus, not being able to supply fuel and at that point, the engines became inoperative. This was later corroborated by the Commander himself who came in and admitted that ***he forgot to transfer fuel from the tip tanks to the main tanks*** before departure SYIB, thus, causing the main tanks to become depleted of fuel.

1.17 ORGANISATIONAL AND MANAGEMENT INFORMATION

The Guyana Civil Aviation Authority is responsible for safety oversight and certification of all aviation organisations and airmen in Guyana.

Roraima Airways Inc, the Owner / Operator of the aircraft holds a valid Air Operator Certificate and an Approved Maintenance Organisation Certificate issued by the GCAA. Both air operation and maintenance of aircraft is done by RAI.

The Commander holds a valid Commercial Pilot's Licence, Type Rating and Medical Certificate issued by the GCAA.

1.18 ADDITIONAL INFORMATION

None.

1.19 USEFUL AND EFFECTIVE INVESTIGATION TECHNIQUES

None.

2. ANALYSIS

2.1 FLIGHT CREW ACTION

a. When the tail (rear) engine failed the Commander secured the engine to minimise drag.

b. After the tail (rear) engine failed, the Commander became aware that there was not enough fuel in the main tanks to supply the engines for continued operation, he promptly switched on both fuel transfer pumps with a view to replenish the main tanks.

c. After the other two (2) engines failed, the Commander realising he was losing altitude and that he could not reach destination aerodrome in time, quickly looked for a safe place to land the aircraft and decided to force-land the aircraft in the swampy sanitary landfill.

d. He and the Observer Pilot's decision to administer first aid and pacify the injured / screaming passenger may have alleviate an otherwise panicky situation.

2.2 HUMAN FACTORS

Flying the same aircraft or similar types of aircraft regularly and using the same checklists and procedures each time may induce familiarity and pilots may take it for granted and believe they "know it by heart". This can lead to complacency and the pilot can miss an item or items of importance.

Pilots who do not observe duty and rest periods may become exhausted, stressed, and lethargic and suffer from physical and mental fatigue. This is indicative in this case, since, the Commander has added management duties to fulfil, and his management tasks often times begin before his flying duties is not finished after flying duties. This is highly likely to induce anxiety and fatigue (both mental and physical) and impinge on his duty and rest periods, thus affecting his judgement and situational awareness as a pilot-in-command.

This accident is a clear case of complacency, the Commander was less assertive and did not adhere to operational and checklist procedures.

3. CONCLUSIONS

3.1 FINDINGS

a. All three (3) engines failed, first the tail (rear) engine, followed by the port and subsequently the starboard engine. All three (3) engines failed because of insufficient fuel in the main tanks to sustain engine operation.

b. The aircraft had enough fuel on board (in the fuel tanks) for the flight schedule (that is total combined fuel in all the tanks), however, not enough fuel was in the main tanks to sustain continued engine operation for the entire flight schedule.

c. All three (3) engines feed from the main fuel tanks only. The Commander did not transfer fuel from the tip tanks unto the main tanks to ensure that there was sufficient fuel in the main tanks to sustain the flight schedule. Fuel in the tip tanks is not useful fuel for engine operation unless the fuel is transferred into the main tanks where it can become useful.

d. It is apparent that the Commander did not pay attention to fuel gauge indications and did not observe that the fuel quantity in the main tanks was inadequate for the flight schedule. He also did not observe RAI Company Operations Manual which require him to confirm fuel quantity with a calibrated dipstick before commencement of flight.

e. He did not transfer fuel from the tip tanks to the main tanks in a timely manner while the aircraft was on the ground. He only commences fuel transfer after the tail (rear) engine lost power. Apparently, this action happened too late, and in any case, since the engine fuel consumption rate is greater than the fuel transfer rate, there still was insufficient fuel in the main tanks to continue engine operation.

f. The pilot's checklist has listed under ***"Pre-Takeoff Checks" Item 5, "Fuel Contents – Checked, Sufficient"***. Either, the Commander did not use the checklist, or he overestimated or erroneously calculated the fuel quantity in the main tanks, as sufficient for the flight. This is indicative of complacency and may be due to familiarity (believing that he knows the checklist and do not have to go through it), undue stress, workload, or fatigue due to his multiple roles in the Company. He is Director of Operations, Captain and Training Pilot for RAI. This mean that his duty begins before flight and does not conclude after flight.

g. RAI Operations Manual was reviewed and checked for adequate procedures that will make certain that the pilot is prompted to check and confirm that there is sufficient fuel in the main tanks for the flight schedule. There is no clear written procedure. The pilots said that there is a verbal procedure which they practice and adhered to.

3.2 CASUAL FACTORS / PROBABLE CAUSE

a. The total fuel on board collectively in the fuel tanks was sufficient to sustain the flight schedule, however, the fuel in the main tanks was not sufficient for the flight schedule. Consequently, all three (3) engines suffered fuel starvation and became inoperative due to insufficiency of fuel.

b. Roraima Airways Inc Operations Manual and the Pilots Checklist procedures were not observed to ensure that there was sufficient fuel in the main tanks.

c. Fuel was not transferred from the tip tanks to the main tanks while the aircraft was on the ground at the departure aerodrome. Had this been done, there would have been enough fuel to sustain the flight schedule.

4. SAFETY RECOMMENDATIONS

After careful consideration of the observations, inspections, investigations, findings, analysis and conclusion, the following safety recommendations have been made:

a. Roraima Airways Inc and the Guyana Civil Aviation Authority should investigate to find out what led to the complacency of the Commander and why he did not transfer fuel from the tip tanks to the main tanks in a timely manner (before take-off SYIB). Why he did not ensure that there was sufficient fuel in the main tanks for the flight schedule.

b. RAI Operations Manual procedures for single crew operations: pilots must callout to themselves the checklist items and ensure they are complied with. This will prevent complacency and the culture ***"I am familiar with the procedures and the checklist; I know it by heart and do not need to check it"***.

c. RAI should review its Operations Manual to include clear written procedures for crew to check before commencement of each flight to ensure that there is sufficient fuel in the main tanks for each flight schedule. The procedures must require pilots to check the fuel tank quantity of each fuel tank (fuel status) and enter the information in the Technical Logbook before each flight. For this aircraft type, fuel quantity must be checked by fuel gauge readings and confirmation of fuel quantity of each fuel tank be done using a calibrated dipstick. This procedure must be clearly stated in RAI Operations Manual.

d. The GCAA should investigate if the Commander was under undue stress due to workload, or if his multiple roles in the Company, including his positions and roles as Director of Operations, Captain and Training Pilot is affecting his decision making and performance, and is impeding his duty and rest periods.

e. The GCAA should carry out an audit of RAI training programme for flight crew and ensure that training include Company Operations Manual and checklist procedures. A review of pilots' training files should also be done to ensure that they have all the required training; including, initial, recurrent and type training.

f. The GCAA need to periodically investigate cases of non-compliance with operations procedures, pilot's checklist procedures and maintenance procedures, and review same for improved efficiency.

g. The GCAA and RAI should investigate if the Commander was observing his required duty and rest periods prior to pilot / flight duties.

h. The GCAA should consider at least the following training for the Commander:

    (i) Pilot-in-Command (PIC) duties and responsibilities, in accordance with the Guyana Aviation Regulations and RAI Operations Manual.

    (ii) Fuel management procedures and policies, including RAI Operations Manual and pilot's checklist procedures, and

    (iii) Single crew resource management.

Note: These recommendations should be applicable to all operators of Trislander or similar aircraft under the Guyana Aircraft Register.

APPENDIX: 1
DIAGRAMS OF TRISLANDER FUEL SYSTEM