COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 139/CENIPA/2017

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**N154KQ**
MODEL:	**KODIAC 100**
DATE:	**10NOV2017**

NOTICE

According to the Law nº 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.

The document does not focus on quantifying the degree of contribution of the different factors, including the individual, psychosocial or organizational variables that conditioned the human performance and interacted to create a scenario favorable to the accident.

The exclusive objective of this work is to recommend the study and the adoption of provisions of preventative nature, and the decision as to whether they should be applied belongs to the President, Director, Chief or the one corresponding to the highest level in the hierarchy of the organization to which they are being forwarded.

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with Appendix 2, Annex 13 to the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree nº 21713, dated 27 August 1946.

Thus, it is worth highlighting the importance of protecting the persons who provide information regarding an aeronautical accident. The utilization of this report for punitive purposes maculates the principle of "non-self-incrimination" derived from the "right to remain silent" sheltered by the Federal Constitution.

Consequently, the use of this report for any purpose other than that of preventing future accidents, may induce to erroneous interpretations and conclusions.

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. Taking into account the nuances of a foreign language, no matter how accurate this translation may be, readers are advised that the original Portuguese version is the work of reference.

SYNOPSIS

This is the Final Report of the 10NOV2017 accident with the KODIAC 100 aircraft model, registration N154KQ. The accident was classified as “[SCF-PP] System/Component Failure or Malfunction Powerplant – Engine Failure in Flight”.

During a transfer flight, the pilot made an intermediate landing on an unapproved runway, located in the city of Goiás Velho - GO, to visually check the amount of fuel, in order to compare with the information available on the aircraft panel.

After the takeoff from that location, the aircraft lost power and collided with vegetation in a rough area.

The aircraft was destroyed.

The pilot suffered serious injuries and the other occupants suffered minor injuries.

An Accredited Representative of the National Transportation Safety Board (NTSB) - USA, (State where the aircraft was designed/registered) was designated for participation in the investigation.

An Accredited Representative of the Transportation Safety Board (TSB) - Canada, (State where the engine was manufactured) was designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

AGL	Above Ground Level
AIM	Airplane Information Manual
ANAC	Brazil's National Civil Aviation Agency
AVANAC	ANAC's Flight Authorization
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CMA	Aeronautical Medical Certificate
DA	Airworthiness Directive
EICAS	Engine Indicating and Crew Alerting System
EPL	Emergency Power Lever
FAA	Federal Aviation Administration
FCU	Fuel Control Unit
IAM	Annual Maintenance Inspection
IFR	Instrument Flight Rules
IFRA	Instrument Flight Rating - Airplane
MFD	Multi-Function Display
MNTE	Airplane Single Engine Land Rating
NTSB	National Transportation Safety Board (USA)
NVM	Non-Volatile Memory
PCM	Commercial Pilot License – Airplane
PPR	Private Pilot License – Airplane
RBHA	Brazilian Aeronautical Certification Regulation
SAMU	Emergency Mobile Care Service
SILC	ICAO Location Designator – Bom Futuro Municipal Aerodrome, Lucas do Rio Verde - MT
SWNS	ICAO Location Designator – Anápolis Aerodrome - GO
UTC	Universal Time Coordinated

1. FACTUAL INFORMATION.

Aircraft	**Model:** KODIAC 100 **Registration:** N154KQ **Manufacturer:** Quest Aircraft Company	**Operator:** MID - Continent Aviation Services INC.
Occurrence	**Date/time:** 10NOV2017 - 1627 UTC **Location:** Vale da Serra Farm **Lat.** 15°56'09''S **Long.** 050°12'01''W **Municipality – State:** Goiás – GO	**Type(s):** [SCF-PP] System/Component Failure or Malfunction Powerplant – **Subtype(s):** Engine Failure in Flight

1.1 History of the flight.

The aircraft took off from the Bom Futuro Municipal Aerodrome (SILC), Lucas do Rio Verde - MT, to the Anápolis Aerodrome (SWNS) - GO, in order to carry out a transfer flight, with a pilot and three passengers on board.

During the flight, the pilot identified conflicting information related to the amount of fuel remaining and chose to make an intermediate landing on an unapproved runway, located in the city of Goiás Velho - GO, in order to check the data visually.

After the conference, the N154KQ took off from that location and, reaching approximately 300ft height, the aircraft lost power, colliding with vegetation 1.86 km from the runway used for takeoff.

Figure 1 - View of the aircraft wreckage with the fire not yet extinguished.

The aircraft was destroyed by the fire. The pilot suffered serious injuries and the three passengers suffered minor injuries.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	1	-	-
Minor	-	3	-
None	-	-	-

1.3 Damage to the aircraft.

The aircraft was destroyed by the fire after crashing against the ground.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours	Pilot
Total	3.000:00
Total in the last 30 days	08:00
Total in the last 24 hours	05:00
In this type of aircraft	08:45
In this type in the last 30 days	08:00
In this type in the last 24 hours	05:00

N.B.: The data related to the flown hours were obtained through the pilot's statement.

1.5.2 Personnel training.

The pilot took the PPR course at the Casa Branca Aeroclub – SP, in 1995.

1.5.3 Category of licenses and validity of certificates.

The pilot had the PCM License and had valid MNTE and IFRA Ratings.

1.5.4 Qualification and flight experience.

The pilot was qualified and had experience in the kind of flight.

1.5.5 Validity of medical certificate.

The pilot had valid CMA.

1.6 Aircraft information.

The aircraft, serial number 100-0154 was manufactured by Quest Aircraft Company, in 2015.

The Airworthiness Certificate (CA) was issued by the FAA and was valid.

The airframe, engine and propeller logbooks records were updated.

The last inspection of the aircraft, the "Annual Inspection" type, was performed on 13JUN2017, by the Mid - Continent Aviation Services Inc., Wichita - KS, USA, having flown 80 hours and 54 minutes after the inspection.

The aircraft was equipped with an Emergency Power Lever (EPL) system, in which a lever was connected to the hand-operated lever of the Fuel Control Unit (FCU) through links, which allowed manual control of the engine's fuel flow.

The EPL was intended to be used in the event of a FCU malfunction, as described in the AIM, Revision 18, October 2016.

In this case, when the engine was running and there was a failure in the pneumatic fuel control unit, the input of the control signal would result in decreased fuel flow and the engine would develop power equivalent to the IDLE position, approximately 48% Ng at sea level (Figure 2).

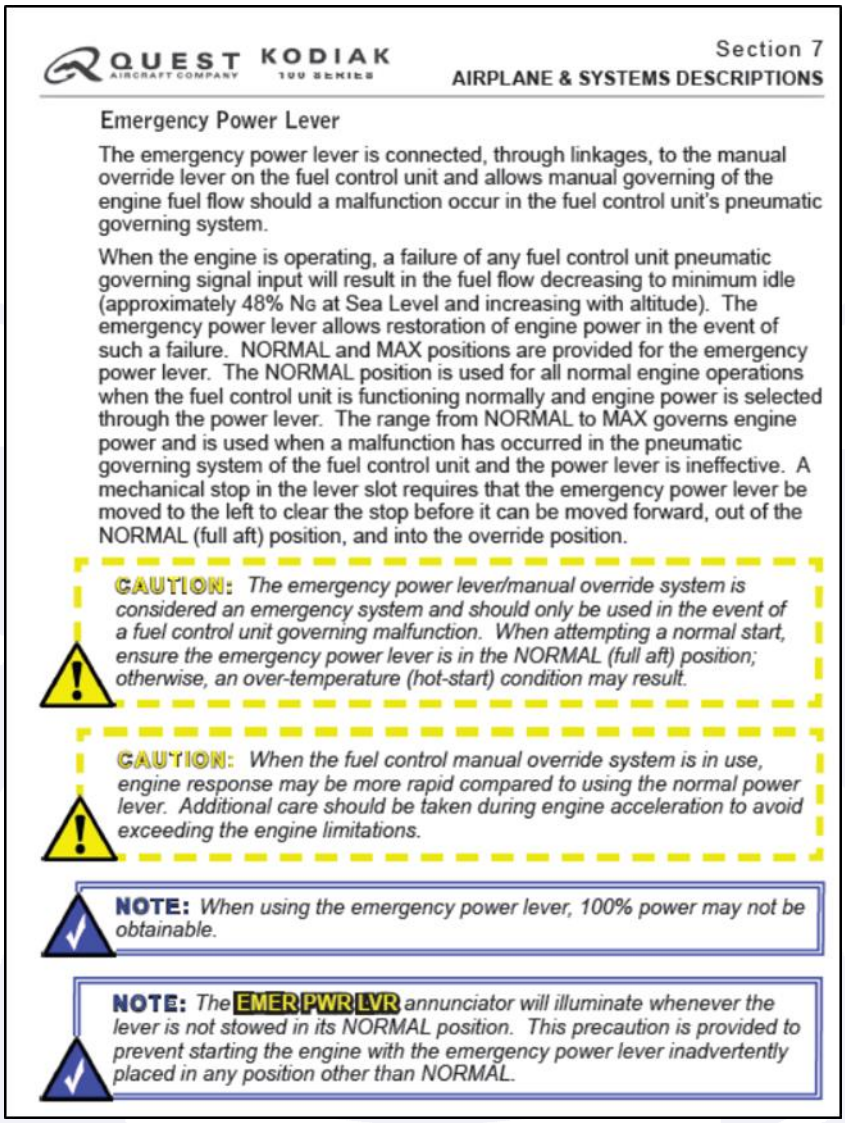


Figure 2 - Description of the Emergency Power Lever, extract from the Airplane Information Manual (Revision 18, October 2016).

The EPL had an operating range between NORMAL and MAX. With the EPL in the NORMAL position, the engine was controlled by the lever, as long as the fuel control unit was functioning correctly. In case of FCU failure, the engine power could be adjusted using the EPL, controlled in the interval between NORMAL and MAX.

1.7 Meteorological information.

According to the interviewed observers, the weather conditions described were favorable for the visual flight.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place outside the Aerodrome.

1.11 Flight recorders.

Neither required nor installed.

The equipment with NVM characteristics, which could be found in flight instruments, navigation instruments or electronic engine components, did not meet survival requirements and were consumed by the fire.

1.12 Wreckage and impact information.

The impact occurred outside the Aerodrome in a mountainous, irregular terrain, with low vegetation and some trees.

The collision happened with the aircraft almost leveled, tilting to the right and with low speed (approximately 60kt). The initial impact against the trees caused a sudden deceleration that resulted in the plane overturning. The wreckage was concentrated and there was a fire after the total stop.

The Powerplant showed damage due to fire in its entire length, with the destruction of the gearbox and the oil tank.

The degree of destruction and carbonization of the aircraft prevented the verification of equipment and instruments.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

There was no evidence that physiological or disability considerations affected the performance of the crewmember.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

According to the information obtained, the pilot started flying in August 2017, without any employment relationship, to an aircraft sales representative company (Thrush), operating another aircraft model belonging to the company operator.

Subsequently, according to the pilot, the owner of this company made a proposal for him to fly with a KODIAK 100 model aircraft, and this invitation was readily accepted. As a result, the pilot started to perform some demonstration flights of this aircraft to potential buyers.

On the flight that originated the occurrence, there were three passengers on board, one of whom was the owner of the company for which he worked, the operator of the aircraft and also a Thrush employee.

The pilot, when noticing that the plane engine had problems, looked for a place for emergency landing. According to his report, the chosen area was quite uneven, however, he had not noticed these conditions until the aircraft approached.

The pilot also reported that, according to his perception, the flights previously performed would not have been sufficient to provide adequate familiarization with the aircraft emergency procedures.

1.14 Fire.

A few moments after the impact against the ground, there was the appearance of fire from the front of the aircraft, which was extinguished by the fire-fighting service of the Goiás Velho municipality - GO.

1.15 Survival aspects.

The pilot was assisted by the passengers to leave the aircraft and, about 20min after the collision with the ground, the occupants were attended by the Emergency Mobile Care Service (SAMU).

1.16 Tests and research.

The remaining parts of the Pratt & Whitney PT6A-34 engine, which equipped the aircraft, were subjected to examinations, tests and research.

The engine had severe damage as a result of the fire and had the rear part, that is, its accessories box, consumed, preventing the checking of the fuel pump, FCU, the main oil filter and other components and accessories of the engine.

The front part of the engine was not affected by the fire, making it possible to inspect the filings detector and the oil return filter of the reduction box. They were clean and without contamination (Figure 3).

Figure 3 - Filings detector and oil filter in the engine reduction box without the presence of filings.

Rubbing marks were found in the turbines, both in the compressor drive and power drive, which were indications that the hot engine section was operational at the moment of impact (Figures 4 and 5).

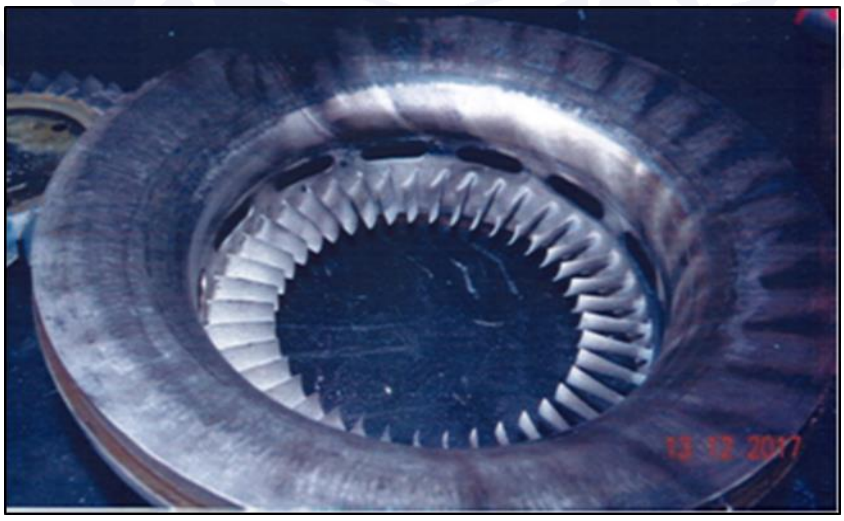


Figure 4 - View of the centrifugal impeller housing with light rubbing marks.

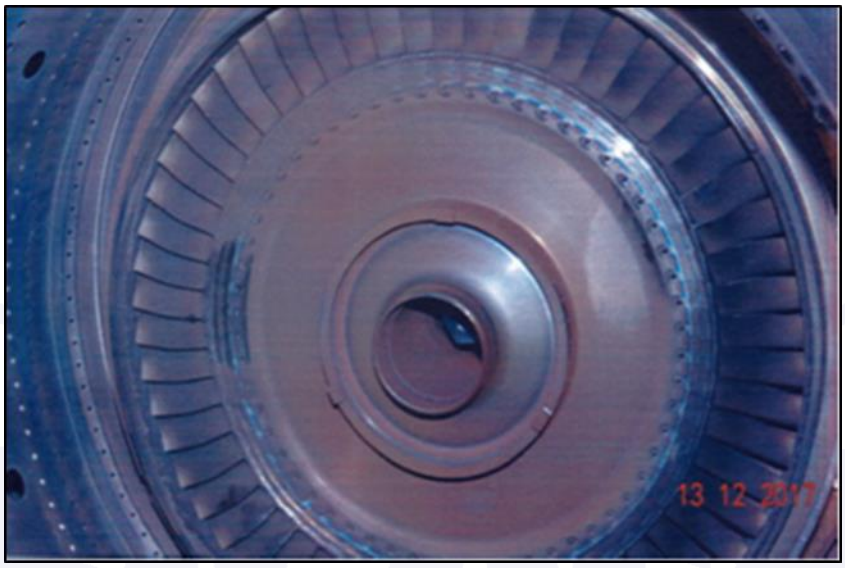


Figure 5 - Rubbing marks on the rotor of the compressor drive turbine, rear side.

The compressor was in normal conditions and no failures were found that could have compromised the operation of the engine. Bearings 1 and 2 were inspected for general condition and for the existence of "pits" caused by leakage of electric current, and were within normal limits.

During the analysis of the propeller, it was observed that one of the blades had a small fracture in its tip and folding facing forward. The others had folded backward at the half of their length. These deformations were consistent with the development of low power by the Powerplant at the time of the impact of the aircraft (Figure 6).

Figure 6 - General view of the propeller. The highlight shows one of the blades folded forward. The rest were backward.

The propeller governor had its minimum stop step broken, due to the collision with the ground. All Py connections were verified and were in accordance with the manufacturer's specifications.

When analyzing the engine P3 hose, it was observed that the connection was damaged by the fire and, during the low-pressure leak test, in which it was submerged in water and subjected to low pressure, several bubbles were observed. The severe action of the fire may have been responsible for the damages that caused the leaks observed in the test (Figure 7).

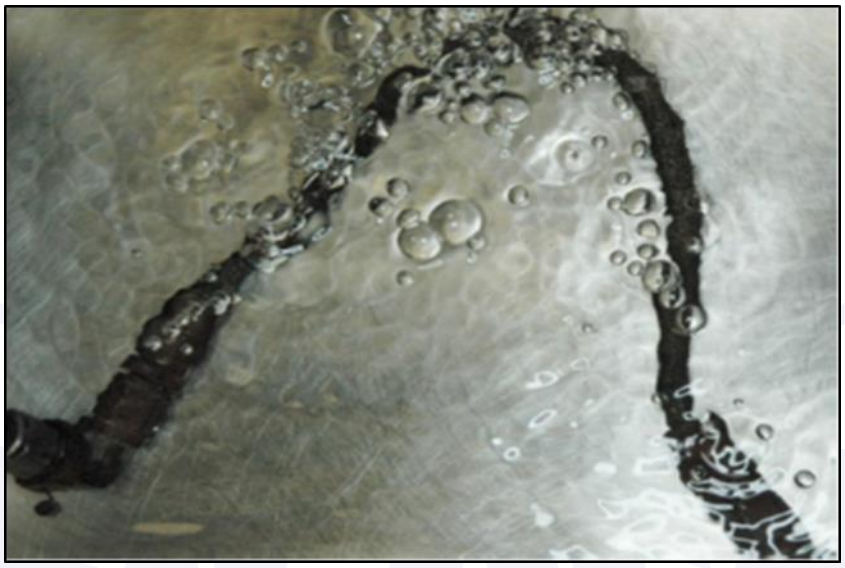


Figure 7 - Bubbles observed in the engine P3 hose during the low pressure leak test.

1.17 Organizational and management information.

The KODIAC 100 aircraft with registration number N154KQ belonged to the American Company Mid-Continent Aviation Services Inc. and had been temporarily exported to the Thrush Aircraft *do Brasil* Company.

According to the information obtained, there was no employment relationship between the Thrush Company and the pilot. His activities in this company had started in a Cessna 210 model aircraft and, subsequently, he started flying the KODIAK 100 model aircraft, involved in this occurrence.

According to data collected during the investigation, Thrush's owner offered the pilot some informal instructions for operating this airplane model. Although the pilot was properly qualified to perform flights with that aircraft, such instructions were intended to facilitate the pilot's familiarization.

According to the reports obtained, these instructions were restricted to the performance of short flights with the execution of normal flight procedures. There were no instructions for failure situations or more detailed procedures to be followed in adverse conditions.

1.18 Operational information.

The aircraft was within the weight and balance limits specified by the manufacturer and its ANAC's Flight Authorization (AVANAC) was valid for the entire national territory.

In August 2017, the commander had his first contact with the aircraft on a transfer flight to the city of São José dos Campos - SP, in which he operated the plane on the left seat, being supervised by a pilot with more experience in the model.

According to his report, he did not experience any difficulties in this operation and during the transfer flight, he became familiar with the details of the aircraft and with the use of the Garmin G1000 navigation equipment.

The aircraft went to the city of Paraty - RJ, where the commander began to receive basic instructions on the model, focused on the qualities and advantages compared to market competitors, detailing landing gear, wings, leading edge differentials, drains and several details that, at a later time, the pilot considered that a training aimed at presenting the aircraft to potential customers.

On the second day in Paraty, the commander made two flights of approximately twenty minutes each. In them, the details of performance and maneuverability were emphasized. On the third day, he took another flight of about twenty minutes operating in the chair on the right.

In September 2017, the commander made a local flight, with two landings and go-around procedures, and another occupant performed the same profile.

The commander was called to perform a series of flights in November 2017, in order to present the aircraft to potential buyers in the State of Mato Grosso.

On 07NOV2017, the commander took off from Anápolis - GO, at about 1100 (UTC), landing on a farm near the municipality of Primavera do Leste - MT. In the afternoon, the aircraft went to the city of Lucas do Rio Verde - MT.

In the municipality of Lucas do Rio Verde, while the passengers were busy with their business, the pilot performed some local demonstration flights of the aircraft for potential buyers.

On 10NOV2017, the aircraft proceeded to the municipality of Sorriso - MT, where a passenger accompanied the fueling. The amount of fuel received should be sufficient to carry out all the activities that remained, due to the lower fuel price. Subsequently, they took off to the Nova Jerusalem Farm to demonstrate the aircraft for two pilots.

On the same day, the pilot and a passenger took off from the Nova Jerusalem Farm to the Lucas do Rio Verde Aerodrome, in order to embark two other passengers and, later, proceed to the municipality of Anápolis - GO.

According to the pilot's report, the take-off took place just before 1400 (UTC) and the climb went smoothly until reaching the FL110 cruise level.

About twenty minutes away from Anápolis, the commander noticed that the fuel quantity indicator had information about being close to the yellow range. However, information from the Garmin G1000 installed on the aircraft showed that the arc of the range at that time was greater than the information observed on the fuel gauge.

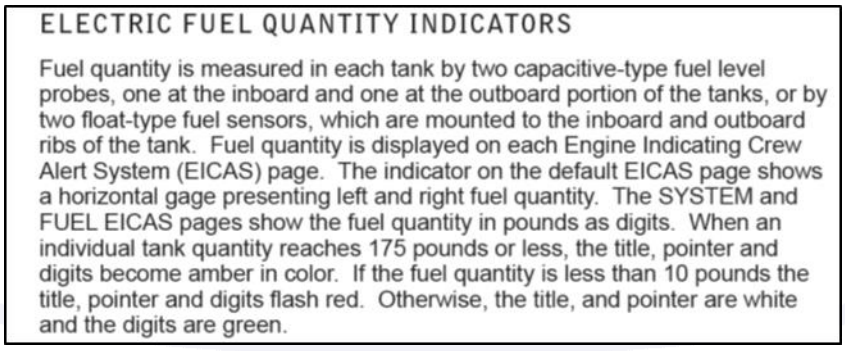
According to the Airplane Information Manual - AIM, the information about the aircraft range, provided by the G1000, depended on the manual insertion of the quantity supplied in the consumed fuel indicator (detotalizer), since it used the remaining fuel to calculate the maximum distance that the aircraft could travel (Figure 8).

FUEL RANGE RING

A fuel range ring is provided through the MFD on the Garmin G1000. This can be a valuable resource as a cross reference to determine if there is sufficient fuel on board to make the flight with the proper reserves. Be aware that this feature has limits, since the fuel range ring is calculated using the LB REM (pounds remaining) from the fuel totalizer which requires pilot input. The current wind conditions are also factored into this calculation and does not factor in winds that will be encountered later on in the flight. For more information regarding the fuel range ring, refer to the *Garmin G1000 Pilot's Guide* (190-00590-XX) for the *Quest KODIAK 100*.

Figure 8 - Fuel Range Ring, extract from the AIM (Revision 18, October 2016).

The aircraft Fuel Quantity Indicators did not depend on entering manual data, as the measurement was performed by a capacitor in each internal and external tank and information was generated in the Engine Indicating and Crew Alerting System (EICAS). The information was amber when the amount of fuel available was 175 lbs or less (Figure 9).



ELECTRIC FUEL QUANTITY INDICATORS

Fuel quantity is measured in each tank by two capacitive-type fuel level probes, one at the inboard and one at the outboard portion of the tanks, or by two float-type fuel sensors, which are mounted to the inboard and outboard ribs of the tank. Fuel quantity is displayed on each Engine Indicating Crew Alert System (EICAS) page. The indicator on the default EICAS page shows a horizontal gage presenting left and right fuel quantity. The SYSTEM and FUEL EICAS pages show the fuel quantity in pounds as digits. When an individual tank quantity reaches 175 pounds or less, the title, pointer and digits become amber in color. If the fuel quantity is less than 10 pounds the title, pointer and digits flash red. Otherwise, the title, and pointer are white and the digits are green.

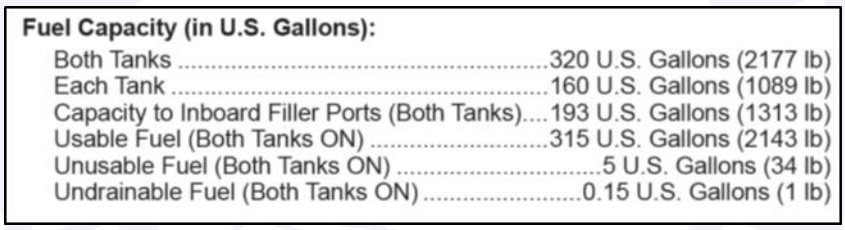
Figure 9 - Electric fuel quantity indicator, extract from the AIM (Revision 18, October 2016).

The pilot talked to the passengers, as two of them had already operated the aircraft. It was decided that they would land on an unapproved runway, located in the municipality of Goiás Velho - GO, in order to check the fuel visually.

The commander, together with a passenger who was the owner of the plane and also a pilot (American License) more experienced in the aircraft, checked the fuel using the rods installed on the wings that, with the aid of a float, visually showed the amount of fuel in the tanks.

After being checked twice, the passenger and the commander concluded that it was still possible to fly for another 1 hour and 15 minutes.

After talking to the passenger who accompanied the refueling of the aircraft in the municipality of Sorriso, the commander was informed that, in the last refueling, only the internal tanks had received fuel. The pilot had inserted a value in the detotalizer that corresponded to the supply of all fuel tanks.

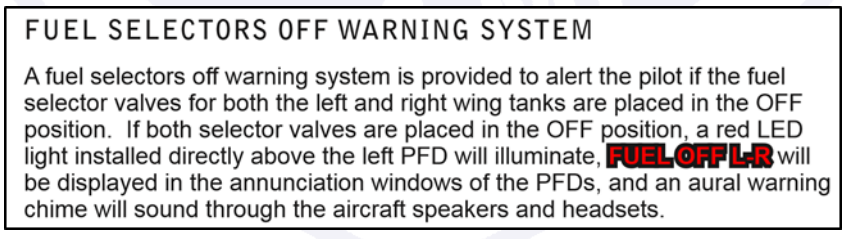


Fuel Capacity (in U.S. Gallons):

Both Tanks	320 U.S. Gallons (2177 lb)
Each Tank	160 U.S. Gallons (1089 lb)
Capacity to Inboard Filler Ports (Both Tanks)	193 U.S. Gallons (1313 lb)
Usable Fuel (Both Tanks ON)	315 U.S. Gallons (2143 lb)
Unusable Fuel (Both Tanks ON)	5 U.S. Gallons (34 lb)
Undrainable Fuel (Both Tanks ON)	0.15 U.S. Gallons (1 lb)

Figure 10 - Capacity of fuel tanks, extract from the AIM (Revision 18, October 2016).

In an interview, the pilot stated that the normal procedures for taking off from the place where the landing had been made, in the municipality of Goiás Velho, were carried out and that the selectors were open, otherwise the aircraft would emit an audible warning.



FUEL SELECTORS OFF WARNING SYSTEM

A fuel selectors off warning system is provided to alert the pilot if the fuel selector valves for both the left and right wing tanks are placed in the OFF position. If both selector valves are placed in the OFF position, a red LED light installed directly above the left PFD will illuminate, FUEL OFF L-R will be displayed in the annunciation windows of the PFDs, and an aural warning chime will sound through the aircraft speakers and headsets.

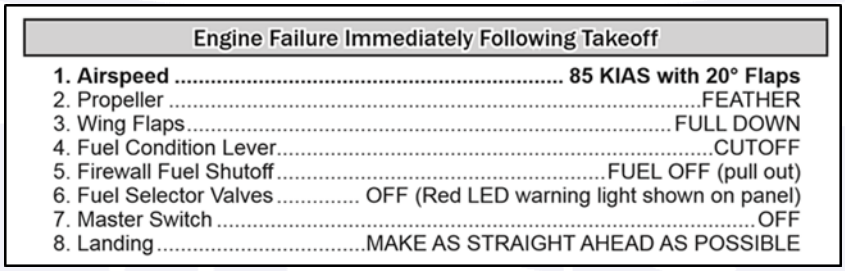
Figure 11 - Fuel Selectors Off Warning System, extract from the AIM (Revision 18, October 2016).

As the engine instruments did not indicate any abnormality and there was nothing apparent to prevent the flight, the commander started the take-off and, at approximately 300ft in height, he commanded the flaps to be retracted. At this point, the engine lost power and the pilot started a curve to try to return to the runway that was used for take-off.

After approximately 180° of turn, according to the pilot's perception, the aircraft was completely without power and the propeller started to rotate, due to the action of the relative wind.

The pilot directed the aircraft to a landing site that he believed was the most suitable one. However, when he got closer, he realized that the terrain was rough.

The following tasks were described in the checklist for the Engine Failure Immediately Following Takeoff:



Engine Failure Immediately Following Takeoff

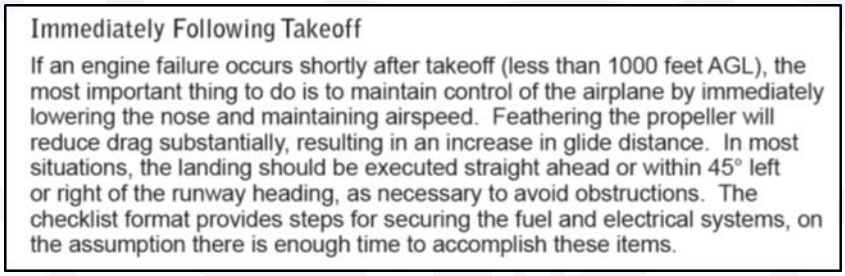
1. **Airspeed ..... 85 KIAS with 20° Flaps**
2. Propeller .....FEATHER
3. Wing Flaps.....FULL DOWN
4. Fuel Condition Lever.....CUTOFF
5. Firewall Fuel Shutoff.....FUEL OFF (pull out)
6. Fuel Selector Valves ..... OFF (Red LED warning light shown on panel)
7. Master Switch .....OFF
8. Landing .....MAKE AS STRAIGHT AHEAD AS POSSIBLE

Figura 12 - Engine Failure Immediately Following Takeoff, extract do AIM (Revision 18, October 2016).

The AIM checklist listed actions to keep electrical and fuel systems safe, when time was sufficient to carry out these items, in order to minimize the consequences of a forced landing.

The Amplified Emergency Procedures provided some additional information that were not possible to be entered in the Immediately Following Takeoff emergency task format and among them was described that the most important in an emergency, immediately after take-off, below 1,000ft Above Ground Level (AGL), was the maintenance of control and speed of the aircraft.

The Amplified Emergency Procedures for Immediately Following Takeoff also stated that in the checklist format there were steps to safely put the fuel and electrical systems in place, assuming that the time available was sufficient to complete the tasks described (Figure 13).

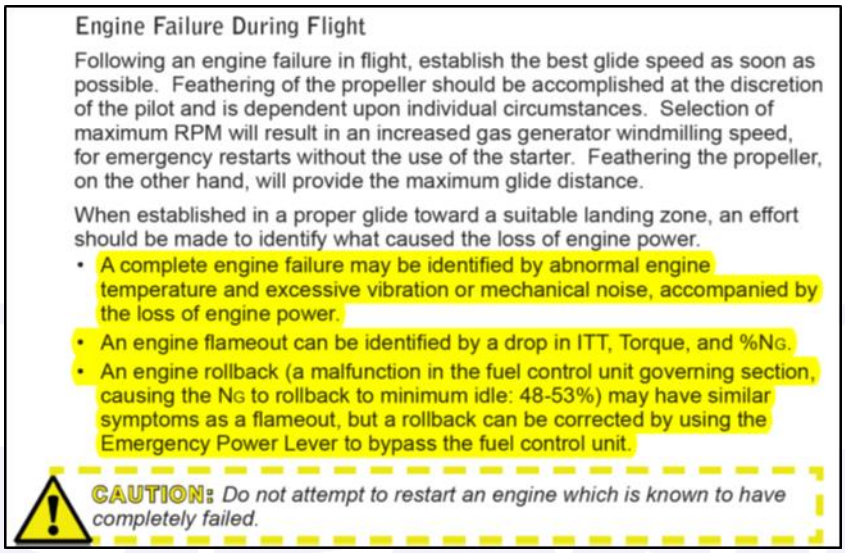


Immediately Following Takeoff

If an engine failure occurs shortly after takeoff (less than 1000 feet AGL), the most important thing to do is to maintain control of the airplane by immediately lowering the nose and maintaining airspeed. Feathering the propeller will reduce drag substantially, resulting in an increase in glide distance. In most situations, the landing should be executed straight ahead or within 45° left or right of the runway heading, as necessary to avoid obstructions. The checklist format provides steps for securing the fuel and electrical systems, on the assumption there is enough time to accomplish these items.

Figure 13 - Amplified Emergency Procedures for Immediately Following Takeoff, extract from AIM (Revision 18, October 2016).

The AIM, in Section 3, referring to emergency procedures, described three different possibilities of Engine Failure During Flight: a complete engine failure, an engine flameout and an engine rollback (Figure 14).



Engine Failure During Flight

Following an engine failure in flight, establish the best glide speed as soon as possible. Feathering of the propeller should be accomplished at the discretion of the pilot and is dependent upon individual circumstances. Selection of maximum RPM will result in an increased gas generator windmilling speed, for emergency restarts without the use of the starter. Feathering the propeller, on the other hand, will provide the maximum glide distance.

When established in a proper glide toward a suitable landing zone, an effort should be made to identify what caused the loss of engine power.

- A complete engine failure may be identified by abnormal engine temperature and excessive vibration or mechanical noise, accompanied by the loss of engine power.
- An engine flameout can be identified by a drop in ITT, Torque, and %NG.
- An engine rollback (a malfunction in the fuel control unit governing section, causing the NG to rollback to minimum idle: 48-53%) may have similar symptoms as a flameout, but a rollback can be corrected by using the Emergency Power Lever to bypass the fuel control unit.

CAUTION: *Do not attempt to restart an engine which is known to have completely failed.*

Figure 14 - Engine Failure During Flight, extract from the AIM (Revision 18, October 2016).

The complete failure of the engine could be identified by abnormal temperature parameters and excessive vibration or mechanical noise, accompanied by loss of power.

The flameout engine and the rollback engine could have similar symptoms, but the second could be corrected by using the Emergency Power Lever.

All the possibilities caused the aircraft to lose traction and, consequently, the inability to continue the upward or level flight.

The pilot did not recall hearing any audible warning of the engine failure and did not report any abnormal mechanical vibration or noise during the loss of power of the powertrain.

The passenger who occupied the right front seat of the aircraft, during an interview, reported that the failure was not instantaneous and that at a certain point in the curve, apparently, the aircraft engine showed power gain before the complete loss of traction.

The pilot did not identify the type of engine failure and did not use the Emergency Power Lever.

1.19 Additional information.

The RBHA 91, in its Subpart A - General, in section 91.7 - Airworthiness of Civil Aircraft, item “b” contained the following:

> "The pilot-in-command of a civil aircraft is responsible for checking the aircraft condition for flight safety".

Section 91.103 - PRE-FLIGHT ASSIGNMENTS contained the following:

> “Each pilot in command must, before starting a flight, become familiar with all available information regarding the flight. Such information should include: (a) for an IFR flight or outside an Aerodrome neighborhood, weather information and forecasts, fuel requirements, alternative Aerodromes available if the planned flight cannot be completed and any known air traffic condition over which the pilot-in-command has been informed by the air traffic control; ”

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a transfer flight, between the SILC and SWNS Aerodromes, with a pilot and three passengers on board.

On 10NOV2017, the fueling was monitored by one of the aircraft occupants, without the pilot's supervision. Thus, only the internal tanks were covered with fuel.

The pilot, believing that the aircraft had been fully fueled, manually entered the data into the aircraft consumed fuel indicator (detotalizer), which used the information entered to calculate the maximum distance that could be covered, and generated visual information range (Fuel Range Ring) in the Multi-Function Display (MFD), which did not correspond to reality.

In turn, the aircraft Fuel Quantity Indicator, which did not depend on entering manual data and indicated the amount of fuel remaining in the EICAS, generated correct and distinct information from the Fuel Range Ring.

The flight went on without any abnormality in the FL110 until the moment that the amount of fuel available approached 175lbs and the pilot realized that the information presented in the EICAS and MFD were different.

The Fuel Range Ring showed that the arc of the aircraft range was greater than the information observed in the fuel gauge, as the Fuel Quantity Indicator had information about being close to the yellow range.

The aircraft occupants talked about the situation, as two of them had already operated the aircraft, and decided to land on an unapproved runway, located in the municipality of Goiás Velho - GO, in order to visually check the fuel to identify which information was correct and if there was enough fuel to reach the destination.

Accompanied by the aircraft owner, the pilot checked the amount of fuel using the rod system, which, with the aid of a float, visually showed the amount of kerosene.

After checking twice, they concluded that it was still possible to fly for approximately 01 more hour and 15 minutes.

At that moment, the commander talked to the passenger who accompanied the aircraft fueling in the municipality of Sorriso, without his supervision, and understood that only the internal tanks had received fuel, making the information in the Fuel Range Ring unreliable, as it was inserted in the detotalizer a value corresponding to that of all tanks fueled.

As he did not supervise the refueling, the pilot was unaware of how this procedure had been carried out, which showed a complacent attitude in relation to flight management and safety, since the RBHA 91, in section 91.7 b and 91.103 a, pointed out that the pilot was responsible for the conditions of the aircraft with regard to safety.

Consequently, this attitude resulted in the ignorance of the real conditions of the aircraft and its flight autonomy, aspects that are important for the maintenance of safety in all types of flight.

Thus, the discrepancies regarding the aircraft autonomy had been generated by the incorrect data entered. The pilot chose to make an unforeseen landing, with the objective of re-checking fuel levels, which would not be necessary if he had accompanied the aircraft refueling.

After concluding that the fuel was sufficient to reach the destination and that the different information on the available quantity of fuel was originated by an incorrect data entry, the pilot and the passengers occupied the aircraft again and the departure and taxi for take-off was carried out.

Upon reaching the threshold of the place where the take-off would take place, the power lever was advanced. As there was any type of alarm and the engine parameters were normal, it was considered that the aircraft was in a position for takeoff.

However, when commanding the retraction of the flaps, after leaving the ground at approximately 300ft height, the pilot and the occupants realized that the aircraft had a loss of power.

The pilot started a turn to try to get back to the take-off location. Until that moment, there was a perception that the aircraft was developing some power.

After approximately 180° of turn, according to the pilot's perception, the aircraft was completely without power and the propeller started to spin due to the relative wind.

After analyzing the wreckage, it was possible to state that the Powerplant developed low power at the time of the collision against the ground, a situation that was compatible with the perception of the aircraft commander.

The pilot maintained control and speed of the aircraft, actions described in the Amplified Emergency Procedures for the Immediately Following Takeoff emergency as the most important to be performed in an emergency immediately after takeoff, below 1,000ft AGL.

Even though the Amplified Emergency Procedures for Immediately Following Takeoff stated that, in the checklist format, there were steps to be taken to safely secure the fuel and electrical systems, the height available from the beginning of the emergency perception, approximately 300ft, has may not been sufficient for the pilot to identify the type of emergency, choose the landing site and perform the other items described in the checklist.

According to the commander's perception, the training previously carried out was not sufficient to provide adequate familiarization with the aircraft emergency procedures, which may have limited the possibilities of his actions, such as more readily identifying the situation experienced in flight and performing the tasks of the checklist.

Since the wreckage of the aircraft was severely affected by the fire that followed the collision with the ground, it was not possible to identify whether the inability to complete the tasks described in the checklist could have somehow influenced the damage to the aircraft.

The examinations to which the remaining parts of the Powerplant were subjected allowed identifying indications that it was operational, since there were marks of rubbing in the turbines of both the compressor drive and the power drive.

The compressor was in normal condition and no faults were found that could have compromised the engine operation. Bearings 1 and 2 showed no damage and were inspected for the existence of "pits" caused by leakage of electric current, but they were within normal limits.

However, due to the fact that it was impossible to analyze the FCU and the fuel pump, it was not possible to identify whether any of these components could have failed causing the loss of power.

Thus, the doubt related to the nature of the fault, fell on the fuel supply system and pneumatic lines of the engine, since any abnormal leakage in the pneumatic section could have caused the loss of engine power experienced in this event.

It is worth mentioning that, although the bubbles observed in the engine's P3 hose, during the low pressure leak test, are due to the severe action of the fire, it cannot be said what the component's pre-existing condition was.

Considering that an engine rollback event could have occurred, even though the use of the Emergency Power Lever could correct the situation, the height reached was not enough to identify and use the resource, in addition to not being required by the checklist.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot had valid CMA;

b) the pilot had valid MNTE and IFRA Ratings;

c) the pilot was qualified and had experience in the kind of flight;

d) according to the commander's perception, the flights previously performed were not enough to provide adequate familiarization with the aircraft emergency procedures;

e) the aircraft had valid Airworthiness Certificate, issued by the FAA;

f) the aircraft was within the weight and balance limits;

g) the airframe, engine and propeller logbooks records were updated;

h) the aircraft had its AVANAC valid for the entire national territory;

i) the weather conditions were favorable for the flight;

j) the pilot did not accompany the last aircraft refueling;

k) the information provided in the EICAS, about the range of the aircraft, depended on the manual insertion of the data in the detotalizer;

l) the information available on the Fuel Quantity Indicator and on the EICAS were conflicting;

m) an intermediate landing was made to visually check the amount of fuel remaining;

n) the remaining fuel was considered sufficient to proceed to the destination after the visual check;

o) the occupants decided to proceed to the destination;

p) the pilot did not identify abnormalities that could prevent the take-off;

q) after the take-off, after commanding the flaps retraction, the pilot noticed a loss of power;

r) there were marks of rubbing on the compressor driving turbine and on the power turbine;

s) the characteristics found in the blades indicated that the Powerplant developed low power at the moment of the impact;

t) the engine's P3 hose was damaged by the fire;

u) the forced landing was made on a rough terrain;

v) the aircraft caught fire after the forced landing;

w) the aircraft was destroyed; and

x) the pilot suffered serious injuries and the passengers suffered minor injuries.

3.2 Contributing factors.

- **Attitude – a contributor.**

The pilot's failure to monitor the fueling showed a complacent attitude regarding the verification of conditions that could affect flight safety. Therefore, the lack of knowledge about the real fuel levels implied the insertion of wrong data and an intermediate landing to check the situation, after its identification.

- **Training – undetermined.**

It is possible that the pilot's little familiarization with the aircraft emergency procedures delayed the identification of the situation and limited his possibilities of action.

- **Insufficient pilot's experience – undetermined.**

The pilot's little experience on the aircraft may have slowed his ability to recognize the emergency and to perform the actions described in the checklist efficiently.

4. SAFETY RECOMMENDATION.

A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies.

In consonance with the Law n°7565/1986, recommendations are made solely for the benefit of the air activity operational safety, and shall be treated as established in the NSCA 3-13 "Protocols for the Investigation of Civil Aviation Aeronautical Occurrences conducted by the Brazilian State".

Recommendations issued at the publication of this report:

To the Brazil's National Civil Aviation Agency (ANAC):

A-139/CENIPA/2017 - 01 **Issued on 12/29/2020**

Disclose the contents of this Final Report, in order to alert pilots to the risks associated with the performance of their activities by people not trained to crew aircraft.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On December 29th, 2020.