FINAL REPORT

Aircraft Accident of Sakurai Aviation Limited, Cessna 172L Skyhawk bearing registration mark 4R-GAF crash-landed at Kimbulapitiya, Negombo, Sri Lanka on 27th Dec 2021

Released by the Civil Aviation Authority of Sri Lanka

Issued on: 13th July 2023

Publishing information

Published by: Civil Aviation Authority of Sri Lanka

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LIST OF ABBREVIATIONS AND ACRONYMS

AASL	-	Airport and Aviation Services (Sri Lanka) Limited
AAC	-	Approach Area Control
ADC	-	Air Defence Clearance
AIS	-	Aeronautical Information Service
AJTL	-	Aircraft Journey and Technical Logs
ANR	-	Air Navigation Regulations
AOC	-	Air Operator Certificate
AME	-	Aircraft Maintenance Engineer
AMO	-	Approved Maintenance Organization
Approx.	-	Approximately
ATC	-	Air Traffic Control
ATO	-	Approved Training Organization
BIA	-	Bandaranaike International Airport
CAASL	-	Civil Aviation Authority of Sri Lanka
CAMO	-	Continuing Airworthiness Management Organization
CAT	-	Commercial Air Transport
CFI	-	Chief Flight Instructor
CPC	-	Ceylon Petroleum Corporation
CPL	-	Commercial Pilot Licence
CRS	-	Certification for Release to Service
DGCA	-	Director General of Civil Aviation
DME	-	Distance Measuring Equipment
ETD	-	Estimated Time of Departure
FAA	-	Federal Aviation Administration
FCL	-	Flight Crew Licence
FOM	-	Flight Operations Manual
Ft	-	Feet
FI	-	Flight Instructor
hrs.	-	hours
ICAO	-	International Civil Aviation Organization
IR	-	Instrument Rating
IS	-	Implementing Standard
ITI	-	Industrial Technology Institute
Km	-	Kilometers
Kts	-	Knots
LT	-	Local Time
MSN	-	Manufacturers Serial Number
NAV	-	Navigation
NM	-	Nautical Miles
NTSB	-	National Transportation Safety Board
PIC	-	Pilot in Command
POB	-	Passengers on Board
RH	-	Right Hand
RPM	-	Revolution per minute
SCT	-	Scattered
SEP	-	Single Engine Piston
SLAF	-	Sri Lanka Air Force
SLCAD	-	Sri Lanka Civil Aviation Directive
SLCAP	-	Sri Lanka Civil Aviation Publication
SLCAIS	-	Sri Lanka Civil Aviation Implementing Standard

S/W	-	Surface Wind
STC	-	Supplemental Type Certificates
UTC	-	Coordinated Universal Time
VCBI	-	Bandaranaike International Airport, Katunayake, Sri Lanka
VCCC	-	Colombo International Airport, Ratmalana, Sri Lanka
VCCK	-	Koggala Airport, Sri Lanka
VCCS	-	Sigiriya Airport, Sri Lanka
VFR	-	Visual Flight Rules
VOR	-	VHF Omini Range
VHF	-	Very High Frequency

Aircraft Accident of Sakurai Aviation Limited, Cessna 172L Skyhawk bearing registration mark 4R-GAF crash landed at Kimbulapitiya, Negombo, Sri Lanka on 27th Dec 2021

INTRODUCTION

Sakurai Aviation Limited is a holder of AOC issued by the Director General of Civil Aviation for the provision of commercial air transportation based at Colombo International Airport, Ratmalana, Sri Lanka.

The accident into an aircraft operated by Sakurai Aviation Ltd was notified to the Civil Aviation Authority of Sri Lanka by the ATC Tower at Bandaranaike International Airport, Katunayake on 27th Dec 2021 through a telephone call. Upon the initial notification, the CAASL dispatched a team to the crash site where the crash landing had taken place at Paththayam Watta, Kimbulapitiya, Negombo located in Gampaha District in Sri Lanka. (7°12'46.3"N 79°54'08.5"E)
(https://www.google.lk/maps/place/7%C2%B012'46.3%22N+79%C2%B054'08.5%22E/@7.2128663,79.9018148,180m/data=!3m2!1e3!4b1!4m6!3m5!1s0x0:0xcf7d6e52fae6a69f!7e2!8m2!3d7.2128652!4d79.9023621?hl=en)

The occurrence was categorized as an "accident" as per the definition given in ICAO Annex 13, on Aircraft Accident and Incident Investigation. The investigation was initiated by appointing an Aircraft Accident Investigation Board (AAIB) in terms of Section 56 of the Civil Aviation Act No 14 of 2010 by the Authority.

The initial notification was sent to the National Transport Safety Board (NTSB) of the United States of America being the State of Manufacture and the State of Design by inviting them to appoint accredited representatives to participate in the investigation. The NTSB appointed an Air Safety Investigator as an accredited representative and an advisor from the Engine Manufacturer, Lycoming.

SYNOPSIS

4R-GAF, Cessna 172L single-engine aircraft operated by Sakurai Aviation Ltd was scheduled to operate as a charter passenger flight on 27th Dec 2021 as below;

I. Colombo International Airport, Ratmalana (VCCC) to Sigiriya Airport (VCCS)
II. Sigiriya Airport (VCCS) to Koggala Airport (VCCK)
III. Koggala Airport (VCCK) to Colombo International Airport, Ratmalana (VCCC)

The charter flight was planned to operate from VCCC to VCCS to accommodate two passengers from VCCS and proceed to their destination, VCCK. Then it was planned to proceed to the final destination at VCCC after refueling at VCCK.

As per the ATC flight plan submitted to ATC Tower, VCCC on 26th Dec 2021, the ETD was 1145 hrs (LT) and later ETD was advanced by 30 minutes on 27th Dec 2021. The flight had departed VCCC at 1115 hrs (LT) to proceed to VCCS as a charter VFR flight with two onboard (the PIC and the other occupant).

Two passengers (male and female of foreign nationals) boarded the aircraft at VCCS and the flight departed at 1304 hrs (LT) with a total of four onboard.

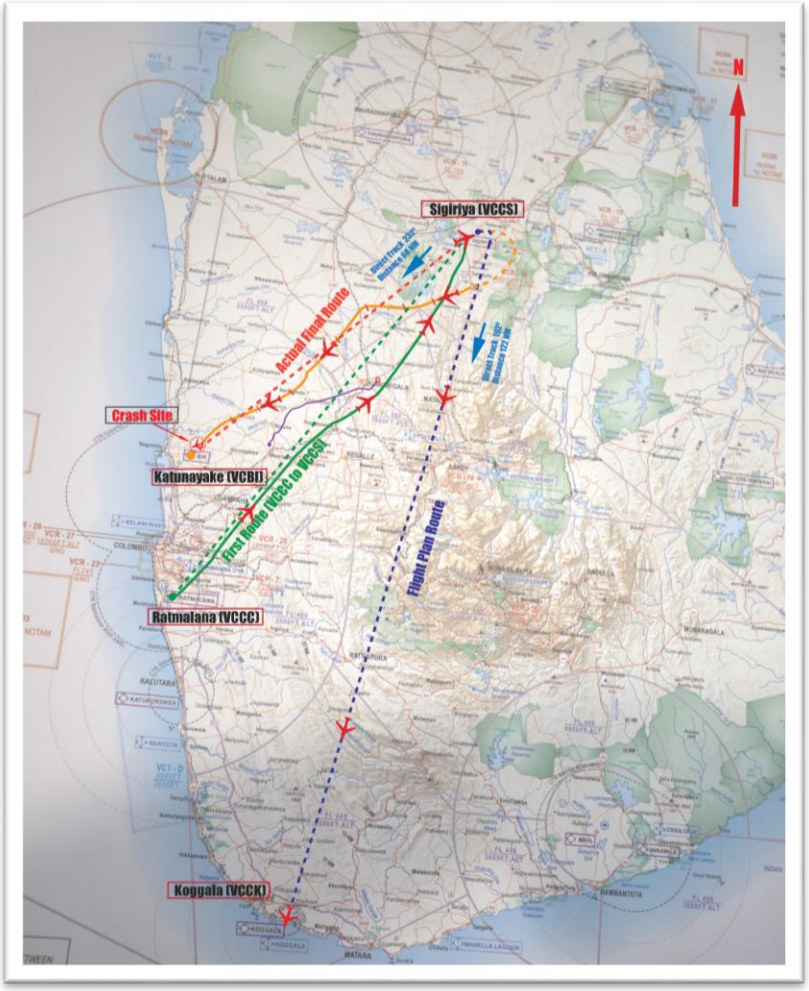


Figure 01: Actual flight path & planned flight path

As per the PIC, the aircraft had encountered an engine RPM fluctuation and subsequent engine failure. Although the flight plan destination was to VCCK, the aircraft had approached runway 22 at VCBI for an emergency landing. While approaching VCBI, the PIC had declared "*MAYDAY*" and crash landed in a paddy field at Paththayam Watta, Kimbulapitiya, Negombo at approx. 1352hrs (LT).

OBJECTIVE

The objective of this investigation is to identify the probable cause(s), contributory factors and issue safety recommendations to prevent the recurrence of similar accidents in the future.

1 FACTUAL INFORMATION

Air Operator	:	Sakurai Aviation Ltd No, 118, Airport Road, Ratmalana, Sri Lanka.
Registered Owner	:	Capt. Gihan Anoma Fernando No 5A, Rock Wood Place, Colombo 07, Sri Lanka.
Aircraft Make	:	Cessna Aircraft Company
Aircraft Model	:	Cessna 172 L Skyhawk

MSN	:	17259798
Aircraft Nationality	:	Sri Lanka (4R)
Aircraft Registration mark	:	4R-GAF
Persons On Board (POB)	:	04 (Pilot in Command, other occupant, and two passengers)
Place of Accident	:	Paththayam Watta, Kimbulapitiya, Negombo, Sri Lanka
Type of Operation	:	Domestic Charter – Passenger
Date and Time	:	27th Dec 2021; approx.1352hrs (LT) /0822 UTC
Local time zone	:	+ 0530hrs

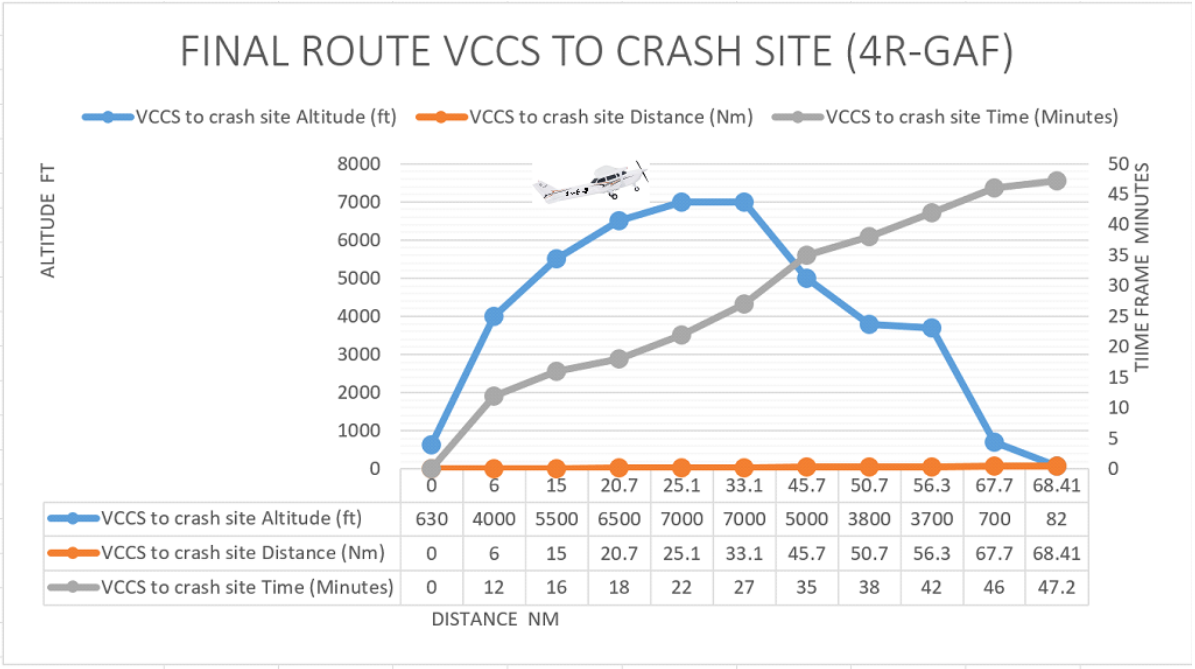
Table 01: Factual Information

1.1 History of Flight

Cessna 172L aircraft of Sakurai Aviation Ltd, bearing nationality & registration mark 4R-GAF was scheduled for a charter flight from VCCC –VCCS –VCCK- VCCC on 27th Dec 2021 as per the ATC flight plan.

The flight had departed VCCC with the PIC and the other occupant at approx. 1115 hrs (LT) to VCCS to accommodate two passengers (foreign nationals) who were expecting to travel from VCCS to VCCK.

Figure 02: Flight Path (source: Radar 24)



	0	6	15	20.7	25.1	33.1	45.7	50.7	56.3	67.7	68.41
VCCS to crash site Altitude (ft)	630	4000	5500	6500	7000	7000	5000	3800	3700	700	82
VCCS to crash site Distance (Nm)	0	6	15	20.7	25.1	33.1	45.7	50.7	56.3	67.7	68.41
VCCS to crash site Time (Minutes)	0	12	16	18	22	27	35	38	42	46	47.2

Figure 03: Final route from VCCS to the crash site

- At approx. 1304 (LT) hrs, 4R-GAF had departed VCCS with a total of four on board to proceed to VCCK. During en route to VCCK, the PIC had reported a technical problem to the Colombo Approach Control Centre while descending from 5000ft to 3500 ft. Subsequently, he had reported a partial engine failure at approx. 1341hrs (LT). The PIC had informed his intention to land at VCBI or else to carry out an emergency landing at a suitable place. The Controller at Colombo Approach Control Centre had advised the availability of both runways for landing at VCBI. The PIC had accepted runway 22 and informed that MAYDAY will be declared if necessary.

During further descending, the PIC had informed the controller that he had no control over the engine power. The Colombo Approach controller had transferred the flight to the BIA Aerodrome tower controller at approx. 1346hrs (LT) and the Aerodrome Tower controller had cleared runway 22 for landing. While on final approach to runway 22 -VCBI, the PIC had initiated a "MAYDAY" call and crash landed in a paddy field, at Paththayam Watta area in Kimbulapitiya, Negombo, Sri Lanka at approx. 1352 hrs (TL).

1.2 Injuries to Persons:

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	01(Female)	-
Minor/None	01	01	01*

Table 02: Injuries information

Note: 01* - the other occupant who was in a control seat.

1.3 Damage to Aircraft:

The aircraft sustained substantial damages to the RH main landing gear, the landing gear attachment structure and fuselage, the propeller, engine mounts, and cowlings.

Figure 04: Wreckage of 4R-GAF

Figure 05: Wreckage of 4R-GAF

1.4 Other damage:

There was no other damage.

1.5 Personnel Information:

1.5.1 Flight Crew (Pilot-In-Command)

Licence	:	Valid CPL (CAASL-72-A-10303) issued by the DGCA, Sri Lanka; Initial issue: 25th June 2014 and valid till 31st March 2023
Last Pilot Proficiency Check	:	The last PPC check for C- 172 was on 11th March 2021 and lapsed on 11th Sep 2021.
Aircraft Ratings	:	SEP(Land) IR(A) FI(A)
Last Air Crew Medical date	:	03rd Nov 2021 and valid till 06th Nov 2022
Age and Gender	:	31 years, Male

Table 03: Personnel information of PIC

1.5.2 Other Occupant

Licence	:	CPL (CPL/A/881) issued by the DGCA, Sri Lanka; Initial issue: 31St Dec 2015 and valid till 26th Jan 2022
Last Pilot Proficiency Check	:	No PPC
Aircraft Ratings	:	C-172 (Last Skill Test was on 20th Aug 2020 and valid till 26th Jan 2022)
Last Air Crew Medical date	:	27th Jan 2021 and expires on 26th Jan 2022
Age and gender	:	27 years, Female

Table 04: Personnel information of other occupant

1.6 Aircraft Information

Type and Model	:	Cessna 172L Skyhawk
Year of Manufacture	:	1971
Manufacturer's Serial No	:	17259798

Certificate of Registration	:	No 327, Registered in Sri Lanka Civil Aircraft Register and valid up to 20th Oct 2022	
Certificate of Airworthiness	:	No 290, Issued by the CAASL and valid up to 23rd Aug 2022.	
Total Airframe Hours	:	4310.3 hrs (*as of 27th Dec 2021*)	
Engine	:	Single engine	
		Model:	Lycoming 0-320-E2D
		Serial Number:	RL-2868-27E
		Total Hours:	1490.3 hrs (*as of 27th Dec 2021)*
		Fitted on:	26th May 2016
		Note: This engine was rebuilt by Lycoming Engines, 652 Oliver St. Williamsport, PA 17701	
Propeller		Model:	1C160/CTM7553
		Serial Number:	710850
		Total Hours:	1490.3 hrs (*as of 27th Dec 2021)*
		Fitted on:	26th May 2016
Type of fuel used	:	MOGAS (30%) AVGAS and (70%) 92 Octane Petroleum as per Petersen Aviation STC	
Type of engine oil used	:	Aeroshell W100 plus	
Fuel capacity	:	Total 42 US gal., usable 38 US gal.	
Weight & Balance	:	There was no evidence of weight & balance calculations.	

Table 05:Aircraft information

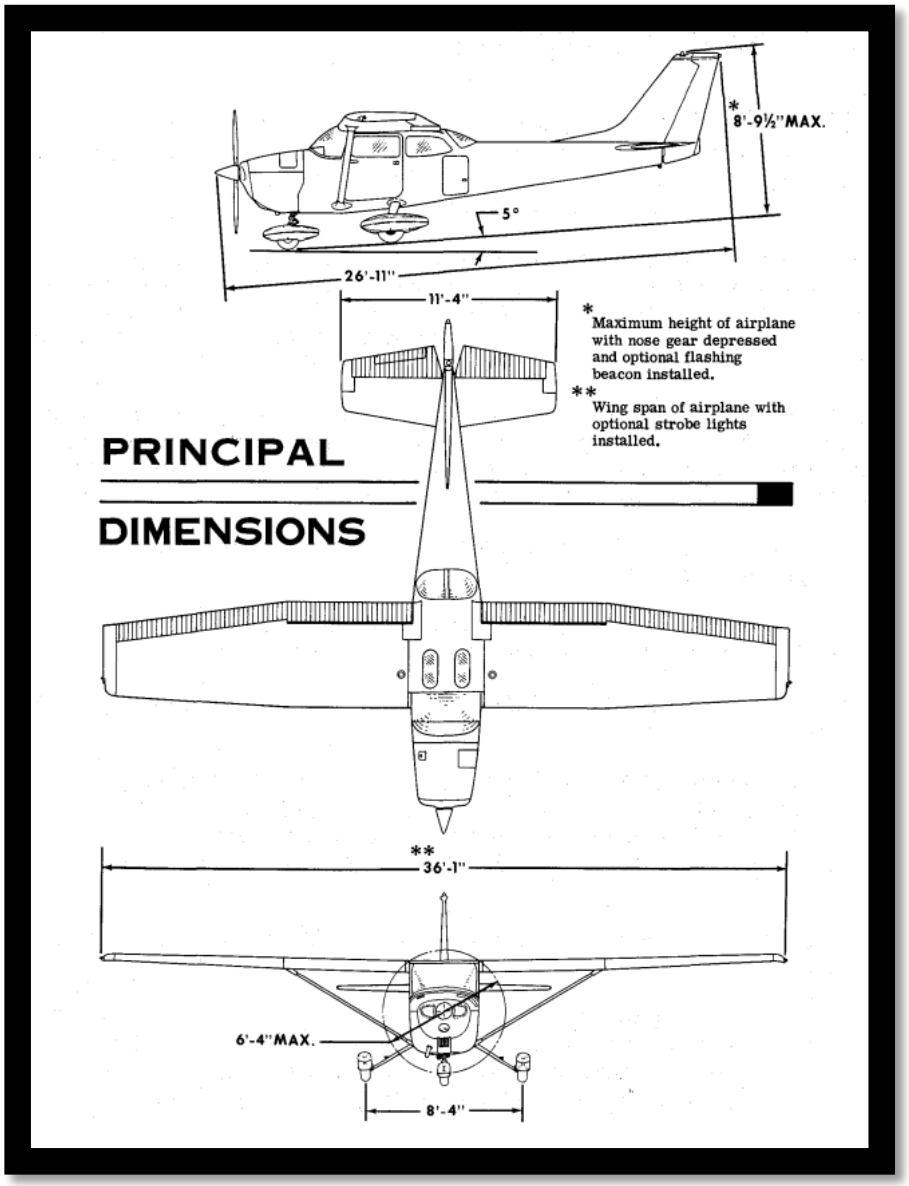


Figure 06: 4R- GAF three-view layout (Cessna 172 L Skyhawk)

1.7 Meteorological Information:

The meteorological information given to the flight at respective ATC Towers was as follows;

VCCS	Surface wind: 060^0 5-8Kts; Visibility: 10 Km; Weather: Partially cloudy Clouds: Scattered 2600 Temperature: 31 ^{0}C ; QNH: 1011
VCBI	Surface wind: 120^0 4Kts; Varying between 070^0 to 170^0 Visibility: 10 Km; Weather: No significant weather Clouds: Sky Clear Temperature: 33 ^{0}C Dew point: 18; QNH: 1012

Table 06: Meteorological information

1.8 Aids to Navigation:

As the aircraft was flying according to visual flight rules, the requirement to use NAV aids does not exist, however, on route to the destination, the KAT-VOR/DME was available.

1.9 Communication:

As per the evidence, aircraft VHF communication units were functioning. The aircraft had communicated via VHF with relevant ATC Units. At the time of the engine failure, the PIC was in communication with Colombo Approach Control Centre, and during the final approach, the control had been handed over to BIA Aerodrome Control Tower before the crash.

	ATC Sector	Frequency (MHz)
First Sector (VCCC- VCCS)	Ratmalana Aerodrome Control Tower	119.1
	Colombo Approach Control Centre	132.4
	Sigiriya Tower	118.9
Second Leg (VCCS- VCBI)	Sigiriya Tower	118.9
	Colombo Approach Control Centre	132.4
	BIA Aerodrome Control Tower	118.7

Table 07: VHF communication with Sectors

1.10 Aerodrome information/Landing area:

The aircraft had carried out a crash landing in a paddy field located at Paththayam Watta, Kimbulapitiya, Negombo located in Gampaha District in Sri Lanka. There were prominent ground marks visible in the rice paddy.

Figure 07: Landing area at Paththayam Watta, Kimbulapitiya

1.11 Flight Recorders:

Not Applicable

1.12 Wreckage and impact information:

The aircraft had crash landed on a paddy field. The nose wheel and right-hand main wheel had been separated and fallen at the crash site at distances from 13m and 38m from the aircraft. A Prominent ground marks were visible after landing in the rice paddy.

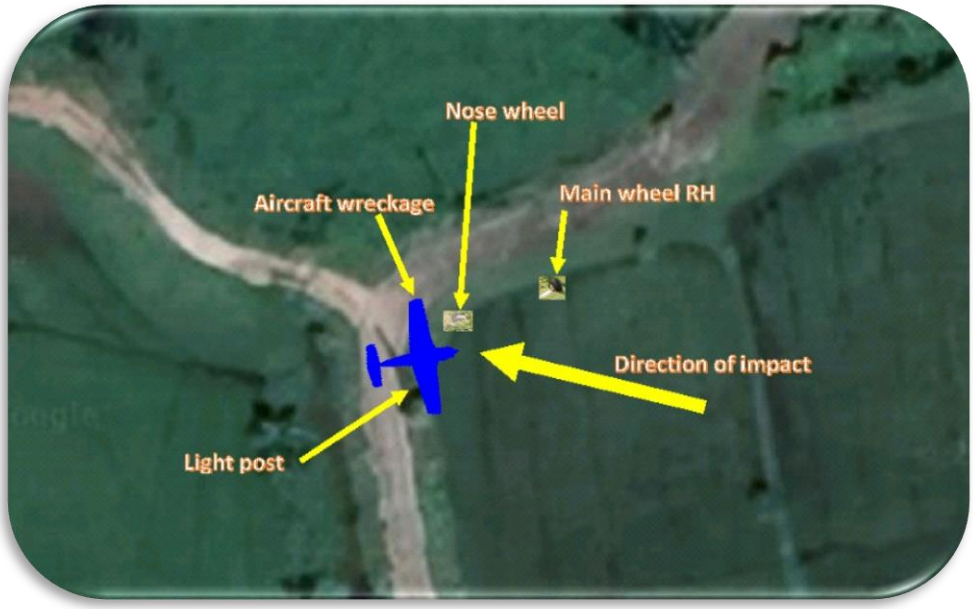


Figure 08: Landed area Paththayam Watta at Kimbulapitiya

Figure 09: Wreckage distribution chart

1.13 Survival aspects:

There were three persons had been transferred to the District General Hospital, Negombo due to injuries, except the male passenger.

With respect to the seating arrangements, the other occupant was seated in the L/H control seat whereas the male passenger was seated behind that seat. The female passenger who was injured was seated behind the R/H control seat which was occupied by the PIC.

Figure 10: Seating View

1.14 Test and Research:

On-site inspection at the crash site was carried out by the CAASL team shortly after the accident. Furthermore, two magnetos and the carburetor of the Engine were sent to the NTSB for detailed examination & testing.

The fuel sampling tests were conducted by the Ceylon Petroleum Cooperation of Sri Lanka (CPC) and Industrial Technology Institute (ITI) of Sri Lanka to check & determine the contamination and standards of the fuel used.

A detailed inspection of aircraft wreckage, controls, and engine were carried out by the Investigation Board.

1.15 Organizational and Management Information:

1.15.1 The Air Operator

Sakurai Aviation Ltd is an AOC holder. The initial AOC was issued on 09th February 2017 and had renewed annually. It had been operated with One Cessna 172 aircraft and One R66 helicopter.

The Accountable Manager (AM), Head of Operations (HOO), Safety Manager (SM), and Quality Manager (QM) have been nominated as approved post holders according to the ANR of 1955 and SLCAP 4100.

1.15.2 The Air Traffic Services Providers

Airport and Aviation Services (Sri Lanka) (Private) Limited (AASL) is the appointed Statutory Service Provider to provide Air Traffic Services, as per the Civil Aviation Act No, 14 of 2010. The Colombo Approach Control Centre, Ratmalana Aerodrome Control Tower, and BIA Aerodrome Control Tower are operated by AASL.

Whereas, ATC Tower at VCCS Airport (which is a military airport) is managed by SLAF.

2 ANALYSIS

2.1 Flight Documents

On reviewing the flight documents which were on board, the following were discovered;

- The Altitude as per the ATC flight plan was 3500ft which was the planned direct route and a single flight plan was filed for all three sectors which had been accepted and disseminated by the AIS.
- The weight & balance sheet was found to belong to 4R-HDC (Previous registration of 4R-GAF) which was not applicable for the particular flight and the date.
- The pink colour copy of the passenger manifest found onboard was supposed to be at the relevant Airport (VCCS) for the 2nd sector (VCCS to VCCK). It included the names of two passengers. The yellow colour copy was not found on board.
- A trainee dispatcher had signed the passenger manifest and the PIC's name and signature was not in the passenger manifest.
- There was no dispatch release found on board.
- The ADC form submitted by the Air Operator indicated that the other occupant as a "pilot".
- The aircraft insurance policy was valid for one year with effect from 18th Dec 2021. The legal liability limit for a passenger provided in the Insurance Policy found on board 4R-GAF was inadequate and not in compliance with the Directive on "Limits of Liability & Insurance Requirements for Aircraft Operators" ref SLCAD 18 issued by the DGCA on 7th Oct 2021.
- There were discrepancies in items included in the laminated checklist with respect to the Owner's Manual which was on board. In addition, the pages of the onboard Owner's Manual were not in order.

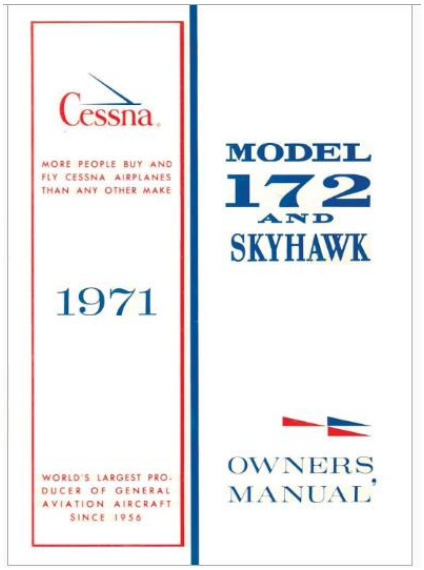


Figure 11: First page of the Owner's Manual

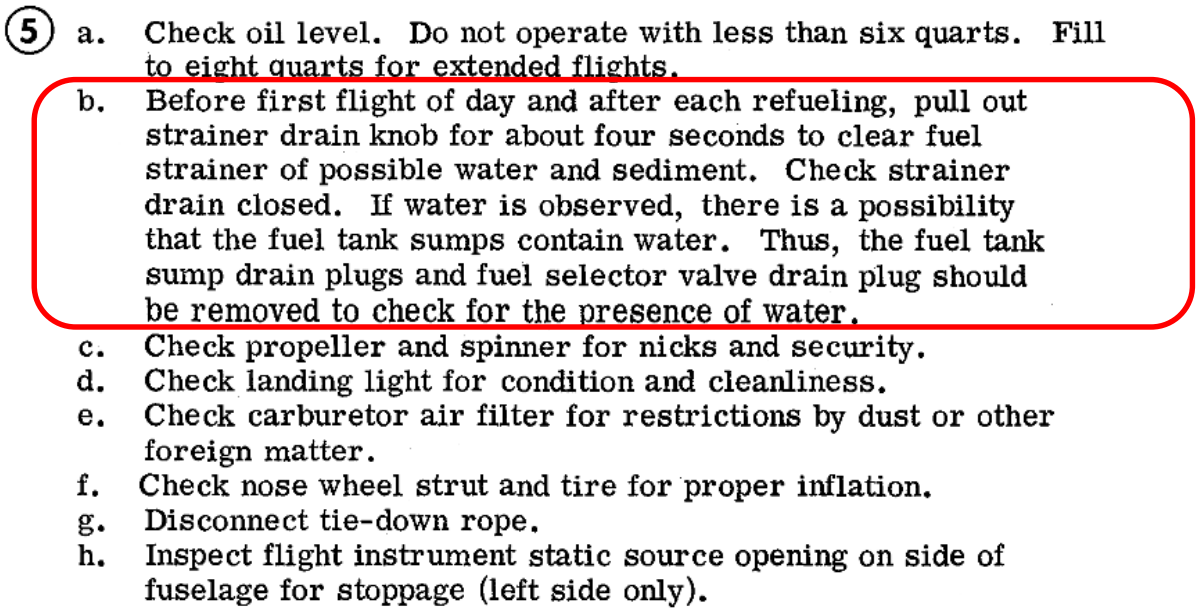
In addition to the above,

- a copy of Ops Specs (certified as a true copy)
- a certified copy of the lease agreement
- the Flight Operations Manual
- the Aircraft Journey and Technical Log (AJTL)

Which are to be carried on a Sri Lankan Registered Aircraft within or outside the territory of Sri Lanka as stipulated in Chapter 10A.20 of Sakurai Aviation Ltd FOM and Appendix 1 of Implementing Standard SLCAIS 020 were not found on board the flight. This revealed that the PIC had not checked the flight documents when accepting the flight.

2.2 Pre-flight checks

During the investigation, the PIC stated that he had carried out the pre-flight checks and fuel quantity except for the fuel drain at VCCC & VCCS. However, the fuel drain was a part of the preflight checks, which were required to be carried out prior to each flight by the PIC, as per Section 1 of the Owner's Manual.



(5) a. Check oil level. Do not operate with less than six quarts. Fill to eight quarts for extended flights.

b. Before first flight of day and after each refueling, pull out strainer drain knob for about four seconds to clear fuel strainer of possible water and sediment. Check strainer drain closed. If water is observed, there is a possibility that the fuel tank sumps contain water. Thus, the fuel tank sump drain plugs and fuel selector valve drain plug should be removed to check for the presence of water.

c. Check propeller and spinner for nicks and security.

d. Check landing light for condition and cleanliness.

e. Check carburetor air filter for restrictions by dust or other foreign matter.

f. Check nose wheel strut and tire for proper inflation.

g. Disconnect tie-down rope.

h. Inspect flight instrument static source opening on side of fuselage for stoppage (left side only).

Figure 12: Excerpts from the Owner's Manual

This aircraft had used MOGAS which was a mixture of 30% AVGAS (Aviation gasoline) + 70% 92 Octane Petroleum (Automotive gasoline) as per the Petersen Aviation auto fuel STCs approved by the FAA. According to the Petersen Aviation STC instructions, it is required to review procedures outlined in the Owner's Manual for dealing with carb ice and also, consult the probability charts during preflight planning which is required to be carried out prior to each flight by the PIC.

Further, as per Chapter 10A, 2.5 on the fueling procedure of FOM of Sakurai Aviation Ltd, no mixing of fuel is permitted for Sakurai commercial passenger operations.

The Authorized Engineer (Head of Engineering) had not performed the aircraft empty weight calculation which was a task related to the Engineering change order no SLA/172/GAF/02 planned on the particular day (27th Dec 2021). This action has invalidated the Certificate of Airworthiness issued to 4R-GAF, according to the special conditions applicable to the

continuation of Airworthiness of Aircraft listed in item "b (vi)" of the Certificate of Airworthiness.

Furthermore, it was found that the aircraft had operated from VCCS without a valid Certificate of Release to Service. It was a mandatory requirement as per Chapter 10A.1.14 of FOM of Sakurai Aviation Ltd.

2.3 Security Procedures

The PIC and the other occupant had not undergone the security screening procedures at VCCC. Furthermore, the passengers have not undergone the security screening procedures at VCCS as required by Part A of Chapter 12 of FOM of Sakura Aviation Ltd. Such action could have adversely affected aviation security.

2.4 Weight and Balance Analysis

The PIC stated that he had not carried out the weight & balance calculations and performance calculations for the flights from VCCC and VCCS, prior to each flight. Which was a requirement given in Chapter 2.3.2 (q) (iii) and Chapter 10A. 1.7 (b,c,d,e,f,g) of Part A of FOM of the Sakurai Aviation Ltd.

The weight & balance calculations were carried out by the Investigation Board, using the basic empty weight of the aircraft which was calculated in 2016 (Since there was no current valid weight & balance), the total fuel weight as per the technical log, two passengers' weight as per the passenger manifest and the actual body weights of the PIC and the other occupant from the last medical records available at the CAASL.

All calculations were carried out by using the weight & balance chart and graph given in the Owner's Manual, data from Air Crew Medicals, Passenger Manifest, and other sources. Since the scheduled aircraft weighing as per the engineering change order no SLA/172/GAF/02 was not carried out before the flight, the value of the previous basic empty weight was used for this table for calculations.

As per the weight and balance graph, the Centre of Gravity (CG) value is 101 and the loaded moment remained within the limits of (CG) defined by the Manufacturer.

Cessna 172L (4R-GAF) WEIGHT & BALANCE	AIRPLANE DETAILS Weight (lbs.)	Moment (lb. -ins. /1000)
1. Licensed Empty Weight (Sample Airplane) . . .	1366.7	51.7
2. Oil (8 qts. - Full oil may be assumed for all flights)	15	-0.2
3. Fuel (Standard - 38 Gal at 6#/Gal)	186	10.9
Fuel (Long Range - 48 Gal at 6#/Gal)		
4. Pilot and Front Passenger (Station 34 to 46) . . .	232	12.6
5. Rear Passengers	330.7	24.8
6. Baggage (or Passenger on Child's Seat) (Station 82 to 108)	88	1.2
7. TOTAL WEIGHT AND MOMENT	2218	101
8. Locate this point (2300 at 101.0) on the center of gravity moment envelope and since this point falls within the envelope, the loading is acceptable.		

Figure 13: Weight & Balance Chart – Cessna 172L (4R-GAF)

Weight & Balance Graph – Cessna 172L (4R-GAF)

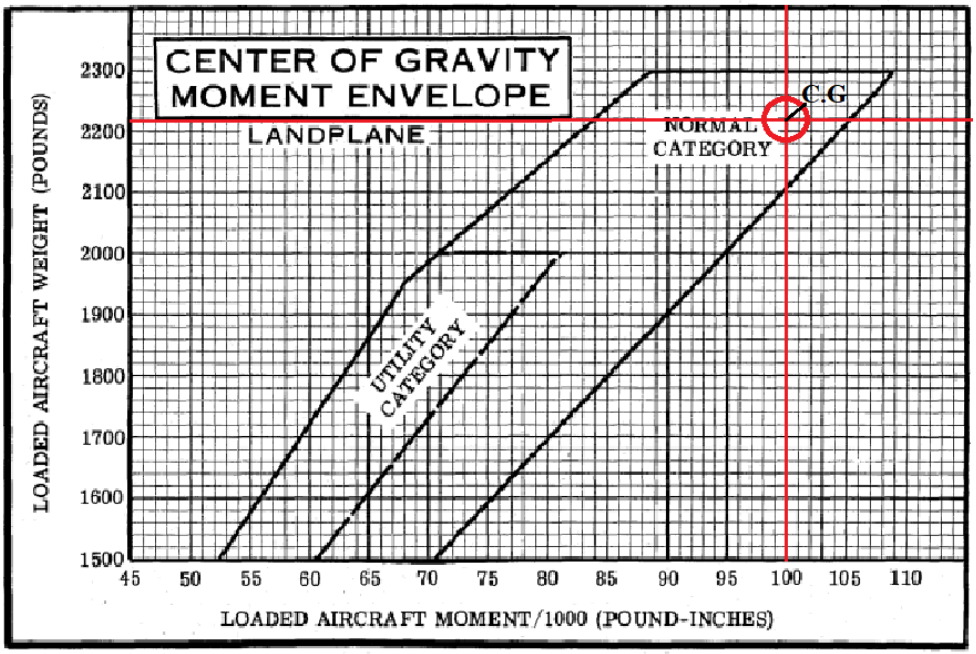


Figure 14: Weight & Balance chart, graph

2.5 Flight Dispatch

The flight was dispatched without a dispatch release at VCCC by a trainee dispatcher who had no Flight Dispatcher Licence issued by the DGCA. The relevant flight dispatch documents had been signed by the trainee dispatcher. It was found from the statements given by the licenced Flight Dispatcher of the Air Operator that he had attended to other duties at that time.

The trainee dispatcher had one month of experience in Sakurai Aviation Ltd and had been working under the supervision of the licenced Flight Dispatcher.

2.6 Subject flight

The PIC stated that during descending close to 5000ft the aircraft engine was getting a bit rough and then he had observed the engine rough running with the RPM fluctuation while descending further from 5000ft to 3500ft en route from VCCS (Approximately 1339hrs, the area west of Kurunegala, Sri Lanka - Please refer *Figure 02: Flight Path -source: Radar 24 and Figure 16*).

As per ATC records, the PIC had initially reported a "small technical error", subsequently "partial engine failure" and finally "no control of the power" to the Colombo Approach Control Center. While passing 3700 ft, the PIC had informed the controller that the engine was intermittent and he had no control over the engine power.

The PIC had used carb heat three times to control the engine's rough running. During the first two attempts the engine had responded to carb heat (RPM recovered around 2000), However, during the continuous descend with the Engine RPM fluctuation he was unable to restore the Engine power. The PIC had informed his effort to do an emergency landing at VCBI and his intention to carry out a forced landing at a suitable place if he cannot make it to VCBI. After he had reported a loss of Engine power. The Colombo Approach Control Center had transferred the flight to BIA Aerodrome Control Tower at approximately 1346hrs. The Duty Controller at the BIA Aerodrome Control Tower had cleared the aircraft for landing on runway 22. While on final approach to runway 22, the PIC had initiated a "MAYDAY" call, (approx. after 6 minutes of informing "no control of the power") on a short final to runway 22. The aircraft crash landed at approx. 1352 hrs (TL) on a paddy field, in the Paththayam Watta area in Kimbulapitiya, Negombo, Sri Lanka.

Based on the ATC transcript & the PIC interviews there was no clear reason for descending the aircraft from 7000ft to 5000ft. If the PIC had maintained the level at 7000ft, at the time of the partial engine failure, probably he would have carried out a safe landing by carrying out the required emergency procedures.

2.7 PIC's Competency

According to the Training Records, the PIC had not carried out Pilot Proficiency Checks (PPC) as required in Section 4.4.1 of the Implementing Standard SLCAIS 018. Thereby, he has not completed the recurrent training on normal, abnormal, and emergency procedures given in Chapters 1.1.3 and 1.2.3(a) of Part D of FOM of Sakurai Aviation Ltd.

It was evident that the PIC had not fulfilled his responsibilities as stipulated in the FOM of Sakurai Aviation Ltd, applicable Implementing Standards & ANR of 1955, and had not enough knowledge of the Owner's Manual.

2.8 Other Occupant

The other occupant who was onboard this flight from VCCC was a CPL holder and a ground instructor of the ATO of Sakurai Aviation Ltd.

The ADC form completed and submitted by the Air Operator to SLAF-ADCC had declared the other occupant as a "pilot". However, the other occupant was not appointed as a "Pilot"

under the AOC he Sakurai Aviation Ltd and she had no valid PPC and currency for the type at the time of the accident.

Further, she was not included in the passenger manifest as a passenger. Hence, she was neither the crew nor the commercial passenger on this flight.

As per the ATC transcripts of the First Sector from VCCC to VCCS and the second Sector from VCCS, it was evident that the other occupant had handled the RT communication including start-up, taxi, and take off clearances, in which she was not authorized to do so.

2.9 The Charter Flight

The Air Operator had scheduled & planned a charter flight from VCCC to VCCS to accommodate two passengers and proceed to VCCK.

The PIC had verbally given instructions to the licenced Flight Dispatcher to amend the relevant documents as the other occupant's name was not there in the first ADC form.

According to the evidence, the PIC had occupied the right-hand seat and the other occupant had occupied the left-hand seat from the sector commenced from VCCS. Pursuant to the Section on "weigh & Balance" given in the Owner's Manual found on board requires the PIC to be occupied in the left-hand seat as the aircraft being a single pilot-operated aircraft.

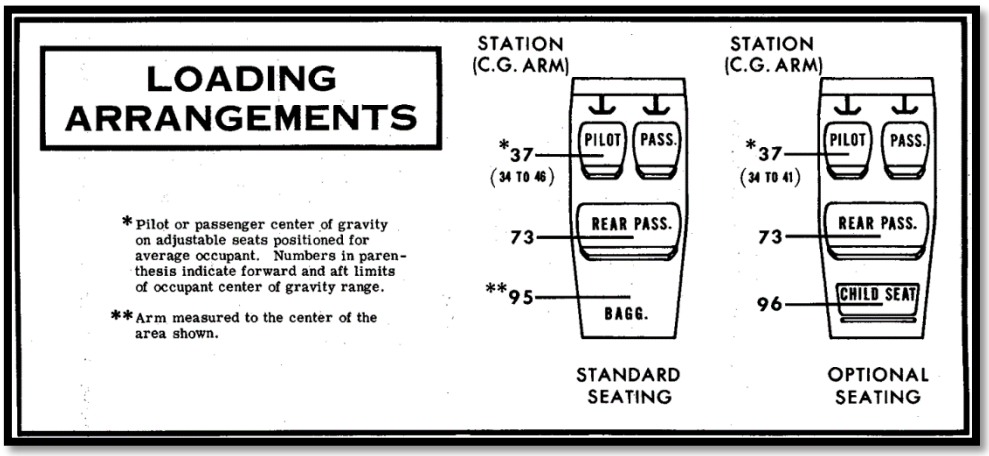


Figure 15: Loading Arrangement given in the Owner's Manual

Furthermore, as per the Regulations, the control seats of an aircraft equipped with fully functioning dual controls shall not be occupied in flight except by pilots, who are licenced in respect of the type of aircraft and the class of operations in which the aircraft is flown or who hold such other licences, endorsements, and ratings, and are authorized by the DGCA.

2.10 Flight path deviation

As per the Radar image from AAC and Flight Radar 24, the 4R-GAF aircraft heading out of VCCS was observed to be not on the direct track towards its intended destination, VCCK as per the flight plan. This deviation was further revealed from the interviews conducted with flight dispatch officers and the Air traffic controller.

During the interviews, the PIC stated that the reasons for the deviation was to avoid turbulences due to mountain waves. The controller's statement stated that he noticed a 5NM deviation

initially from the track. It was observed that the duty controller had not timely observed the traffic scenario to identify that there was a significant deviation of track and to inquire from the aircraft as to why they were deviating off track. The PIC had also not made any attempt to inform the duty controller that they are deviating off track.

However, neither the PIC nor the Controller had verified the reasons for the deviations in any instances. Deviations of this nature can be a serious threat to flight safety and national security.

2.11 Notification of technical issue of the aircraft

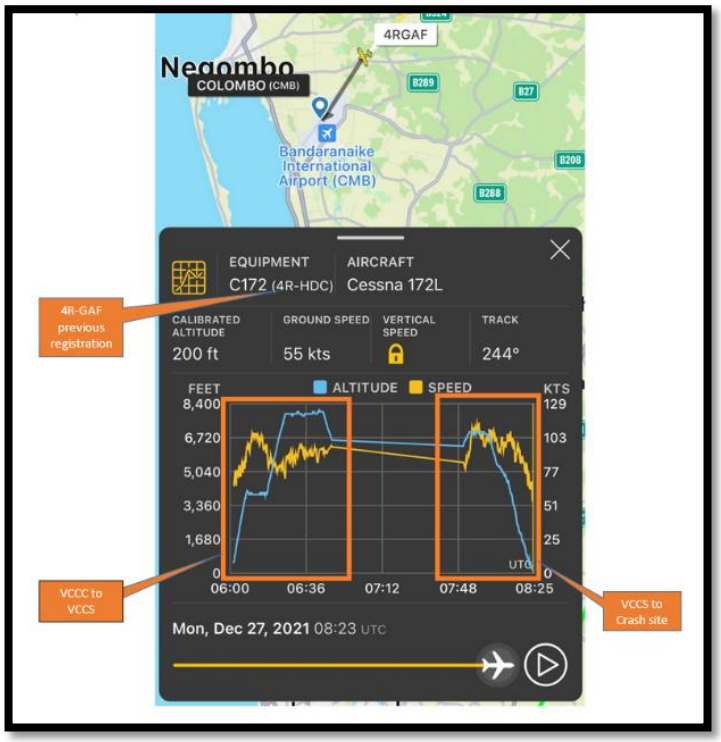
As per the ATC records;

The other occupant had requested 9500ft from ATC before take-off from VCCS. On contacting Colombo Approach Control Center, the PIC had requested to maintain 7000ft and then requested to descend and maintain 5000ft. At 1339 hrs (LT), the PIC informed the Approach Control of "a small technical problem "and requested to further descend from 5000ft to 3500ft.

As per the PIC's statements;

He stated that close to 5000 ft the aircraft engine was getting a bit rough. He further stated that the issue continued during descend from 5000 ft to 3500ft.

As per the Eyewitness (Passenger) statements;
It was probable that the technical issue of the aircraft had started 35 minutes after take-off from VCCS.



(Note*: 4R-HDC is the old registration of the 4R-GAF)
Figure 16: Altitude vs Speed chart (source: Radar 24)

2.12 Air Navigation Services

In respect of this accident, transferring the distress aircraft from the Colombo Approach Control frequency to the BIA Aerodrome Control Tower frequency (on finals to VCBI), whilst the tower controller did not have the sight of the aircraft in distress to better provide any other assistance, is a situation that should have been avoided. Further, the risk of losing radio contact,

during the transfer of communications from one frequency to another, is a factor that should have been considered before initiating the transfer of communication.

According to ICAO Annex 10 volume 2, distress (Mayday) and urgency (Pan-Pan) traffic shall normally be maintained on the frequency on which such traffic was initiated until it is considered that better assistance can be provided transferring that traffic to another frequency. In this type of scenario, it would have been advisable that the aircraft was kept with the Colombo Approach Control frequency without transferring the aircraft to the BIA Aerodrome Control Tower frequency especially when the tower controller did not have the aircraft in sight.

2.13 Providing information to Security authorities

The Air Operator had included an unauthorized person as a “pilot” and submitted to the SLAF via ADC form before commencing the flight, which seems to be a loss of integrity towards the security authorities. In addition, as the other occupant had boarded the flight from VCCC without undergoing a proper Airport security screening procedure, her status for the flight had not been detected by Airport Security.

2.14 Aircraft Fuel System:

The Fuel is supplied to the engine from two tanks, one in each wing. The 4R-GAF was equipped with standard fuel tanks. The total usable fuel was 38 gallons (USG). Fuel from each tank flows by gravity to a selector valve. Depending upon the setting of the fuel selector valve, fuel from the left, right, or both tanks flow to a fuel strainer and carburetor to the engine induction system.

According to the PIC, he had placed the fuel selector valve in the "BOTH ON" position when departing VCCS and it remained in that position until the accident. When the CAASL team arrived at the crash site, the fuel selector valve had been set to the "LEFT" position. The fuel selector valve in the aircraft is shown in *Figure 17*, below.

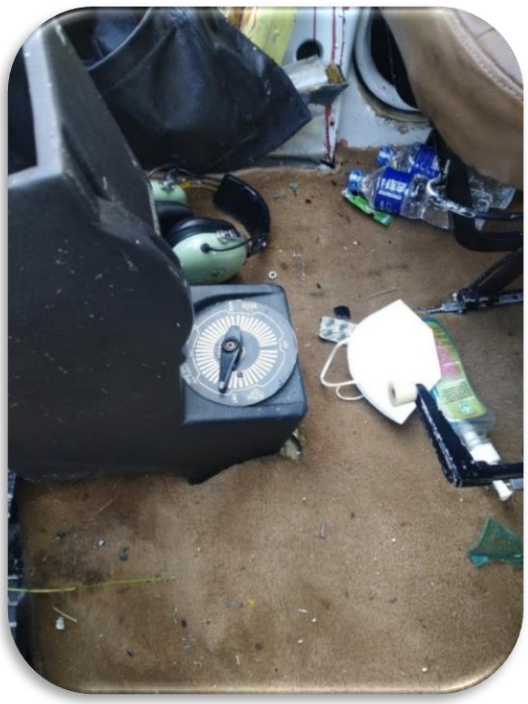


Figure 17: Fuel selector valve

The wing tanks were opened and inspected. These were rigid removable fuel tanks that were attached to the inner surface of the wing. Each wing tank had two fuel outlets, one forward and one aft. During visual inspection, it was found the wing tanks were clean and the fuel outlets appeared normal. The Fuel Tank Vent was checked for any blockage and it was found free of obstacles.

2.15 Detailed Examination

The following tests & checks had been conducted by a qualified member of the Aircraft Accident Investigation Board as per the Manufacturer's instructions in consultation with NTSB.

- The engine cylinder boroscope inspection
- Cylinder compression
- Magneto to engine timing
- Valve clearance limits
- The spark plug condition and serviceability tests in a pressurized test chamber.

The outcome of the above tests and checks was shared with NTSB. Detailed examination of Carburetor, Magnetos, and Engine were conducted by NTSB.

2.15.1 Engine:

4R-GAF fitted with Lycoming engine bearing model O-320-E2D. As per the Engine Exam report sent by the accredited Representative of NTSB, the engine had sustained minimal impact damage and appeared to be in good condition. It had displayed normal wear signatures, and all internal components were lubricated and free of heat distress. There was no evidence of detonation, catastrophic failure, foreign object ingestion, or any pre-accident anomalies that would have precluded normal operation. The Engine Exam report is attached in Annex 01.

2.15.2 Magneto, Carburetor, and carburetor fuel inlet strainer

Examinations of the magnetos, carburetor fuel inlet strainer, and carburetor were conducted at FAA repair station TZ3R885L in Simi Valley, California by the appointed Accredited Representative of NTSB. The Examination revealed that the right magneto was inoperative due to a failed coil (secondary side) and there was no evidence of internal catastrophic failure. The throttle arm of the carburetor had moved freely, with the corresponding movement of the butterfly valve and accelerator pump plunger. There was no evidence of a fuel leak. There were no anomalies noted to the carburetor, except for its fuel inlet strainer, which was occluded with a fibrous material. The Examination Report on Magneto and Carburetor is attached in Annex 02.

2.16 Technical Documents

2.16.1 Aircraft Journey and Technical Log

It was found that the Aircraft Journey & Technical Log format used by the Air Operator was not in compliance with the format given in Chapter 10A.1.15 of Part A of FOM of the Sakurai Aviation Ltd.

There was no maintenance release issued at VCCS and the aircraft had operated out of VCCS without a Certificate of Release to Service (CRS) which is a mandatory requirement as per paragraph 1.14 of Chapter 10A of Part A of FOM of Sakurai Aviation Ltd.

2.16.2 Owner's Manual

The PIC stated that he had followed his own checklist on iPad and not used the checklists which were on board. However, the Air Operator had not obtained approval from the CAASL to use Electronic Flight bags as per the requirement stipulated in Section 7 of Implementation Standard SLCAIS-015.

2.17 Aviation Fuel

The Fuel approved by the engine manufacturer Lycoming through Service Instruction Number 1070AB, dated 08th April 2020, which has listed the fuels that can be used from the effective date for the Lycoming 0-320-E engine, authorizes the use of;

- Leaded Aviation Fuels,
- Unleaded Aviation Fuels and
- Automotive Fuels
- Unleaded MOGAS, provided it meets the specifications in ASTM D4814 and EN228.

However, Lycoming does not permit fuel containing ethanol to be used for their engines.

As per the records, this aircraft had been used MOGAS, a combination of 30% AVGAS (Aviation gasoline) + 70% 92 Octane Petroleum (Automotive gasoline) according to the Petersen aviation auto fuel STCs which was approved by FAA for non-CAT operations. The CAMO had not taken the STC acceptance from the CAASL.

Furthermore, the mixing of fuel is not permitted for Sakurai commercial passenger operations as stipulated the Chapter 10A, 2.5 on the fueling procedure of FOM of Sakurai Aviation Ltd.

According to the evidence during the investigation, 4R-GAF aircraft had refueled by using Avgas de-fueled from 4R-ASE and 92 octanes of Petroleum of automotive fuel (MOGAS). This was confirmed during the review of the fuel stock monitoring form maintained by AMO.

2.17.1 Testing of Fuel:

The following fuel samples were tested as a part of the investigation.

- A sample from 4R-GAF aircraft
- A sample from Lanka filling station, Ratmalana
- A sample from Drum 1 (Mogas)
- A sample from Drum 2 (Mogas)
- A sample from the fuel cart (Avgas)

The fuel samples were tested by two independent facilities. As per the test reports there was no evidence of contamination.

2.18 Vapor Lock

As per the Petersen Aviation instructions, vapor lock can occur with either aviation or automotive gasoline. Due to its higher volatility and boiling point (IBP,) automotive gasoline has more potential for vapor lock.

Mogas (Motor Gasoline) is not intended for aviation use and in comparison with Avgas (Aviation Gasoline) has different physical properties and quality requirements, which require additional quality checks to be carried out on the fuel, additional maintenance requirements, and entries that have to be made in the aircraft and engine log books.

A further significant difference is that in comparison to Avgas, Mogas has a relatively high vapor pressure and is therefore much more susceptible to causing vapor lock in aircraft fuel systems, particularly at elevated temperatures and higher altitudes. So, although an engine may be able to operate on Mogas, other aircraft components have to be considered because of the potential for vapor lock within the fuel system, as well as potential adverse effects on seals and components.

As per the PIC's statements during the investigation, he had taken actions to restore the engine power twice through carb heat operation during engine power loss. Hence, it is very unlikely that the vapor lock had led to this incident.

2.19 Carburetor icing

Carburetor icing doesn't just occur in freezing conditions, it can occur at temperatures well above freezing temperatures when there is visible moisture or high humidity. Icing can occur in the carburetor at temperatures above freezing because the vaporization of fuel, combined with the expansion of air as it flows through the carburetor, (Venturi Effect) causes sudden cooling, sometimes by a significant amount within a fraction of a second. Carburetor ice can be detected by a drop in RPM in fixed-pitch propeller airplanes. Usually, there will be a roughness in engine operation.

The graph below shows the probability of carburetor icing for various temperature and relative humidity conditions:

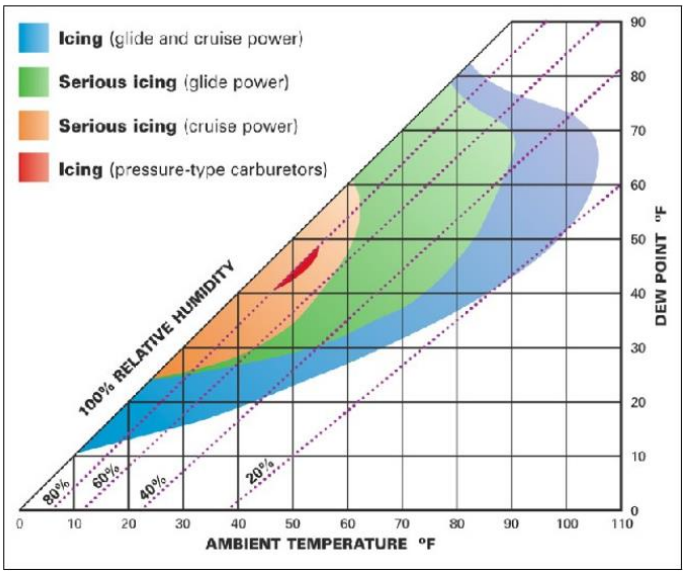


Figure 18: *Carburetor icing chart*
(source: Special Airworthiness Information Bulletin on Carburetor Icing Prevention ref: CE-09-35 dated 06th June 2009 issued by Federal Aviation Administration.)

As per the Petersen Aviation instructions, the higher volatility of auto fuel allows the fuel to absorb more heat from the mixing air when vaporizing, resulting in ice accumulation at higher ambient temperatures. Therefore, the likelihood of carb icing is higher on automotive gasoline than on aviation gasoline.

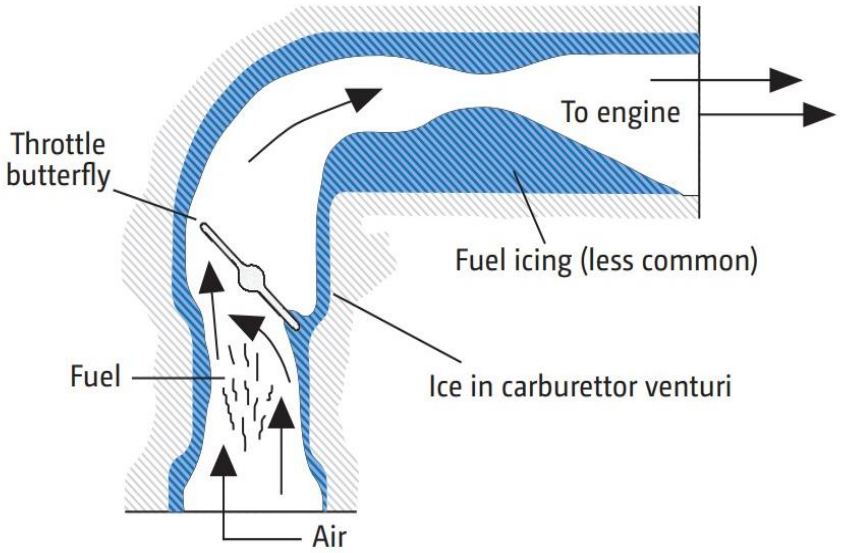


Figure 19: The formation of carburetor ice may reduce or block fuel-air - flow to the engine

The below table contained the weather information received from the Meteorological Department of Sri Lanka. The relevant temperature and dew points were derived from the closest Weather Station which is Kurunegala District in Sri Lanka.

Time of Observation	Kurunegala		Katunayake	
Local (SLST)	Temp Dry (ºC)	Dew Point (ºC)	Temp Dry (ºC)	Dew Point (ºC)
0830	25.0	21.3	26.0	24.0
1130	30.1	17.7	31.0	18.0
1430	31.8	18.8	33.0	17.0
1730	29.8	19.2	31.0	19.0

Table 8: Weather information (temperature and dew point)

The below chart illustrates the combinations of atmospheric temperatures and dew points where there is a risk of carburetor icing.

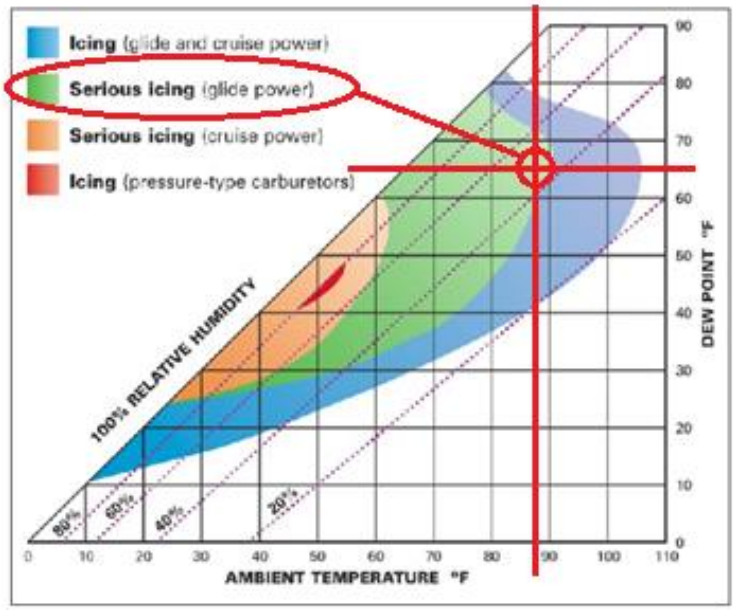


Figure 20: *Carburetor icing chart – derived point for this scenario*

At the time of this accident, the interpolated temperature and the dew point were 31.2^{0}C (88.16 ^{0}F) and 18.4 ^{0}C (65.12 ^{0}F) respectively. In these conditions, there was a high possibility of carburetor icing at glide and cruise power settings.

2.20 Procedures for Rough Engine Operation or Loss of Power and Carburetor ice

The Owner's Manual described the proper emergency procedures and instructions on how to identify and deal with rough engine operation or loss of power and carburetor ice during the cruise phase. However, there was no evidence that the PIC had followed the procedures on "rough engine operation or loss of power" and "carburetor ice" during the cruise phase as per the onboard Owner's Manual (Figures 21 and 22, below).

ROUGH ENGINE OPERATION OR LOSS OF POWER.

SPARK PLUG FOULING.

An engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from "BOTH" to either "LEFT" or "RIGHT" position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the normal lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the "BOTH" position of the ignition switch unless extreme roughness dictates the use of a single ignition position.

MAGNETO MALFUNCTION.

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from "BOTH" to either "LEFT" or "RIGHT" ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if

3-2

continued operation on "BOTH" magnetos is practicable. If not, switch to the good magneto and proceed to the nearest airport for repairs.

Figure 21: Excerpts from Owner's Manual (given on page 3-2).

CRUISE.

Normal cruising is done between 65% and 75% power. The power settings required to obtain these powers at various altitudes and outside air temperatures can be determined by using your Cessna Power Computer or the OPERATIONAL DATA, Section VI.

Cruising can be done more efficiently at high altitudes because of lower air density and therefore higher true airspeeds for the same power. This is illustrated in the table below, which shows performance at 75% power at various altitudes. All figures are based on lean mixture, 38 gallons of fuel (no reserve), zero wind, standard atmospheric conditions, and 2300 pounds gross weight.

To achieve the lean mixture fuel consumption figures shown in Section VI, the mixture should be leaned as follows: pull mixture control out until engine RPM peaks and begins to fall off, then enrichen slightly back to peak RPM.

Carburetor ice, as evidenced by an unexplained drop in RPM, can be removed by application of full carburetor heat. Upon regaining the origi-

nal RPM (with heat off), use the minimum amount of heat (by trial and error) to prevent ice from forming. Since the heated air causes a richer mixture, readjust the mixture setting when carburetor heat is to be used continuously in cruise flight.

The use of full carburetor heat is recommended during flight in heavy rain to avoid the possibility of engine stoppage due to excessive water ingestion or carburetor ice. The mixture setting should be readjusted for smoothest operation.

In extremely heavy rain, the use of partial carburetor heat (control approximately 2/3 out), and part throttle (closed at least one inch), may be necessary to retain adequate power. Power changes should be made cautiously followed by prompt adjustment of the mixture for smoothest operation.

Figure 22: Excerpts from Owner's Manual (given on pages 2-13 and 2-14)

2.21 Safety Culture of the Air Operator

Sakurai Aviation Ltd had Safety Management System Manual accepted by the CAASL at the time of the accident. As per the Implementing Standard SLCAIS 070, every SMS Organization, shall commit and comply with all applicable regulatory requirements. Notwithstanding these requirements, the Air Operator had not ensured compliance with the relevant Regulations in Air Navigation Regulations of 1955 and relevant Implementation Standards issued by the DGCA.

The Accountable Executive of SMS Organization has ultimate authority over the safe operation of the organization. He shall have the authority to make decisions on behalf of the organization, and have control of resources, both financial and human.

However, there were non-standard practices followed by the Air Operator (*from the point of authorizing the flight with an occupant, dispatching /releasing of flight documents by a trainee and releasing the aircraft without completing required maintenance actions*) throughout the flight which raised serious concern whether they were had operation in compliance to their accepted SMS.

3 CONCLUSION

3.1 Findings

3.1.1 The PIC

I. The PIC had a CPL issued by the DGCA.
II. The PIC did not comply with Regulation 223(2) (a) and (b) of the Air Navigation Regulations of 1955 as he had flown almost three months without a valid operational Pilot Proficiency Check (PPC) as per the requirement stipulated in the Paragraph 4.4.1 of Implementing Standard SLCAIS 018, Chapter 9.4.4 of ICAO Annex 6 to the Convention and Chapter 6.4.1 of FOM of Sakurai Aviation Ltd.
III. The PIC had not completed the recurrent training on normal, abnormal, and emergency procedures as per Chapter 1.1.3 and 1.2.3a of Part D of FOM of Sakurai Aviation Ltd.

IV. The PIC had not complied with the Appendix 1 of Implementing Standard SLCAIS 020 by not carrying the mandatory documents required to be on board.

V. The PIC did not comply with his duties & responsibilities stipulated in Chapter 2, 2.3, Part A of FOM of Sakurai Aviation Ltd, for commercial air transport operations as described below;

   a. There was no evidence that the PIC had calculated the weight & balance, and performance calculation prior to the flight from VCCC and VCCS as required in Chapter 2.3.2 (q) (iii), Chapter 10A 1.7 (b, c, d, e, f, g) of Part A of FOM of Sakurai Aviation Ltd.
   b. The PIC had not signed the passenger manifest of the Commercial Flight as per the Part A of Chapter 3.4 (d) of FOM of Sakurai Aviation Ltd.
   c. The PIC had not checked the dispatcher documents when accepting the flight as per the Part A of Chapter 3.4 (d) of FOM of Sakurai Aviation Ltd.
   d. There were discrepancies in items included in the checklist (laminated) and the copy of the Owner's Manual which were on board. The pages of the copy of the Owner's Manual were not in order.

VI. It was evident that the PIC had followed his own checklist on an iPad. The Air Operator had not obtained approval to use an Electronic Flight Bag as per Section 7 of Implementation Standard SLCAIS 015 by the CAASL.

VII. During the investigation it was found that the PIC had not followed the "rough engine operation or loss of power" emergency procedure as per the onboard Owner's Manual (given on page 3-2 of the Owner's Manual).

VIII. The fuel drain checks had not been carried out by the PIC, which was a requirement as per the Operating Check List of Section 1 of the Owner's Manual.

IX. The PIC had not followed the security screening procedures at VCCC and he had not ensured the security screening of passengers as required in Chapter 12.13 of Part A of FOM of Sakurai Aviation Ltd.

X. The PIC had not adhered to the aircraft release procedure and had operated the aircraft out of VCCS without a Certificate of Release to Service (CRS) as per Chapter 10A 1.14 of FOM of Sakurai Aviation Ltd.

XI. The PIC had not occupied the left-hand seat throughout the commercial flight, whereas he was checked out as a commercial pilot in a left-hand seat. The reference is given in the Owner's Manual "Weight and Balance" Section.

XII. The PIC had allowed other occupant who occupied in Left-hand seat to handle the Radio Telecommunication.

XIII. The PIC had changed the planned route without obtaining prior approval from the ATC Tower as required in Chapter 10A 1.8(b) of FOM of Sakurai Aviation Ltd.

XIV. The PIC had not declared the MAYDAY at the time of the distress of the single-engine aircraft and he had declared MAYDAY at the last moment just prior to the crash landing.

XV. The PIC had not carried out the performance calculation as per the Owner's Manual 'Operational data chart' in maximum glide data, to plan for the glide and emergency landing to a suitable field.

XVI. The PIC did not check for a failed magneto as described in Section III on Emergency Procedure – Rough Engine Operation or Loss of Power of Owner's Manual.

3.1.2 The Other Occupant

I. As a CPL holder, the other occupant who was declared as a "pilot" in the ADC Form and joined the flight, had not complied with Regulation 223(2) (a) and (b) of the Air Navigation Regulations of 1955.
II. She had not gone through the security screenings at VCCC.
III. As a CPL holder, she had not complied with Part 2 of paragraph 4 (I) of Implementing Standard SLCAIS 50 and FCL.305 of Implementing Standard SLCAIS 72 issued by the DGCA.
IV. The other occupant had carried out RT communications during the flight which could have endangered flight safety.
V. She had occupied the left-hand control seat.

3.1.3 The Accountable Manager of the Air Operator

I. The Accountable Manager had not ensured that the overall operations are conducted in compliance with the applicable laws and approved Standard Operating Procedures stipulated in FOM of Sakurai Aviation Ltd.

3.1.4 Head of Operations of the Air Operator

I. Head of Operation had not monitored the PIC's Pilot Proficiency Check as per the requirement stipulated in Chapter 2.2.2 (h). 25 of FOM of Sakurai Aviation Ltd.
II. He had not fulfilled his responsibility stated in Chapter 2.2.2 (d) of Part A of the FOM of Sakurai Aviation Ltd.
III. He had not overseen the non-standard practices of the air operator, in which he is responsible for all flight operational activities as per Paragraph 2.2.4 (g) of Chapter 2 and is responsible for the supervision of the operation as per paragraph 3.1 of Chapter 3 of Part A of FOM of Sakurai Aviation Ltd.
IV. The Head of Operations had not ensured to obtain approval from the CAASL to use Electronic Flight Bags as per Section 7 of Implementation Standard SLCAIS 015.
V. The Head of Operations had not complied fully with all instructions relating to the duties contained in the Operations Manual as required in Regulation No. 214 (3) of ANR of 1955.

3.1.5 Flight Operations Officer (Flight dispatcher)

I. The Flight Operations Officer (Flight dispatcher) had authorized an Assistant Flight Dispatcher who had no Flight Dispatcher Licence to authorize the flight docs with his signatures, who was not authorized to perform such a task.
II. He had not checked the licence validity of the PIC, weight & balance, and other documents which should be in the Dispatch Release prior to releasing the flight as required in Section 3.4(d) of Part A of FOM of Sakurai Aviation Ltd.
III. There was no evidences that the Flight Operations Officer had taken the responsibility for operational control of the flight operations as required in Section 3.4 (f) of Part A of FOM of Sakurai Aviation Ltd.

3.1.6 The Aircraft Maintenance Engineer

I. The Aircraft Maintenance Engineer had released the aircraft, while the maintenance actions were going on and without carrying out the weight and balance checks at

VCCC, which is non-compliance to the Engineering Change Order no SLA/172/GAF/02.

II. He had used the MOGAS, a combination of 30% AVGAS (Aviation gasoline) + 70% 92 Octane Petroleum, which is non-compliance to Chapter 10A 2.5 of the FOM of Sakurai Aviation Ltd.

III. He had performed the refueling task by using Avgas, which was defueled from 4R-ASE to make MOGAS, which is a non-compliance with the Chapter 10A 2.5 of the FOM of Sakurai Aviation Ltd.

3.1.7 The Air Operator

I. The aircraft had a valid certificate of Registration.

II. The Air Operator had a valid AOC issued by the DGCA.

III. The aircraft was maintained by an approved AMO and CAMO.

IV. The AMO and CAMO of the Air Operator had valid CAASL approvals.

V. The Accountable Manager of the Air Operator was the Accountable Manager for Sakurai Aviation AMO, CAMO, ATO, and the Head of Operations of the Organization.

VI. The center of gravity of the aircraft was within the prescribed limits according to the calculation done by the Investigation Board.

VII. There were navigation charts and other documents found on board not relevant to this aircraft.

VIII. There were no defects or malfunctions found in the engine during post engine run.

IX. There was no contamination found during fuel sampling tests.

X. The Air Operator had not ensured compliance to Regulation 223(2) (a) and (b) of Air the Navigation Regulations of 1955 by including the other occupant as a “pilot” in the ADC Form and allowing an unauthorized person to travel in a Commercial flight.

XI. The Air Operator had not ensured the carrying out of the Weight & Balance check prior to the departure from VCCC and VCCS.

XII. The Air Operator had not ensured the completion of Flight Documentation as per FOM of Sakurai Aviation Ltd.

XIII. The Air Operator had not ensured the approved flight dispatching procedure as per FOM of Sakurai Aviation Ltd.

XIV. The Aircraft had been released for the flight without weighing after relevant maintenance task related to the Engineering change order no SLA/172/GAF/02

XV. The aircraft was accepted without weight and balance checks and had been released without a flight dispatch release.

XVI. The Air Operator had no effective mechanism to check the licence validity and competency of the PIC.

XVII. The Mass & Balance sheet found in the flight bag were not for the subject flight.

XVIII. The Air Operator’s FOM does not specify that the Pilots are to be in uniforms in CAT operations.

XIX. The Air Operator had not complied with Section 6. (a) of the CAASL Directive on “Limits of liability & Insurance requirements for Aircraft Operators”, SLCAD 18 issued by DGCA on 07th Oct 2021.

XX. The aircraft had used the MOGAS, a combination of 30% AVGAS (Aviation gasoline) + 70% 92 Octane Petroleum, which is a non-compliance with Sakurai Aviation Ltd FOM.

XXI. The aircraft had been refueled by using Avgas defueled from 4R-ASE to make MOGAS, which is non-compliance with the FOM of Sakurai Aviation Ltd.

XXII. There was no maintenance release issued at VCCS and no CRS issued at VCCS, which is non-compliance to the FOM of Sakurai Aviation Ltd.

XXIII. The Air Operator had not arranged the security screening process at VCCS.

XXIV. The Air Operator, had no mechanism to brief Pilots during commercial operations and ensure strict compliance to applicable rules & regulations when cross utilized in commercial flights as evident by the CFI of ATO who was the PIC in this particular flight had no concerns about regulatory requirements and approved procedures.

3.1.8 Air Navigation Service Provider

I. Transfer of communications should not have taken place from Colombo Approach Control Center to BIA Aerodrome Control Tower during the final stage of flight as the Aerodrome controller was not able to visually sight the aircraft in distress at the time of transfer.

II. The deviation of the flight track identified through the Radar Observation, which was significant in nature, was not inquired by the duty controller.

3.1.9 Weather

I. The atmospheric conditions on the accident day were conducive to the carburetor icing.

3.2 Probable cause(s)

According to the evidence, tests, and examinations, it can be concluded that the carburetor ice was the probable cause for this accident.

Inability to identify carburetor icing at the initial stage and failure to prevent serious icing condition during cruise phase as per the Owner's Manual were contributed to this accident.

4 SAFETY ACTIONS

A Safety Bulletin on Carburetor Icing Prevention was issued by DGCA to all AOC and ATO holders on 21st Feb 2022.

5 SAFETY RECOMMENDATIONS

5.1 The Air Operator

I. The Air Operator shall undergo a comprehensive audit conducted by the CAASL to reinstate the AOC.

II. The Air Operator to include training sessions into PPC's on actions in hazardous flight operations (including carb ice).

5.2 The Accountable Manager of the Air Operator

I. The Accountable Manager is to undergo an assessment by a Panel appointed by the DGCA on applicable provisions on the overall operation and his responsibilities as an accountable manager.

5.3 Head of Operations of the Air Operator

I. The Head of Operations is to undergo an assessment by a Panel appointed by the DGCA on applicable provisions on flight operation stipulated in the Air Navigation Regulations of 1955, Civil Aviation Acts, Implementing Standards and Directives issued by the CAASL.

5.4 Flight Operations Officer (Flight Dispatcher)

I. The Flight Operations Officer shall undergo a refresher training on flight dispatch procedure and dispatcher's responsibility as stipulated in the FOM of Sakurai Aviation Ltd.

5.5 Aircraft Maintenance Engineer

I. The Aircraft Maintenance Engineer shall undergo an assessment conducted by a panel appointed by the DGCA on applicable regulations and aircraft maintenance procedures as stipulated in CA Act (Chapter IV, V), Implementing Standards (SLCAIS 56,66,80,84,85,86,94) Directives (SLCAD 10,13,14) and Company procedures included in FOM, AMMs, MOE, and CAME.

6 SAFETY RECOMMENDATIONS TO ANSP, SAKURAI AVIATION LTD, THE PIC, AND THE OTHER OCCUPANT (ALREADY ISSUED)

6.1 Air Navigation Services Provider (ANSP) – (Issued on 25th Feb 2022)

I. Traffic In distress (MAYDAY) or an Urgency Situation (Pan-pan) shall be maintained on the frequency on which such traffic was initiated until it is considered that better assistance can be provided by transferring that traffic to another frequency.

In respect of this incident, transferring the distress aircraft from the Colombo Approach Control frequency to the BIA Aerodrome Control Tower Frequency, whilst the Tower Controller did not have the sight of the aircraft in distress to provide better assistance needed at that moment of time. Further, the risk of losing the Radio Contact, during the transfer to another frequency is another factor that should have been considered before making such a decision.

6.2 The Air Operator (Issued on 25th Feb 2022)

I. Sakurai Aviation to cease the operation of the entire fleet of aircraft until the investigation is completed.

II. Sakurai Aviation shall be responsible to issue strict guidelines to the flight crew to inform any form of track adjustment/deviation under any circumstances of the relevant Air Traffic Control Unit.

III. Sakurai Aviation shall ensure to submit ATC Flight Plan with correct heights and crew details.

IV. Sakurai Aviation shall ensure to submit Air Defence Clearance Request Form with an approved crew of the particular flight.

V. Sakurai Aviation to ensure all commercial pilots to be adhered with the requirements stipulated in the Implementing Standard 018 "compliance to Annex 6 – Part 1 -

Aeroplane flight crew" on the validity of the ratings /competencies and Chapter 6.4.1 of Sakurai Aviation Ltd FOM.

VI. Sakurai Aviation shall ensure that the Flight Dispatcher to assist and furnish information to the PIC prior to each flight.

VII. Sakura Aviation shall ensure that all pilots to declare "MAYDAY" at the initial point when the PIC identified that the aircraft is in distress.

VIII. Sakurai Aviation shall ensure that the Weight & Balance checks are completed at each destination and PIC to check the weight & balance sheet by considering possible last minute changes prior to the release of the flight.

IX. Sakurai Aviation shall ensure that relevant & current navigational charts are kept onboard and use of same by the flight crew during operations.

X. Sakurai Aviation shall ensure that all crew and passengers to undergo security checks when boarding the aircraft.

XI. Sakurai Aviation shall ensure whenever an aircraft is refueled, the Journey log entry shall be raised by an authorized AME/ authorized PIC certifying the fuel mixture used (if applicable) and/ or other fuel used (AVGAS).

XII. Sakurai Aviation shall ensure to carry journey log on board on all flights.

XIII. Sakurai Aviation shall ensure to train all pilots on normal, abnormal and emergency checklist procedures.

XIV. Sakurai Aviation shall ensure to carry only passengers with the PIC in single pilot operations.

XV. Once an aircraft is released by an authorized AME from the Main base, Sakurai Aviation shall ensure to issue a certificate of release to service (CRS) by an authorized AME or authorized PIC in all other sectors.

6.3 The Air Operator (issued on 30th Dec 2022)

I. The Air Operator shall establish a mechanism to check the pilot's competencies prior to each flight.

II. The Air Operator shall ensure not to engage any other person in any activity which requires a licence, rating, certificate of competency or permit.

III. The Air Operator shall ensure not to accept any aircraft for a flight in any un-airworthy condition.

IV. The Air operator shall ensure that Pilots (PIC) to be occupied in the left-hand seat in dual control flight in CAT operations.

V. The Air Operator shall ensure that all docs are to be carried onboard as stipulated in Chapter 10A.20 of Sakurai Aviation Ltd FOM and Appendix 1 of Implementing Standard SLCAIS 020.

VI. The Air Operator shall ensure that the ATC flight plans are submitted with accurate details.

VII. The Air Operator shall ensure that all commercial pilots to be in uniform and Sakurai Aviation Ltd FOM to be amended accordingly.

VIII. The Air Operator shall ensure that the fuel draining is carried out by pilots prior to each flight.

IX. The Air Operator shall ensure that the proper dispatch procedure is being practiced.

X. The Air Operator shall ensure to comply with the Insurance Directive issued by the CAASL in terms of the third-party coverage.

XI. Air Operator shall not use MOGAS for any CAT operations and shall ensure the use of fuel (not mixed fuel) as stipulated in Chapter 10A, 2.5 on the fueling procedure of the Sakurai Aviation Ltd FOM.

XII. The Air Operator shall ensure to implement a mechanism to brief Pilots during commercial operations and ensure strict compliance to applicable Implementation Standards & regulations by them.

6.4 The PIC (Issued on 23rd Nov 2022)

Recommended trainings for the PIC

I. Air Law examination, Implementing Standards (ISs) relevant to Commercial Air Transport Operation and licensing requirements.
II. Duties and responsibilities of a PIC, including the procedures on Security, weight & balance and performance calculation as per the Flight Operations Manual (FOM) of Sakurai Aviation Ltd.
III. Aircraft release procedure specified in Sakurai Aviation Ltd FOM and the Implementing Standard, SLCAIS 080 (IS-M).
IV. A comprehensive study of the Owner's Manual including Operating Check Lists, aircraft performance, weight & balance, loading arrangement and emergency procedures.
V. Aviation Security training programme applicable to Flight Crew.
VI. A training on normal, abnormal and emergency procedure as per the Part-D of FOM of Sakurai Aviation Ltd with the DGCA nominated instructor.
VII. Approved Safety Management System training.
VIII. Refresh on all subjects in Air Transport Pilot Licence Knowledge Examinations
IX. After completing the above trainings/examinations an assessment to be conducted by the DGCA.

6.5 The Other Occupant (Issued on 23rd Nov 2022)

Recommended below trainings for the other occupant;

I. Air Law examinations
II. CPL holder's responsibilities in Implementing Standards SLCAIS 50 and SLCAIS 72 related to Flight Crew Licensing.
III. Approved Safety Management System training.
IV. After completing the above training/examinations an assessment to be conducted by the DGCA.

ANNEX 01: 4R-GAF ENGINE EXAMINATION REPORT FROM NTSB

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594

GAA22WA065

ENGINE EXAM

May 4, 2023

A. ACCIDENT

Location: Katunayake, Sri Lanka

Date: Dec 27, 2021

Time: 01:52 LCL

Airplane: Cessna 172L 4R-GAF

B. ENGINE EXAM

Accredited Rep	Eliott Simpson NTSB
Technical Advisor	Mark Platt Lycoming Engines

C. SUMMARY

The engine sustained minimal impact damage and appeared to be in good condition. It displayed normal wear signatures, and all internal components were lubricated and free of heat distress. There was no evidence of detonation, catastrophic failure, foreign object ingestion or any pre-accident anomalies that would have precluded normal operation.

D. DETAILS OF THE EXAMINATION

1.0 Engine Examination

Model Number: O-320-E2D

Serial Number: RL-2868-27E

The engine arrived in a crate and was removed for examination (figure 1, below). The magnetos and carburetor had already been removed and examined separately.

The engine was intact and appeared to have sustained damage limited to bending of the number 4 cylinder cooling fins in the area of the exhaust port (figure 2); crushed number 4 cylinder intake tube (figure 3); small dent to the number 3 cylinder rocker box cover and an associated broken oil fitting (figure 4).

There was no evidence of oil leak, or crankcase perforation.

The top spark plugs were removed and examined. All electrodes were coated in light/dark grey deposits and exhibited “normal” to, “worn out-normal” wear signatures (figure 5) when compared with the Champion Aviation Products AV-27 “check-a-plug” chart (attachment 1).

The rocker covers were removed and the valve assemblies were intact. The rocker arms and springs were wet with oil and did not show evidence of seizure or excessive heat. The springs were intact, and all keepers were in place at the valve stems (figure 6).

All cylinders were intact, and there was no evidence of cracks or damage. All cylinder heads bolts appeared tight, and the pushrod shrouds were all straight.

The crankshaft could be rotated via the vacuum pump accessory drive gear, and there was no evidence of binding. All rocker arms moved appropriate heights and in firing order.

Examination of the inlet ports at each cylinder indicated that the back side of the intake valve head and upper stem was coated in wet black coke-like buildup consistent with high, but not abnormal oil consumption due to leakage past the valve guides (figure 7).

The oil sump (figure 8) and accessory case (figure 9) were removed and appeared intact. All accessory gears were clean, and coated in oil (figure 10, 11). There was no evidence of gear damage, and the crankshaft gear dowl was in place.

Within the accessory case, the oil pump drive coupling rotated smoothly, and the fuel pump plunger moved smoothly within its guide. The vacuum pump drive gear was intact and could be rotated smoothly.

The oil pump gears, and corresponding pump cavity were clean, coated in oil, and did not display any gouges or evidence of distress (figure 12,13).

Both the oil suction screen and the main oil screen were free of debris (figure 14, 15).

All cylinder head assemblies were removed, during which all head bolts could be unscrewed without undue pressure, and there was no evidence of thread stripping. Within the crankcase, all components were clean, coated with oil, with no evidence of thermal distress or catastrophic failure (figure 16).

The camshaft rotated smoothly, and the cam lobes were intact with no evidence of galling or significant wear (figure 17). The tappets were clean and free of gouges or scratches, and the pushrods were straight.

The pistons were removed and were all intact. Their rings moved freely (figure 18), and the crowns were all coated in normal light tan deposits (figure 19, 20). The valve heads were intact; the inlet valve heads were coated in similar light tan deposits, and the exhaust valves exhibited concentric coloration features (figure 21). The lateral valve stem movement was appropriate, and when removed, the valve stems did not exhibit any evidence of carbon buildup or damage that could have indicated a stuck valve.

All piston and pushrod assemblies were then disassembled. All wrist pins were intact, and free of scratches. All journals (figure 22), bearing shells and bushings were clean, free of excessive gouges or indications of thermal distress (figures 23, 24, 25, 26).

The engine was then partially reassembled and placed back in the crate for shipment (figure 27, below).

2.0 Examination Photos

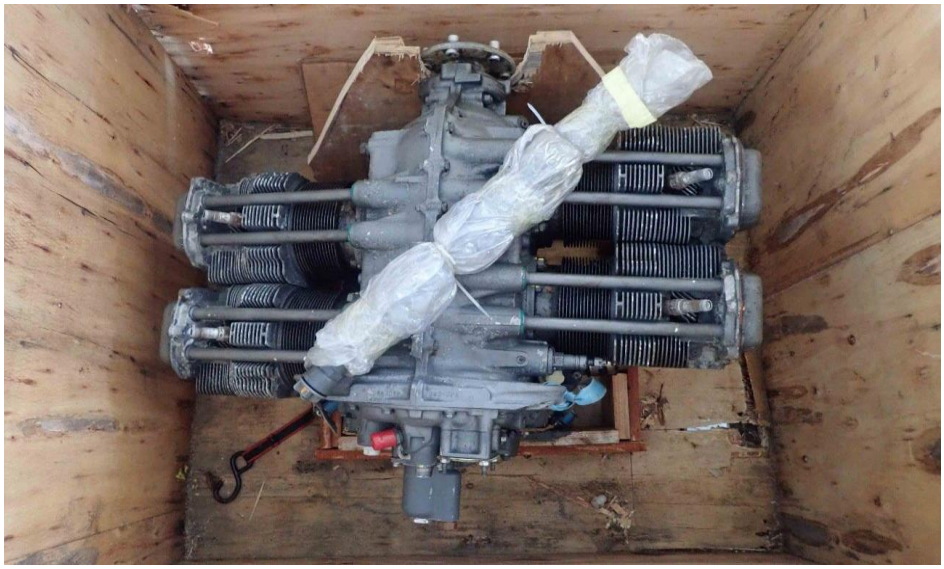


Figure 1 – Engine as-received

Figure 2 – Number 4 cylinder fin damage

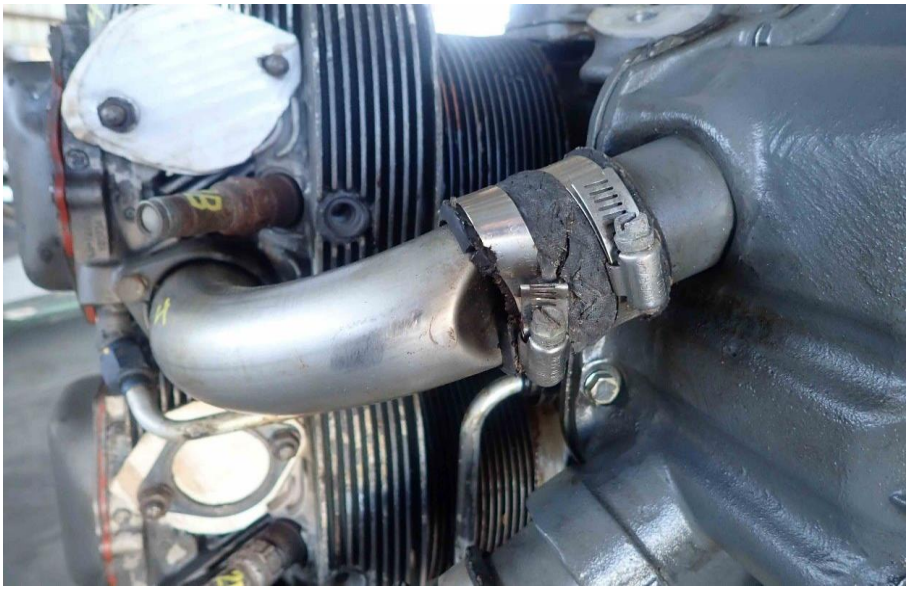


Figure 3 – Number 4 cylinder inlet manifold damage

Figure 4 – Number 3 cylinder rocker cover and oil return fitting damage

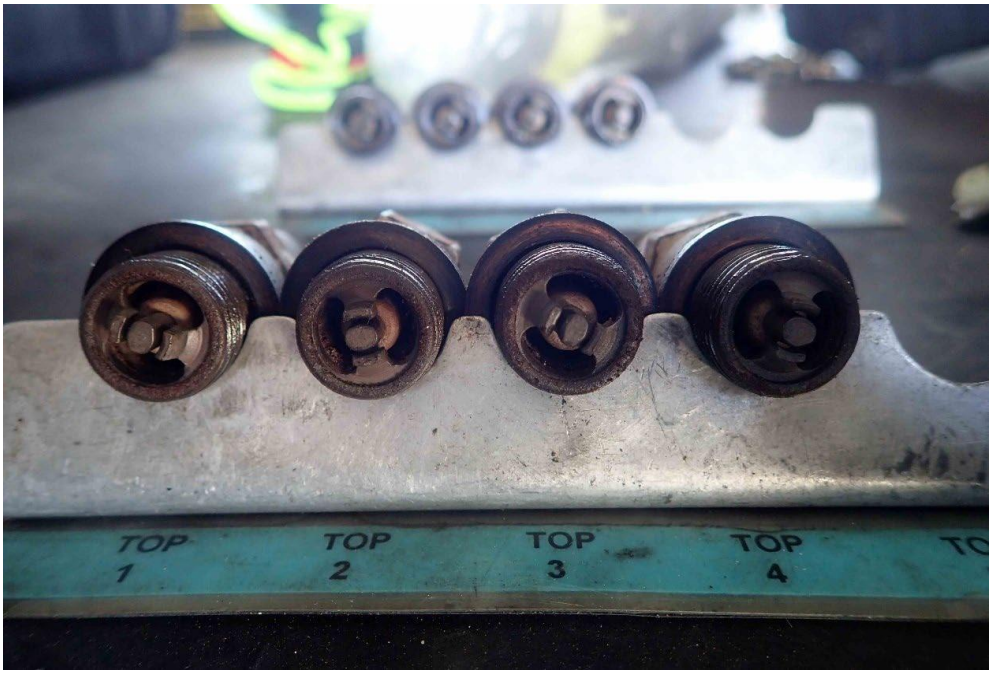


Figure 5 – Top spark plugs

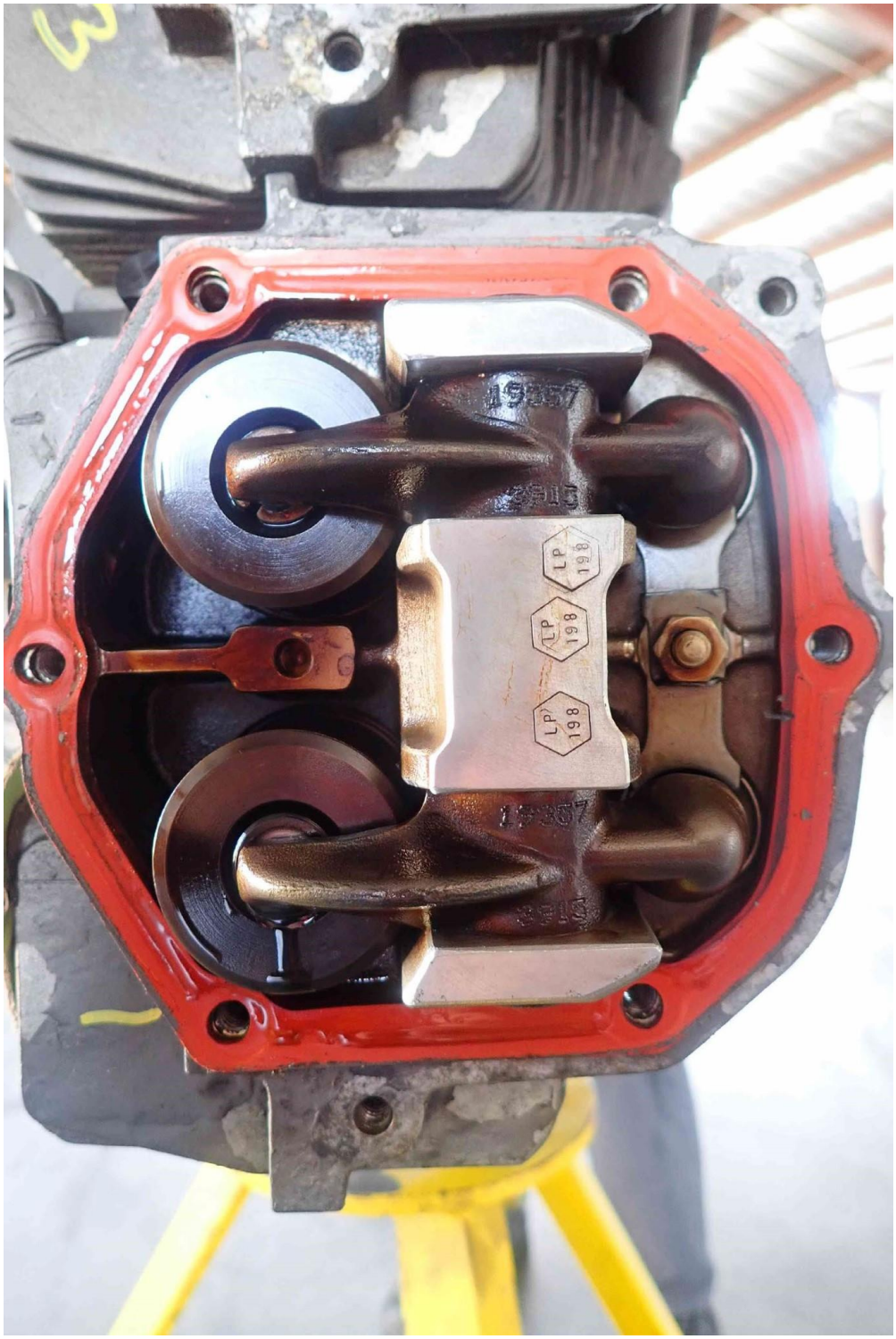


Figure 6 – Number 1 cylinder rocker assembly

Figure 7 – Intake cylinder valve guide stem and back of valve face

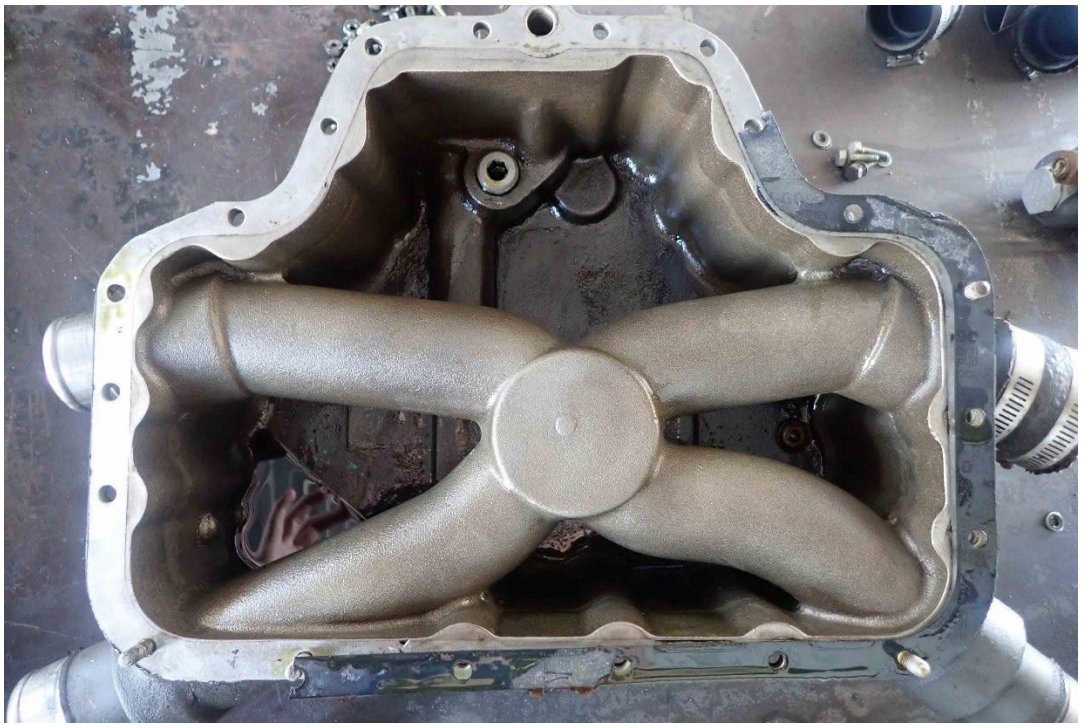


Figure 8 – Oil sump

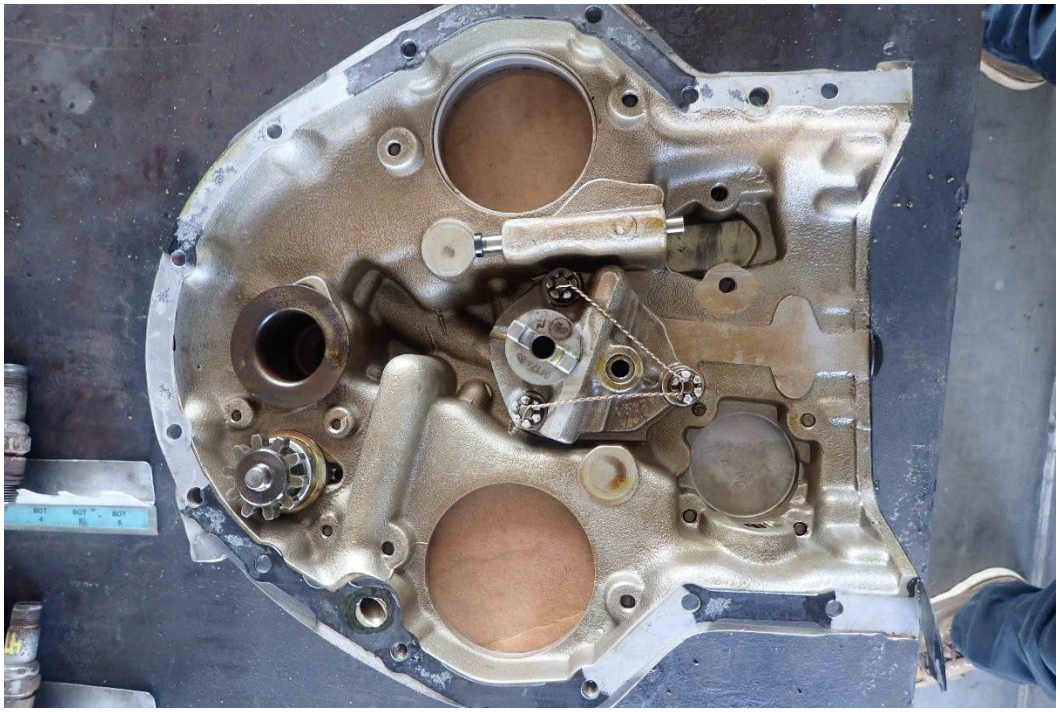


Figure 9 – Accessory case and oil pump

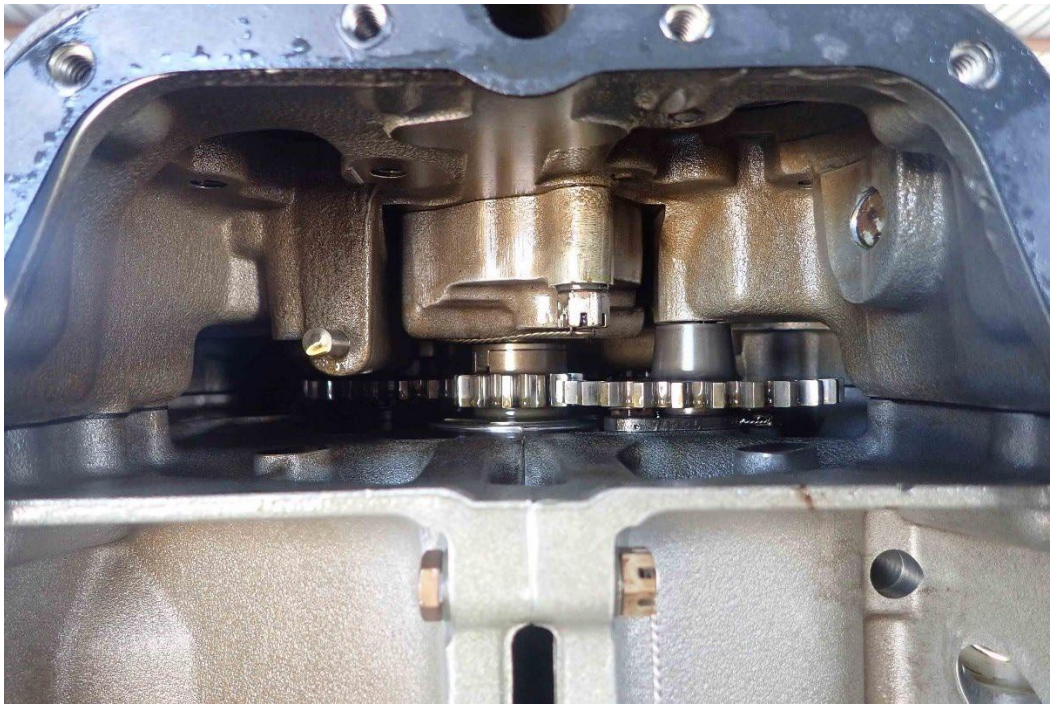


Figure 10 – Accessory gears

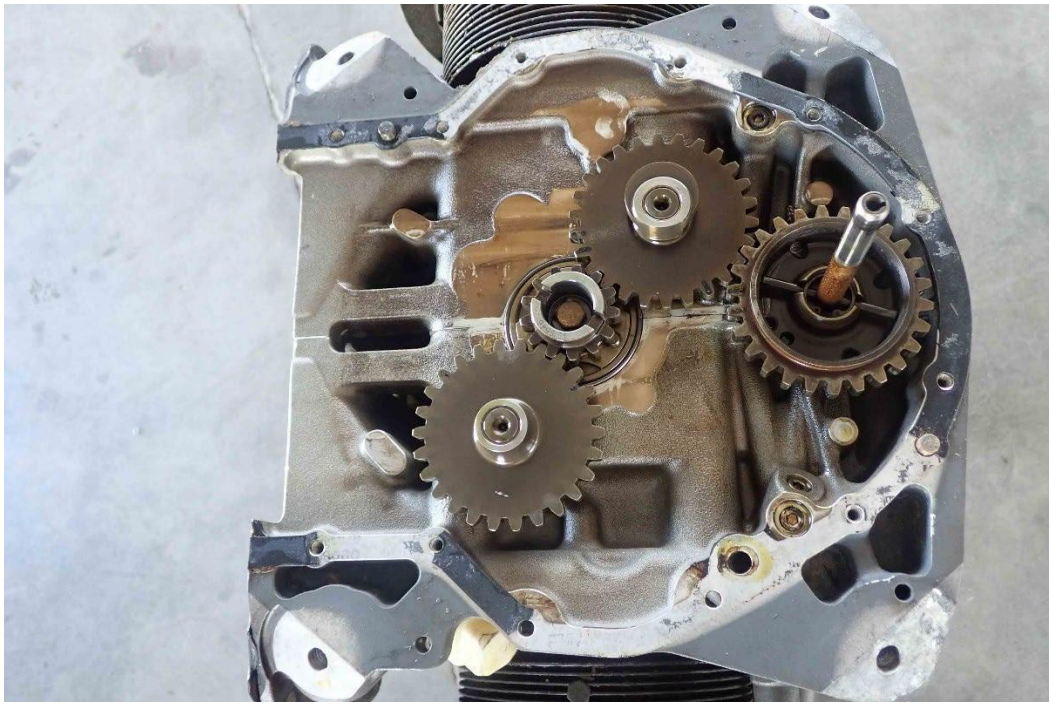


Figure 11 – Accessory gear train

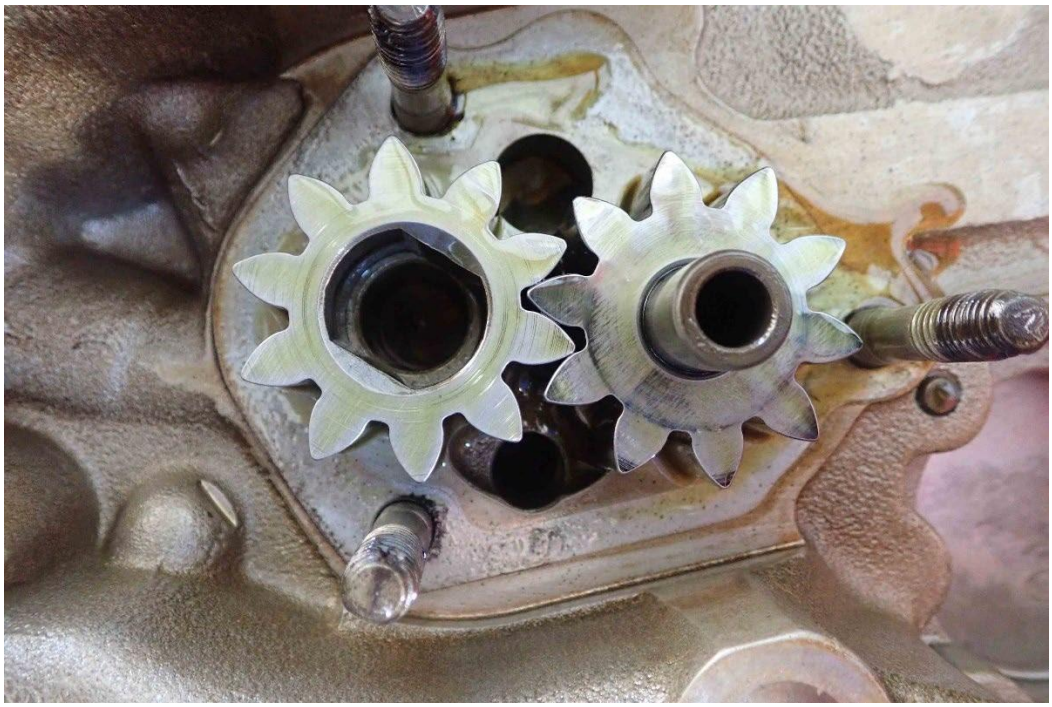


Figure 12 – Oil pump gears

Figure 13 – Oil pump housing

Figure 14 – Oil suction screen

Figure 15 – Main oil screen

Figure 16 – Piston rod and crankshaft

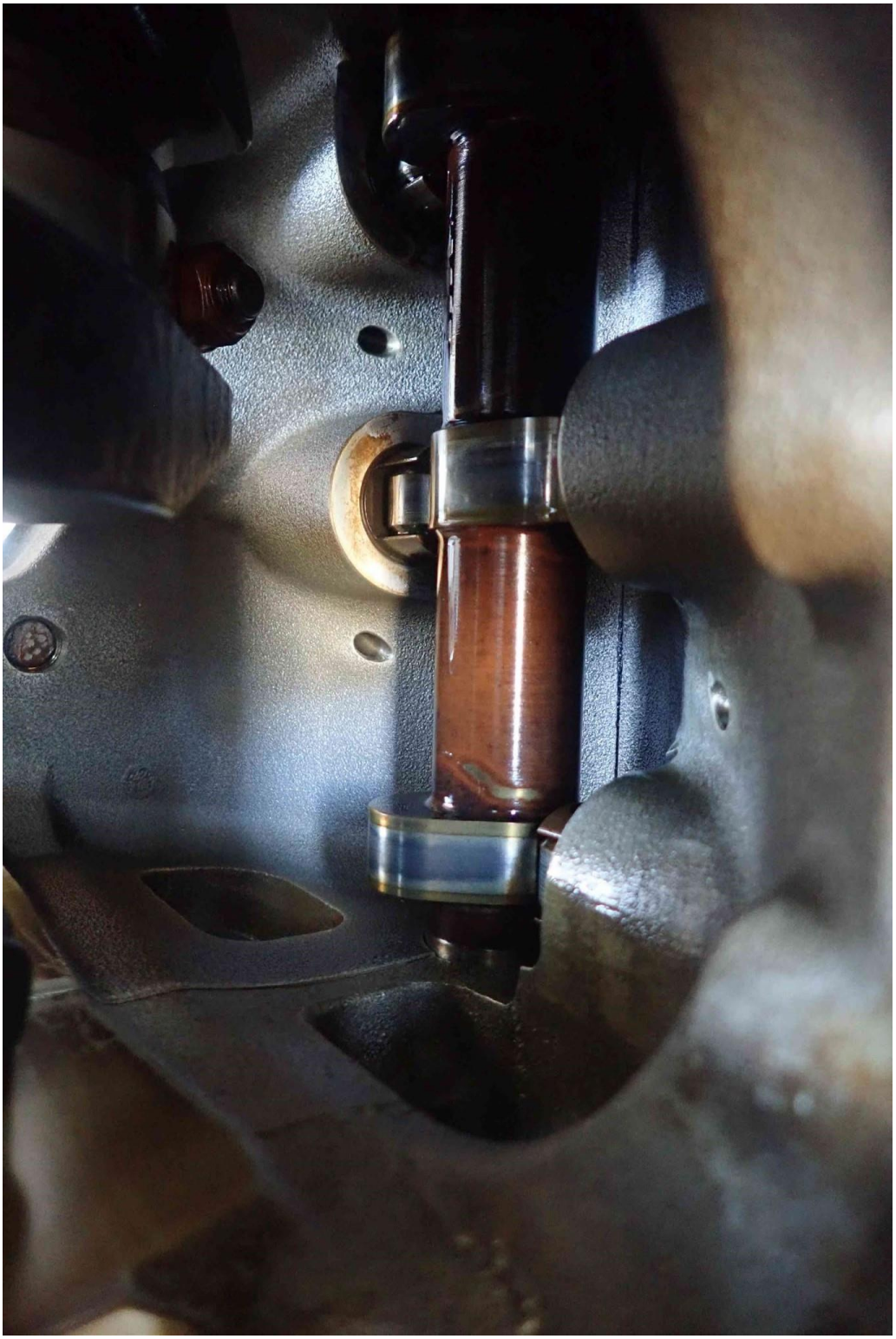


Figure 17 – Camshaft and roller tappets

Figure 18 – Number 2 piston with rings

Figure 19 – All piston and head assemblies

Figure 20 – Number 2 piston crown

Figure 21 – Number 2 cylinder head chamber

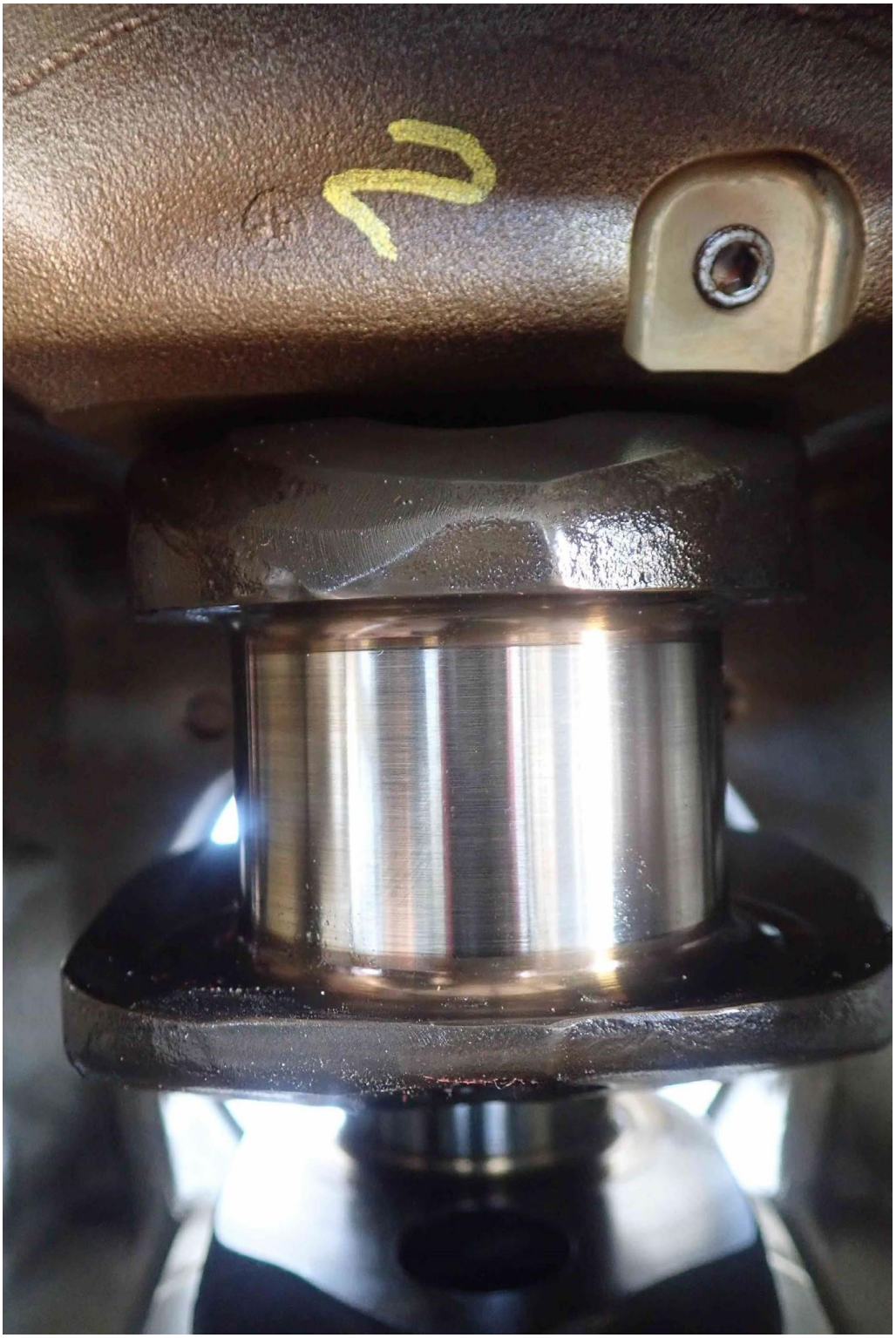


Figure 22 – Number cylinder 2 main journal

Figure 23 – Cylinder number 1 assembly

Figure 24 - Cylinder number 2 assembly

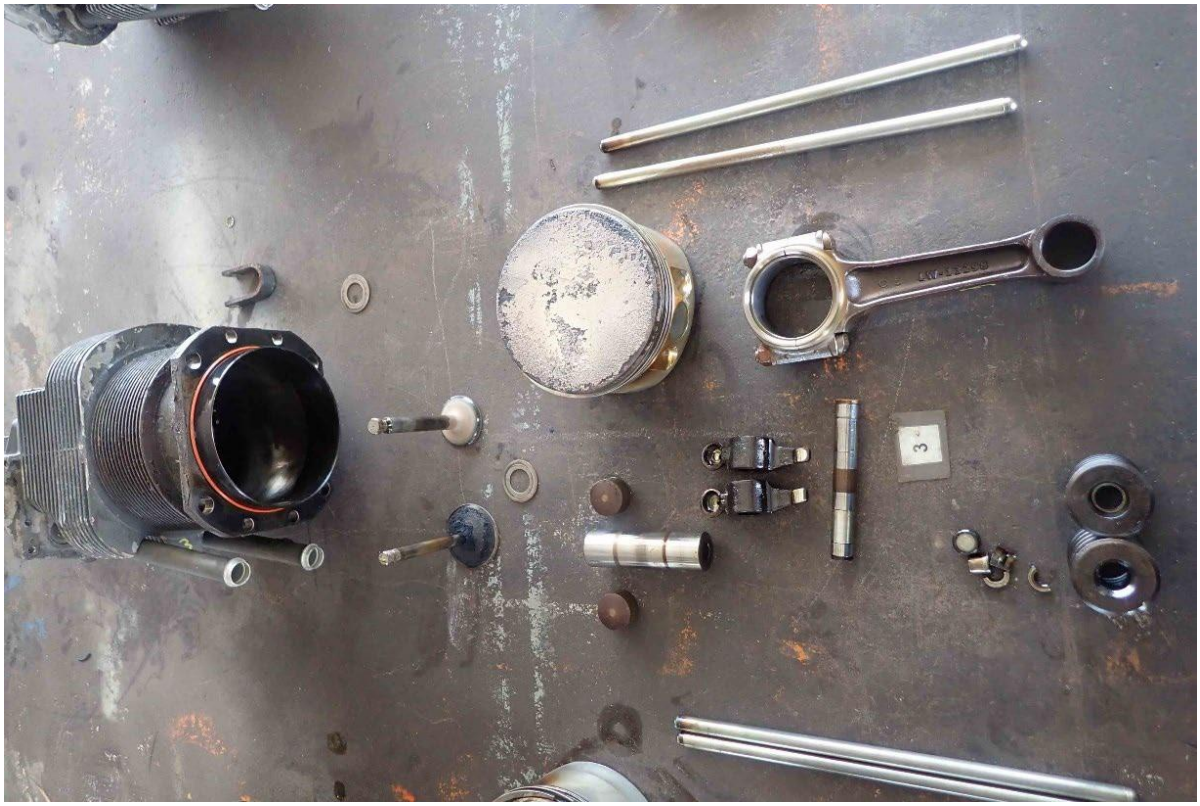


Figure 25 - Cylinder number 3 assembly

Figure 26 - Cylinder number 4 assembly

Figure 27 – Repackaged engine

Attachment 1 to Annex 01

Submitted by:

Mr. Eliott Simpson
Senior Aviation Accident Investigator

ANNEX 02: EXAMINATION REPORT ON MAGNETOS AND CARBURETOR FROM NTSB

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

SYSTEMS EXAMINATION

GAA22WA065

A. ACCIDENT

Location: Katunayake, Sri Lanka

Date: December 27, 2021

Aircraft: Cessna 172L, Registration 4R-GAF, S/N 17259798

B. SUMMARY

Examination of the magnetos and carburetor was conducted at FAA repair station TZ3R885L in Simi Valley, California on March 14, 2022. Examination revealed that the right magneto was inoperative due to a failed coil (secondary side). No anomalies were noted to the carburetor, except for its fuel inlet strainer, which was almost completely occluded with a fibrous material.

C. DETAILS OF THE INVESTIGATION

1.0 Examination

Left Magneto

Model Number: 4371

Serial Number: 15050986

The left magneto appeared externally undamaged, and evidence suggested it had been opened since manufacture in 2015.

The unit was installed in a magneto test stand and operated at speeds from 500 to 2,500 rpm. All output leads produced a spark in sequential order, with no indication of hesitation or misfire (photo 1).

Right Magneto

Model Number: 4370

Serial Number: 15090982

The right magneto appeared externally undamaged, and evidence suggested it had been opened since manufacture in 2015.

The unit was installed in a magneto test stand and operated at speeds from 500 to 2,500 rpm. The magneto did not produce a spark at any lead at all speeds (photo 2).

The unit was disassembled, and there was no evidence of internal catastrophic failure. The capacitor appeared to be manufactured by Kelly Aerospace and had a date code of 2019 and a capacitance of 0.36 MFD (nominal 0.35 MFD +/- 10 %).

There was no obvious date code on the points, but they appeared to be the original equipment type. Examination revealed a point gap of about 0.04 inches, the nominal value is between 0.08 and 0.10 inches

The rotor cap electrode posts and rotor finger were intact and exhibited black deposits to their contact surfaces, typical of normal operation.

The coil was tested in place with an ohmmeter, revealing an open circuit in the secondary winding, rather than the standard resistance of between 13 K ohms to 20.5 K ohms (photo3). The primary winding measured 0.9 ohms (nominal between 0.5 and 1.2 ohms), (photo4).

The coil date code was from 2015, indicating that it was likely the original coil (photo 5).

Carburetor

Manufacturer: Avstar
Model: LVC-5-4PA
Part number: AV10-5217
Serial number: AV20799315

The carburetor appeared externally undamaged (photo 9). All bowl bolts were tight and equipped with safety tabs. One bolt was coated in blue bolt seal, indicating the unit had likely not been opened since manufacture.

The throttle arm moved freely, with corresponding movement of the butterfly valve and accelerator pump plunger. There was no evidence of fuel leak. The idle mixture screw was intact, and could be rotated 2.5 turns to its stop, which was appropriate for the carburetor type.

The bowl was removed, revealing brass floats. The float-to-body clearance was appropriate. The float hinge was intact, and there was no evidence of float-to-bowl contact, or float puncture. The bowl-to-body gasket was still soft and pliable, indicating it was providing a good seal.

A strong smell of automobile gasoline was present within the bowl, which was free of debris or containments. The idle and main jets were clear, and the float valve was pliable and undamaged, (photo 6, 7,8). All internal ports and chambers were clear.

Removal of the fuel inlet strainer revealed that it was almost completely blocked a fibrous lint-like material (photo 10, 11, 12)

1.1 Examination Photos

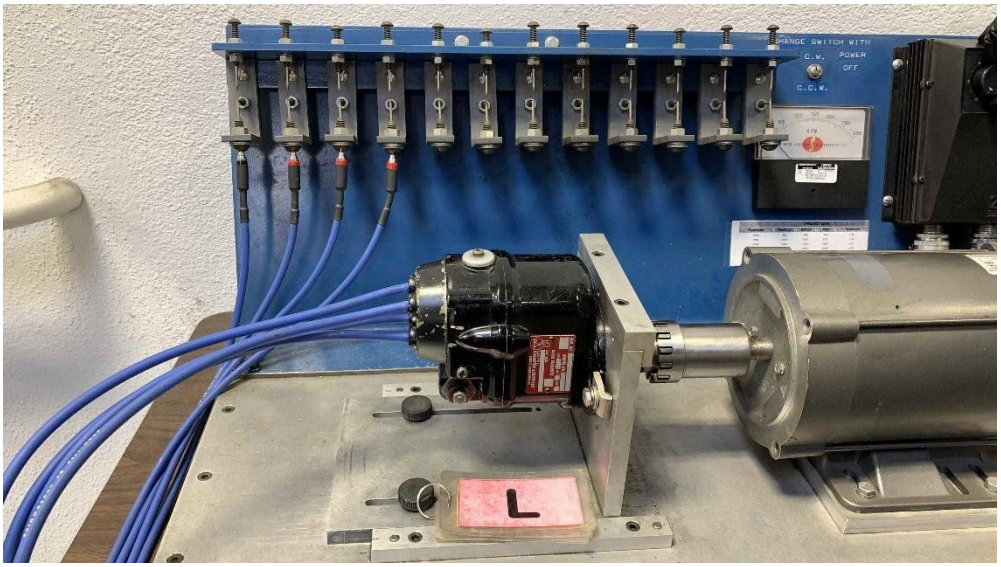


Figure 1 – Left magneto on test stand

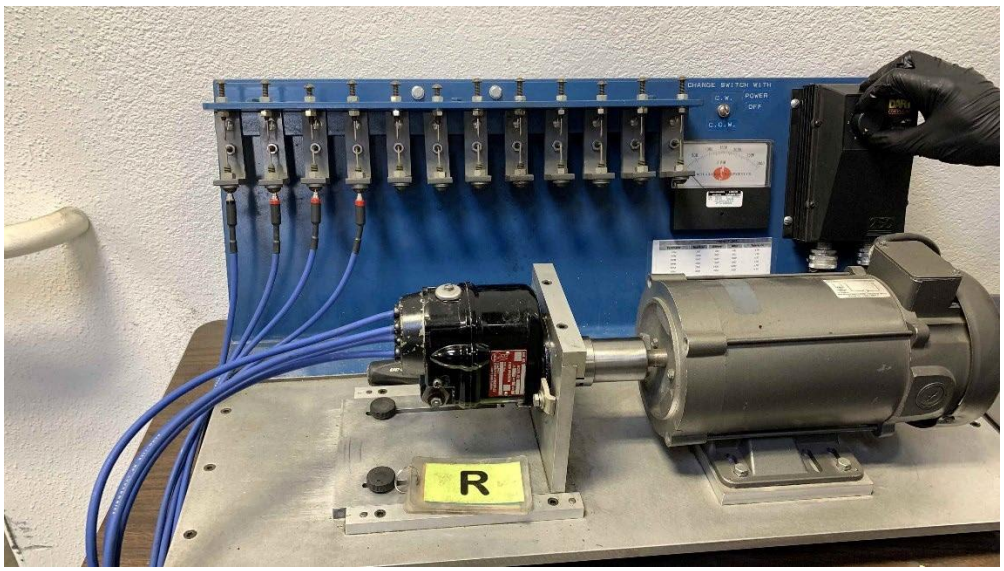


Figure 2 - Right magneto on test stand

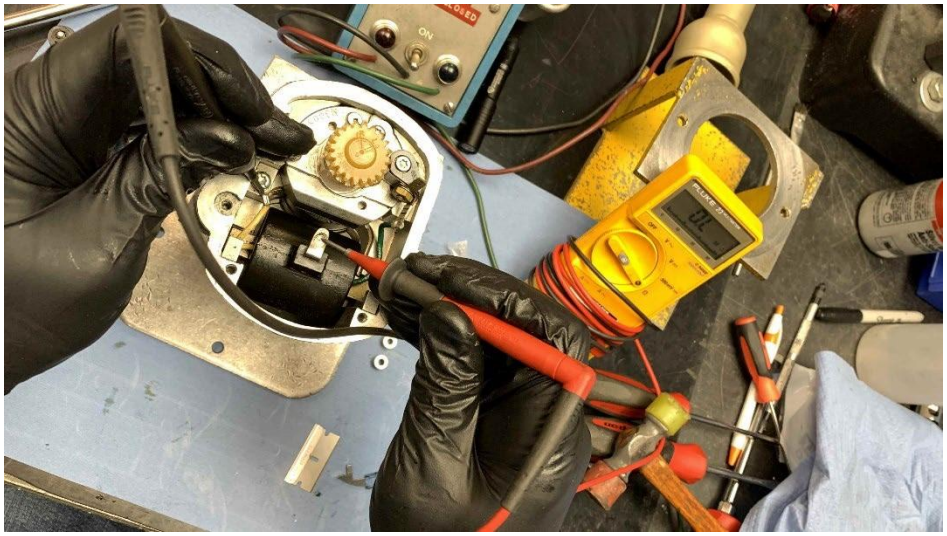


Figure 3 – Coil secondary winding resistance

Figure 4 - Coil primary winding resistance

Figure 5 – Coil with data code

Figure 6 – Main jet passage

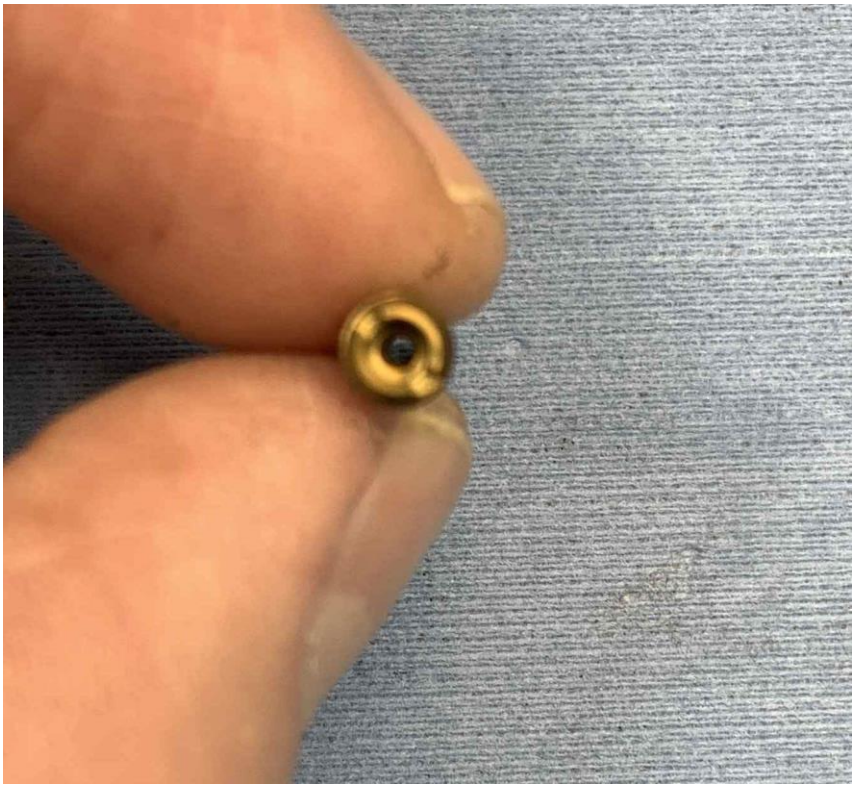


Figure 7 – Idle jet passage

Figure 8 – Float arm and valve

Figure 9 – Carburetor

Figure 10 – Fuel inlet strainer

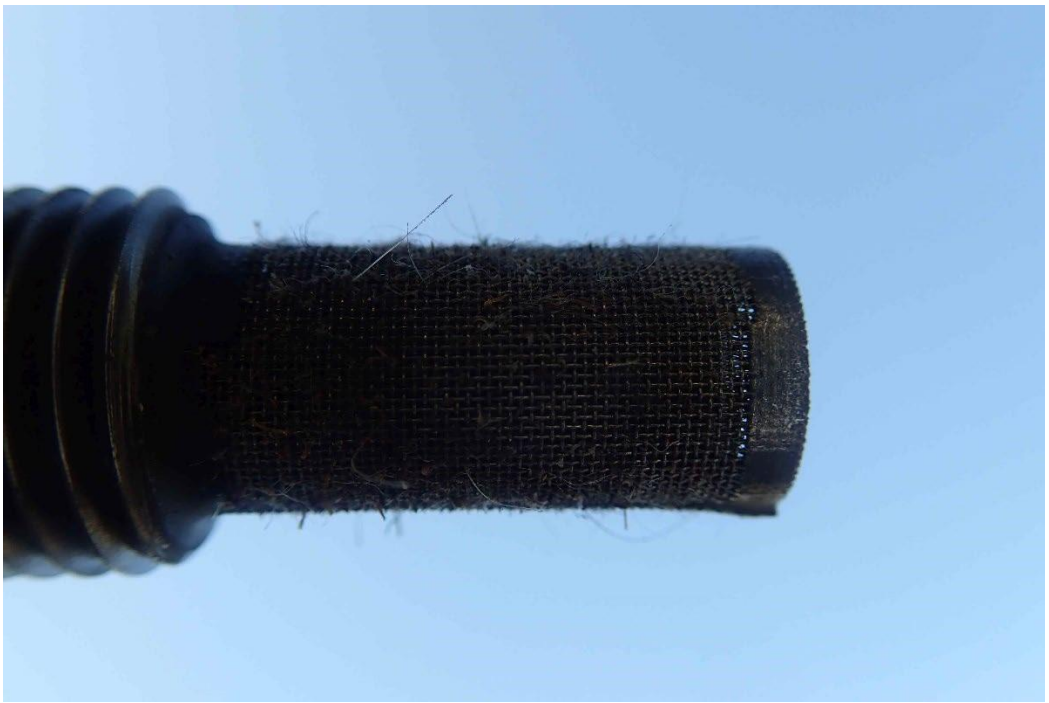


Figure 11 – Fuel inlet strainer

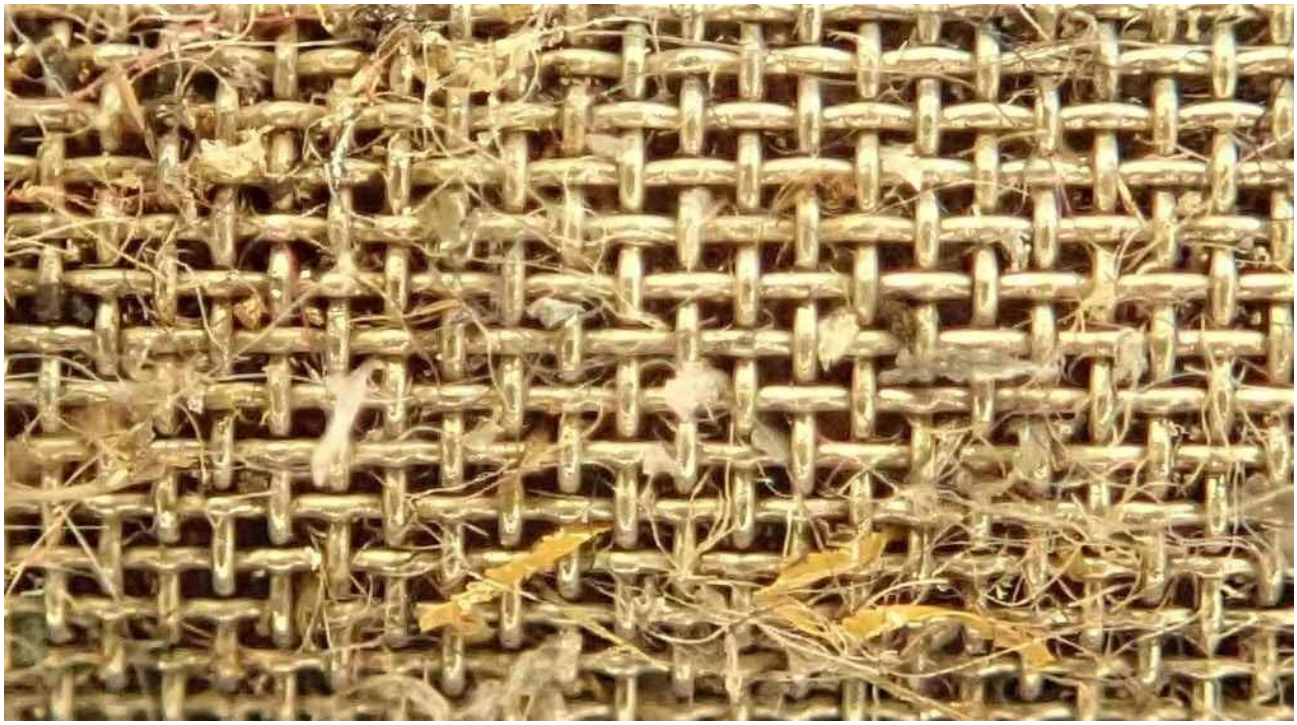


Figure 12 – Fuel inlet strainer debris

Submitted by: Mr. Eliott Simpson, Senior Aviation Accident Investigator

-END-