Republic of the Philippines
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES

AIRCRAFT ACCIDENT INVESTIGATION AND INQUIRY BOARD

FINAL REPORT

RP-R5380
ALLIED AG-CAT, G-164A

OPERATOR: AEROWURKZ AERIAL SPRAYING SERVICES

TYPE OF OPERATION: AGRICULTURAL SPRAYING

DATE OF OCCURRENCE: SEPTEMBER 24, 2019

PLACE OF OCCURRENCE: WITHIN THE VICINITY OF BARANGAY SAYON, SURIGAO DEL NORTE, PHILIPPINES

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(Allied Ag-Cat G-164A, RP-R5380 Final Report)

FOREWORD

This report was produced by the Aircraft Accident Investigation and Inquiry Board (AAIIB), Civil Aviation Authority of the Philippines, MIA Road, Pasay City, Philippines.

The report is based upon the investigation carried out by the AAIIB in accordance with Annex 13 to the Convention on International Civil Aviation, Republic Act 9497 Section 42, and Philippine Civil Aviation Regulation Part 13.

Readers are advised that the AAIIB investigates for the sole purpose of enhancing aviation safety. Consequently, AAIIB reports are confined to matters of safety significance and may be misleading if used for any other purpose. It should be noted that the information in AAIIB reports and recommendations is provided to promote aviation safety, and in no case is it intended to imply blame or liability.

Furthermore, no part of the AAIIB report or reports relating to any accident or investigation shall be admitted as evidence or used in any suit or action for damages arising out of any matter mentioned in such report or reports.

FINAL REPORT

TITLE: Accident involving an Allied Ag-Cat G-164A type of aircraft with Registry Number RP-R5380 operated by Aerowurkz Aerial Spraying Services, experienced forced landing due to engine failure within the vicinity of Barangay Sayon, Surigao Del Norte, Philippines, on September 24, 2019/0752H.

Notification of Occurrence to National Authority

The Notification of the accident to AAIIB CAAP was relayed by the Operator of the aircraft at 1530H (LOCAL) on September 24, 2019.

Identification of the Investigation Authority

The Aircraft Accident Investigation and Inquiry Board (AAIIB), the mandated accident investigation organization within the Civil Aviation Authority of the Philippines (CAAP) as the state of Occurrence/Registry/ Operator conducted the investigation.

Organization of the Investigation

In accordance with provisions of Philippine Civil Aviation Regulation (PCAR) Part 13, an Investigator-In-Charge was appointed.

Authority Releasing the Report

The Final investigation report was released by Aircraft Accident Investigation and Inquiry Board (AAIIB) and published on the CAAP website on **07 March 2025**.

Synopsis:

On September 24, 2019, at about 0752H, an Allied Ag-Cat G-164A type of aircraft with Registry Number RP-R5380 operated by Aerowurkz Aerial Spraying Services, experienced forced landing due to engine failure within the vicinity of Barangay Sayon, Surigao del Norte, Philippines. The pilot did not sustain any injuries; however, the aircraft sustained substantial damages as a result of the occurrence. Visual Meteorological Condition (VMC) prevailed at the time of the incident. The cause of the occurrence was attributed to the failure of engine cylinder #4 resulting to the forced landing due to engine failure.

LIST OF ACRONYMS AND ABBREVIATIONS

AAIIB	:	Aircraft Accident Investigation and Inquiry Board
AD	:	Aerodrome
AGL	:	Above Ground Level
AMO	:	Approved Maintenance Organization
AMSL	:	Above Mean Sea Level
AOC	:	Air Operator Certificate
CAAP	:	Civil Aviation Authority of the Philippines
CHT	:	Cylinder Head Temperature
COA	:	Certificate of Airworthiness
CPL	:	Commercial Pilot License
ELT	:	Emergency Locator Transmitter
FT	:	Feet
GPS	:	Global Positioning System
M	:	Meter(s)
MHZ	:	Megahertz
PCAR	:	Philippine Civil Aviation Regulation
RWY	:	Runway
UTC	:	Universal Time Coordinated
VFR	:	Visual Flight Rules

1. FACTUAL INFORMATION

Aircraft Registration No.	:	RP-R5380
Aircraft Type/Model	:	Allied Ag-Cat /Ag-Cat G-164A
Operator	:	Aerowurkz Aerial Spraying Services
Address of Operator	:	General Aviation Group Area, Old Airport Road, Sasa, Davao City, Philippines
Place of Occurrence	:	Within the vicinity of Barangay Sayon, Surigao Del Norte, Philippines
Date/Time of Occurrence	:	September 24, 2019 at about 0752H/2352UTC
Type of Operation	:	Agricultural Spraying
Phase of Flight	:	Take-off
Type of Occurrence	:	Forced landing due to engine failure

1.1 History of Flight

On or about 0752H, September 24, 2019, an Ag Cat G-164A with Registry Number RP-R5380 sustained damage on both its wings and landing gear after encountering engine failure upon take-off at Tagbina Airstrip, Surigao Del Norte. The aircraft was operated by Aerowurkz Aerial Spraying Services, under PCAR Part 11. There were no injuries to the pilot on board. Visual meteorological conditions prevailed, and since the flight was a restricted operation, no flight plan had been filed. The flight originated from Tagbina Airport, Barangay Santa Fe, Tagbina, Surigao del Sur, at 0742H for a routine aerial spraying operation.

Upon becoming airborne at about 200 feet above ground level (AGL), the pilot noticed smoke coming from the engine, followed by a partial forced landing due to engine failure. The pilot then immediately dumped the chemical load and turned left to bring the aircraft back at Tagbina Airstrip. The pilot assessed that he could not safely make it back to the airstrip, so he opted to force land the aircraft in a field in front of him. The aircraft came

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in contact with the ground about 1.5 kilometers before the runway end of Tagbina airstrip. The aircraft sustained substantial damage on both wings and the nose section due to impact. The pilot got out of the aircraft safely with no injuries. Witnesses on the ground stated that white smoke was visible coming out of the engine while it was descending.

Figure 1 - The aircraft at its final resting point.

1.2 Injuries to Person (s)

Injuries	Crew	Passengers	Others	TOTAL
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	1	0	0	**1**

1.3 Damage to Aircraft

The aircraft sustained substantial damage.

1.4 Other Damages

The aircraft collided with two (2) hardwood trees along its descent path.

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1.5 Personnel Information

1.5.1 Pilot-In-Command (PIC)

Pilot-In-Command	:	Male
Date of Birth	:	February 8, 1954
Nationality	:	Filipino
License	:	107206-CPL
Valid up to	:	January 31, 2014
Type Rating	:	Airplane: Single Engine Land-Ag-Cat
Medical Certificate	:	Class I, Expiry January 28, 2020
Time on G-164A	:	8,000 Hours as per Pilot logbook
Grand Total time	:	15,000 Hours as per Pilot logbook

1.6 Aircraft Information

In 1955, Grumman aircraft's preliminary design for a "purpose-built" crop-dusting airplane as a means of fulfilling a pressing need in the agricultural community, as well as the perceived need for Grumman to diversify its product lines. The "A" model is the basic model airplane and was certified with four different engine variants.

Figure 2 – The Ag Cat G-164A aircraft.

1.6.1 Aircraft Data

Registration Mark	:	RP-R5380
Manufacturer	:	Allied Ag-Cat Productions, Inc.
Country of Manufacturer	:	United States of America
Type/Model/Type Certificate	:	Allied Ag-Cat /Ag-Cat G-164A/1A16
Operator	:	Aerowurkz Aerial Spraying Services

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Serial No.	:	671
Date of Manufacture	:	1969
Certificate of Airworthiness valid up to	:	Valid until February 8, 2020
Certificate of Registration valid up to	:	Valid until September 9, 2022
Category	:	Restricted
No. of crew	:	1
Airframe total time	:	12,009+28 Hours

1.6.2 Engine Data

Manufacturer	:	Pratt & Whitney
Type	:	Piston
Type/Model	:	Radial/R-985 AN14B
Engine SN #	:	20868
Engine TSO	:	200 +32 Hours
Engine Total Time	:	9,278 +02 Hours

1.6.3 Propeller Data

Manufacturer	:	Hamilton Standard
Type	:	Variable Pitch Constant Speed
Type/Model	:	Metal Alloy/2D30-301
Prop Blade SN #	:	T21665
Propeller TSO	:	152+16 Hours
Propeller total time	:	5,278 + 09 Hours

1.7 Meteorological Information

Visual Meteorological Conditions prevailed at the time of the occurrence.

1.8 Aids to Navigation

The flight departed under Visual Flight Rules (VFR). Using VFR, the pilot must be able to operate the aircraft with visual references to the ground and visually avoiding obstructions and other aircraft.

The pilot also made use of a Garmin GPS – SatNav for spray operation guidance.

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1.9 Communications

The aircraft was equipped with a standard radio transceiver. Communications were carried out between the pilot and air traffic controller within the area.

1.10 Aerodrome Information

Tagbina Aerodrome, Surigao Del Norte is listed as 1A in the Civil Aviation Authority of the Philippines - Aerodrome and Air Navigation Services Oversight Office (CAAP-AANSOO) approved aerodrome facility data.

1.10.1 General Information

Aerodrome Name	:	Tagbina Aerodrome
Aerodrome Operator Address	:	Barangay Santa Fe, Tagbina, Surigao del Sur
Aerodrome Certificate Number	:	AGA-P-025A-2015
Coordinates (WGS-84)	:	08 28 41.6N 126 08 02.7E
Operating Frequency	:	167.375 Mhz
Azemuth	:	18/36
Dimensions	:	940 meters x 45 meters
Runway Surface	:	Macadam (Graded) 4646 psi
Rwy obstacles	:	Trees app Rwy 18
Elevation	:	46m CAAP
Traffic permitted	:	VFR
Apron	:	Macadam
Threshold	:	White
Windcone	:	Available/Operational
Rwy & Taxiway marking	:	Side markers, Angular markers, distance-to-go markers, Runway Strip End Markers (Available)
Rwy Number and Center line	:	None
Holding point Marker	:	White
AD category fire-fighting service	:	Portable fire extinguisher
Rescue equipment	:	Wheel type Fire Extinguisher: BFP trained personnel
Security office	:	24H

1.11 Flight Recorders

The aircraft was not equipped with any flight recorders, and the existing Philippine Civil Aviation Regulation does not require them to be installed for that type of aircraft.

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1.12 Wreckage and Impact Information

The aircraft collided with trees before making a ground impact approximately 1.5 kilometers away from runway 18 of the Tagbina Airstrip. The wreckage area has a coverage of about thirty (30) square meters. Most of the damaged aircraft parts and components were still attached to the fuselage. The main landing gears were damaged; both wings have traces of collision with trees on their leading edges. Damage to the engine firewall resulted in its slight separation from the fuselage. The propeller was still attached to the engine and showed no rotational movement upon ground impact. The aircraft settled upright with coordinates 8.460324 N, 126.135081 E and fuselage heading North.

1.13 Medical and Pathological Information

The pilot medical certificate was current and met the CAAP and ICAO Annex 1 medical standards for exercising the privileges of the license held. There was no medical impediment on the pilot's part that could have had a bearing on this occurrence.

1.14 Fire

Inspection of the wreckage on-site revealed no evidence of a post-crash fire.

1.15 Search and Survival Aspects

The accident was survivable since the cockpit integrity was not hampered and the pilot was properly wearing his seatbelt and harness even though the aircraft received substantial damage upon impact with the terrain. No distress signal was received by any ELT monitoring facility worldwide.

1.16 Test and Research

A teardown inspection was conducted on the aircraft engine on 30 September 2019, at the operator’s Aircraft Maintenance Organization facility in Davao City.

1.17 Organizational and Management Information

1.17.1 Operator

Aerowurks Aerial Spraying Services has an Air Operator Certificate (AOC) valid until July 15, 2020 authorized to perform restricted operations that provides agricultural

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aerial spraying services to the agricultural industries. They cater to banana, sugarcane, palm oil and rice plantations in Visayas and Mindanao area. They are located at BTC Hangar, Gen. Aviation Area, Old Airport, Sasa, Davao City and Araneta St., Singcang Bacolod City. The aircraft RP-R5380, is listed on the AOC Operations specification.

1.17.2 Maintenance

The maintenance function of RP-R5380 is being undertaken by Aerowurkz Aerial Spraying Services, Approved Maintenance Organization (AMO) with a current Certificate number 104-11 with facility located at BTC Hangar, Gen. Aviation Area, Old Airport, Sasa, Davao City.

2.0 ANALYSIS

2.1 General

The pilot on board was a reliever to the morning flight that day. It was his third aerial spray operation on the banana plantation for Malixi farm at Barangay Tagbina, Agusan del Sur. The aircraft loaded about 600 liters of chemicals after refueling. The pilot, together with the mechanics, performed their routine three hundred sixty (360) degrees aircraft visual inspections and found no discrepancies.

The pilot made a straight-out departure for take-off going to the spray area. Upon airborne, after reaching 200 feet AGL, he noticed the smell of burning oil. Surprisingly, there was smoke coming from the engine and starting to make its way into the cockpit. The pilot instantaneously observed the engine tachometer reading decrease, followed by an unusual engine vibration. The pilot immediately dumped his chemical load and tried to return to the airstrip but to no avail. While maneuvering, he admitted that he was too far and low from the airstrip, and after setting vital aircraft switches to the “off” position, he opted to force land the aircraft on its path. RP-R5380 has a Cylinder Head Temperature (CHT) gauge installed inside the aircraft (Figure 3). Through the CHT gauge, the pilot can monitor and take necessary preventive measures in case there is an abnormal cylinder head temperature and excessive manifold pressure.

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Figure 3 – RP-R5830 Cylinder Head Temperature (CHT) gauge with placard.

On-site investigators revealed that engine oil was coming out from one of the engine cylinders. The engine oil is scattered from a certain trajectory, which can be found in some isolated areas of the engine only (Figure 4). It is possible that this condition was a pre-impact event that occurred before ground impact. The aircraft propeller shows a bend of one of its blades pointing towards the fuselage, and this is due to ground impact. As per the witness statement, white smoke was visible coming out of the engine while it was descending.

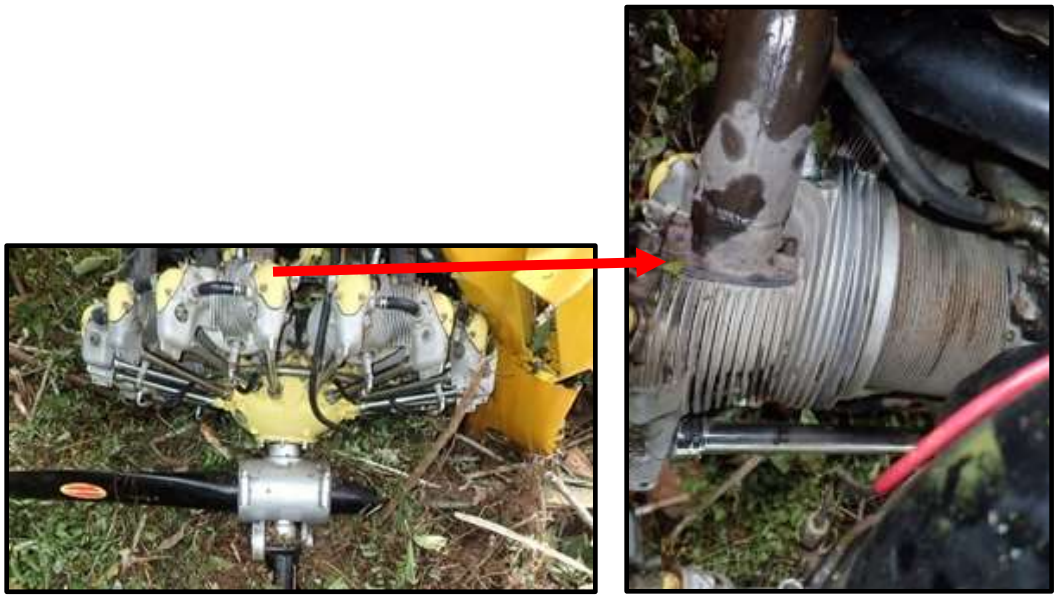

Figure 4 – Visible oil coming from the cylinder.

2.2 Engine Examination

Records show that on January 18, 2019, the CAAP-Airworthiness inspector approved the company's airworthiness inspections of the aircraft. The maintenance also covered the

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installation of a newly overhauled propeller. Visual inspection of the engine and its components was undertaken. An engine compression test was also done and was found satisfactory.

The engine teardown inspection revealed a crack in cylinder #4. This undetected crack progressed, which induced mechanical failure and/or malfunction of the engine. This occurrence is frequently known as "blown cylinder" or "cracked cylinder" from the aircraft engine that would have precluded normal operation. Aircraft piston-engine cylinders have basic failure modes. They involve the intake and exhaust valves, general cracking at various locations on the cylinder head, and head/barrel separation (Figure 5).

Figure 5 – Crack on cylinder #4.

Cracking is perhaps the most pernicious type of cylinder failure. A crack occurs in the combustion chamber, specifically between a spark plug port and a valve. At a minimum, cracks result in low compression. At worst, they portend potentially catastrophic failure of the cylinder and/or engine, including the possibility of fire. Exhaust stains often lead to the location of many cracks, which should not be the case. There was evidence of shearing off and cracks in the corners of the intake/exhaust near the spark plug area on the engine of RP-R5380.

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Figure 6: Visible crack where the oil was coming out.

Nevertheless, operating an engine at high power settings, at high cylinder head temperatures, or with leaking exhaust ports greatly increases the likelihood of cracks, low compression, oil loss, and other damage. An undetected crack in the aircraft piston engine may have serious or fatal consequences for the safety of the crew and the aircraft. It is therefore important that careful, routine inspections are accomplished to detect cylinder cracks and other faults prior to partial or complete engine failure.

The crack near the spark plugs on engine cylinder number #4 (Figure 6). The tear-down inspection revealed that the crack split open between the cooling fins. The separation was apparently due to pre-ignition or detonation stresses, which no longer allowed the pushrods to operate the valves. This resulted in a forced landing due to engine failure during the initial climb after take-off. Pre-ignition is the ignition of the air-fuel charge while the piston is still compressing the charge. A cracked spark plugs tip, carbon or lead deposits in the combustion chamber, or a burned exhaust valve can act as a glow plug, causing the ignition source to ignite the charge prematurely. Detonation is an explosion of the fuel-air mixture inside the cylinder. It occurs after the compression stroke, either near or after the top dead center. During detonation, the fuel/air charge explodes rather than burning smoothly. Because of this explosion, the charge exerts a much higher force on the piston and cylinder, leading to increased noise, vibration, and cylinder head temperatures.

2.3 Cylinder Management Tools

There are some basic methods that can be employed to manage and monitor the condition of the cylinders on piston engines. The simplest method involves considering the correct tools required for the job. Another is a close, detailed visual inspection. When one is conducted, we are looking for cracks, often highlighted by discoloration or casting marks as an indication that a crack is developing. Excellent lighting is mandatory, as may be an inspection mirror or magnifying glass. Many cracks may first appear to be a casting mark, so suspect features in the cylinder itself should not be dismissed as nothing to worry

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about; this refers to the manufacturer's Service Bulletin No. 1785 dated November 1977, Ultrasonic and Visual Inspection of Cylinder-head (Appendix A), or FAA Airworthiness Directive 78-08-07.

A compression test is another way to check and verify a cylinder's integrity. Tests should be in adherence to the R-985/manufacturer-specific and general operating instructions. A typical test pumps pressurized shop air into the cylinder and measures the extent to which the air leaks out. Some leakage is normal, but if the cylinder is only able to hold, say, the minimum pressure, further investigation is mandatory. Maintenance personnel may hear the air leaking past the valves. If it is not, it is either leaking past the piston rings and pressurizing the engine crankcase or it is getting out through a crack.

3.0 CONCLUSIONS

3.1 Findings

a. The pilot was qualified on the Allied Grumman Ag-Cat, G-164A type of aircraft.
b. The pilot was trained and familiar with company procedures.
c. The pilot failed to use basic flight procedures like using the aircraft checklist.
d. The pilot has a valid license and medical certificate issued by the CAAP.
e. The pilot safely got out of the aircraft.
f. Visual meteorological condition prevailed at the time of the occurrence.
g. The aircraft was properly released for flight without any discrepancies noted on its logbook.
h. The aircraft has current Certificates of Airworthiness and Registration.
i. The aircraft 100hrs inspection was being performed by Aerowurkz Aerial Spraying Services, Approved Maintenance Organization.

3.2 Probable Cause

3.2.1 Primary Cause Factor

a. The failure of engine cylinder #4 resulting to loss of engine power. (Material Failure).

3.2.2 Contributory Cause Factors

a. Low compression, fatigue crack between the spark-plug port and intake/exhaust port.
b. Non-inclusion in the pre- and post-flight visual inspection of the cylinder head cooling fins for discoloration or casting marks as an indication that a crack is developing.

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4.0 SAFETY RECOMMENDATIONS

4.1 Following the completion of the safety investigation, the **Aircraft Accident Investigation and Inquiry Board** proposes the following safety recommendation to the **CAAP-FSIS**:

4.1.1 To ensure that the operator includes in their schedule maintenance inspection manual the thorough inspection of aircraft piston-engine cylinders and the condition of its components (R-985 AN14B engine).

4.1.2 To ensure that the operator strictly adheres to Service Bulletin No. 1785 dated November 1977, ultrasonic and visual inspection of the cylinder head.

----**END----**

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