



**FINAL INVESTIGATION REPORT ON  
INCIDENT TO  
M/s. NFTI DIAMOND DA-42 AIRCRAFT, VT-NFT  
ON 05.12.2021 AT GONDIA**

**GOVERNMENT OF INDIA  
O/o, DIRECTOR AIR SAFETY, WESTERN REGION,  
NEW INTEGRATED OPERATIONAL OFFICE COMPLEX,  
SAHAR ROAD, VILE PARLE (EAST), MUMBAI-400099**

## **OBJECTIVE**

This investigation is conducted in accordance with the provisions of Aircraft (Investigation of Accidents and Incidents) Rules, 2017 of India.

The sole objective of this investigation is the prevention of accidents and incidents and not to apportion blame or liability.

## **FOREWARD**

This document has been prepared based upon the evidence collected during the investigation, opinions obtained from the experts, and laboratory examination of various components. Consequently, the use of this report for any purpose other than for the prevention of accidents or incidents could lead to erroneous interpretations.

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## **ABBREVIATIONS**

A/c	Aircraft
Aircraft	Incident aircraft
AME	Aircraft Maintenance Engineer
AMM	Aircraft Maintenance Manual
ARC	Airworthiness Review Certificate
ATC	Air Traffic Control
CAS	Calibrated Air Speed
CSI	Cycles Since Inspection
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DGCA	Director General of Civil Aviation, India
DME	Distance Measuring Equipment
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration, United States of America
FDR	Flight Data Recorder
FO	Co-Pilot/ First Officer
FRTO	Flight Radio Telephone Operator
GDA	Gondia VOR Identifier
IR	Instrument Rating
IST	Indian Standard Time
LH	Left Hand
Operator	FTO holding approval

PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
QNH	Pressure setting to indicate elevation
RADAR	Radio Detection and Ranging
RH	Right Hand
ROD	Rate of Descent
Tower	ATC Tower
TSI	Time Since Inspection
TSN	Time Since New
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VOR	Very high frequency Omni Range

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**M/s. NFTI DIAMOND DA-42 AIRCRAFT, VT-NFT**  
**ON 05.12.2021 AT GONDIA**

1.	<b>Aircraft Type</b>	Diamond DA-42
2.	<b>Nationality</b>	Indian
3.	<b>Registration</b>	VT-NFT
4.	<b>Owner</b>	CAE Oxford Aviation Academy Pheonic Inc., USA
5.	<b>Operator</b>	National Flying Training Institute Pvt. Ltd.
6.	<b>Pilot In- Command</b>	Flight Instructor's Rating holder
7.	<b>Co-Pilot</b>	Student Pilot License holder
8.	<b>Extent of Injuries</b>	Nil
9.	<b>Date and Time of Incident</b>	05/12/2021, 0840 UTC approx.
10.	<b>Place of Incident</b>	Gondia Local Flying Area
11.	<b>Geographical location of site of Occurrence (Lat. Long.)</b>	18°13'42.73"N, 74°35'3.15"E
12.	<b>Last point of Departure</b>	Birsi Airport, Gondia
13.	<b>Intended Place of Landing</b>	Birsi Airport, Gondia
14.	<b>No. of Personnel On-Board</b>	02
15.	<b>Type of Operation</b>	Training Flight
16.	<b>Phase of Operation</b>	Cruise
17.	<b>Type of Incident</b>	Propellor related event

**All timings in this report are in UTC.**



## **SYNOPSIS**

On 05th December 2021, M/s NFTI multi-engine Diamond DA-42 aircraft, Reg. VT-NFT, was authorized for abnormal & emergency exercise training. During this training exercise, one engine would be secured and restarted by the instructor. Thereafter, the same would be practiced on the other engine by the student pilot. After carrying out the pre-flight briefing and inspection, the aircraft took off from RWY 04 of Gondia airport at 0815 UTC and was cleared by the ATC to climb to 6000 ft. At approx. 0830 UTC, the instructor demonstrated the securing of the LH Engine and feathered the propeller. Thereafter, the propeller was unfeathered using the LH unfeathering accumulator, and the LH engine was restarted successfully. After this demonstration, the instructor advised the student pilot to carry out the same exercise on the RH engine. The student pilot secured the RH engine, however, the propeller failed to unfeather. Consequently, the RH engine could not be restarted. Although the instructor tried to restart the engine by increasing the speed of the aircraft with a nose down maneuver and cranking, the RH engine could not be restarted. The instructor decided to carry out a single-engine landing. The aircraft landed back uneventfully at 0855 UTC at Birsi Airport, Gondia. There was no injury to the crew and no damage was sustained by the aircraft.

The incident was investigated by Investigator In-Charge and the Member, appointed by DGCA, India vide letter No. DGCA-15018(19)/9/2021-DAS dated 17/12/2021 in the exercise of power under Rule 13(1) of the aircraft (Investigation of accidents and incidents) Rules 2017.

The cause of the incident is attributed to the failure of the RH unfeathering accumulator.

## **1. FACTUAL INFORMATION**

### **1.1 History of the Flight**

On 05.12.2021, M/s NFTI Diamond DA-42 aircraft VT-NFT was cleared by the AME after carrying out the daily inspection schedule, during which no abnormalities were observed. Prior to the incident sortie, the aircraft was utilized for five circuit and landing pattern sorties carried out by the same instructor and another student pilot. The sorties were uneventful and no defects were recorded.

The aircraft was then allotted to another student pilot and the same instructor for abnormal and emergency exercise training, authorized by the Dy.CFI. This sortie intended to impart knowledge to the student pilot about engine in-flight shutdown and restart in cruise through a demonstration that included identifying the dead engine, troubleshooting, feathering, unfeathering, and restart of the engine. During this simulation, while at cruise, the instructor would secure and restart one engine to demonstrate the above and then the student pilot would practice the same on another engine.

After the briefing for the sortie, the pre-flight inspection of the aircraft was carried out by the student pilot. The engine's start was successful and all the checklists till taxi were performed satisfactorily. Before take-off checklist was carried out by the crew including the feathering check wherein the propeller levers are pulled back and then advanced to high, keeping RPM drop not to exceed 300 rpm. This was found to be satisfactory.

The aircraft took off from RWY 04 at 0815 UTC and was cleared by ATC, Gondia to climb to 6000 ft. The instructor was verbally instructing the student pilot on how to identify failed engine and troubleshoot. At approx. 0830 UTC, the instructor demonstrated the procedure of securing and restart of LH engine. The exercise was demonstrated without any abnormality. Thereafter, the instructor advised the student pilot to practice the exercise on the RH engine. The student pilot secured the RH engine successfully. As the student pilot tried to unfeather the RH propeller to restart, the propeller pitch angle did not change from coarse pitch (feathered state) to fine pitch. The instructor took over the controls and carried out a nose down maneuver to increase the speed and tried to crank start the engines. However, the engine did not restart. The abnormality was informed to the ATC and the crew decided to return.

The crew requested for a priority landing and the same was permitted by the ATC . The ATC informed the ARFF on standby to hold at holding point RWY 04 at TWY B. The aircraft came over RWY 04 at 5000ft and then descended to 2000ft, which is the circuit altitude. The crew made a right-hand circuit for RWY 04 and landed safely at approx. 0855 UTC.

After touchdown, the instructor advised the student pilot to cut-off the LH engine to avoid excess rudder pressure. After coming to halt, the instructor re-started the LH engine and RH engine. The RH engine started roughly with the propellers being on coarse pitch and thereafter, engine started functioning smoothly, propellers returning to fine pitch. The aircraft taxied to apron on its own power.

## **1.2 Injuries to Persons**

<b>Injuries</b>	<b>Crew</b>	<b>Passengers</b>	<b>Others</b>
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor	Nil	Nil	Nil
None	02	Nil	Nil

## **1.3 Damage to Aircraft**

There was no damage to the aircraft.

#### 1.4 Other Damage

NIL

#### 1.5 Personnel Information

Details		Instructor (PIC)	Student pilot
License		CPL	SPL
Date of Initial Issue		18 OCT 2016	11 DEC 2019
Valid up to		17 OCT 2026	10 DEC 2024
Category		Aeroplane	Aeroplane
FRTTO License valid upto		17 OCT 2026	17 AUG 2030
Total flying experience		3654 hrs	187:50 hrs
Experience	SE	3121 hrs	185 hrs
	ME	533 hrs	2.8 hrs
Experience as PIC	SE	2971.5 hrs	105.2 hrs
	ME	519.4 hrs	NIL
Total flying experience during last 365 days		862.9 hrs	187.8 hrs
Total flying experience during last 180 days		401.4 hrs	98.9 hrs
Total flying experience during last 30 Days		81.9 hrs	23.8 hrs
Total flying experience during last 07 Days		27 hrs	2.8 hrs
Total flying experience during last 24 hrs		6.3 hrs	1.8 hrs

The student pilot had completed his 185 hrs of flying training on single-engine aircraft Diamond DA-40. He had started his training on multi-engine and had accumulated 2.8 hrs of flying training as on date of incident. The FTFR records of the student pilot reveal his performance to be ‘Good’ or ‘Satisfactory’ for most of his sorties.

#### 1.6 Aircraft Information

##### 1.6.1 Airframe

The Diamond DA-42 aircraft is a twin-engine, low-wing cantilever monoplane, commonly used as a general aviation aircraft for touring and training purposes.

The Aircraft VT-NFT (MSN:42 AC068) was manufactured in year 2007. The aircraft was transferred from M/s CAE Oxford Aviation Academy Phoenix, USA and was registered with DGCA in the name of M/s National Flying Training Institute Pvt Ltd. The aircraft had already accumulated 8152:30 airframe hours when it was registered with DGCA. The aircraft is registered under Category ‘A’ and issued Certificate of Registration No. 5226 on 07.08.2020.

The Certificate of Airworthiness Number 7329 under ‘Normal’ category with subdivision “Passenger” was issued by DGCA on 07.01.2021. The specified minimum operating crew is “one” and the maximum all up weight is 1785Kgs. ARC was issued on the same day and is valid till 06.01.2022.

The aircraft and its engines were being maintained as per the maintenance program, approved by DGCA, consisting of Calendar Period/ Flying Hours based maintenance.

Prior to the incident sortie, the aircraft had logged a total of 8495:55 airframe hours. The last major inspection was 100 hrs/06 months carried out on 21.09.2021. The oil upliftment register maintained by the operator indicates satisfactory oil consumption by this aircraft.

As per the approved weight schedule, the Empty weight of the aircraft is 1259.922 Kg. The maximum usable fuel quantity is 208.224 Kg. The maximum payload with fuel tanks full is 116.374 Kg. Empty weight CG is 2.401 meters aft of datum.

The load sheet of the incident sortie was calculated correctly and the C.G was within limits.

All the concerned Airworthiness Directive, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine were complied with as on date of incident.

### 1.6.2 Powerplant

The aircraft is equipped with Lycoming IO-360 M1A engine on LH side and Lycoming LIO-360M1A engine on the RH side. The engines can produce 180 HP outpower at a maximum continuous rotation speed of 2700 rpm.

The engines were pre-installed when the aircraft ownership was transferred to NFTI from M/s CAE Oxford Aviation Academy Pheonix, USA. At the time of transferring the aircraft, the left engine and right engine had already accumulated a time of 1149:30 hrs since new. As on 05.12.2021, the left engine and right engine had logged 1492:55 Hrs since new.

As per the approved AMP, the engines have an overhauling interval of 2000 hrs. Therefore, both left and right engines were never subjected to an overhaul.

	LH Engine	RH Engine
Make	Lycoming	Lycoming
Model	IO-360 MIA	LIO-360 MIA
Part No.	RENPL-RT10051	RENPL-RT10591
Serial No.	RL-3685-51E	RL-1130-67E

The last inspection carried out on both engines was during 50 hrs/03-month inspection on 18.11.2021. No abnormalities were observed.

### 1.6.3 Propeller

The aircraft is fitted with 02 no.s of three-bladed MT variable pitch and feathering propeller manufactured by MT-Propellers. The blades of the MT propellers are made from wood and covered with GFRP. The propellers are subjected to overhaul every 1800 hrs.

Propeller Make	LH Engine	RH Engine
	MT Propeller	MT Propeller
Model	MTV-12	MTV-12
Part No.	MTV-12-B-C-F/CF183-59b	MTV-12-B-C-F/CFL183-59b
Serial No.	100190	120409
TSO	176:15 hrs	40:55 Hrs

No observation w.r.t. the RH propeller pitch change behavior or deviation in engine/propeller RPM were recorded in the logbook

#### 1.6.3.1 Propeller Governor

The governor controls the propeller pitch hydraulically wherein the engine oil flows through internal oil galleries to the governor. The governor has a geared oil pump that increases the oil pressure and directs the oil to the propeller as necessary to control the propeller pitch.

The pilot moves the propeller pitch control lever fully aft and through a small gate to set the propeller to the feather position. The propeller governor allows all the oil in the propeller to flow back to the engine and the counterweights will cause the propeller blades to move to the feather position.

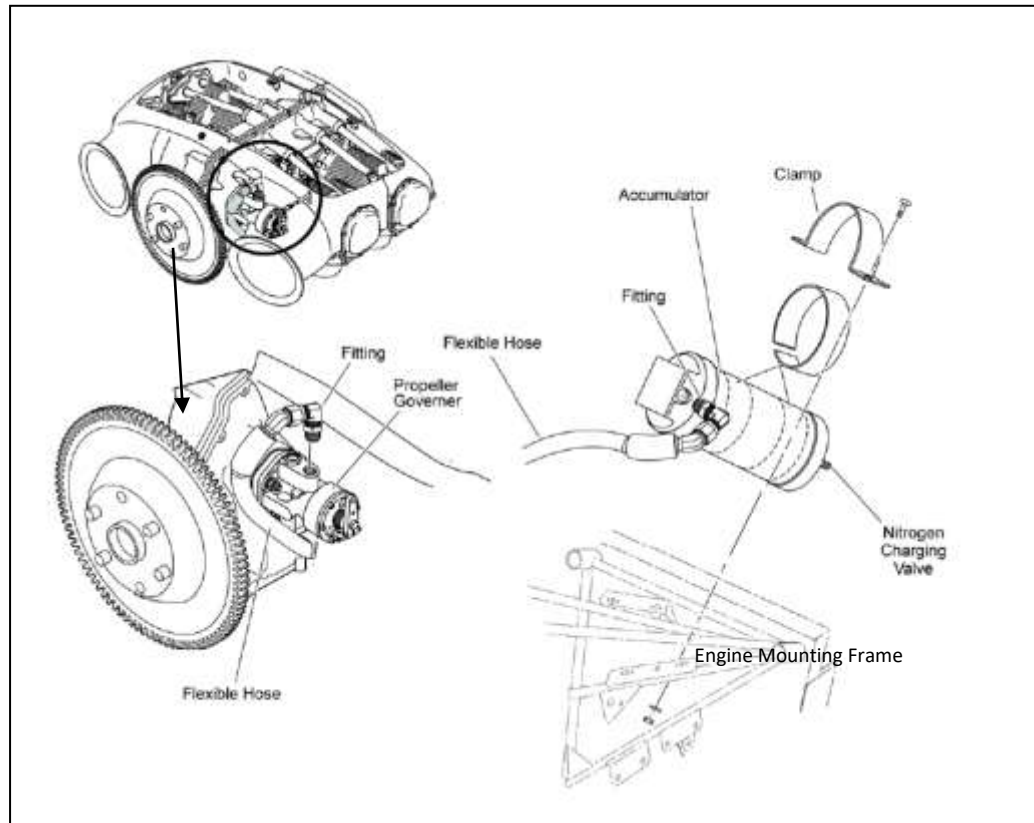


Fig. 1: Position of Propeller Governor and Unfeathering Accumulator

During normal operation high pressure oil also flows from the propeller governor to the unfeathering accumulator. The un-feathering accumulator can be used to un-feather the propeller when the engine is not operating.

The propeller governor has a TBO of 2400 hrs/06 years. Prior to the occurrence, the RH propeller governor had accumulated 1492:55 hrs TBO. There had not been any snag/defect reported afterwards.

### 1.6.3.2 Unfeathering Accumulator

MT Hydraulic unfeathering accumulator (P/N: P-893-2) is connected to the governor of the propeller. A hydraulic accumulator has been attached to each governor which enables unfeathering without running the engine. The accumulator is used to unfeather a feathered propeller during in flight engine restart.

The governor is modified to provide an external high-pressure oil outlet through a check valve, as well as a device for unseating the check valve.

The external outlet is connected to an accumulator. One side of the accumulator is filled with compressed nitrogen and the other side with oil. This allows the oil to be stored under high pressure, as it is during normal flight.

When the propeller is feathered, a microswitch operated by the propeller control lever closes the two-position electrical magnetic valve and maintains oil pressure in the accumulator. When the propeller control is moved from feather to low pitch, the check valve is unseated, permitting the high-pressure oil in the accumulator to flow to the governor pilot valve allowing the oil to flow to the propeller and move the blades to fine pitch.

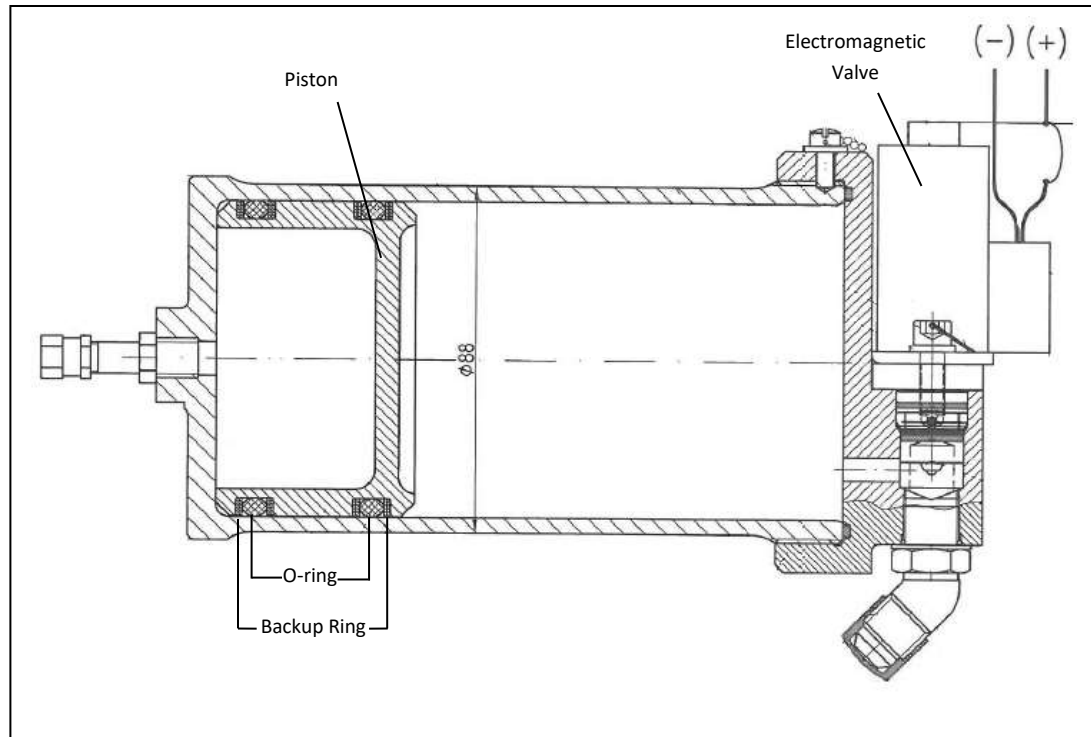


Fig. 2: Unfeathering Accumulator (sectional-diagram)

The unfeathering accumulator is on the air side charged with 125 +/- 5 psi using compressed air or nitrogen.

The RH unfeathering accumulator was fitted in DA-42 aircraft VT-NFM on 21.09.2009. The TBO of the unfeathering accumulator was increased from 2000hrs/6yrs to 2400hrs/6yrs vide MT-Propeller Service Bulletin 1R3 dated 06.07.2018. The accumulator was subjected to regular overhaul as recommended by the OEM. The last overhaul was completed on 10.01.2020 wherein all the dimensions of the accumulator parts were found to be within limits and no abnormalities were found. The accumulator was fitted on aircraft VT-NFT on 17.10.2020.

The details of the unfeathering accumulators are as follows:

Make	RH Propeller
	MT Propeller
Part No.	P-893-2
Serial No.	09A102
TSN	4704:50 Hrs
TSO	343:25 Hrs

The air pressure check of the unfeathering accumulators is carried out during the 100hrs/06 monthly and above inspections. Prior to the incident the air pressure of RH accumulator was checked during the 100hrs inspection on 20.09.2021 and was found to be within limits. Subsequent to this, the abnormal emergency exercise utilizing the unfeathering accumulator was carried out five times, including the incident sortie. Prior to the incident, the RH unfeathering accumulator was utilized previously on 03.12.2021 while carrying out the same exercise by another set of crew and no abnormality was reported for the sortie.

During troubleshooting after the incident, the RH Accumulator pressure was checked and it was found to be 93 psi. The ground run up was carried out and after reducing the engine rpm to idle; the propeller was set to feather mode followed by unfeathering. The RH propeller failed to unfeather while the LH propeller was feathering satisfactorily. This exercise was carried out 03 times and for all three times, RH propeller failed to unfeather.

Thereafter, the RH unfeathering accumulator was charged with 125 psi and the ground run was carried out. The feathering and unfeathering operation was checked on ground and found satisfactory. No further troubleshooting was recommended by the OEM.

## **1.7 Meteorological Information**

The visibility is quantified by the sighting of various obstacles (such as towers, overhead tanks, etc). A portable weather instrument is stationed at ATC for obtaining the wind parameters, temperature & dew point, humidity, and QNH.

The CFI/ Dy. CFI declares the operations to be fit as he/she finds the clouds to be in VMC conditions. At 0845 UTC, the visibility reported was 5000m, the wind was calm and the temperate was 29°C. The weather was not a factor in this incident.



## 1.8 Aids to Navigation

Gondia airport is equipped with VOR, DME and NDB. All Nav-aids were working properly on date of incident. The Nav-aids are maintained by the Airports Authority of India.

## 1.9 Communication

The Communication frequencies available at Gondia are 122.175 MHz (TWR), 118.35 MHz (APP), and 135.35 MHz (Ground). Hotlines with Mumbai and Nagpur are available at the ATC. There was always a two-way communication between the ATC and the aircraft.

## 1.10 Aerodrome Information

M/s NFTI operates from Birsir Airport, Gondia which is spread across approx. 513 hectares.

The airfield is located in the eastern part of the state of Maharashtra and as on the date of occurrence, the airfield was uncontrolled.

Air Traffic Services were being provided by NFTI, whereas airside infrastructure, Communication & Navigation aids, and ARFF were being maintained by AAI. The elevation of the airport is 301 m (AMSL). The runway is 2290 m in length and 45 m in breadth. The orientation of the runway is 04/22. The details are as follows:

<u>Runway</u>	<u>Dimension</u>	<u>Type</u>	<u>PCN</u>	<u>Elevation</u>
04/22(044°/224°)	7513 feet x 150 feet (2290 m X 45 m)	Tarmac	86/F/A/W/T	987 ft

The airspace around Gondia airport is uncontrolled (Class G) with effect from 20 January 2020. An airspace of 5 NM and 1000 ft AGL has been allotted to Gondia for circuit and training flying. FIC and ADC are not required to operate in this airspace.

Due to the minimum airspace, an area of 25 NM till 8000 ft AMSL is considered as Local Flying Area of Gondia. FIC/ ADC and prior coordination with Nagpur & Mumbai is mandatory to operate in this area

## 1.11 Flight Recorders

The aircraft was not equipped with DFDR or CVR recorder, which is not mandatory as per CAR Section 2 Series I Part V.

## 1.12 Wreckage and impact information

Nil.

### **1.13 Medical and pathological information**

Prior to operating their first sortie of the day, the instructor had undergone BA test and was found negative while the student pilot had submitted a declaration that he had not consumed any alcohol in the past 12 hours i.a.w. with the then DGCA order in force.

**1.14 Fire** There was no fire before or after the incident.

**1.15 Survival Aspects** No human injuries were reported in the incident. The incident was survivable.

### **1.16 Tests and research**

#### **1.16.1 Tear-down inspection of the component by MT Propeller**

The involved unfeathering accumulator was sent to the manufacturer M/s MT Propellers for strip analysis. The following was submitted by the MT propeller:

- The seat of the accumulator was found damaged.
- The cylinder was found with heavy deep scratches possibly caused by very dirty oil inside.

M/s MT propeller concluded that the leak was caused by deep scratches inside the cylinder. Also, the accumulator lost oil pressure through the seat of the control valve.

#### **1.16.2 SOAP analysis of the engine oil**

Based on the observation by MT Propellers on their report regarding the possibility of dirty/viscous oil being a cause of scratches inside the cylinder, the engine oil (approx. 1L) drained from both the engines, prior to the troubleshooting, was sent to an accredited agency for SOAP (Spectrometric Oil Analysis Program) Analysis using ASTM D5185-2018 test method.

The analysis report revealed the composition of different metal constituents in mg/kg. The engine manufacturer M/s Lycoming was approached with the results. As per Lycoming all the properties were normal and within limits.

#### **1.16.3 Functional Test of Component**

The involved unfeathering accumulator was subjected to a functional test as per the overhauling manual at the certified overhauling facility and the following observations were made.

- No external leakage was observed through the air side.
- No signs of external leakage were observed on the oil side.
- To check for the movement of the piston, air pressure was applied to the air charge valve and the displacement of piston to the oil side was confirmed.

Thereafter, the air was released from the air side and was charged on to oil side and the smooth displacement of the piston to the air side was observed.

- No leakage was observed on the Electric Magnetic Valve.

### 1.17 Organizational and Management Information

National Flying Training Institute (NFTI) is a joint venture between CAE Inc. and Airport Authority of India (AAI) and was established in 2007. Academy provides ab-initio training to pilots. It operates from AAI's Gondia airport located at Birsi Village in Gondia, Maharashtra.

The organization is structured under the management of Accountable Manager. The Engineering setup of NFTI is under the approval system of the DGCA and is an Approved Maintenance Organization in CAR-M Subpart 'F' and an approved CAMO under Subpart 'G' to cover maintenance and continuing airworthiness activities of aircraft, engines, instruments, radio communication, navigation equipment and battery installed on the aircraft operated by the institute.

### 1.18 Additional Information

**Instructor Submission:** As per the instructor this was the second sortie of the day for him. Prior to the incident sortie, he had carried out five circuits and landing exercises with another student pilot on the same aircraft and no abnormalities were observed with the aircraft. In the incident sortie, the instructor briefed the crew on identifying the failed engine, securing it, and then engine restart. The same was demonstrated to the student pilot on the LH engine satisfactorily. Subsequently, the student pilot practiced the same on the RH engine. The RH engine was secured but the propellers did not unfeather. He tried to restart the engine by cranking but it failed. Hence, a single-engine landing was carried out. After landing, the RH engine was restarted and started successfully.

**Student pilot Submission:** As per the statement of the student pilot, he was doing the training exercise for single engine failure (securing and restarting). After the instructor successfully demonstrated the exercise on the LH engine, the student pilot secured the RH engine. However, when he tried to unfeather the propeller to restart the engine, it did not unfeather. The controls were then taken over by the instructor.

#### 1.18.1 Engine Securing (Feathering) Procedure

The engine feathering procedure as stated in the AFM is as follows:

- (a) Maintain lateral & directional control.
- (b) MIXTURE control levers..... full forward
- (c) PROPELLER RPM levers ..... full forward
- (d) THROTTLE levers..... full forward
- (e) LANDING GEAR & FLAPS ..... UP
- (f) Inoperative engine..... identify and verify

Shut down and feathering of the affected engine:

- (g) Operative engine ..... Apply maximum power or  
power as required to keep safe  
flight

Securing the feathered engine:

- (h) THROTTLE lever..... affected engine IDLE  
(i) PROPELLER RPM lever..... affected engine - FEATHER  
(j) MIXTURE control lever ..... affected engine - IDLE cut-off  
(k) Ignition switch (magneto) ..... affected engine - OFF  
(l) ALTERNATOR..... affected engine - OFF  
(m) FUEL PUMP..... inoperative engine - OFF  
(n) FUEL SELECTOR..... inoperative engine - OFF  
(o) THROTTLE control lever on dead engine..... up enough to silence the gear horn.

As per the instructor and the student pilot, the feathering procedure for the RH engine was carried out as per the stipulated procedure.

### 1.18.2 Unfeathering & Restarting the Engine In Flight

As per the AFM, Restarting the engine is possible at all airspeeds above a safe flying airspeed up to VNE (194 KIAS) and up to the maximum demonstrated operating altitude. The procedure is as follows:

(a) Preparation:

- (1) Airspeed..... 90 KIAS minimum  
(2) FUEL SELECTORS..... ON  
(3) FUEL PUMP ..... check ON  
(4) THROTTLE lever ..... set (3-4 cm forward of IDLE)  
(5) ALTERNATE AIR ..... as required

(b) Unfeathering the engine:

- (1) PROPELLER RPM Lever ..... Fully forward

(c) Starting the windmilling engine:

- (1) MIXTURE control lever ..... Rich  
(2) Ignition switch ..... BOTH  
(3) ALTERNATOR ..... ON

(d) If the engine does not windmill:

- (1) Ignition switch ..... START, until propeller windmills

(e) If the engine does not start:

- (1) MIXTURE control lever ..... IDLE cut-off  
(2) MIXTURE control lever ..... advance forward slowly until  
the engine starts.

### 1.19 Useful or Effective Investigation Techniques

Nil

## **2. ANALYSIS**

### **2.1 Operational review of the sortie**

Both the student pilot and the instructor were valid on their appropriate license, ratings, and medical as on date of the incident. They were fit to undergo the sortie. The instructor had already carried out normal circuits and landing sortie with another student pilot on the incident aircraft while this was the first sortie of the day for the student pilot. The sortie had been authorized by the Dy. CFI. Pre-flight inspections were done by the student pilot and no abnormalities were found. The load and trim was correctly calculated.

Prior to operating the sortie, the instructor briefed the student pilot regarding the emergency exercise to be carried out. The feathering check was done by the student pilot as a part of the before take-off checklist and was satisfactory.

The flight instructor and student pilot, in-flight, the instructor had demonstrated the procedure for securing and restarting of LH engine successfully. Thereafter, as advised by the instructor, the student pilot secured the RH engine successfully. As the student pilot tried to unfeather the RH propeller, the propeller pitch was stuck in feathered position. The instructor took over and tried to unfeather the propeller, however, it did not unfeather.

The sortie was called-off and decided to return to the airfield. The communication between ATC and the aircraft was appropriate. After the touchdown, as per the advice of the instructor, the student pilot had cut-off the left engine to reduce the rudder pressure, which is also appropriate to the situation.

After coming to halt, the crew tried to start both engines one after the other. The RH engine got started and subsequently, RH propeller got unfeathered. Thereafter, the aircraft taxied to the apron on its own power.

The crew actions were not the contributory factor to the incident.

### **2.2 Aircraft**

#### **2.2.1. Airworthiness of the aircraft**

The aircraft had a valid Certificate of Airworthiness and the ARC had been valid as on the date of the incident. As per the records, the aircraft had been maintained in accordance with the Approved Maintenance Program.

The aircraft had accumulated 8152:30 hrs when it was registered with DGCA. Prior to the incident flight, the aircraft had logged a total of 8495:55 airframe hours.

The engines were installed with the aircraft when it was transferred to NFTI while both LH and RH engines had accumulated 1149:30 hrs TSN. As on the day of incident, both the engines had logged 1492:55 Hrs since new. As per the AMP the engines have an overhauling interval of 2000 hrs and therefore, both engines were never subjected to an overhaul.

The aircraft and its engines were being maintained as per the maintenance program, approved by DGCA. All the concerned AD, mandatory SBs, and DGCA mandatory modifications on this aircraft and its engine were complied with as on date of the incident. The last major inspection was 100 hrs/06 months completed on 21.09.2021. The last scheduled inspection was 50 hrs/03-month inspection which was completed on 18.11.2021. No defects were observed during any of the inspections. CRS was issued thereafter.

Prior to the operation of the first sortie of the day, the AME had carried out the daily inspection, and no abnormalities were observed. The aircraft was then allocated for a dual circuit and landing wherein 06 C/L were carried out without any abnormality.

Therefore, the aircraft was airworthy as on the date of the incident.

#### **2.2.2. Propeller Governor**

As per the records, both the propeller governor had been maintained i.a.w. the AMP. The RH governor had accumulated 1492:55 hrs after the last overhaul. The engine, oil, and fuel parameters which were recorded during the ground run after the last 100 hr and 50 hr inspections were found to be satisfactory. All parameters were found normal during the flight by the crew. Also, the parameters were found within the normal range during the troubleshooting. No other observation w.r.t. the RH propeller pitch change behavior or deviation in engine/propeller RPM were recorded in the logbook. Hence, it may be inferred that the RH propeller governor was working normally and had not contributed to the incident.

#### **2.2.3. Unfeathering Accumulator**

The RH unfeathering accumulator was installed on another DA-42 aircraft on 21.09.2009. The TBO of the unfeathering accumulator was increased from 2000hrs/6yrs to 2400hrs/6yrs vide MT-Propeller Service Bulletin 1R3 dated 06.07.2018. The accumulator was subjected to regular overhaul as recommended by the OEM. The accumulator was fitted onto aircraft VT-NFT on 17.10.2020 after overhaul on 10.01.2020.

No abnormalities were observed during the overhaul. As on the date of the incident, the RH hydraulic accumulator had accumulated 343:25 hrs TSO.

Therefore, it may be inferred that, post-overhaul, the accumulator was airworthy for further operation.

The scheduled inspection, which was made i.a.w. the AMM time limits, the accumulator's nitrogen pressure has to be checked during 100hrs/06 months inspections and higher. The same was last checked during the 100 hrs inspection on 21.09.2021 and a pressure of 125 psi has been documented for the RH accumulator. Post 100 hrs inspection and prior the incident, the aircraft was utilized to carry out the abnormal emergency exercise on four occasions wherein the unfeathering accumulator was used successfully.

During troubleshooting after the incident, the RH accumulator pressure was checked and it was found to be 93 psi indicating a loss of approx. 32 psi of pressure. Subsequently, the unfeathering operation of both the propeller was carried out more than three times, however, the RH propeller again failed to unfeather until it was pressurized to 125 psi.

#### **2.2.3.1. Component Investigation**

The RH accumulator investigation reports from the OEM indicates deep scratches inside the cylinder and damage to the seat of the control valve.

The oil was drained, the oil filter was changed and the oil was renewed during the last 50 hrs inspection on 18.11.2021. Thereafter, the aircraft had only operated for approx 39:20 hrs till the time of occurrence. The oil consumption rate of the engines was also found to be satisfactory. Also, as per Lycoming, the results of the SOAP analysis of oil doesn't specify anything alarming. Further, the engine and the governor had been working satisfactorily. Thus, the possibility of dirt in the oil or the source of foreign particles could not be explained.

The functional test confirmed that there had not been any leakage from either of the sides.

Also, the movement of the piston to both sides, with the application of pressure, confirms that the internal displacement of the piston would not be a contributory cause to the occurrence.

The cause of damage to the seat of the control valve of the accumulator, which had just accumulated 343:25 hrs since overhaul, could not be identified. Nevertheless, no leakage was found through the control valve during the functional test and the test had performed satisfactorily. Hence it can be concluded that there had not been any leak through the control valve.

During normal operation, the electromagnetic valve would be open allowing the continuous flow of oil into the accumulator. A microswitch operated by the propeller control lever closes the electromagnetic valve when the lever is moved past the feather stop and the oil is trapped in the accumulator with a pressure of approx. 320 psi. When sufficient air pressure is available at the airside, while the propeller lever is moved forward, the switch opens and the electromagnetic valve allows the oil to flow to the propeller moving the blades to fine pitch. The air side may get gradually filled with the oil from the oil side deep scratches inside the cylinder.

Also, a gradual air pressure loss from the air side to the oil side would occur, through the deep scratches, during the unfeathering operation and when the oil pressure had not been maintained, i.e., during a static phase, when the engine is not running.

Hence, the only possible cause for the reduced air pressure at the air side would be owing to the gradual internal leak of air to the oil side through the deep scratches inside the cylinder during the several unfeathering operations of the unfeathering accumulator.

### **3. CONCLUSION**

#### **3.1 Findings**

- 3.1.1. The Airworthiness Review Certificate of the aircraft was valid and the aircraft was maintained in accordance with the approved maintenance program.
- 3.1.2. The aircraft was airworthy before the release for incident sortie.
- 3.1.3. The aircraft had carried out normal circuits and landing sorties before the operation of the incident sortie.
- 3.1.4. Both the instructor and the student pilot had a valid license to fly the aircraft and their medical was also valid at the time of the incident.
- 3.1.5. The feather check done, as part of taxi checks, was satisfactory.
- 3.1.6. All parameters were found normal during the flight by the crew.
- 3.1.7. The student pilot was briefed adequately about the emergency exercise by the instructor prior to and during the operation of the sortie.
- 3.1.8. The instructor demonstrated the complete procedure for securing and restarting of LH engine without any abnormality
- 3.1.9. The student pilot had successfully secured the RH engine and the propellers were in feathered condition.
- 3.1.10. When the student pilot tried to unfeather the RH propeller to restart the engine, it did not unfeather. The instructor had also tried to unfeather the RH propeller, however, the propeller remained in the feathered state.



- 3.1.11. The instructor tried cranking the engine by making a nose dive increasing the speed. However, the RH engine could not be restarted.
- 3.1.12. There had not been a history of defect regarding the RH propeller pitch change behavior and deviation in engine/propeller RPM.
- 3.1.13. The last overhaul was carried out on 10.01.2020 by the approved agency as per the OEM schedule. No abnormalities were observed during the overhaul and all the dimensions of the accumulator were found to be within limits. The component had TSO of 343:25 hrs as on the incident day.
- 3.1.14. The air pressure of both the LH & RH accumulators were last checked during the last 100 hrs inspection carried out on 21.09.2021 and is documented to be 125 psi. Subsequent to this, the RH unfeathering accumulator was used on four occasions prior to the incident and the unfeathering operation was found satisfactory.
- 3.1.15. The accumulator had lost approx. 32 psi of pressure as on the date of troubleshooting.
- 3.1.16. The concentration of elements in the oil, as per the SOAP analysis, was within limits.
- 3.1.17. During the functional test, neither the air side nor the oil side was observed with any kind of leak. There had not been any leak of oil through the control valve.
- 3.1.18. The accumulator was in service for approx. 13 years and had accumulated 4704:50 hrs since new.

### **3.2 Probable Causes**

The probable cause of the incident is attributed to the gradual loss of air pressure to the oil side through the deep scratches inside the cylinder of the unfeathering accumulator, which prevented the RH propeller from unfeathering.

## **4. SAFETY RECOMMENDATIONS**

Nil

(Vaishnav Vijayakumar)  
Air Safety Officer  
Member

(Ancy Anto)  
Assistant Director Air Safety  
Investigator In-charge/VT-NFT

Date: 06.09.2023

Place: Mumbai