بسم الله الرحمن الرحيم

ACCIDENT INVESTIGATION COORDINATING COMMITTEE

AIRCRAFT SERIOUS INCIDENT REPORT 2020/02

FINAL REPORT ON INVESTIGATION OF THE SERIOUS INCIDENT INVOLVING CESSNA 172 RG AIRCRAFT, 8Q-GAD, OPERATED BY ASIAN AVIATION ACADEMY AT GAN INTERNATIONAL AIRPORT, MALDIVES, ON 04 JANUARY 2020

INTRODUCTION:

Maldives is a signatory to the Convention on International Civil Aviation (Chicago, 1944) which established the principles and arrangements for the safe and orderly development of international air transport. Article 26 of the Convention obligates Signatories to investigate accidents to civil aircraft occurring in their State.

This report is based upon the investigation carried out by the Accident Investigation Coordinating Committee (AICC) in accordance with Annex 13 to the Convention, the Civil Aviation Act 2/2001 and the Civil Aviation Regulations. The sole objective of this investigation is to prevent accidents and serious incidents. It is not the purpose of this investigation to apportion blame or liability as envisaged in Annex 13 to the Convention.

The AICC was assisted by Maldives Civil Aviation Authority (MCAA), Asian Academy of Aeronautics Pvt Ltd (AAA) and Textron Aviation.

All timings in this report are in local time unless otherwise stated. Time difference between local and UTC is +5 hours.

The report is released on 28 April 2021.

ACCIDENT INVESTIGATION COORDINATING COMMITTEE
MALDIVES

Mr. Abdul Razzak Idris

Chairperson

Accident Investigation Coordinating Committee

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List of Abbreviations:

AAA	Asian Academy of Aeronautics Pvt. Ltd.
AIA	Addu International Airport Pvt. Ltd.
AICC	Accident Investigation Coordinating Committee
ATC	Air Traffic Controller
ATO	Approved Training Organisation
CPCP	Corrosion Prevention Control Procedure
CPL	Commercial Pilot License
DME	Distance Measuring Equipment
EASA	European Union Aviation Safety Agency
FAA	Federal Aviation Administration (USA)
FSTD	Flight Simulation Training Device
GAN	ICAO designated three letter code for Gan International Airport
GIA	Gan International Airport
GoM	Government of Maldives
lbs.	Pounds
MACL	Maldives Airports Company Limited
MCAA	Maldives Civil Aviation Authority
MCAR	Maldives Civil Aviation Regulations
MLG	Main Landing Gear
N/A	Not Applicable
NLG	Nose Landing Gear
RAF	Royal Air Force (United Kingdom)
STO	State Trading Organisation Limited
TAT	Total Air Time
UTC	Universal Time Co-ordinated
VHF	Very High Frequency
VRMG	IATA designated four letter code for Gan International Airport

SYNOPSIS:

On 04 January 2020, a Cessna 172RG aircraft, registration 8Q-GAD owned and operated by Asian Academy of Aeronautics (AAA), met with a serious incident during landing at Gan International Airport (VRMG) at approximately 15:21 hrs. The aircraft was returning to land after completion of the second training flight of the day, with two crew onboard, one being the instructor pilot and the other a student pilot, pursuing a training course at AAA.

On approach, the instructor pilot reported a malfunctioning landing gear system; green light failed to illuminate after the landing gear selector lever was selected down which is an abnormal and unsafe condition. In an effort to verify the condition of the nose gear with the Air Traffic Controller (ATC), aircraft carried out several low fly passes. To ATC, all three landing gears appeared down but their locked condition could not be ascertained.

With all efforts exhausted, the crew decided to land with all precautionary measures taken. On landing and as soon at the nose landing gear touched the runway it collapsed (Figure 1, para 5.5). Aircraft came to a halt with the propeller striking the runway. The crew evacuated the aircraft without any injuries.

To clear the aircraft from the runway, the nose of the aircraft was lifted and the nose landing gear doors were manually opened. The collapsed nose landing gear was then manually forced into the locking position. This action enabled the aircraft to be finally pushed to the hangar for further investigation.

The serious incident was notified to the AICC at 1542 hours, on the same day. Investigation began on 6 January 2020 with two Investigators arriving in Gan.

1. FACTUAL INFORMATION:

Aircraft Owner:	Asian Academy of Aeronautics
Registered owner:	Asian Academy of Aeronautics
Operator:	Asian Academy of Aeronautics (ATO Certificate No: 001, Initial issue 25 July 2010 and last renewed on 01 Jan 2018)
Aircraft Type:	Cessna 172 RG
Nationality:	8Q (Republic of Maldives)
Registration:	8Q-GAD
Aircraft Manufacturer:	Cessna Aircraft Corporation
Manufacturer's Serial No.:	172RG0293
Place of Incident:	Gan International Airport (VRMG) Latitude: 0° 41' 36'' S Longitude: 73° 9' 20'' E
Date and Time:	04 January 2020 at 15:21 hours

1.1 History of Flight:

1.1.1 Background:

The aircraft, registration 8Q-GAD was scheduled to operate a total of 04 training flights on the day. The first flight on this aircraft was done by another pair, an Instructor pilot and a trainee, which lasted for 1 hour 2 minutes. The affected flight was the second flight of the day on the aircraft. The aircraft departed from VRMG with an instructor and a student pilot, and the incident occurred during landing. The Instructor pilot reported to duty at 12 noon and completed a training flight with another student on aircraft 8Q-GAA. This was the introductory flight to the type of aircraft Cessna 172RG, and the first flight of the day for the student pilot involved. According to the load sheet completed, the aircraft had a total of 336 lbs of fuel on board. Take-off mass of the aircraft was 2380.5 lbs.

The crew carried out the pre-flight and walk-around checks prior to the flight. No abnormalities were recorded or reported by the pilots during or after the checks accomplished. The company usually schedules a series of training flights back to back on the aircraft and issues a combined "flight release" for all such flights on a given day. The instructor was seated on the right seat while the student pilot was seated on the left.

After few training circuits, on approach to land, the instructor pilot reported a malfunctioning landing gear system; green light failed to illuminate after the landing gear selector lever was selected down which is an abnormal and unsafe condition. In an effort to verify the condition of the nose gear with the Air Traffic Controller (ATC), aircraft carried out several low fly passes. To ATC, all three landing gears appeared down but their locked condition could not be ascertained.

After having exhausted all their efforts to confirm positive extension of the landing gears with ATC, the instructor pilot landed the aircraft. On landing however, the nose landing gear collapsed (Appendix, Figure 1, para 5.5). Aircraft came to a halt with the propeller striking the runway. The crew evacuated the aircraft without any injuries.

The debriefing comment in the "CPL PREP" Assessment criteria sheets states that as part of the training, the effects of landing gear was demonstrated and practiced one time; and manual gear extension was demonstrated to student and practiced one time.

1.1.2 Aircraft:

Cessna Aircraft Model 172RG, Manufacturer's Serial Number 172RG0293 was built in 1980 and as of incident date it had accrued a TAT of 9,140.53 hours.

1.1.3 Flight crew:

The instructor had flown Cessna 172 RG aircraft for over 62 hours prior to the incident. The instructor reported for duty at AAA Gan, as scheduled at 12 noon and conducted one training flight with a different student, on another aircraft, before this flight. The student pilot had accumulated a total of over 174 hrs. flying.

1.2 Injury to persons:

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	0	0	0	NIL
Serious	0	0	0	NIL
Minor	0	0	0	NIL
None	2	0	2	NIL
Total	**2**	**0**	**2**	**NIL**

1.3 Damage to aircraft:

During the investigation carried out, the following components were found damaged;

- Propeller assembly
- NLG door assemblies
- Engine exhaust pipe stack

No other obvious damages were observed.

1.3.1 Damages to the landing gear:

No obvious damages were identified during the post-incident investigations carried out on the landing gears although the nose landing gear actuator assembly is the prime suspect which led to this incident.

During the multiple retraction and extension checks carried out, with the aim of duplicating the failure on NLG down and lock condition, the NLG was found to be operating normally within the Service Manual prescribed limits. Each time the function check was carried out the NLG down and locked condition indicator light (green) illuminated in the cockpit. The checks accomplished did not confirm that the landing gear system, including the landing gear actuator assembly was defective. Thus, the incident is deduced to be the result of an intermittent defect occurred on the landing gear system.

1.3.2 Damages to the engines and propellers:

Propeller is found badly damaged; blades bent, twisted and chafed, as seen in the images in the Appendix 5.7 of this report.

While no physical damages can be observed on the exterior of the powerplant, it may have sustained damage.

1.3.3 Other damage:

There were no damages to any other property or objects.

1.4 Personnel information:

1.4.1 Instructor;

Age:	33 yrs.
License:	CPL-A (valid till 29 April 2025)
Aircraft Ratings:	Nil
Last proficiency check:	25 April 2019
Last instrument rating renewal:	25 April 2019
Last line check:	N/A
Last medical:	Class I – valid till 8 Aug 2020
Flying experience	
Total all types:	1611.1 hours
On Type:	65.8 hrs.
Last 90 days:	22.6 hrs.
Last 28 days:	22.6 hrs.
Last 24 hours:	3.0 hrs.

1.4.2 Trainee

Age:	28 yrs.
License:	N/A
Aircraft Ratings:	N/A
Last proficiency check:	N/A
Last instrument rating renewal:	N/A
Last line check:	N/A
Last medical:	Class I – Issued 22 Dec 2019

Flying experience

Total:	172.4 hrs.
Last 90 days:	1.1 hrs.
Last 28 days:	1.1 hrs.
Last 24 hrs.:	1.1 hrs.

1.4.3 Cabin Crew

None

1.5 Aircraft Information:

1.5.1 General information;

Cessna Model 172RG aircraft is a high-wing monoplane of all-metal semi-monocoque construction. It is equipped with fully retractable tricycle landing gear consisting of tubular spring-steel main gear struts and a steerable nose gear. The steerable nose gear is equipped with an air/hydraulic fluid shock strut. The aircraft is configured to seat four people including the crew. Aircraft is powered by a four-cylinder, horizontally-opposed air-cooled Lycoming engine which drives an all-metal constant-speed McCauley two-bladed propeller. This model 172RG features rear side windows, a "wrap-around" rear window and a swept-back fin and rudder.

Manufacturer:	Textron Aviation (previously Cessna Aircraft Company)
Registration:	8Q-GAD
Manufacturer's Serial Number (MSN):	172RG0293
Year of construction:	1980
Total Air Time at time of incident:	9,140.53 hours
Certificate of Airworthiness:	Perpetual, issued on 14 March, 2011 by MCAA
Airworthiness Review Certificate:	Last issued on 25 October 2019. It expires on 24 October 2020

Last periodic inspection	(100 hourly) carried out on 27 December, 2019
Last inspection carried out at TAT	50,533.17 hrs.

The aircraft is incorporated with a modification; installing a red indicator light replacing the UP indicator (amber) light which cautions the pilots of GEAR UNSAFE condition. The GEAR UNSAFE (red) light is ON anytime the gear is in transit (retract cycle), or whenever system pressure drops below 1000 psi with the safety (squat) switch closed.

During a normal cycle, landing gear extended and locked can be detected by illumination of the DOWN indicator (green) light.

AAA could not demonstrate the basis (approved data) for installation of the red light. This could only be carried under a Service Letter or Service Bulletin published by the manufacturer or a Change Bulletin developed and approved by an approved design organization endorsed by MCAA.

1.5.2 Engines and Propellers:

Aircraft is installed with a four-cylinder, horizontally-opposed air-cooled Lycoming Engine which drives an all-metal constant-speed McCauley two-bladed propeller.

Engine (single)	
Manufacturer:	1 x Lycoming O-360-F1A6 piston engines (4 cylinders)
Year of manufacture:	UNKNOWN
Serial Number:	L-17181-36A
Last Maintenance check carried out:	100 Hrs Check
Total hrs. since overhaul:	To be inserted before release of report
Propeller (Single)	
Manufacturer:	McCauley
Model:	B2D34C220-B
Serial number:	951448

1.5.3 Cabin Layout and Configuration:

The aircraft is fitted with a total of four seats to accommodate both crew and passengers. The aircraft has two large doors which can be served as exits. It also has a small lockable cargo holder, normally kept locked on the left hand-side of the fuselage.

1.5.4 Recent maintenance:

The last scheduled Maintenance Check (100 hourly) carried out on 27 December 2019 was complied with at Total Air Time (TAT): 9,118.41 hours.

The Maintenance Checks are split into:

- Preflight - complied with before every flight by pilots
- Daily Inspection - complied with prior to the first flight of the day
- 50 hourly Check - complied with at intervals not exceeding 50 hours
- 100 hourly Check - complied with at intervals not exceeding 100 hours
- Annual Check - complied with annually (100 hourly check items)
- CPCP - complied with, every year

The Checks are part of the Light Aircraft Maintenance Program – Aeroplanes reference MP/C 172/01 approved by MCAA, dated 01 January 2016. The aircraft had no outstanding deferred defects at the time of incident or any defects reported on the day of the incident occurrence.

1.5.5 Flight Controls

The flight controls consist of conventional, manually actuated primary flight controls operated through cables, pulleys, and mechanical linkages. Rudder and elevator trim are manually controlled and mechanically actuated; aileron trim is electrically actuated. Secondary flight controls consist of electrically operated wing flaps.

1.5.6 Fuel

According to the load sheet completed, the aircraft had 336 lbs. of fuel when it departed on the intended training flight: VRMG-VRMG.

Aviation gasoline AVGAS 100LL, stored by the company was used for this aircraft as well as all the other aircraft in the operator's fleet.

Fuel from the same stock was used on all other aircraft refuelled on the day of the incident and there were no issues reported. Hence, the possibility of any fuel contamination is ruled out.

1.5.7 Accessories

None

1.5.8 Defects

At the time of the incident, the aircraft had no open defects as per the information available with AAA.

1.5.9 Aircraft load

Load Limitations:

Take-Off Weight and Moment	2380.5 lbs; 92.38 inches
Zero Fuel Mass	2052.5 lbs; 76.98 inches

The above figures plotted on Center of Gravity Moment Envelope graph, the CG of the aircraft remained within limits.

The aircraft was last weighed on 11 September 2018. The basic empty weight calculated is 1711.5 lbs. while the Centre of gravity remained at 37.98" from the datum.

The Instructor pilot prepares the load sheet and leaves a copy on the ground prior to departure.

1.6 Meteorological information:

The information prescribed below was gathered from ATC at Gan International Airport.

METAR VRMG 041000Z 04003KT 9999 -SHRA SCT017 FEW018CB 30.6/24.8 Q1008.8 CB N,SSE,OVHD TEMPO 5000 -SHRA=

1.7 Aids to navigation:

The aircraft was operating under the visual flight rules. Navigation was not a factor in this incident.

1.8 Communications:

The aircraft was equipped with one VHF radio set which was serviceable at the time of departure. Communication between the crew and the ATC was normal all throughout. Communication was not a factor in the incident.

1.9 Aerodrome information

GAN (VRMG) is an international airport with day and night landing facilities.

Reference 0° 41' 36" N 73° 9' 20" E

Gan Airport is now owned and managed by AIA - a company owned by GoM, MACL and STO. The GIA is an airport with a 3600-meter asphalt runway with fire category CAT 7, and is open for international traffic. AAA flying school along with AAA's maintenance facility is housed in GIA since 2010.

1.10 Flight Recorders

None required.

1.11 Wreckage and impact information:

1.11.1 Accident site visit

AICC investigators visited the incident site to investigate into the cause of the serious incident.

1.11.2 Salvage operations:

To remove the aircraft from runway, the nose of the aircraft was lifted manually after which the nose wheel well doors ~~was~~ were forced open and the nose gear forced down and locked. The aircraft was then pushed to the hangar.

1.11.3 Medical and pathological information

None

1.12 Fire

None

1.13 Survival Aspects

Instructor and trainee pilot evacuated themselves immediately after the incident. Normal exits of the aircraft were used for evacuation.

No survival equipment was used. The only survival equipment available on board was life jackets

1.14 Tests and research

The defect connected with nose landing gear collapse could not be duplicated on ground by repeated cycling of the landing gear systems. Since the suspected part was the nose landing gear actuator assembly, part number 1280514-9, this part required removal and thorough testing in an overhaul shop to establish the root cause.

1.15 Organizational and Management Information:

Asian Academy of Aeronautics Pvt Ltd (AAA) is a MCAA approved training organization holding Approved Training Organisation (ATO) Certificate No 001. AAA provide training courses including the use of Flight Simulation Training Device (FSTD) to trainee pilots with a fleet of 13 aircraft (including the affected aircraft) comprising of Cessna 150, 152, 172, Piper PA34. The company holds Continuing Airworthiness Management Organisation Approval MV.MG.004 for managing the maintenance, and MCAR M, Subpart F, approval MV.MF.001 for carrying out maintenance on the aircraft on its register.

Regular inspections and periodical flight checks were conducted on the operation and crew by the MCAA to verify compliance and competency.

Annual audits with random spot checks and regular Airworthiness Review Inspections were found being carried out by the MCAA.

1.16 Additional Information:

AICC investigation team assessed the evidences available on site. Instructor and Trainee Pilots, ATC plus key eyewitnesses were interviewed by the investigators.

1.17 Useful or Effective Investigation Techniques

N/A

1.18 Tests and Research:

1.18.1 Landing gear function check:

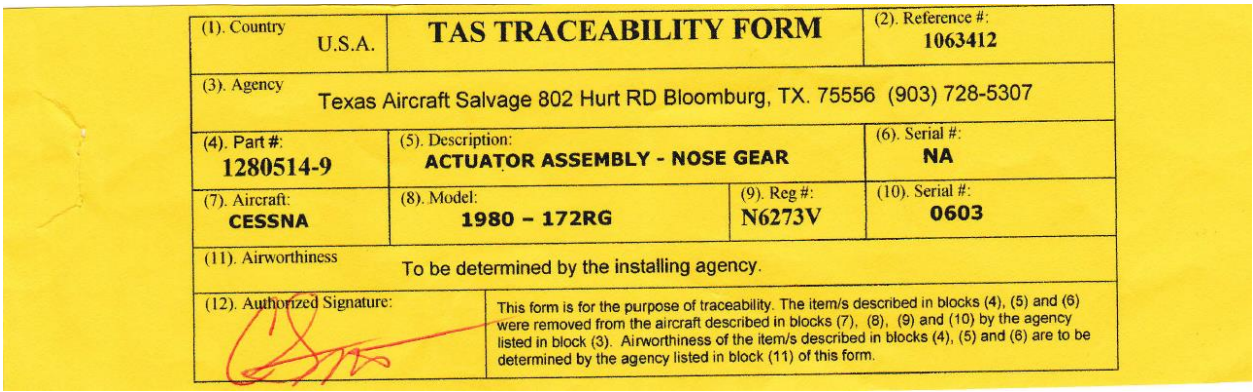
The tasks listed below were accomplished on the incident-stricken aircraft, parked in the hangar located at GIA with an aim of identifying the root cause of the nose landing failure.

- Visual inspection of the damaged areas/components, and for any hydraulic leaks etc.;
- removed the nose landing gear doors to facilitate landing gears retraction and extensions;
- removed nose landing gear doors i.a.w Cessna 172RG, Service Manual, Section 5-122;
- jacked up the aircraft i.a.w Service Manual, Section 2-4 and verified satisfactory operation of the landing gear indication system indication lights, retraction and extension of the landing gears, flap actuated (20 degree) warning horn and operation of the emergency hand pump.

Landing gear function check was carried out to duplicate the defect affecting NLG collapse occurred, and hence establish the root cause of the serious incident. However, no conclusive results could be drawn from the repeated functional checks performed on the landing gear system.

1.18.2 Review of Maintenance Records:

Review of the records confirm that the nose gear actuator assembly installed was received with TAS TRACEABILITY FORM, reference 1063412, issued by Texas Aircraft Salvage 802 Hurt RD Bloomburg, TX 75556 (903) 728-5307. The document identifies 0603 as the serial number of the aircraft to which it was last installed. Serial number of the installed unit stamped (4-digit number) is known to be 1059 . Field 11 of the Traceability Form states (in field 11) that Airworthiness status “to be determined by the installing agency”, which can be confirmed by the screen-print copied below.



(1). Country U.S.A.	**TAS TRACEABILITY FORM**		(2). Reference #: 1063412
(3). Agency	Texas Aircraft Salvage 802 Hurt RD Bloomburg, TX. 75556 (903) 728-5307		
(4). Part #: 1280514-9	(5). Description: ACTUATOR ASSEMBLY - NOSE GEAR		(6). Serial #: NA
(7). Aircraft: CESSNA	(8). Model: 1980 – 172RG	(9). Reg #: N6273V	(10). Serial #: 0603
(11). Airworthiness	To be determined by the installing agency.		
(12). Authorized Signature:	This form is for the purpose of traceability. The item/s described in blocks (4), (5) and (6) were removed from the aircraft described in blocks (7), (8), (9) and (10) by the agency listed in block (3). Airworthiness of the item/s described in blocks (4), (5) and (6) are to be determined by the agency listed in block (11) of this form.		

In spite of the statement made in the TAS Traceability Form received with the unit, AAA was unable to confirm determination of the Airworthiness status prior to installation of the actuator assembly on the aircraft.

Survey of past maintenance records show a number of defects relating to the landing gear system recorded. Details of the defects and rectification actions taken by AAA are summarized in the table below:

Date	ATL page #	Defect	Rectification Action
6 June 2017	514	Alternator & Landing gear fuse came out while deploying	Checked on ground. Alternator and landing gear syst. Failure not observed. Request flight test to check landing gear and DME failure
7 June 2017	515	Alternator & Landing gear fuse came out twice	Found power pack motor damaged. Replaced with new P/N 9881128, serial # 1104. Replaced nose wheel tyre Part Number 070-312-0, s/n 4191500203
21 Aug 2017	545	Gear pump circuit breaker popped out. Used manual extension	Performed service on fluid level on power pack. Aircraft landing gear check on jacks. No failure observed. Aircraft ready to service
10 Oct 2017	567	Ldg Gear circuit breaker popped out	Replaced landing gear breaker. Hyd level checked and re filled
13 Oct 2017	568	Landing Gear circuit breaker popping out and discharging	All electrical connection cleaned and secured. Checked ok
21 Oct 2017	575	Landing Gear not lock in up position	refilled hydraulic tank

17 May 2018	674	Right landing gear does not retract completely	Installed new MLG actuator part # 9882015-2 serial # 16068. Performed flight test. Satisfactory
16 July 2018	707	Gear up not working	Replaced relay part # UN10110. Checked. Found working properly

Physical survey carried out confirm that AAA had installed an indication light (red) in the cockpit of the aircraft on the aircraft to indicate a 'gear unsafe indication light (red)' condition. While its intent is sincere, AAA could not demonstrate approval of the modification by MCAA and hence it is construed as an unapproved modification.

2. ANALYSIS:

Being unable to establish the root cause of NLG failure from successive function checks performed on the landing extension and retraction system and the fact that regulatory non-compliances were observed from the records reviewed, the NLG actuator assembly was removed and shipped to Textron Aviation for analysis.

Test carried out by Textron as received confirm that the actuator rod seal leaks intermittently depending on sideloading and hydraulic pressure applied. It was also confirmed that, although the actuator extends while applying side loading at the rod cylinder interface, significant side play also existed.

Visual checks performed after disassembly of the NLG actuator assembly confirm wear and scratches and scoring in the Bearing End bore (PN 1280600-5) and, scratches and wear in the area near the rod end although the seal and backup ring was intact and did not show visually obvious defects.

Further, the dimensions of the Bearing End (PN 1280600-5) and Piston (PN 1280241-2) taken revealed that the Bearing End bore presented significant wear with the surface finish and dimensions beyond limits. The Piston rod presented significant wear with the dimensions and surface finish beyond limits too. (See Appendix 5.6, Examination Report by Textron Aviation attached).

3. CONCLUSION:

3.1 Findings:

1. The NLG actuator assembly installed on the aircraft was not airworthy at the time of installation;
2. Intermittent leakages observed from the actuator rod seal;
3. Wear and scratches in the Bearing End bore PN 1280600-5 and in the area near the rod end;
4. Bearing End bore has significant wear beyond limits;
5. Unapproved modification embodied on the aircraft.

3.2 Causes:

The incident was caused by the failure of the Nose Landing Gear actuator assembly installed on the aircraft. The NLG actuator assembly was procured as a unit requiring determination of its serviceability prior to installation on the aircraft. As such, it is determined that the NLG actuator assembly was not airworthy at the time it was installed on this aircraft.

4. SAFETY RECOMMENDATIONS:

1. The operator to:
   a) Establish additional procedures to ensure all components installed on aircraft are fully serviceable and in compliance with the applicable MCARs, Company Policy and Procedures, as approved by MCAA;
   b) Ensure that no modifications are embodied on the aircraft unless the modifications are duly approved by the MCAA;
2. MCAA to:
   a) Establish procedures to ensure that only airworthy components/parts are installed on the aircraft;
   b) Ensure all modifications embodied on the aircraft are in compliance with applicable MCARs, Company Policies and Procedures.

5. APPENDICES:

5.1 Load Sheet

DATE	4/01/2020
SERIAL NO.	12/5526
A/C REG.	8Q GAD
STUDENT	MARCOW
INSTRUCTOR	HARIS

172RG

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb. -ins. /1000)	Weight (lbs.)	Moment (lb. -ins. /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil)	1624	61.6	1711.5	64.48
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (62 Gal. Maximum)			336	15.8
Reduced Fuel (44 Gal.)	264	12.7	-	
3. Pilot and Front Passenger (Station 34 to 46)	340	12.6	341	12.5
4. Rear Passengers	340	24.8		
5. * Baggage Area 1 (Station 82 to 108 - 200 Lbs. Max.)	90	8.6		
6. * Baggage Area 2 (Station 108 to 124 - 50 Lbs. Max.)				
7. RAMP WEIGHT AND MOMENT	2658	120.3	2388.5	92.78
8. Fuel allowance for engine start, taxi and runup	-8	-.4		
9. TAKEOFF WEIGHT AND MOMENT (Subtract Step 4 from Step 7)	2650	119.9	2380.5	92.38
10. Locate this point (2650 at 119.9) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable.		ZFM	2052.5	76.98

* The maximum allowable combined weight capacity for baggage Areas 1 and 2 is 200 lbs.

Figure 6-5. Sample Loading Problem

5.2 Techlog Sheet for affected flight

A/C Type	A/c Reg.No	AIRCRAFT TECHNICAL LOG SHEET Asian Academy of Aeronautics (Pvt) Ltd. Gan International Airport, Republic of Maldives	DATE	Tech Log Serial No.
CESSNA 172 RG	8Q-GAD		04/01/2020	992

I certify that I have inspected this Aircraft in accordance with approved Daily Inspection Schedule	CAM Signature	Lic No	66.0675
Pre Flight Iinspection carried out (Signature of Pilots)			

S #	FROM	TO	FLIGHT TIME T/O	FLIGHT TIME LAND	FLIGHT TIME TOTAL	FUEL (Gal) UP LIFT	FUEL (Gal) TOTAL	OIL (qts) UP LIFT	OIL (qts) TOTAL	CAPTAIN'S NAME	LIC NO	SIGN	LDGS	HOBBS TIME 1114.7
1	VRMG	VRMG	1210	1312	0102	-30-	211	-0.5-	7qts	BALA	910		1/L	14.7 - 15.9 = 1.2
2	VRMG	VRMG	1430	1526	0101					WARIS	936		1/L	15.9 - 17.0 = 1.1
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
				TOTAL	02.03								2/L	2.3 = 2:18

TOTAL AIRCRAFT TIME & LEGS STATE	Total Time	T/L
BRING FWD	9138.35	
THIS PAGE	2.18	9/L
CARRY FWD	9140.53	
CERTIFICATE OF RELEASE TO SERVICE		
SERIAL NUMBER	AD010/19	
TOTAL A/C TIME		
ISSUED TIME	DATE	
CERTIFICATE OFMAINTENACE REVIEW		
LAST SCHEDULE CHECK SERVICE		
Description	100H	
Done at	9118.41	
NEXT SCHEDULE CHECK SERVICE		
Description	50H	
Due at	9168.41	
Remaining	30.06	

No.	DEFECT (State if Nil)	Rectification
1	- NIL	
2	NOSEWHEEL COLLAPSED WHILE LANDIG	
3		
4		
5		
6		
7		
8		
9		
10		
11		
DIFERRED LIST		— NIL —

NOTE

A new sheet must be started for each days flying as well as defect has been recorded and rectified

Distribution of Tech Log Sheet	
White	Stay in Log Book
Pink	Maintenance
Green	Flight Operation

	CRS CAM Signature	CAM Lic. No.	Dual Signature	Licence Number	DATE
Certifies that the work specified except as otherwise specified was carried out in accordance with MCAR-M and in respect to that work Aircraft in considered ready for Release to service					

5.3 ATO Certificate copy

بسم الله الرحمن الرحيم

MALDIVES CIVIL AVIATION AUTHORITY
REPUBLIC OF MALDIVES

ATO No: 001

APPROVED TRAINING ORGANISATION CERTIFICATE

Pursuant to Civil Aviation Regulation MCAR – AIRCREW, and subject to the conditions specified below, the Maldives Civil Aviation Authority hereby certifies,

ASIAN ACADEMY OF AERONAUTICS (PVT) LTD
AAA Hanger
Gan International Airport,
Addu Atoll
Republic of Maldives
Telephone: (960) 6898829 (960) 759 9149
Fax: (960) 689 8829
E-mail: info@aaa-fta.com, ceo.ht@aaa-fta.com

as a Part-ORA certified training organisation with the privilege to provide Part-FCL training courses, including the use of FSTDs, as listed in the attached training course approval.

CONDITIONS

This certificate is limited to the privileges and the scope of providing the training courses, including the use of FSTDs, as listed in the attached course approval.

This certificate is valid whilst the approved organisation remains in compliance with Part-ORA, Part-FCL and other applicable regulations.

Subject to compliance with the foregoing conditions, this certificate will remain valid to the expiry unless the certificate has been surrendered, superseded, limited, suspended or revoked.

Date of initial issue: 25th July 2010
Date of renewal: 1st January 2018

MALDIVES CIVIL AVIATION AUTHORITY · MALDIVES ·

Hussain Jaleel
CHIEF EXECUTIVE

5.4 AMO approval

بسم الله الرحمن الرحيم

MALDIVES CIVIL AVIATION AUTHORITY
REPUBLIC OF MALDIVES

Reference:
MV.MF.001

MAINTENANCE ORGANISATION APPROVAL CERTIFICATE

Pursuant to Civil Aviation Regulations for the time being in force and subject to the conditions specified below, the Civil Aviation Authority hereby certifies:

ASIAN ACADEMY OF AERONAUTICS PVT LTD
AAA HANGER AND OFFICE FACILITIES
GAN INTERNATIONAL AIRPORT
ADDU CITY
REPUBLIC OF MALDIVES

as a maintenance organisation in compliance with MCAR-M Section A Subpart F, approved to maintain the products, parts and appliances listed in the attached approval schedule and issue related certificates of release to service using the above references.

CONDITIONS

1. This approval in limited to that specified in the scope of approval section of the approved maintenance organisation manual as referred to in Section A of MCAR-M Subpart F, and
2. This approval requires compliance with the procedures with the procedures specified in the approved maintenance organisation manual, and
3. This approval is valid whilst the approved maintenance organisation remains in compliance with MCAR-M.
4. Subject to compliance with the foregoing conditions, this approval shall remain valid for an unlimited duration unless the approval has previously been surrendered, superseded, suspended or revoked.

Revision Number: 04
Date of this Revision: 03 October 2016
Date of Original Issue: 09 August 2012

Signed:
For the Civil Aviation Authority

CAA Form 3-MF, Issue 02, 1 November 2014

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MAINTENANCE ORGANISATION APPROVAL SCHEDULE

Reference: **MV.MF.001**

Organisation: **ASIAN ACADEMY OF AERONAUTICS PVT LTD**

CLASS	RATING		LIMITATION
AIRCRAFT	A2	Aeroplanes	Cessna 150 Series
			Cessna 172 Series
			Piper PA-34 Series
ENGINES	B2	Piston	Lycoming O-235 Series
			Lycoming O-320 Series
			Lycoming O-360 Series
			Rolls-Royce Continental O-240 Series
			Continental O-200 Series
			Teledyne Continental TSIO-360 Series
			Teledyne Continental LTSIO-360 Series
COMPONENTS OTHER THAN COMPLETE ENGINES OR APUs	C4	Doors — Hatches	All maintenance specified in the Scope of Work in the Company MOE
	C5	Electrical Power	
	C8	Flight Controls	
	C12	Hydraulic	
	C14	Landing Gear	
	C16	Propellers	
	C20	Structural	

This approval is limited to the products, parts and appliances and to the activities specified in the scope of work section of the approved maintenance organisation manual.

Maintenance Organisation Exposition Reference: MV.MOE.MF.001 at latest amendment

Revision Number: 04
Date of this Revision: 03 October 2016
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Signed:
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5.5 Photographs

The below photos show the damages to the aircraft caused due to the incident

Figure 1: Aircraft on runway

Figure 2: NLG wheel well

Figure 3: Bent Propeller

Figure 4: Manual System handle

Figure5: landing gear selector switch and gear position indicator lights

5.6 Examination Report issued by Textron Aviation

Beechcraft | Cessna | Hawker

TEXTRON AVIATION

Material & Process Engineering Report

Report Title: Examination of a NLG Actuator, p/n 1280514-9, SN 1059 from Model 172RG-0293, Tail No. 8Q-GAD.

Report No.: 20-359-123
Revision: -
ECR No.: 085435
Date: December 11, 2020

To: Jennifer Barclay
cc:
Prepared by: Dennis Scarberry
Checked by: -
Approved by: Bret Vogel
(See Electronic Signature Sheet)

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Subject Information

P/N:	1280514-9	**A/C Model:**	172RG
Part description:	NLG Actuator	**A/C Serial No.:**	0293
Part Serial Number:	1059	**A/C TT:**	9140.5
Part Model Number:	N/A	**Total Landings**	Unknown

Summary

Accident Investigation submitted a Nose Landing Gear Actuator to M&P for examination. The actuator assembly was removed from aircraft 172RG-0293, tail No. 8Q-GAD with 9140.53 flight hours. The actuator was installed on the subject aircraft that experienced a nose landing gear collapse. The purpose of this report was to examine the actuator for defects.

Upon completion of the examination the following conclusions were reached:

1. Intermittent significant leakage at the bearing end to rod interface was observed while hydraulically operating the actuator.
2. The bearing end bore was worn beyond manufacturing limits.

Results of Examination

The actuator was attached to a hydraulic hand pump containing MIL-H-5606 hydraulic fluid. Washers were added to the lock mechanism/rod end through bolt to simulate attachment to NLG (Figure 2). Several washers were also repositioned per the installation drawing to provide the correct lock mechanism spacing.
Prior to receiving the actuator at Textron Aviation the lock indication switch was removed, therefore it was not possible to evaluate electrical lock indication.
The actuator was initially pressurized to unlock the actuator. The lock mechanism disengaged; no anomalies were noted. The valve on the hand pump was selected to pressurize the actuator retract (gear extend) port. Initially, before a pressure buildup, a significant leak was observed at the actuator rod seal (Figure 3). Pumping was continued and the leakage stopped. The actuator was hydraulically retracted to the locked position, no anomalies were noted with the lock mechanism. The actuator was once again hydraulically extended. During the second retraction, alternating side load to the rod to actuator cylinder interface was applied. While manipulating the actuator, significant leakage was once again observed. The leakage was intermittent throughout the stroke, depending on sideloading and hydraulic pressure.
A test was performed to determine the integrity of the piston and cylinder. The actuator was hydraulically actuated to the fully retracted position and 1500 psi was applied. Significant piston seal leakage was not observed. During this test the rod seal that previously experienced significant leakage did not leak (Figure 4). The opposite was performed, pressure was applied to the extend port. The actuator bottomed in the cylinder in the extended position and 1500 psi applied, internal piston leakage was not observed.
With the actuator extended while applying side loading at the rod cylinder interface, significant side play was observed.
A disassembly was performed. Visual examination revealed wear and scratches in the Bearing End bore PN 1280600-5 (Figure 5). Visual examination of the rod revealed an area near the rod end with slight scoring, scratches and wear. The rod seal and backup ring was intact and did not show visually obvious defects.
Dimensions of the Bearing End PN 1280600-5 and Piston PN 1280241-2 were taken. The Bearing End bore presented significant wear with the surface finish and dimensions beyond limits (Figure 6). The Piston rod presented significant wear with the dimensions and surface finish beyond limits.

Conclusion

The actuator may experience significant external leakage during the retract actuation due to significant wear to the Bearing End bore and Piston rod beyond serviceable limits. The external leakage may be intermittent depending on multiple factors including extended position, side loading, and pressure. During the period when the leakage is present, it is significant enough that the actuator would be incapable of producing the designed retract force. If the leakage persisted it may deplete a significant amount of the reservoir fluid volume.

Figure 1 Overall View As Received

Figure 2 Washers Added to Simulate Gear Attachment

Figure 3 Piston Rod Leakage

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Figure 4 Piston Leakage Check

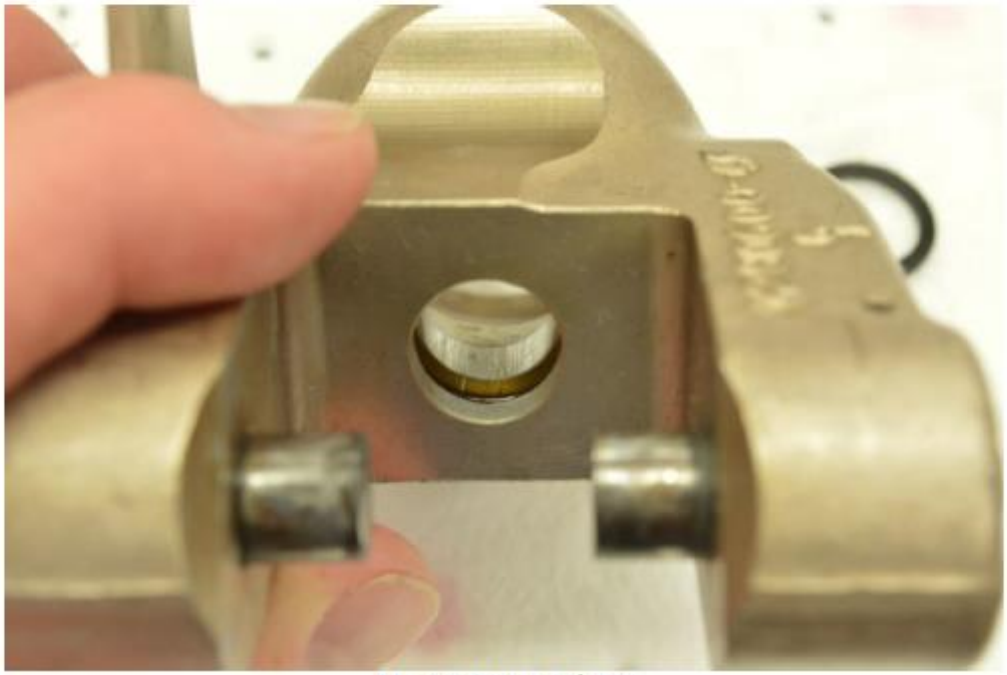

Figure 5 Bearing End Bore

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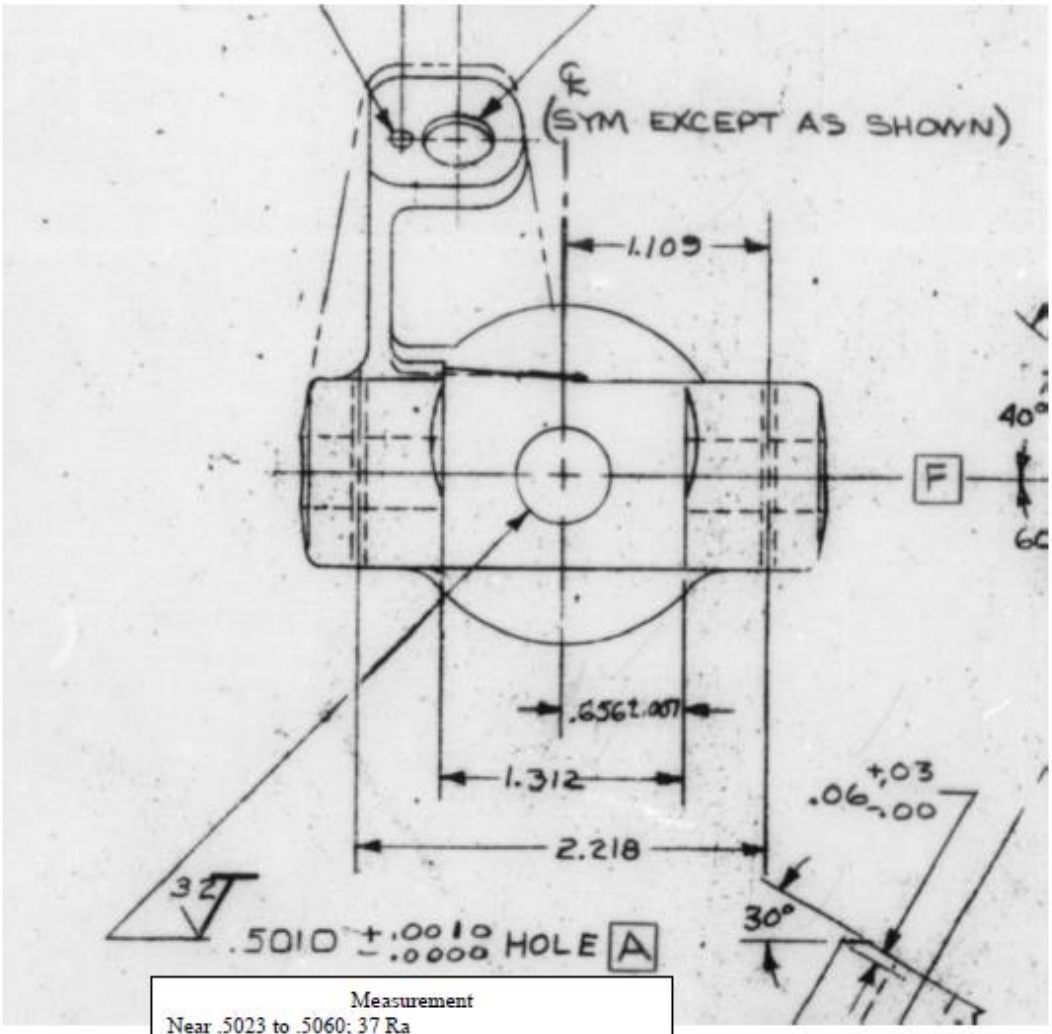

Measurement
Near .5023 to .5060; 37 Ra
Far .5023 to .5120; 113 Ra

Figure 6 Bearing End 1280600-5 Measurements