AIRCRAFT ACCIDENT

FINAL REPORT

A 03/20

Air Accident Investigation Bureau (AAIB)

Ministry of Transport Malaysia

Accident Involving Fixed Wing Aircraft Diamond Star DA 40D

Registration 9M-HMU

at Sultan Mahmud Airport, Kuala Terengganu, Terengganu

On 13 February 2020

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FINAL REPORT A 03/20

AIR ACCIDENT INVESTIGATION BUREAU (AAIB)
MALAYSIA

REPORT NO.: A 03/20

OPERATOR	**:**	**HALIM MAZMIN AEROSPACE**
AIRCRAFT TYPE	**:**	**DIAMOND STAR DA 40D**
NATIONALITY	**:**	**MALAYSIA**
REGISTRATION	**:**	**9M-HMU**
PLACE OF OCCURRENCE	**:**	**SULTAN MAHMUD AIRPORT** **KUALA TERENGGANU** **TERENGGANU**
DATE AND TIME	**:**	**13 FEBRUARY 2020 AT 1315 LT**

The sole objective of the investigation is the prevention of accidents and incidents. In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of this investigation to apportion blame or liability.

All-time in this report is Local Time (LT) unless stated otherwise. LT is UTC +8 hours.

INTRODUCTION

The Air Accident Investigation Bureau of Malaysia

The Air Accident Investigation Bureau (AAIB) is the air accident and serious incident investigation authority in Malaysia and is responsible to the Minister of Transport. Its mission is to promote aviation safety through the conduct of independent and objective investigations into air accidents and serious incidents.

The AAIB conducts the investigation in accordance with Annex 13 to the Chicago Convention and Civil Aviation Regulations of Malaysia 2016.

It is inappropriate that AAIB reports should be used to assign fault or blame or determine liability since neither the investigation nor the reporting process has been undertaken for that purpose.

In accordance with ICAO Annex 13 paragraph 4.1, notification of the accident was sent on 18 February 2020 to the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, the Civil Aviation Safety Investigation Authority Republic of Austria as the State of Design and Manufacture. A copy of the Preliminary Report was subsequently submitted to the State of Design and Manufacture and the Civil Aviation Authority of Malaysia (CAAM) on 13 March 2020.

In accordance with ICAO Annex 13 paragraph 6.3, a copy of the Draft Final Report was sent on 20Aug 2021 to the State of Registry/Occurrence, Operator, Design and Manufacture, inviting their significant and substantiated comments on the report.

Unless otherwise indicated, recommendations in this report are addressed to the investigating or regulatory authorities of the State having responsibility for the matters with which the recommendations are concerned. It is for those authorities to decide what action is taken.

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GLOSSARY OF ABBREVIATIONS

A	
AAIB	Air Accident Investigation Bureau, Malaysia
ATC	Air Traffic Controller
ATS	Air Traffic Services
C	
CAAM	Civil Aviation Authority of Malaysia
CPL	Commercial Pilot License
D	
DA 40D	Diamond Star Aircraft
E	
ECU	Electronic Control Unit
F	
FI	Flight Instructor
FOD	Foreign Object Debris
H	
HMA	Halim Mazmin Aerospace
I	
ICAO	International Civil Aviation Organisation
L	
LDA	Landing Distance Available
M	
MAHB	Malaysia Airport Holding Berhad
MOR	Mandatory Occurrence Report
N	
NLG	Nose Landing Gear
P	
PAPI	Precision Approach Path Indicator
R	
RT	Radio Telephony

S

SOP	Standard Operating Procedure
SP	Student Pilot
SPL	Student Pilot License
STRIDE	Science and Technology Research Institute of Defence

W

WRVR	Wind and Runway Visual Range

SYNOPSIS

An aircraft Diamond Star DA 40D registered as 9M-HMU making a third attempt to land at Sultan Mahmud Airport, Terengganu after the pilot, who is a student pilot (SP), had attempted two unsuccessful landings. By the third attempt on final Runway 04, with the wind at 080 degrees at 10 knots, a clearance to land was issued by the tower controller for 9M-HMU. On landing, the nose wheel collapsed and the propellers struck the runway surface on lowering the nose wheel. The aircraft skids for approximately 200 meters before it stops 600 meters from threshold Runway 04. SP escapes with no injuries. The propellers and nose wheel were severely damaged.

A Mandatory Occurrence Report (MOR) was submitted to the Civil Aviation Authority of Malaysia (CAAM) a copy to Air Accident Investigation Bureau, Malaysia (AAIB) on 13 February 2020.

1.0 FACTUAL INFORMATION

1.1 History of the flight

On 13 February 2020, the aircraft, Diamond DA 40D bearing registration 9M-HMU taxiing out from Halim Mazmin Aerospace (HMA) apron piloted by SP for a departure flying to training area around Batu Rakit. SP with call sign MAHA547 had been cleared by the Air Traffic Controller (ATC) to take-off from Runway 04 at Sultan Mahmud Airport, Kuala Terengganu for his first solo flight to the training area. The clearance issued was for the SP to maintain on runway heading and then climb to 2000 feet before making a left turn heading towards the training area. SP acknowledged the clearance, however on departure he turned left on passing 500 feet. This action is against the permission clearance given, leading to a separation breakdown with two other aircraft holding at 1000 and 1500 feet in the circuit area. The unauthorised manoeuvre executed by the SP is the standard departure for the training area where on reaching 500 feet, the pilot will turn left towards the training area Batu Rakit and climb to 1500 feet until the training area is established.

The ATC commented and transmitted his concern about the SP's action, which jeopardises safety. Traffic information was also given to two other aircraft which were holding in the circuit area as a precautionary action.

The SP of MAHA547 decided to shorten his training in the area and returned to the airport after completing only two exercises. The ATC cleared the aircraft to re-join for landing and was given clearance to land Runway 04. The pilot could not land the aircraft on the runway on his first attempt, where the aircraft bounced, and the pilot decided to go around. He made a second attempt to land but was still unable to put the aircraft down onto the runway. Another go-round was initiated, and SP flew the aircraft joining the circuit pattern for another attempt to land.

Clearance was given again by the tower controller for MAHA547 to land Runway 04 with the wind indicated blowing from 080 degrees at 10 knots. The aircraft finally touched down at approximately 400 feet from threshold Runway 04, with the nose wheel impacting hard on the runway and collapsed. The propellers strike the runway, and the aircraft veered to the right of the centreline. The aircraft stopped at

approximately 200 meters from the first impact point. The pilot escaped with no injuries.

1.2 Injuries to persons

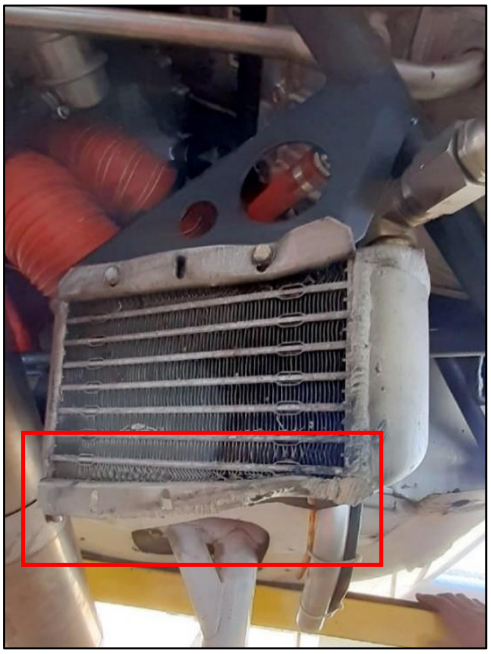
Injuries	Crew	Passenger	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor	Nil	Nil	Nil
None	1	Nil	Nil

1.3 Damage to aircraft

The aircraft sustained substantial damage. The propellers and the whole nose wheel structure were severely damaged by the impact sustained when the nose gear collapsed onto the runway during the third landing. The pictures below received from the damage assessment report made by the operator illustrate some of the damages suffered by the aircraft as a result of the accident.

Picture 1: Nose landing gear (NLG) strut badly scraped at the NLG leg pivot end due to contact with the runway during the landing roll.

Picture 2: All three propeller blades broke, and tips were missing.



Picture 3: Oil cooler scraped at the bottom part.

Picture 4: NLG strut fairings broken.

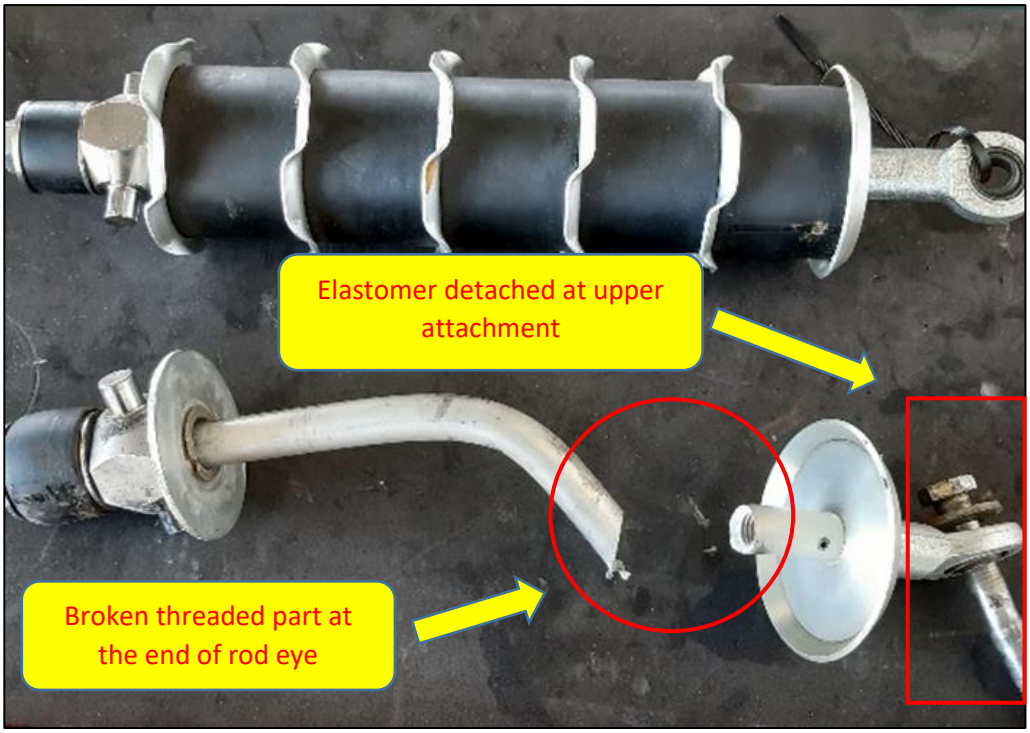
Picture 5: NLG yoke scrapped due to contact with the runway.

Picture 6: Engine mount frame – elastomer upper connecting bolt hole (at bulkhead firewall) found elongated.

Picture 7: Lower engine fairing badly scraped.

Picture 8: Lower fuselage skin was severely torn at the forwarding of the Gascolator access panel.

Picture 9: Fibre structure at NLG trunnion bulkhead found damaged.



Picture 10: NLG shock absorber Elastomer detached at the upper attachment. It was broken at the threaded part of the rod eye end.

Picture 11: Fibre structure above NLG RH trunnion found punctured.

1.4 Other damage

Nil

1.5 Personal information

1.5.1 Pilot

Status	Student Pilot
Nationality	Malaysian
Age	21 years old
Gender	Male
Licence Type	SPL (13253)
Licence Validity	Valid until 31 January 2021
Total Hours Operating on DA40D	26hours 45minutes
Total Flying Hours	26hours 45minutes
Rest Period Since Last Flight	> 24 hours
Medical Expiry Date	SPL for CPL / 31 January 2023

SP is holding a valid SPL for CPL type of license with 26 hours and 45 minutes flying hours on the aircraft type. He holds a Class ONE medical certificate with a "Shall Wear Corrective Lenses" limitation. He had an adequate rest prior to the flight operated on the ill-fated day.

According to the SP's performance record, the instructor made a few comments to urge the SP to "need to work hard" due to the weak and slow progress in his performance and significantly to improve on RT’s.

1.6 Aircraft information

C of A No.	D4.166
C of A Expiry Date	27 February 2021
C of R No.	AR/17/116

C of R Expiry Date	06 April 2020
Engine Serial Number	02-02-04015
Time Since New	8742:30 (Airframe hours)
Time Since Overhaul (TSO)	1142:10
Time Since Fitted (TSF)	1142:10
Cycle Since New (CSN)	17573 (Airframe cycle)
Cycle Since Overhaul (CSO)	1585
Cycle Since Fitted (CSF)	1585
Date Fitted	15 May 2016
Time Between Overhaul	2100

Based on the report from the operator, the last inspection for the aircraft was performed during 200 hours check, which was completed on 17 January 2020 at TSN 8691 hours. The next inspection is 100 hours check due at 8791 on 16 February 2020.

The following EASA AD 2009-0016 was carried out on the aircraft on the 24 January 2009 traceable to Jobcard 012685. Carried out an inspection on NLG leg for cracks at the nose gear leg pivot IAW MSBD4-046/1. Nil crack was found (refer to Figure 1).

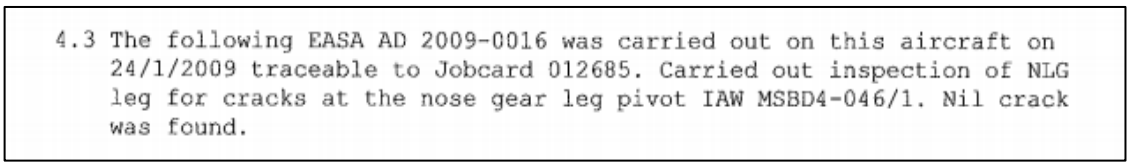

4.3 The following EASA AD 2009-0016 was carried out on this aircraft on 24/1/2009 traceable to Jobcard 012685. Carried out inspection of NLG leg for cracks at the nose gear leg pivot IAW MSBD4-046/1. Nil crack was found.

Figure 1: Operator Preliminary Accident/Incident Investigation Report

There was no history of NLG failure before the accident. At the time of the accident, the nose wheel was found intact, and upon removal of the nose wheel to facilitate aircraft recovery, it was found that there was NIL sign of crack at the area of interest.

1.7 Meteorological information

The weather forecast by the Malaysian Meteorological Department for 1200LT was fine weather with light haze. The wind is from 080 degrees at 05 knots, and visibility is more than 10 kilometers. A similar weather condition was reported for 1300LT with slight changes in the wind direction blowing from 100 degrees with the same velocity of 5 knots. Weather was not a factor that caused nor contributed to the accident.

1.8 Aid to navigation

SP was using the Precision Approach Path Indicator (PAPI) Lights to guide his approach for landing.

1.9 Communication

Throughout the flight, communication between the control tower and MAHA547 was done on Terengganu Ground 121.6 Megahertz and Terengganu Tower 119.05 Megahertz frequencies.

1.10 Aerodrome information

Sultan Mahmud Airport Terengganu (WMKN) is situated at 052253 North and 1030617 East with an elevation of 20 feet. Runway 04 was used for the landing with no abnormality in the surface condition. 3480 meters of runway length available for the landing (Landing Distance Available - LDA) with a width of 45 meters. Precision Approach Path Indicator (PAPI) lights with 3 degrees' slope used for Runway 04 and Runway 22.

1.11 Flight recorders

The aircraft is not fitted with a Flight Data recorder or a Cockpit Voice Recorder.

1.12 Wreckage and impact Information

Runway 04 is used for landing, and the aircraft nose wheel touches the runway approximately 400 meters from the threshold. Upon contact with the runway, the nose wheel collapses, the aircraft remains in motion for 200 meters before it stops on the right side of the runway.

1.12.1 Significant marks on the Runway

Upon arriving at the airport, the investigation team with a few airport personnel inspect the runway after getting permission from the airport authority. Pictures were taken at the aircraft's last known position, sweeping the runway with extended single line formation moving backwards towards the suspected 1st point of touchdown and back to the aircraft's last known position. Several significant marks on the runway had been identified. The pictures were taken as shown below.

Picture 12 depicts the embedded marks resulting from the bolt and nut from the nose wheel fork that hit the runway surface during the 3rd landing. As can be seen, the spot left on the hard runway surface is quite deep, proving that the NLG collapses as soon as it touches the ground.

Due to the heavyweight of the aircraft, the NLG shock absorber Elastomer breaks then break the rod within the elastomer pack, which then causes a lengthy deep line on the runway (refer to Pictures 13, 14, and 15).

Pictures 16 and 17 show the lengthy drag marks caused by the nose wheel fork and the broken elastomer rod before the aircraft comes to a complete stop. Finally, Pictures 18 and 19 illustrate the front part of the aircraft is resting on the broken NLG after it stops, whereby the NLG breaks and bends inwards.

Picture 12: Bolt and nut marks embedded on the runway surface

Picture 13, 14, and 15: Marks from the broken rod

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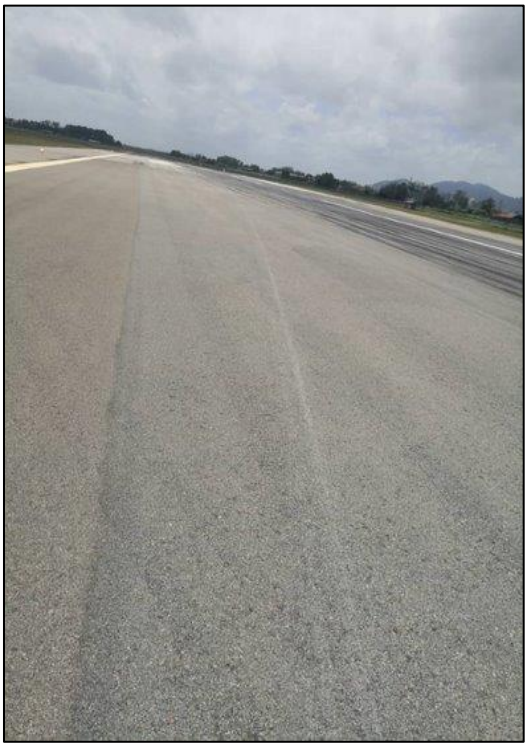


Picture 16 and 17: Skid marks cause by the nose wheel fork

Picture 18: Rear view of the nose wheel

Picture 19: Side view of the nose wheel

1.13 Medical information

The SP did not suffer any injuries. He was sent to the nearest hospital by ambulance for medical examination. There was no evidence that physiological factors or incapacitation affected the performance of the SP reported.

1.14 Fire

There was no evidence of fire in flight or after the impact.

1.15 Survival aspects

After having discovered an accident had occurred on Runway 04 at 1315hrs, the tower assistant immediately informed the Airport Fire & Rescue Services of the event. It took approximately one (01) minute for the AFRS trucks to get to the crash site and assisted the SP with his evacuation.

The nearest hospital was contacted and an ambulance was dispatched to the airport. At approximately 1340hrs, the ambulance arrived at the location and the SP was taken straight to the hospital for further treatment and follow-up check-up.

The operator removed the aircraft as soon as approval was obtained from AAIB, and it was kept at the operator's hangar within the airport vicinity. Runway inspection was carried out to ensure it was clear from foreign object debris (FOD), and at approximately 1440hrs, the runway was re-opened and back in operation.

1.16 Test and research

Broken Elastomer Bungee was sent to Science and Technology Research Institute for Defence (STRIDE) for metal fatigue analysis. A Material Microscopic Analysis was performed on the aircraft's nose landing gear shock elastomer pack. The report covers metallurgical failure analysis of the aircraft's fractured nose landing gear elastomer pack (Figure 2). It was reported that the component was fractured during landing due to the hard impact. The fractured location is shown in Figure 3.

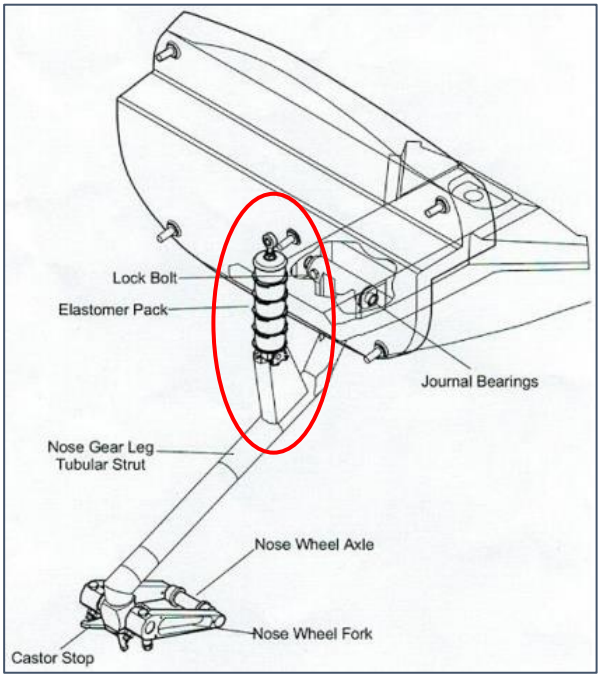


Figure 2: Diamond Star DA 40D's aircraft nose landing gear with elastomer pack

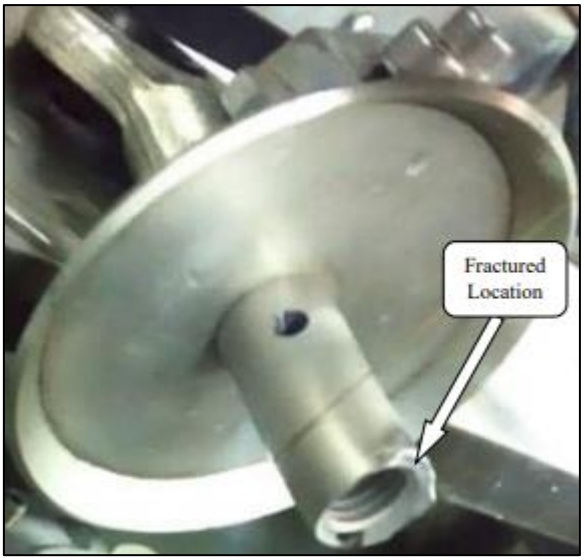


Figure 3: Diamond Star DA 40D's aircraft fractured nose landing gear elastomer pack.

1.16.1 Microscopic examination

A FESEM FEI Apreo Electron Microscope was used to examine further the fracture surface and cross-section of Diamond Star DA 40D's aircraft nose landing gear elastomer pack. Examination at higher magnification on the component at several locations of the fracture surface has found dimple features, as shown in Figure 4 and Figure 5.

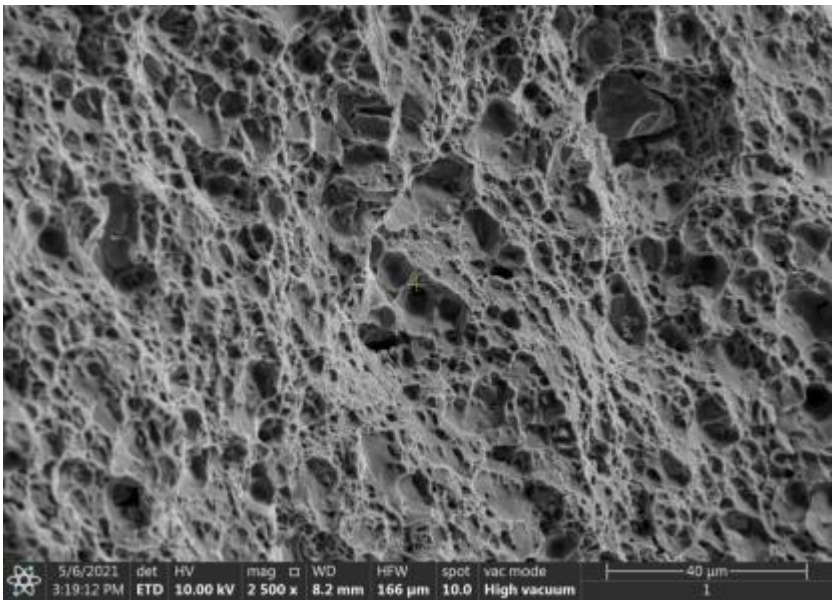


Figure 4: Fracture surface of Diamond Star DA 40D's aircraft nose landing gear elastomer pack on 2500x magnification.

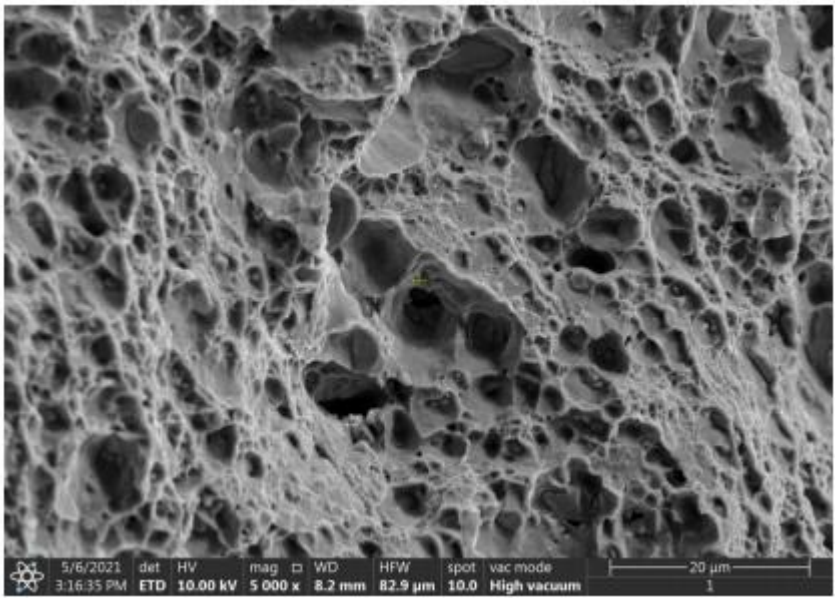


Figure 5: Fracture surface of Diamond Star DA 40D's aircraft nose landing gear elastomer pack on 5,000x magnification.

1.16.2 Metallographic examination

One section of the Diamond Star DA 40D's nose landing gear elastomer pack was prepared for metallographic examination. The samples were polished and etched to reveal their microstructure. The microstructure examination images are shown in Figure 6 and Figure 7. It is found that there's no evidence of material degradation or manufacturing defects.

Figure 6: Microstructure of surface of Diamond Star DA 40D's aircraft nose landing gear elastomer pack on 10x magnification.

Figure 7: Microstructure of surface of Diamond Star DA 40D's aircraft nose landing gear elastomer pack on 20x magnification.

1.16.3 Chemical composition analysis

A FESEM FEI Apreo Electron Microscope was used to determine the chemical composition of the fractured component. The chemical composition analysis is shown in Table 1.

Table 1: Chemical composition result of samples Diamond Star DA 40D's aircraft fractured nose landing gear elastomer pack.

No.	Elements	(%)
1	Magnesium (Mg)	0.7
2	Silicon (Si)	0.6
3	Copper (Cu)	10.1
4	Sulphur (S)	0.2
5	Iron (Fe)	2.5
6	Aluminium (Al)	Balance

1.16.4 Analysis findings and conclusion

Based on the analysis performed, several findings have been identified from the examinations as listed below:

- Examination at higher magnification on several locations of the fracture surface has revealed the dimple feature that indicates the components' failure is suggested due to overload failure.
- The metallographic examination has confirmed no evidence of material degradation or manufacturing defects.
- The chemical analysis of the components has suggested the part are made from aluminium alloy 2000 series.

The analysis concluded that the mode of failure of Diamond Star DA 40D's aircraft fractured NLG elastomer pack was due to overload failure.

1.17 Organisational and management information

1.17.1 Air Traffic Services (ATCS)

Air Traffic Services at Sultan Mahmud Airport, Terengganu, provided by the Civil Aviation Authority of Malaysia (CAAM). Malaysia Airport Sdn. Bhd. (MASB) on the other hand is the organisation responsible for the maintenance of the airport. Meanwhile, Meteorology Malaysia (Met Malaysia) provides weather information services.

All the ATC personnel stationed at this airport are qualified, rated, and very experienced in handling air traffic. However, only one of them ever experienced working in an airport with a flight training organisation long ago. The rest had never served in an airport with a flight training organisation and dealt with student pilots.

1.17.2 The Operator (Terengganu detachment)

Halim Mazmin Aerospace (HMA Aerospace Sdn. Bhd.), the Flight Training Academy (Terengganu Detachment), was detached to Sultan

Mahmud Airport, Terengganu (approximately two weeks) away from their home base in Langkawi International Airport, Kedah. The detachment has been established to cater to additional training areas for the flight training operations when Langkawi cannot cope and cater for flexibility of operations during the prevailing monsoon seasons.

Regarding the SOP, AAIB only received the operator's draft SOP during the investigation, particularly for the TGG operation. Matters like detachment brief on aerodrome and training area operations and student familiarity to training area must be conducted by the operator to the aerodrome operator. This is to improve and enhance the coordination and understanding between the operator and the aerodrome operator to smoothen the operational process.

1.17.3 Meteorological Services

The Wind and Runway Visual Range (WRVR) is one of the available facilities in Sultan Mahmud Airport, Terengganu. It is an automatic system that measures logs and displays wind and visibility data in the aerodrome for the ATC information. The system is provided and maintained by MET Office.

However, from the interview recording, the ATC stated that the system has been out of service since October 2019. Therefore, the controller had to rely on the hourly weather report and a visual indication of the windsock to estimate the wind condition that needed to be transmitted to the pilot for departure and landing.

Without WRVR, controllers need to rely on visual observation of the actual wind condition. The forecast issued by the MET office will only give the general and average reading hourly. WRVR sensor is usually located close to the landing or touchdown area, which will give the correct real-time of the wind condition. As for the windsock is situated at various locations on the grass strips; it might give a good wind direction. Still, the wind velocity depends on the controller's observation and experience to give out the wind speed based on the angle of the windsock sways.

The accuracy of the wind indication based on the windsock (windsock gives the direction of the wind blowing and the approximate velocity of the wind at the touchdown zone) is not as accurate as the WRVR indication. Factor such as rain will also affect the readings from the windsock because when it rains, the windsock becomes wet and heavy. This will provide a false indication, especially to the reading of wind velocity.

Even though the MET Office provides the WRVR facility, it is the responsibility of the ATS as the end-user to inform MET Office should the said equipment be unserviceable or not functioning properly so that MET Office can take necessary actions.

1.17.4 Student Pilot's Radio Telephony (RT) Performance

Throughout the investigation, it was found that the SP has difficulties with his RT's. Based on his performance record, the FI had made a few comments to urge him to "need to work hard" due to the weak and slow progress in his performance, significantly to improve on RT's. When asked why he didn't follow the ATC's instruction during the interview, the SP said he could not understand the instruction and found it unusual.

According to the statement given by the FI during the interview, the SP's spoken and understanding of RT's is very weak, and he had mentioned many times to the SP that his RT is not good. FI also said that when there are slight changes of RT from the SOP, the SP will be lost, and he will not know what to do.

1.18 Additional information

1.18.1 Interview with Student Pilot

An interview was conducted and a written statement had been obtained from the SP. The main findings found from these two sources are as follows:

a) SP was on his first solo for training area and he crashed during the third attempt landing.

b) He does not execute the instruction given by the ATC as he could not understand the ATC and finds the instruction is unusual and proceeds with the standard climbing procedure.
c) He claims that the ATC shouted and scolded him; he apologises and straight away loses his focus throughout the flight.
d) On the way back upon re-joining, SP was feeling down and scared due to what had happened after take-off. His anxiety was on the ATC.
e) First landing attempt, the aircraft bounced three times and SP decided to go around, the second attempt was also bouncy and once again go-around was performed. Third landing attempt SP notices an unusual noise coming from outside the aircraft and suspects it is coming from the nose wheel.
f) The aircraft's nose wheel collapses as soon as it touches the ground during the third landing.
g) He also claims that the wind was quite strong, and the touchdowns were hard during the first and second landing attempts.
h) When the aircraft bounces during landing, SP does not pitch the nose down; instead, he holds the aircraft's nose attitude and lets the aircraft sinks as per the proper landing techniques taught by the FI.
i) SP states that he has difficulties using the words 'say again' to the ATC if he does not capture or understand the instructions as he is worried that it will annoy and anger the ATC.

1.18.2 Interview with SP's Flight Instructor

An interview was conducted and a written statement had been obtained from the FI. The main findings found from these two sources are as follows:

a) Prior to the flight, SP was well briefed by the FI on all DA40 9M-HMU aircraft first area solo procedures.
b) Clearance was given by ATC to climb to 2000 feet on runway heading, then turn left for training area.
c) SP could not understand the RT, then made a mistake by turning left at 500 feet for training area as per SOP.

d) SP was nervous and could not concentrate on flying after being scolded consecutively by the ATC.
e) FI apologises to ATC for the mistake made by the SP.
f) SP's performance is sometimes good, sometimes not good, and RT spoken and understanding is feeble, and he had mentioned many times to the SP that his RT is not good.
g) If RT changes slightly from the SOP, the SP will be lost, and he doesn't know what to do.
h) SP has the tendency to pitch down when he comes in high for landing, and he is told and corrected by the FI many times.
i) The weather was clear and good and the wind was within the allowed limit for SPs to perform their training.

1.18.3 Interview with Air Traffic Controller (duty on departure)

The interview was conducted and a written statement had been obtained from the ATC (on duty during departure). The main findings found are as follows:

a) Instructs SP to climb to 2000 feet and maintain runway heading, and clears the aircraft for take-off.
b) He observes the aircraft taking off, and a moment after that it turns to the left into the circuit direction. He immediately engages SP through the radio, asking what he is doing and clarifying if SP understands the instruction.
c) After the SP had made corrective action, the ATC emphasised to the SP to follow the instruction given by the ATC in the future.
d) ATC also engages the SP's FI and tells him to ensure the student understands all instructions given by ATC before clears him for flight.
e) ATC admits that he raised his voice to the SP during the climbing incident due to shock from what had just happened.

1.18.4 Interview with Air Traffic Controller (duty on arrival)

An interview was conducted and a written statement had been obtained from the ATC (on duty during arrival). The main findings are as follows:

a) After aircraft reported for final, surface wind was reported at 080°/07 knots based on observation of the windsock.
b) During 1st attempt landing, the aircraft was seen to be unstable and after a few bounces made, SP requested clearance to commence go-around.
c) Aircraft comes in for 2nd landing attempt, surface wind given was 080°/08 knots and again aircraft to be seen unstable during the approach, upon touches the runway it bounces and swerves to the right and commences go-around for the 2nd time.
d) For the 3rd attempt, the surface wind was given at 080°/10 knots and the aircraft was seen to be more stable than the previous two earlier attempts.
e) Immediately after the accident, the colleague was informed and other necessary actions were taken.
f) Throughout her observation of all the landings, the 1st landing attempt seems to be harder than the 2nd landing attempt.

1.19 Useful or effective investigation techniques

Nil.

2.0 ANALYSIS

In this section of the report, the relevant evidence and factual information will be discussed and analysed to determine the cause and contributing factors to the accident. The conclusions will provide the answer to why the accident occurred.

2.1 Flight Operations

2.1.1 Crew qualifications – SP performance

As for the SP, the training carried out on the day of the accident was his first solo flight to the training area. This means he has accumulated a certain amount of flight hours and satisfactorily performed in all the flights and tests required to qualify him to endure and proceed with the subsequent training module.

Based on the recording of RT between the SP and ATC on duty prior to departure, there is no issue arising other than the standard RT which can be heard from both parties. However, issues started as soon as the plane took off as the ATC instructed SP to maintain runway heading until 2000 feet and make a left turn. The SP read back the instruction given but did not execute it, and he continues with the standard procedure, which is to turn left after 500 feet and maintain 1000 feet until establish Batu Rakit. This has clearly shown that SP does not follow according to what has been stipulated in their SOP which states pilots are to comply with all instructions given by ATC unless it is impossible or unsafe to do so (refer to Figure 8).

3.5.3 Instructions/Signals from ATC.

a. Pilots are to comply with all instructions given by ATC unless it is impossible or unsafe to do so. Where it is not possible to comply or it would be unsafe to comply with an ATC instruction, the pilot shall notify ATC of the reason for non-compliance immediately. Pilots are ultimately responsible for their aircraft.

b. Signals may be given to an aircraft at any aerodrome by the use of lights. Pilots are to be familiar with all light signals and shall comply with all light signals given by the ATC.

Figure 8: HMA Training Manual (HMA.TRG.DOC.03 – 119 page 3-19)

During the interview, he was asked why he didn't follow the instruction given by the ATC. He said the instruction was unusual. He panicked and decided to proceed with the standard climbing procedure. Due to his action, the ATC firmly asked him if he understood the instructions and instructed him to adhere to the instruction strictly. Subsequently, the SP could not concentrate on his flying and could not finish some of the exercises required to perform and decided to end the training early.

As mentioned before, it was found that the FI had made several comments on SP's having difficulties with his RT, such as having difficulty in understanding verbal RT and not complying with RT as per the written comments in his performance record and needs to be improved. FI's statement further supports this during the interview session, in which he indicates that the SP's RT is "very weak" and "not good", and it's getting worse day by day. He also mentions that if there are slight changes in the RT, the SP will not understand and doesn't know what to do. Nevertheless, overall, the SP shows good performance in controlling and flying the aircraft.

2.1.2 Operational procedures – Landing technique

When an aircraft is experiencing bouncing or ballooning during landing, it is essential for the pilot to correct the situation by applying the correct and proper flying technique to overcome the situation. In this case, the SP claims that the aircraft bounces several times during the 1st and 2nd landing, requiring him to initiate a go-around. The go-around initiated complies with the training manual para 3.3.9 a.(5), which stated that Cadet Pilots should initiate go-around in the event of a bounced landing (refer to Figure 9)

3.3.9 Go-around and Mis-Landing Action.

a. Cadet Pilots, AFIs or FIs shall initiate go-around/mis-landing action if there is any doubt regarding the ability to land the aircraft safely. In particular, go-around/mis-landing action shall be initiated:

(1) If the landing area is obstructed.

(2) The approach path or speed is unsatisfactory.

(3) The prevailing wind or weather exceeds his limits or ability.

(4) When initiated by Air Traffic Control.

(5) In the event of a bounced landing or pilot induced oscillation.

Figure 9: Training Manual (HMA.TRG.DOC.03 – 119)

During the interview session, the SP explains that on the 1st landing attempt, he was coming down low for approach and the speed was increasing. Once the aircraft touches down, it bounces and he tries to pitch the nose attitude up to prevent the aircraft NLG from hitting the ground. After the 3rd bounce, he puts full power and initiates the go-around. On the 2nd landing attempt, SP was coming down a bit high for approach, and the aircraft again bounces. During the 3rd bounce (the hardest impact), all landing gears touch the ground including the nose wheel. Subsequently, he applies full power and a go-around was initiated again. Coming down for the 3rd landing, the approach was good with two reds and two whites. SP flares up for the touchdown and when the aircraft touches down, as soon as the nose wheel hits the ground, it collapses instantly.

The FI mentions that the SP's approach was good for most of his flight with the SP. Before solo, the SP had the tendency to pitch the aircraft down as the approach and round out was always high most of the time. However, the FI had told him many times not to pitch the aircraft down. He corrected him by saying if the round out is high, just go around, and if the round out is low, just hold the pitch attitude and feel the sink and backpressure as per the SOP. Nevertheless, the SP had improved his landing technique since then; thus, he cleared him for solo.

In conclusion, the SP tends to pitch the aircraft attitude down when he comes in high for approach and round out. This is supported by the FI's statement that before solo, the SP always comes in high during approach and round out and tends to pitch the aircraft nose down. However, the FI had corrected and reminded him many times not to do so. Eventually, after sometimes the SP improved his performance, especially in his landing technique.

In conclusion, from interview statements from the SP and Arrival Duty Air Traffic Controller on the SP's landing, evidence shows that the continuous hard landing bounces due to high flaring attitude and incorrect correction technique when the aircraft bounce from the first and second attempt landing most probably caused the NLG shock elastomer pack to break. The broken NLG shock elastomer pack most probably caused the unusual noise coming from the NLG area during the third landing attempt, as the SP mentioned. Test results from STRIDE confirm NLG elastomer pack broke due to overload failure. This resulted in the NLG collapsing immediately on the third attempt landing as shown by embedded marks resulting from the bolt and nut of the nose wheel fork hitting the runway surface in Figure 12.

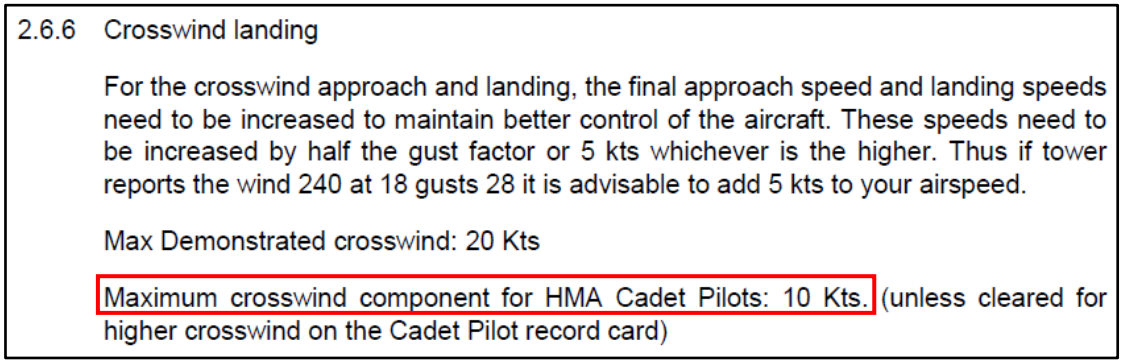
2.1.3 Weather – Wind condition

Based on all the statements obtained from the witnesses who had been interviewed, it was found that the weather on the day of the accident was clear and good.

However, during the interview, the SP claims that during final, the wind condition had affected the state of the flight and had made it difficult for him to control the aircraft. He further claims that wind was strong, approximately from 12 to 13 knots during the 1st landing and 9 to 10 knots during the 2nd landing, which subsequently caused him to commence with the go-around.

From the FI's statement, on that day the weather is clear and the wind condition is good, approximately from 5 to 8 knots, and it's not going to be a problem for students to perform their training. Hence, due to the good weather

condition, he clears the SP for the training area. The FI further added that they would not send the students for training if the wind condition is more than 10 knots. This statement is consistent with the Standard Operating Procedures Diamond DA-40 TDI para 2.6.6, which stated that the maximum crosswind component for HMA Cadet Pilots is 10 knots (refer to Figure 10).



2.6.6 Crosswind landing

For the crosswind approach and landing, the final approach speed and landing speeds need to be increased to maintain better control of the aircraft. These speeds need to be increased by half the gust factor or 5 kts whichever is the higher. Thus if tower reports the wind 240 at 18 gusts 28 it is advisable to add 5 kts to your airspeed.

Max Demonstrated crosswind: 20 Kts

Maximum crosswind component for HMA Cadet Pilots: 10 Kts. (unless cleared for higher crosswind on the Cadet Pilot record card)

Figure 10: Standard Operating Procedures Diamond DA-40 TDI (HMA.TRG.DOC.12 – 117)

According to the ATC who was on duty during the accident, during the 1st landing, the surface wind was 7 knots; it increases to 8 knots during the 2nd landing and 10 knots for the 3rd landing. All these readings were given based on her observation of the windsock. It is important to note here that wind reading was an estimate from observation only, not the actual measurement which can be obtained from WRVR, which is unserviceable at the time of the accident.

It can be concluded that the wind condition was well within the operating limitation during the time of the accident. The SP was operating in an environment that is within the permissible requirement by the SOP, and the FI had released the SP to perform the training according to what's written in the SOP. Any SP that has made it to this stage should be able to handle this kind of situation; otherwise, they will not be cleared by the FIs.

2.1.4 Air Traffic Controller

All air traffic controllers on duty are qualified and properly licenced to perform their tasks. Nevertheless, their lack of experience dealing with pilots on

training and understanding of their limitations could affect the smoothness in controlling the air traffic as well as the flight operations process.

It is important to emphasise that SPs tend to make mistakes while performing flight training, especially on solo flights. They are in the process of learning and not as experienced as the online pilots. Different SPs have different learning attributes. They may face initial problems understanding aviation words and phrases that the ATC generally uses. When they get confused with some words used by ATC or instructor, it will be difficult for them to focus, learn and concentrate on their flying. In this case, the SP gets confused when he receives an unfamiliar instruction given by the ATC which is different and unusual from the syllabus that he had learned.

However, this gap can be overcome by conducting coordination meetings or discussions between ATC and HMA periodically. This will further enhance the understanding between the two parties and each will be more aware of the needs that need to be done if any issues arise. While from the perspective of flight operations, FIs are to emphasise and encourage SPs to request ATC to repeat the air traffic instruction if they are unsure of or could not comprehend the words or phrases used. A method called ‘challenge’ is being used all the time whereby the pilot's reading back is a must. If the pilot did not read back, the ATC would challenge to ensure and verify that the instruction given is received and understood.

2.2 Psychological attributes affecting Student Pilot’s performance

The psychological characteristics of the pilot will have an impact on flight safety, mainly in the pilot’s intention. In other words, this means the pilot’s psychological experience of flight status under the influence of various factors and the preference for decision-making or behavioural value displayed. The pilot’s intention is to reflect the cognitive state that the pilot showed during the manoeuvring of the aircraft. There are four main attributes that will affect the

psychology of an individual, namely personality[1], attention[2], attitude[3] , and emotion[4]. These four attributes will then affect the physiological factors of that person.

As for the SP, upon receiving the instruction to climb to 2000 feet and maintain runway heading by the ATC, he hears the instruction clearly and acknowledges it. But in fact, he does not understand what the instruction meant because according to him the instruction received was very unusual as he had never heard it before. When he was asked by the investigators why he never clarifies the instruction with the ATC, the SP says that he is afraid to ask again because the ATC might scold him. The SP's anxiety has shown the personality characteristic in corresponding towards the situation.

Due to not understanding the instruction given, the SP proceeds with the standard procedure to turn left at 500 feet to continue to the training area and performs the exercises that need to be completed. This action indicates the SP’s attention, the point of concentration of mental activity on what he is supposed to do that day, and indirectly disregarding the instruction given to him by the ATC earlier on.

As a result of his action, the ATC on duty firmly instructs him to follow the instruction given and asks him if he understands the instruction, which he then apologises for the mistake done. This is the starting point that has impacted the SP’s attitude (psychology and behaviour) throughout the flight. The SP’s attitude is already unstable at this point; he loses his focus and could not concentrate on performing the training area exercises and decides to return early to base.

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[1] Personality - refers to a person’s stable attitude toward reality and the personality characteristics expressed in habitual behaviour corresponding to this attitude. Personality embodies the social attributes of character, and the core of character differences between individuals is the difference in personality.

[2] Attention - the point and concentration of mental activity on certain objects. It is a common psychological feature in the psychological processes of perception, memory, thinking, and imagination. The attention of the pilot in the cockpit is critical to flight safety.

[3] Attitude - the stable psychological tendency of an individual to hold a particular subject. The attitude of the pilot will affect their behaviour. Poor attitudes could lead to mishandling of pilots, resulting in flight accidents.

[4] Emotion - a general term for a series of subjective cognitive experiences. It is the psychological and physiological state of multiple emotions, thoughts, and behaviours. Both positive and negative emotions trigger motivation for action.

With mixed feelings, multiple emotions, and thoughts, this had affected SP's psychological state of mind. Subsequently, the psychological situation experienced by the SP will influence his physiological character and it will be seen through his behaviour. This was clearly shown during the landing phase, where due to loss of focus and concentration, SP was unable to execute the landing properly and required him to make three attempts to land.

3.0 CONCLUSIONS

3.1 Findings

3.1.1 Aircraft

a) The aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures.

b) The aircraft was airworthy when dispatched for the flight.

c) There was no evidence of any defect or malfunction in the aircraft that could have contributed to the accident.

d) The aircraft NLG is broken due to hard impact and overload failure.

3.1.2 Student Pilot.

a) The SP was medically fit and adequately rested to operate the flight.

b) It was found that the SP heard the instruction given by the ATC but did not understand and did not clarify with the ATC due to fear of being reprimanded.

c) SP did not follow the instruction given by the ATC.

d) Performance Report and interview statement indicated that SP had poor RT.

e) After being reprimanded by the ATC for the mistake, SP could not focus and concentrate on his flying.

3.1.3 The Operator

a) The Flight Training Academy (Terengganu Detachment) is newly operated at Sultan Mahmud Airport, Terengganu (approximately two weeks) other than their home ground in Langkawi International Airport, Kedah.

b) Minimal coordination (meetings and discussion) between the operator and ATC, which can improve understanding and coordinating SOPs, limitations, and other issues that arise.

3.1.4 Air Traffic Services (ATS) and Airport Facilities

a) The ATCs were properly licensed, medically fit and correctly rated to provide the service.

b) ATC on duty immediately engages SP through the radio, asking what he was doing and clarifying if SP understands the instruction given.

c) ATC admits that he raises his voice to the SP during the climbing incident due to shock from what had happened.

d) There is a lack of experience and understanding of ATC in dealing with SPs and their limitations.

e) The Wind and Runway Visual Range (WRVR) system available at the airport has been out of service since October 2019.

3.2 Cause

The cause of the accident was the collapse of aircraft NLG during the last landing attempt made by SP due to the overload failure suffered by the NLG from the hard impact during the earlier landing attempts.

3.2.1 Contributory factors

a) The SP experiences an unstable psychological state of mind throughout the flight after being reprimanded by the ATC due to the mistake that he had made after take-off.

b) Having difficulties and deficient in RT, the SP does not comply with the ATC's instruction.

4.0 Safety recommendation

It is recommended that:

4.1 The Operator

a) To ensure all Student Pilots are well equipped with RT knowledge regarding the usage of standard and non-standard RT phraseology.

b) To conduct meetings and discussions periodically with the ATS to establish and improve coordination between the two organisations.

4.2 Civil Aviation Authority of Malaysia (CAAM)

a) ATC to provide aerodrome and training area familiarisation briefing to all future detachments by Flying Academy for flight training away from home base on arrival at the detachment aerodrome.

b) ATS to inform and advise MET Office to take appropriate maintenance actions to repair the unserviceable meteorological service system facility, i.e., WRVR provided at the airport.

5.0 COMMENTS TO THE REPORT AS REQUIRED BY ICAO ANNEX 13 PARAGRAPH 6.3

As required by ICAO Annex 13, paragraph 6.3, the draft Final Report was sent to State of Registry (CAAM), State of Manufacture (Austrian Civil Aviation Safety Investigation Authority), the Operator (Halim Mazmin Aerospace), and the aerodrome operator (MASB) inviting their significant and substantiated comments on the Report. The following is the status of the comments received: -

Organisations	Status of Significant and Substantiated Comments
Civil Aviation Authority of Malaysia (CAAM)	Report received and no comments.
Austrian Civil Aviation Safety Investigation Authority	Report received and no comments.
Halim Mazmin Aerospace (Operator)	Comments that are accepted have been amended accordingly in this report. Comments not agreed upon have been appended in **Appendix C**.
Malaysia Airport Sdn. Bhd. (MASB)	Comments accepted and have been amended accordingly in this report.

Figure 11: Status of Significant and Substantiated Comments

Investigator in-charge
AAIB
Ministry of Transport

APPENDICES

A	Audio Transcript between MAHA 547 with Terengganu Tower (Departure)	A-1 to A-3
B	Audio Transcript for MAHA547's Incident	B-1 to B-4
C	Comments to Draft Final Report from the Operator that are not agreed upon	C-1 to C-6

APPENDIX A

Audio Transcript between MAHA 547 with Terengganu Tower (Departure)

Pilot MAHA 547	Terengganu Tower, MAHA 547 on 123.6. good afternoon
Controller	MAHA 547, Terengganu, afternoon. confirm ready?
Pilot MAHA 547	MAHA 547 ready at holding point Charlie and no. 1
Controller	MAHA 547, line up Rwy 04
Pilot MAHA 547	Line up Rwy 04, MAHA 547
Controller	MAHA 11, maintaining 1500 feet, left turn to hold downwind 1500
Pilot MAHA 11	Maintaining 1500 feet on Rwy heading and… the after that, hold 1500, MAHA 11
Controller	MAHA 11
Pilot MAHA 547	MAHA 547 ready for take-off
Controller	MAHA 547 standby
Pilot MAHA 547	Standby, MAHA 547
Controller	MAHA 547, climb 2000 feet, maintain Rwy heading Rwy 04, clear for take-off
Pilot MAHA 547	2000 feet, maintain Rwy heading, clear for take-off. MAHA 547
Controller	MAHA 547, confirm turning left now
Pilot MAHA 547	Say again sir
Controller	Confirm turning left to Batu Rakit now
Pilot MAHA 547	Batu Rakit 5000 feet and below MAHA 547
Controller	MAHA 547, confirm you turning left to Batu Rakit now
Pilot MAHA 547	Make left to Batu Rakit MAHA 547
Controller	MAHA 547 instruction to maintain Rwy heading 2000
Controller	MAHA 547 advice air traffic holding it downwind 1000 and 1500
Pilot MAHA 547	Traffic 1000 and 1500 MAHA 547
Pilot MAHA 08	XXXXXXXXXX

Controller	MAHA 11 and MAHA 08 advice traffic MAHA 547 now turning left tracking for Batu Rakit
Pilot MAHA 11	XXXXXXXXXX MAHA 11 affirm sir visual MAHA 08
Controller	MAHA 547 Terengganu
Pilot MAHA 547	Go ahead MAHA 547
Controller	MAHA 547 do you still understand the instruction to maintain Rwy heading
Pilot MAHA 547	Sorry sir I am maintain Rwy heading MAHA 547
Controller	You are not maintaining Rwy heading, you turn left
Instructor MAHA 547	Johani now turn left
Controller	MAHA 547 my take-off clearance to maintain Rwy heading climb 2000, maintain Rwy heading
Controller	What I observed you turn left to Batu Rakit not maintaining 2000
Pilot MAHA 547	Turning left maintain 2000 feet clear for training area Batu Rakit
Controller	MAHA 547 you understand instruction to maintain Rwy heading after take-off, climb 2000. do you understand what I mean
Pilot MAHA 547	Understand sir. Sorry sir MAHA 547
Controller	You turning left, 2 traffic aircraft is holding in circuit,1000 and 1500 feet. You jeopardise the traffic. Traffic circuit should be 500 feet separation. That's why I climb you 2000 feet
Pilot MAHA 547	Turning left to Batu Rakit arrr 3200 feet
Controller	MAHA 547 report establish Batu Rakit
Controller	MAHA 547 Terengganu
Pilot MAHA 547	XXXXXXXXXX Batu Rakit MAHA 547
Controller	MAHA 547 next time xxxxxxxxxx ask you to maintain Rwy heading climb maintain Rwy heading. Don't turn any direction
Pilot MAHA 547	My apology sir MAHA 547
Controller	MAHA 547

Pilot MAHA 547	Apology sir I am approaching Batu Rakit MAHA 547
Controller	MAHA 547 copied xxxxxxxxxx to operate 5000 feet and below, report ops normal
Pilot MAHA 547	XXXXXXXXXX 5000 feet and below, report again ops normal MAHA 547
Controller	MAHA 547 next time to understand instruction
Pilot MAHA 547	My apology sir MAHA 547
Controller	MAHA 547
Controller	Instructor in flight, please do something to your student, than make them understand what the instruction by the Air Traffic Controller
Instructor MAHA 547	Copied that, xxxxxxxxxx my apology
Controller	Okay
Controller	MAHA 08, cancel hold, resume circuit report final
Pilot MAHA 08	Resume circuit and report final Rwy 04 MAHA 08

APPENDIX B

Audio Transcript for MAHA547's Incident

AUDIO TRANSCRIPT FOR MAHA 547'S INCIDDENT

Please note that all time is in UTC and according to AAT personnel the server is not sync with the GPS clock therefore the time was late about 7 mins from real time.

[04:58:14]	Pilot MAHA 547	MAHA 547 leaving training area batu rakit 1500 feet
	Controller	MAHA 547 "errr" request intention
	Pilot MAHA 547	Leaving training area batu rakit request rejoin to land
	Controller	MAHA 547 copied approved, standard rejoin 1500 feet and report lefthand downwind runway 04
	Pilot MAHA 547	Report lefthand downwind runway 04 MAHA 547
	Pilot AXM 6228	Tower... Redcap 6228 8 miles final and runway 04 runway insight
	Controller	Redcap 6228 surface wind 0 8 0 degrees 0 7 knots runway 04 cleared to land
	Pilot AXM 6228	Runway 04 cleared to land Redcap 6228 and Redcap 6228 "uhhh" say again the wind speed
	Controller	Redcap 622
[04:59:05]	Controller	Wind "aaa" 0 7 0 degrees 0 7 knots
	Pilot AXM 6228	Copied Redcap 6228
[05:00:19]	Controller	9MAZM report distance viktor kilo romeo
	Pilot 9MAZM	One seven miles viktor kilo romeo AZM
	Controller	9MAZM
[05:00:38]	Pilot MAHA 547	MAHA 547 downwind 1000 feet to land
	Controller	MAHA 547 descend to circuit height.. hold downwind
	Pilot MAHA 547	Descend to circuit height.. hold downwind MAHA 547
[05:01:41]	Controller	9MAZM establish localizer.. clear for approach report 5 miles final
	Pilot 9MAZM	Roger. Clear for the approach establish localizer call again 5 miles final AZM
	Controller	AZM
[05:02:49]	Controller	Redcap 6228 vacate runway via Alpha main apron bay number 3
	Pilot AXM 6228	Vacate via alpha and bay number 2 Redcap 6228
	Controller	Redcap 6228 bay 3
	Pilot AXM 6228	Bay number 3 Redcap 6228 apologize

[05:03:55]	Controller	MAHA 547 continue hold downwind standby for final. You are number 2 in sequence.
	Pilot MAHA 547	Continue holding. Standby for final number 2 in sequence MAHA
[05:04:05]	Controller	MAHA 547
[05:04:52]	Pilot 9MAZM	AZM 5 miles final runway 04
	Controller	9MAZM surface wind 0 8 0 degrees 0 7 knots runway 04 cleared to land
[05:05:05]	Pilot 9MAZM	Runway 04 cleared to land 9MAZM
[05:06:45]	Controller	MAHA 547 cancel hold. Resume circuit report final runway 04
	Pilot MAHA 547	Cancel hold resume circuit report final runway 04 MAHA 547
[05:07:08]	Controller	9MAZM "and" to vacate via charlie proceed to helipad
	Pilot 9MAZM	Roger. To vacate via charlie proceed to helipad copied 9MAZM
[05:09:15]	Pilot MAHA 547	MAHA 547 turning final for fullstop
	Controller	MAHA 547 QNH 1 0 1 3, surface wind 0 8 0 degrees 0 7 knots runway 04 cleared to land
	Pilot MAHA 547	Surface wind copied cleared to land MAHA 547
[05:09:36]	Pilot 9MAZM	Tower 9MAZM
	Controller	9MAZM Tower
	Pilot 9MAZM	Roger ma'am, any possibility for us to position "aa" at bay 1 ma'am for refuelling and then after we airborne to IPK
	Controller	9MAZM standby.. will check with the MAB
	Pilot 9MAZM	Okay ma'am 9MAZM
[05:10:43]	Pilot MAHA 547	MAHA 547 go around
	Controller	MAHA 547 and "aa" go around 1000 feeeet left turn join downwind
	Pilot MAHA 547	1000 feet left hand downwind MAHA 547
[05:11:01]	Controller	9MAZM Terengganu tower
	Pilot 9MAZM	Go ahead ma'am
[05:11:05]	Controller	9MAZM from MASB, all chopper to park at helipad "aa" refuelling will be done at helipad and "aa" then you will airborne to IPK
	Pilot 9MAZM	Copied ma'am AZM, can you advise Petronas for me
	Controller	AZM copied
	Pilot 9MAZM	Thank you ma'am AZM

[05:12:32]	Pilot MAHA 547	MAHA 547 downwind 1000 feet for fullstop
	Controller	MAHA 547 report final
	Pilot MAHA 547	Report final MAHA 547
[05:13:34]	Controller	9MAZM Terengganu tower
	Pilot 9MAZM	Go ahead ma'am AZM
	Controller	AZM from MASB "aa" arrangement for refuelling to be made by your side. I have their phone number
	Pilot 9MAZM	It's okay ma'am. Will advise my operation to call a refuelling person thank you
	Controller	Most welcome
[05:14:12]	Pilot MAHA 08	Terengganu tower good afternoon, this is MAHA 08 at taxiway charlie fully ready on board
	Controller	MAHA 08 standby charlie
	Pilot MAHA 08	Standby charlie MAHA 08
[05:14:32]	Pilot MAHA 547	MAHA 547 turning final for fullstop
	Controller	MAHA 547 surface wind 0 8 0 degrees 0 8 knots runway 04 cleared to land
	Pilot MAHA 547	Surface wind copied. Cleared to land MAHA 547
[05:16:05]	Pilot MAHA 547	MAHA 547 going around
	Controller	MAHA 547 climb 1000 feet left turn join downwind
	Pilot MAHA 547	Copied. Report again downwind MAHA 547
[05:16:37]	Controller	MAHA 08 enter runway, line up runway 04
	Pilot MAHA 08	Line up runway 04 MAHA 08
[05:17:55]	Pilot MAHA 08	MAHA 08 ready for departure
	Controller	MAHA 08 maintain runway heading climb one
[05:18:05]	Controller	500 feet runway 04 cleared for take off
	Pilot MAHA 08	Runway heading 1500 feet cleared for take off runway 04 MAHA 08
	Pilot MAHA 547	MAHA 547 downwind 1000 feet for full stop
	Controller	MAHA 547 report final
	Pilot MAHA 547	Report final MAHA 547
[05:20:06]	Controller	MAHA 08 "aaa" resume circuit 1000 feet report downwind
	Pilot MAHA 08	"aaa" ma'am we request for training area batu rakit "aa" [inaudible]

[05:20:25]	Controller	MAHA 08 my apology, copied and "aa" when ready left turn for batu rakit, report establish batu rakit
	Pilot MAHA 08	Left turn roger ma'am will report once establish training area batu rakit MAHA 08
	Pilot MAHA 347	MAHA 347 final for full stop
	Controller	MAHA 347 surface wind 0 8 0 degrees 1 0 knots runway 04 cleared to land
	Pilot MAHA 347	Surface wind copied cleared to land MAHA 347
[05:21:41]	Pilot MAHA 347	[noise inaudible] MAHA 347...
[05:21:53]	Controller	MAHA 347 Terengganu tower
	Pilot MAHA 347	Go ahead ma'am MAHA 347
	Controller	MAHA 347 and"aaa" standby... confirm "aaa" crash on runway
[05:22:05]	Pilot MAHA 347	Crash on runway MAHA 347
	Controller	MAHA 347 "aaa" standby
[05:22:35]	Controller	MAHA 347 are you okay? Are you hurt?
[05:23:12]	Pilot MAHA 08	MAHA 08 establish training area batu rakit maintaining 1500 feet and...
	Controller	MAHA 08 and "aa" copied cleared to operate 5000 feet and below report ops normal every 1 5 minutes
	Pilot MAHA 08	Copied that and willco MAHA 08
[05:26:16]	Pilot MAHA 08	MAHA 08 at training area batu rakit maintaining 1500 feet request to join for full stop landing
	Controller	MAHA 08 and "aa" standby.. continue operate batu rakit initially. Be advise runway obstructed
	Pilot MAHA 08	Copied that sir MAHA 08.

APPENDIX C

Comments to Draft Final Report from the Operator that are not agreed upon

NO	PARA	TOPIC	COMMENTS BY HM AEROSPACE	COMMENTS BY AAIB
1.	1.1	History of the Flight	Although the Student Pilot (SP) acknowledged the ATC's instructions to maintain runway heading until 2,000 feet before turning left, it is understandable why the SP turned left at 500 feet as per the SOP which was taught to him. As he was on his First Solo flight to the training area, he is not used to this type of ATC instructions. Turning left at 500 feet did not jeopardize safety as the other 2 aircraft had acknowledged that they were visual with MAHA 547.	Will not be amended as it is factual information regarding the history of the flight.
2.	1.3	Damage to Aircraft	The Nose landing Gear (NLG) collapsed during the third landing but there is no evidence to state that it was damaged during the third landing. The NLG (and the propeller blades) could have very well, been damaged during the first 2 unsuccessful landing attempts where the aircraft bounced several times due to the hard landings. The SP also heard unusual noise before his third landing which was probably due to the damaged propeller blades. The entire damage to the aircraft resulted from the heavy landings, collapsed NLG and propeller strike on the runway surface.	The paragraph explains the propellers and the whole nose wheel structure, which probably was already damaged during earlier landing attempts, suffered further damage by the impact sustained when the nose gear collapsed onto the runway during the third landing.

3.	1.5.1	Personal Information of Pilot	Instructor's report on SP's performance that he "needs to work hard" and improve his RT is again understandable as the SP had only achieved 26:45 hours of flying experience out of the 200:00 hours he would fly for the whole course**. His RT is not expected to be perfect at this stage!!** Such comments are for the SP to improve which are covered during debrief and entered into the student record. An experienced ATC Controller would have been able to cater for such mistakes by SPs and handle them coolly. **In any case, his poor RT did not cause the accident.**	The performance report regarding SP RT's needs to be included as factual information as it is one of the issues that need to be discussed in the report.
4.	1.16 1.16.1 1.16.2 1.16.3 1.16.4	Test and Research	We feel that other than recording the obvious damage to the aircraft around the NLG, propeller blades and underside of the aircraft, there was no need to send the damaged parts to STRIDE for metal fatigue analysis, material microscopic analysis, to use the FESEM FEI Apreo Electron Microscope to examine the fractured surface and cross-section of the NLG plus a chemical composition analysis and to conduct a Metallographic examination of the NLG Elastomer Pack to arrive at the conclusion that all parts of the NLG failed due to the overload failure due to the heavy landings. It was an obvious conclusion which **could have saved a lot of time and money** for this investigation. **The NLG did not fail and cause the accident!!**	The Tests and Research results will remain in the report as it is part of the process undertaken in connection with the investigation. It is to rule out conclusively the possibility of fatigue or manufacturing failure.

5.	1.17.4	Student Pilot's RT Performance	It is unnecessary to harp on the SP's RT performance as it did not contribute to the accident. At a low amount of experience (26:45 hours) any SP will not have perfect RT performance. The SP's personal FI made comments in the Student Performance Record for debrief and record purposes in order to improve the SP's performance as he progresses in his flight training and if there is a change of an FI.	It is necessary to discuss the SP's RT performance as it was one of the causal factors that led to the rest of the chain of events. At this stage, SP RT performance is not expected to be perfect, but SP should've reasonably been able to understand a simple instruction given by the ATC.
6.	1.18.1	Interview with SP	The unintentional failure of the SP to comply with the ATC instructions on departure from the airfield was unnecessarily exaggerated by the ATC on duty that day where he reprimanded the SP several times. The ATC also reprimanded the SP's FI over the radio. However, after being scolded by the ATC, the SP apologizes and takes corrective action. The scolding by the ATC caused the SP to become scared and lose his temperament. That affected the remainder of his sortie causing him to cut short his training and return to base. His experience during the take-off still lingered in the SP's mind and that caused him to make judgmental errors during his 3 approaches to land and the subsequent hard landings, bounces and finally crash.	The error committed by the SP was intentional as he knew for a fact that he did not understand the unfamiliar instruction given by the ATC; nevertheless, he decided to proceed with the normal climb procedure, which was against the instruction given by the ATC.
7.	1.18.3	Interview with ATC Controller during Departure	The ATC Controller had no experience in dealing with SP flying and to allow some leeway for errors expected of SPs. He harshly reprimanded and scolded the SP for not following his instructions and continued doing so even after the SP apologized and took corrective action. The ATC Controller even engaged the SP's FI over the radio and told him to ensure that his SP understood all	Will not be amended,

			instructions from ATC before he cleared the SP for flight. This conduct is totally unprofessional. His agitation, anger and unpreparedness in handling SP flying totally ruined the SP's temperament and confidence that led to this unfortunate accident.	
8.	1.18.4	Interview with ATC Controller during Arrival	After the ATC Controller saw the SP making 2 unsuccessful landings which were hard and made the aircraft bounce several times, she should have asked the SP to hold at downwind while she consulted an FI of the operator. In the interests of safety, the FI could have been summoned to the tower to evaluate the situation and ask the SP to make a slow and low fly-past the tower in order to make a visual observation (with binoculars, if necessary) to see if there were any obvious damage to the undercarriage. The FI could have communicated with the SP to reassure him and build up his confidence before asking him to make another approach to land. He could have talked down the SP during the approach and guide him to adjust his speed and height before touchdown with the correct attitude just as if he was with him in the cockpit. This could have prevented the accident.	These are some of the points that can be discussed between the ATO and the ATS during the periodic meetings and discussions to reach some understanding with regards to the flight operations to improve coordination between the two organisations. (Refer para 4.1b)
9.	3.1 3.1.3	Findings - The Operator	The operator is not new to Kuala Terengganu Airport. It has been operating there since 2006, although it has pulled back the detachment from time to time. Sufficient coordination had been made with the airfield operator and ATC in the form of meetings and discussions. All SOPs were in place as evidenced by the approval given by CAAM Flight Operations to re-commence training operations there after a successful audit.	Will not be amended as there is no information obtained pertaining to the operating of the ATO since 2006 and the coordination with the ATS.

10.	3.2	Cause	**The Cause of the accident is NOT due to the collapse of the NLG as stated.** It is due to SP's unstable psychological state of mind caused by the ATC Controller when he reprimanded and scolded the SP during the departure. This state of mind led to the SP to cut short his sortie and while still having the fear of further scolding by the ATC, he made an unstable approach to land resulting in heavy landings and bounces and eventually the crash.	These are the causal factors that led to the accident. Although SP's state of mind is said to be unstable due to being reprimanded/scolded by the ATC, which led him to make an unstable approach during landing resulting in heavy landings and bounces, if the NLG did not collapse, the probability for the accident to occur might have been avoidable.
11.	3.2.1	Contributory Factors	**The stated contributory factors are not correct.** ATC Controllers at Kuala Terengganu airport are not experienced in handling flight training sorties by SPs. They must be vigilant of the SP's flying and be a lot more tolerant if SPs make mistakes in complying with ATC instructions. A lot of latitude should be given to SP flying and whenever necessary, assistance should be sought from FIs of the operator to guide SP correctly in the interests of Safety.	As far as the State is concerned, all ATC Controllers are trained, licensed, qualified and certified by CAAM. Any dispute or dissatisfaction regarding the licensed ATCs that have been certified by CAAM, can be reported to CAAM.
12.	4.0 4.1 (a)	Safety Recommend-ation - The Operator	All the Cadet Pilots are trained and educated on the use of R/T before sending them for Solo flight. However not every Scenario can be simulated and taught on the ground. On such occasions, the ATC Controller must play an important role by assisting the Solo Cadet instead of questioning him and making him lose his focus and confidence, as long as Safety is not jeopardized. In this situation, even though the Cadet did not comply to the ATC instructions, there was no imminent danger of an air-to-air collision or close proximity as the two Flight Instructors who were flying in the Circuit at that time and were visual with the Solo Cadet.	These are some of the points that can be discussed between the ATO and the ATS during the periodic meetings and discussions to reach some understanding with regards to the flight operations to improve coordination between the two organisations. (Refer para 4.1b)

			The Flight Instructors in the Circuit mentioned that they were visual with the Solo Cadet and had sufficient separation between them.	
13.	4.1 (b)	The Operator	Regular meetings are conducted with ATS.	Will not be amended as there is no evidence obtained pertaining to the meetings conducted with ATS.