BUREAU OF AIR ACCIDENT INVESTIGATION

This investigation has been conducted in accordance with *Annex 13 to the ICAO Convention on International Civil Aviation*, *EU Regulation No 996/2010* and *The Civil Aviation (Investigation of Air Accidents and Incidents) Regulation; Legal Notice 16 of 2013*.

Under these Regulations, the sole objective of the investigation of an accident or incident is the prevention of accidents and incidents in the future. It is not the purpose of this investigation to assign fault or blame and the reporting process should not be used to determine liability.

9H-AEB runway excursion at Malta International Airport 1st November 2021

Table of Contents

1. General Information.

Location: Malta International Airport	**Accident Number:** BAAI/SIR 011121
Date & Time: 1st November 2021, 15:00	**Registration:** 9H-AEB
Aircraft: Piper PA-34-200T Seneca II	**Aircraft Damage:**
Defining Event: Runway excursion during landing from RWY31	**Injuries:** No injuries Reported

2. Synopsis

2.1 A Piper PA-34-200 Seneca performed a controlled crash landing on RWY 31 in the afternoon of 1st November 2021. After take-off, the landing gear was retracted at a speed higher than the recommended *gear retraction speed (VLO)*. The right main landing gear did not fully retract and stopped at an intermediate position.

2.2 The reaction of the crew was to recycle the landing gear and this time it operated normally. This was confirmed by the landing gear position indicator lights in the cockpit centre instrument panel.

2.3 During the approach to land, after selecting the gear down, the right main landing gear did not extend to the full down and locked position.

2.4 Following an unsuccessful attempt to manually extend the landing gear, and after performing a series of manoeuvres, the landing gear still did not unjam, a decision to perform a controlled crash landing was made.

2.5 In the final stage of the approach, the right engine was turned-off close to the threshold of RWY31. The Pilot now had to deal with a single engine and partial gear up landing.

2.6 After landing, the aircraft skidded on the runway for 300 meters, following which it suffered an excursion into the grass.

3. Factual Information

3.1 Aircraft and Owner/Operator Information

Aircraft Make: Piper

Model/Series: Piper PA-34-200T Seneca II

Aircraft Owner: Falcon Alliance

Registration: 9H-AEB

Aircraft Category: Multi-engine airplane

Year of Manufacture: 1978

Landing Gear Type: Tricycle

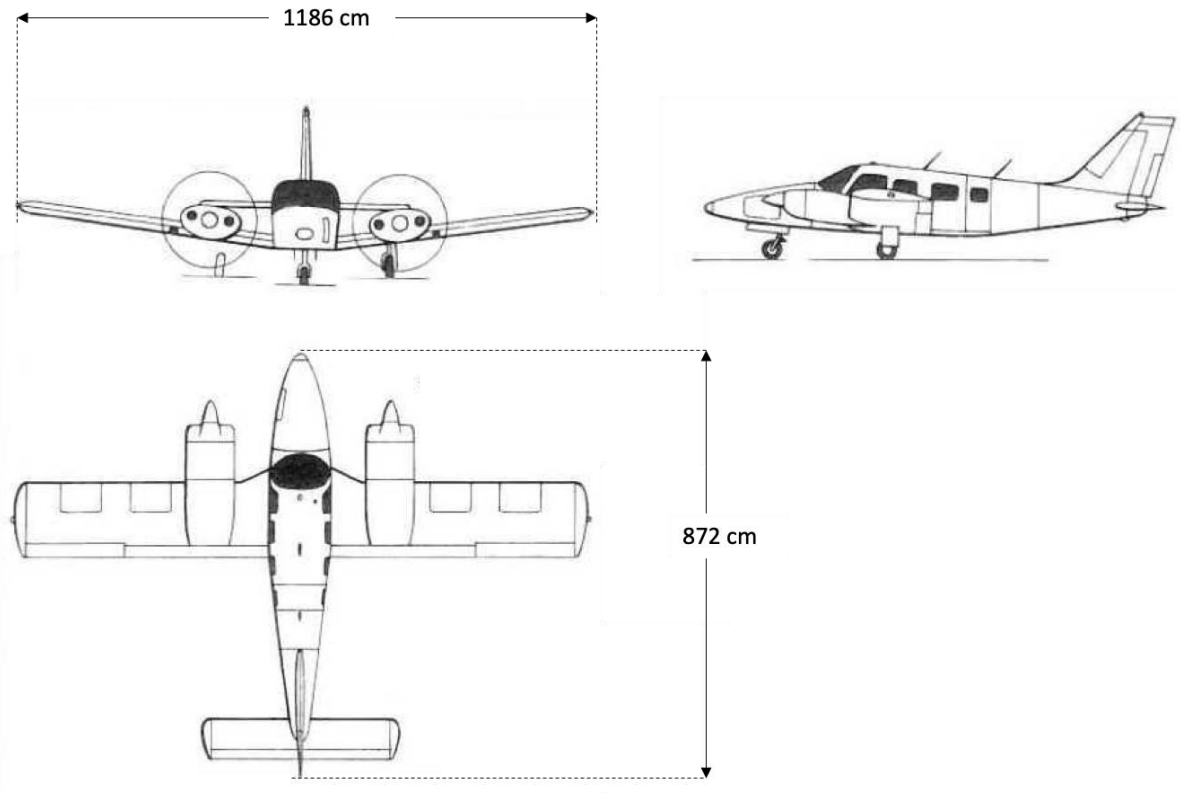

Fig. 1: Overview of the aircraft dimensions

3.2 Meteorological Information

Conditions at Accident Site: Visual conditions clear

Condition of Light: Day

Lowest Cloud Condition: N/A

Visibility: More than 10 km

Lowest Ceiling: N/A

Wind Speed/Gusts: 5 – 8 kts

Forecast/Actual: Reported

Wind Direction: 90 degrees

Forecast/Actual: Reported

Altimeter Setting: N/A

Temperature/Dew Point: N/A

Precipitation and Obscuration: None

Note: Weather is not considered to have contributed to the accident

3.3 Airport Information

Airport: Malta International Airport

Geographical coordinates: N $35^{0}51'$/E $014^{0}28'$

Runway Designation: RWY 31

Runway Heading: 312^{0}

Runway Surface Type: Tarmac

Airport Elevation: 230 ft

4. On-Site Evidence

4.1 The BAAI was called onsite shortly after the accident. The aircraft lay resting on the grass adjacent to RWY31. Markings on the runway indicate that the aircraft had skidded on the runway for 300m before coming to rest. The footrest ploughed through the grass, as shown in Fig. 1. Fig 2. shows the landing gear (*on the right-hand side of the aircraft*) that had failed to fully extend. Fig. 3 shows the final resting position of the aircraft relative to RWY31. Fig. 4 shows a trajectory of the airplane after touchdown.

Fig. 1. Aircraft in its final resting position (tail view).

Fig. 2. The aircraft in its final resting position (nose view) with detail of un-extended landing gear

Fig. 3: Overview of the airport runways.

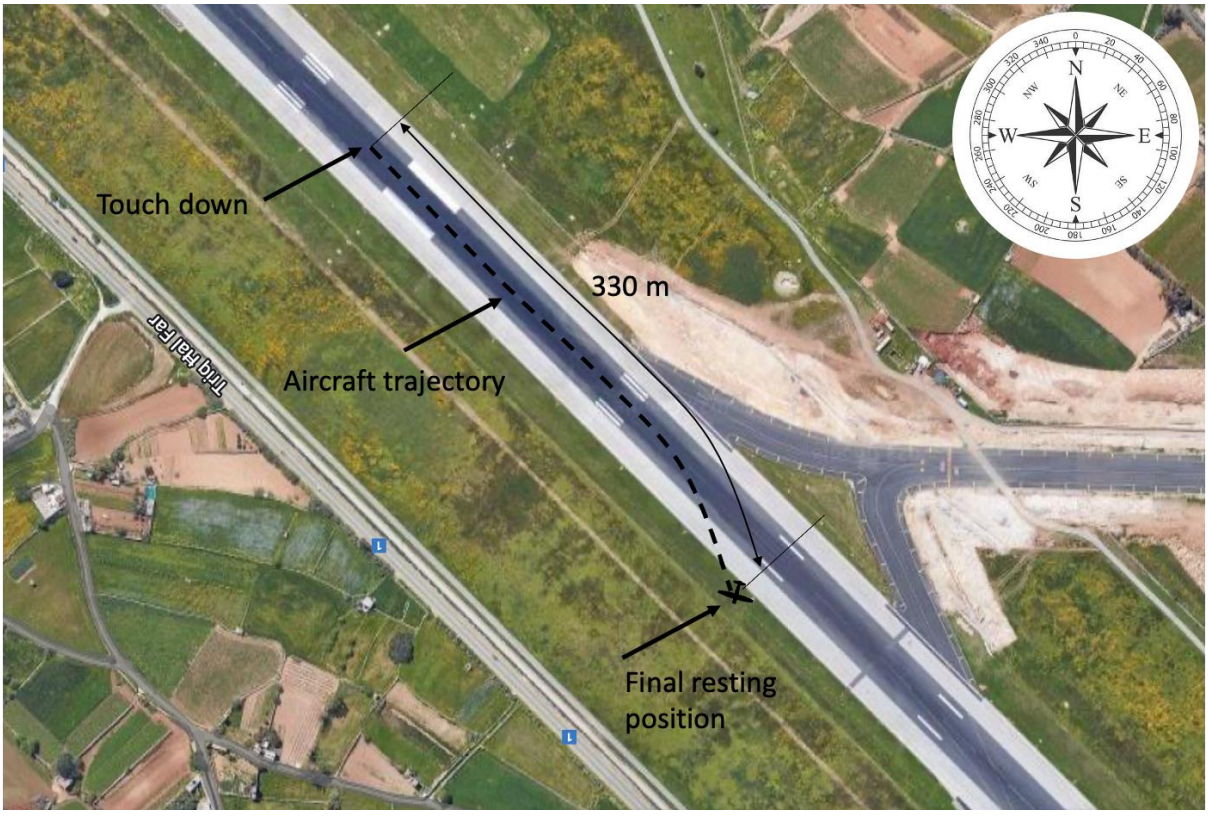

Fig. 4. Sketch of the aircraft trajectory on the runway.

5. Inquiry

Since the failed component was the right main landing gear, this inquiry proceeded with an engineering investigation in parallel to interviews with the concerned personnel. The following section provides an in-depth review of the landing gear system.

5.1 The Piper PA-34-200T Seneca II is fitted with a tricycle retractable landing gear system. The system is hydraulically operated and electrically powered and controlled. The nose landing gear (NLG) retracts forward, and the main landing gear (MLG) retracts inboard. The system uses its own hydraulic power pack, located in the aircrafts nose, and is controlled by two solenoids operated from the cockpit selection switch. These control a reversible electric motor, which provides pressure in either the up or down sense to each of the three gear hydraulic actuators.

5.2 Several switches are installed in the system for control and warning purposes. Each landing gear has an UP-limit switch, which is activated whenever the gear is physically in the up position, and a DOWN limit switch which actuates once the gear is down and fully locked in position. Additionally, the left gear is fitted with a safety (weight on wheels) switch, such that when the gear is compressed on the ground, it actuates and isolates electrical power from the UP solenoid in the hydraulic power pack and so prevents the landing gears from being inadvertently retracted.

5.3 The aircraft is equipped with three green gear-down and locked lights as shown in Fig. 5 and a warning horn is sounded. These lights are connected to their respective DOWN limit switches on each gear and, when these operate, the lights illuminate.

5.4 Once all three DOWN limit switches are activated as the gear locks down, power to the DOWN solenoid is removed and the hydraulic motor stops. The gear is retained in the down and locked position by over-centre springs in the side-stay lock links. However, should any one of the three DOWN limit switches indicate that a gear is no longer locked down, the hydraulic motor restarts, generating pressure in the gear down sense, and attempts to re-lock the gears down.

5.5 The gears are not physically or mechanically locked in the UP position; but instead, they rely on the retention of hydraulic pressure in the UP lines of the system. If the pressure drops, as is likely due to internal leakage, a pressure switch commands the UP solenoid to energise the electric motor in the hydraulic power pack and re-apply pressure to the UP lines. This ensures the gear remains retracted. To extend the gear manually, an emergency lever is provided which, when pulled, dissipates the hydraulic pressure in the UP lines of the system and allows the gears to free-fall under the influence of gravity. The over-centre springs on the lock links then lock the side-stays, and hence the gears, into the DOWN position.

Fig. 5: Green lights indicating gear down and locked.

5.6 The electrical control system and hydraulic power pack are protected by two circuit breakers (CBs). The Landing Gear Control CB protects the control system and if this is tripped, then the GEAR UNSAFE, the green down and locked lights and the warning horn do not operate. In addition, there would be no control of the UP and DOWN solenoids in the hydraulic power pack. The Landing Gear Pump CB protects the hydraulic power pack motor and if this is tripped then the hydraulic motor does not operate in either direction.

5.7 The nose landing gear doors are operated mechanically and close once the nose landing gear has retracted into its bay. As it does so, it applies upward pressure to a roller assembly in the roof of the nose landing gear bay. This assembly is connected by push rods to the doors and causes them to close as shown in Fig. 6.

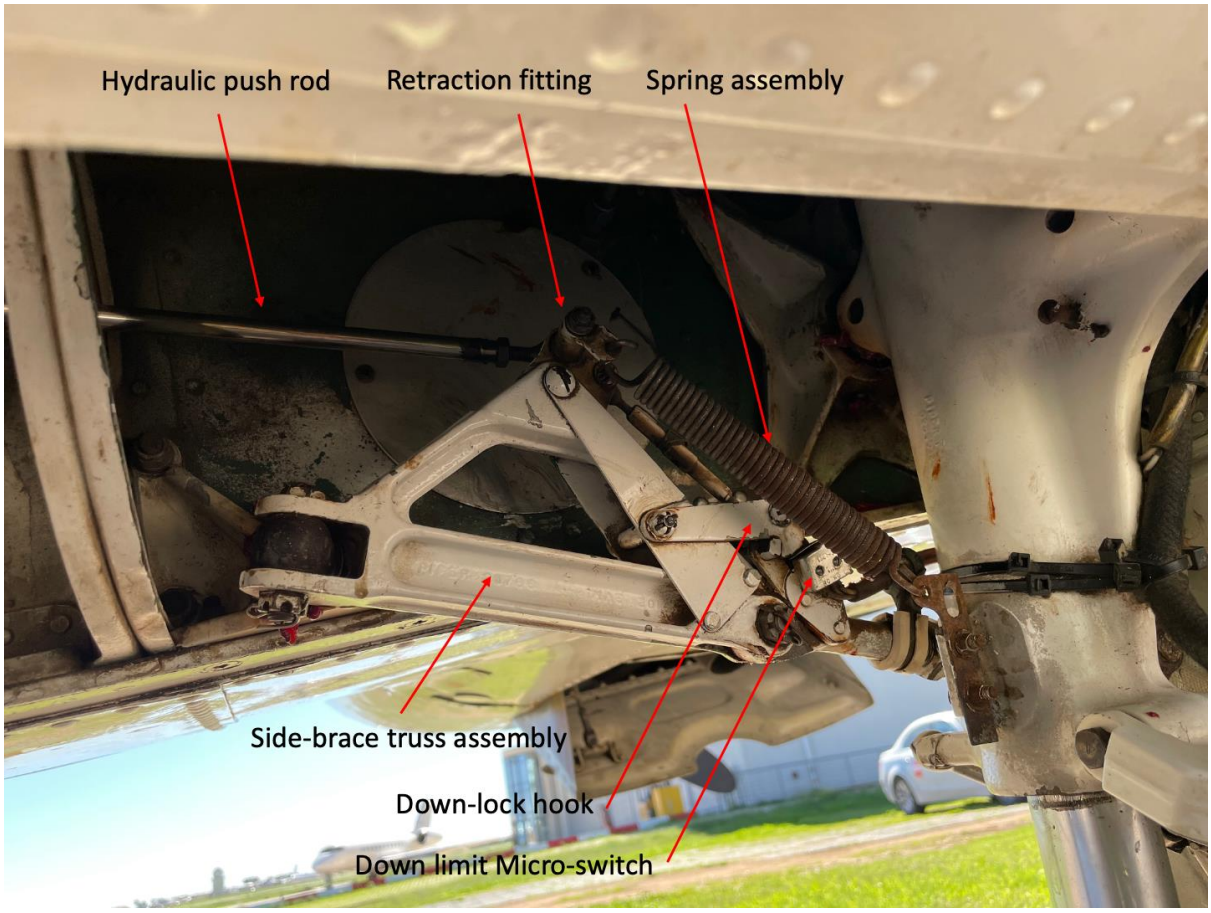

Fig. 6. Photo of the landing gear assembly

5.8 Throughout the course of this investigation, four interviews were held with the following personnel.

Interview 1: The instructor on board the aircraft who was the pilot in command (PIC)

Interview 2: The head of safety

Interview 3: The head of training

Interview 4: The head of engineering / Hanger manager

The result of the interviews is highlighted in the following paragraphs:

5.9 After take-off, the landing gear lever was selected up as per normal procedure. The right main landing gear got jammed and did not fully retract. The PIC assumed that the probable cause for this was “because the student pilot retracted the landing gear at a higher speed” than the retraction speed specified by the aircraft operations manual. A decision was taken to recycle the landing gear by selecting the gear lever down which resulted with the landing gear to extend to the full down and locked

position; confirmed by 3 green lights in the flight deck. The PIC presumed that the jam occurred due to the incorrect gear retraction speed and decided to select the landing gear in the up position. The landing gear fully retracted and the PIC decided that it was safe to continue with the training session since this time the landing gear operated normally. During the approach for landing, the crew selected the landing gear down. However, the right main landing gear did not fully extend to the down and locked position which was confirmed with the landing gear lights in the cockpit showing two green lights and one red.

5.10 The '*manual gear extension'* procedure was performed but was unsuccessful. ATC and the training school were informed that they had a problem with the extension of the landing gear. The crew noted that they had enough fuel left *(3 hours of flight time),* during which they did a series of manoeuvres in an attempt to get the right main landing gear to move in the down and locked position. Despite these efforts by the crew, the landing gear still did not move from its stuck position. For landing, the crew requested to land on the RWY 31 which is longer than RWY 23 and had a more favourable wind condition. RWY 23 had a mild crosswind and therefore would have been slightly more challenging to land the aircraft on RWY23. The wind speed at the time varied between 5-8kts. The crew were given the go ahead by ATC to land on RWY31 as requested.

5.11 During the flight, the crew requested assistance from the school. The interview with the PIC revealed that messages between the PIC and the head of training were relayed through the head of safety, and that PIC never communicated directly with the head of training. The chain of communication was broken, and the PIC received several instructions from different people within the school, making it confusing and as a result, ground assistance was inadequate. The PIC was advised to perform a controlled crash landing during which the right engine is to be switched off during the final stages of the approach. The recommended procedures specified in the Piper Seneca Information Manual does not recommend switching just one engine off at any time during the approach. During the course of this investigation, it emerged that the crew failed to follow and perform all the items as suggested in the 'Gear-Up Emergency Landing' procedure, but instead, the crew followed instructions they were receiving over the radio from the school.

"GEAR-UP EMERGENCY LANDING"

a. *Approach with power at a normal airspeed.*
b. *Leave flaps up (to reduce wing and flap damage).*
c. *Close throttles just before touch down.*
d. *Turn off the master and ignition switches.*
e. *Turn fuel selector valves to "OFF"*
f. *Contact the surface at minimum airspeed.*

At no point it is suggested to land with a single engine. An engine failure is not considered to be a catastrophic failure in a multi engine aircraft, but it can be very demanding on the crew. Deliberately switching off a serviceable engine in flight has the same effect as an engine failure and should be avoided. Asymmetric thrust causes a slip and moment towards the inoperative engine (*and in this case the failed landing gear*). The rudder must be used to maintain directional control of the aircraft. Therefore, the decision to switch off an engine of an aircraft which was already dealing with a partial gear up landing problem, intensified the issue. The crew now had two problems: a partial gear-up landing problem and a single engine landing.

The Piper Seneca Information Manual suggests that in a single engine landing, the rudder trim is neutralized before touchdown. This allows the pilot to maintain directional control of the aircraft on the ground. The crew elected to perform this procedure and switching-off the remaining operating engine after touchdown, thus giving themselves no time to deal with the landing gear and single/securing engine problem. CCTV footage of the landing show the right wing dropping immediately on touchdown and the pilot losing directional control of the aircraft.

During the interview with the flight instructor, it emerged that despite the decision to turn off one engine, the crew did not consult the single engine landing procedure.

5.12 The pilot landed the aircraft with flaps up to reduce the possibility of wing and flap damage. Touch down was made close to the threshold.

5.13 Throughout the course of the investigation, it was found that the communication channel between the instructor and the school was chaotic. The poor communication practices involved multiple players relaying instructions with the pilot being given different priorities. At the same time, it was noted that the head of training was at no point involved in the decision-making process.

5.14 The engineering section within the school offered no reason why the landing gear became stuck in an intermediate position. The fault was described as being intermittent, which may be more difficult to diagnose. It was highlighted that in the past there had been incidents in which the pressure goes down and the hydraulic pump switches on for a few seconds. This leads to a suspicion of a leakage in the hydraulic system. Piper suggested that this may also be due to a fault in the microswitch. Other potential causes may include an improper lubrication of the arm and centre springs which may be worn and do not lock into position. This investigation could not clearly identify the source of the engineering problem.

5.15 CRM.

A management system which makes optimum use of all available resources (equipment, procedures and people) to promote safety and enhance the efficiency of flight operations" – Definition by the United Kingdom Civil Aviation Authority. Good CRM employs personal knowledge and skills as well as the individual or the group's collective attitude. Other characteristics of good CRM are:

- good and effective communication,
- situational awareness,
- problem-solving,
- decision-making and teamwork

During the various interviews with the people concerned, it emerged that better use of CRM may have assisted the crew in dealing with this situation.

6.0 Recommendations

6.1 The following recommendations are being made:

To the flying school:

Recommendation 1

The flying school should have a clear process so that in case of emergency, communication with the pilot is clear through a single point of contact. Safety should be put first at all costs and management interference with these procedures should be avoided.

Recommendation 2

Since the fault may be intermittent, it is recommended that in the repair process, the hydraulics are inspected for leakages and the associated wiring, and electrical systems are inspected for any signs of dormant failures. As a precaution, it is suggested to consider changing the landing gear wiring and microswitches. Other moving and non-moving parts of the landing gear should be thoroughly inspected for correct operation.

The proper procedures and checklists should be followed thoroughly. Whilst the check list was available on flight, it was found to be crammed and printed on a double-sided A4 paper with very small fonts, as shown in Appendix 1. It is suggested that the checklist should be sub-divided between "normal operating procedures" and an "abnormal and emergency checklist". The format could be expanded to a booklet format that is easy to identify and larger font that is easy to read during an emergency procedure and a time of high workload.

NOTE: Reference is made to EASA, Research project EASA.2012/1, Principles, and guidelines relative to the design and checklists and working methods in the cockpit, Appendix 1 and Appendix 4. For ease of reference, a link to these appendices is being provided in Appendix 2 of this report.

To the Competent Authorities and Aircraft Manufacturers

Recommendation 3

It is recommended that the quality and interface properties of the checklist is considered during the certification process, primarily using the guidelines found in EASA, Research project EASA.2012/1: Appendix 1 and Appendix 4. This includes type and size of font, items that should be included, materials and the ability for the checklist to be easily held in one hand.

References:

AAIB Aircraft accident report:
https://assets.publishing.service.gov.uk/media/5422f801ed915d137400068f/Piper_PA-34-200T_Seneca_II__G-ROUS_06-09.pdf

BAAI Aircraft accident report:
https://baai.gov.mt/en/Documents/Incident-report/ACCIDENT%20final%20report%20Seneca.%20Gear%20up%20landing%2014-09-2017.pdf

AAIB aircraft accident report:
https://assets.publishing.service.gov.uk/media/5f58f2ade90e071469c5e303/Piper_PA-34-200T_Seneca_II_G-FILE_03-19.pdf

EASA, Research project EASA.2012/1, Principles and guidelines relative to the design and checklists and working methods in the cockpit, Appendix 1and Appendix 4
https://www.easa.europa.eu/en/document-library/research-reports/easa20121

ABBREVIATIONS

ANSP	-	Air Navigation Service Provider
ATC	-	Air Traffic Control
ATCO	-	Air Traffic Control Officer
BAAI	-	Bureau of Air Accident Investigation
CB	-	Circuit breaker
MLG	-	Main landing gear
NLG	-	Nose landing gear
PIC	-	Pilot in command
RFFS	-	Rescue and Fire Fighting Service
RWY	-	Runway
TWY	-	Taxiway

Appendix 1

EUROPEAN PILOT ACADEMY

AIRCRAFT CHECKLIST
9H-AEB PA-34 SENECA II

Version 1.4
March 2016

PREFLIGHT CHECK

COCKPIT PREPARATION

Aircraft Documents---------- Stowed
Parking Brake---------- ON
First Aid Kit---------- Stowed
Fire Extinguisher---------- Check
Gear Selector---------- Down
Gear Emergency Selector-------In & Guarded
Battery Master Switch---------- On
Landing Gear Lights---------- Three Greens
Fuel Quantity----------Adequate + Reserve
Battery Master Switch---------- OFF
Magneto Switches---------- OFF
Mixture---------- Iddle cut-off
Trim Indicators---------- Neutral
Flaps---------- Check Operation
Flying Controls----Full Free Correct Movement
Empty Seats---------- Fasten Belts
Cross Feed Drains---------- Operate

OUTSIDE CABIN

Battery Master Switch---------- ON
Exterior Lights---------- On / Check/Off
Stall Warning Vanes---------- Check
Pitot Heat ----Check (Max 3 min ground ops)
Battery Master Switch---------- OFF
Windshield ---------- Clean
Bagage and rear door ---Secure and Locked

BEFORE STARTING ENGINE

External Checks---------- Completed
Main Doors---------- --Closed & Latched
Seats/Belts/Harnesses--------Adjusted and Set
Parking Brakes---------- SET
Alternate Air Controls---------- OFF
Circuit Breakers---------- IN
Cowl Flaps---------- Open
Battery Master Switch---------- ON
Avionics Master & Radio---------- ON
ATIS Copied and Start-up Clearance–Obtained
Altimeter---------- Set with local QNH
Radio & Avionics Master---------- OFF
Battery Master Switch--------If no clearance OFF

STARTING ENGINES

Battery Master Switch----------confirm ON
Beacon light (Fin light)---------- ON
Auxiliary Fuel Pumps---------- OFF
Avionics Master---------- OFF

Starting Engine Nº 1

Fuel Selector Nº 1---------- On
Mixture Nº 1---------- Full Rich
Propeller Nº 1----------Full Forward
Throttle Nº 1---------- Half Travel
Magnetos Switches Nº 1---------- On
Prime----------(3 Secs Warm, 6 Secs Cold)
Propeller Area---------- Clear
Starter---------- Engage

When Engine Starts

Throttle-------Retard and Set 1000 / 1200 RPM
Oil Pressure Nº 1—Check (Rise Within 30 Secs)
Alternator Nº 1---ON and Check (Max 60 Amps)
Gyro Pressure---Check / Warning Indicator OFF
Alternator Nº 1---------- OFF

Starting Eng Nº 2--- Repeat procedure for Nº 2

Alternators---Both ON check balance approx 15 AMP each

AFTER START CHECK LIST

PFD---------- ON
Electrical Trim----------ON/Check/Set
MFD---------- Check units
Avionics Master Switch---------- On
Intercom----------Check On & Volume Set
Comms/Navs 1&2 / DME / ADF ---------- On
Transponder ---------- Standby

Left Fuel Selector — Check Shutoff / X-Feed /ON
Right Fuel Selector - Check Shutoff / X-Feed /ON

Avionics ----------CHECK & SET for departure
Markers---------- On
A/P------- ON / Check / Disconnect (red button)
Cabin Heat/Defrost---------- Check
Air Intake---------- Open
Heat/Fan Switch ---------- Check
Defrost Switch----------Check
Fan---------- As required
Clock ---------- Set (UTC)
Stop Watch---------- Wound
Nav Lights---------- As req.
Fuel Pumps---------- ON & OFF Check
Flight Instruments----------Set and Check
Radios---------- Intentions & request taxi

TAXI CHECKLIST

Look outside and Check-----(Right & Left Clear)
Parking Brake---------- OFF
Brakes & Steering (Both Pilots)---------- Check
Flight Instr. (TC, HIS, Compass, AH, RMI) Check

POWER CHECKS

Position----------Into Wind & Area Clear
Parking Brake---------- On
Temperatures & Pressures----------Check
Cowl Flaps---------- As Required
Fuel Selectors---------- ON
Throttle---------- 1200 RMP

Commence With Left Engine Checks

Propeller Feather--------Check Max. 300 RPM
Throttle---------- 1900 RPM
Propeller Control---------- Exercise
Propeller----------Check Governor
Alternate Air---------- On Then Off
Magnetos----------Check 150/50

Alternators Output----------Check
Gyro pressure----------4.8 – 5.1"Hg
Throttle-------Close/Check Idle (700 –900 RPM)
Throttle---------- 1000 RPM
Pressures & Temperatures----------Check
Fuel Flow----------Check (Usually 5 –7 GPH)
De-Icing Boots----------Check
(Inflate (6 secs) Suction Drops 6")
Propeller De-Icing------ -Check Twice On & Off
Annunciator Panel----------Test

BEFORE TAKE OFF CHECK

Trimmers---------- Set / (T.O. pos.)
Throttle Friction---------- Set
Mixtures---------- Rich
Fuel Selectors---------- On Check Content
Propellers----------Fully forward(Max RPM)
Auxiliary Fuel Pumps----------Off
Flaps----------(As required) Set for T.O.
Cowl Flaps---------- Set (1/2 or fully open)
Alternate Air---------- Off
Cabin Heater/Defrost----------As Requested
Seat Belts/Seat Back---------- Secure/Erect
Main Doors----------Latched & Closed
Flying Controls----------Full/Free Movement
Auto Pilot---------- Confirm Off
Departure Clearance----------Copied
TO and Departure briefing --------Completed
Altimeters--------QNH set / Check vs elevation
Avionics----------Confirm RAD/NAV
Engine Instruments----------Check
Propeller De-Icing----------As Required
Vent Fan---------- Off
Take Off ---------- Clearance

RWY ITEMS

T.O. Time ---------- Noted
Flaps---------- Check
Transponder----------Set ALT Mode
Landing, Recognition, Anti-Collision Lights---On
Pitot Heat------As Required (Max 3 Min on gnd)
RWY HDG----------Check when aligned

AFTER T.O. CHECK LIST

Gear-------Up (Max Retraction Speed 107KTS)
Flaps----------Retract Above 200' AGL
Power----------Set 32"/2450 RPM
Landing lights----------OFF
Altimeters----------Set / Cross Checked
Icing---------- Check
Radio Aids----------Identify If Required

CRUISE CLIMB CHECK LIST

Climb PWR----------Set 32" / 2450 RPM
Pitch down ----------(Speed 100 / 110 KIAS)
Cowl Flaps----------As Required
ATC Liaison to proceed as VFR / IFR

EUROPEAN PILOT ACADEMY

AIRCRAFT CHECKLIST
9H-AEB PA-34 SENECA II

Version 1.4
March 2016

CRUISE CHECKS

Cruise Power——Set as Required
Mixtures——Lean ROP
EGT——check max 1550° F
Engine Instruments——Check
Cowl Flaps——As Required
Icing——Check OAT
FREDA CHECKLIST

DESCENT CHECKS

ATIS——Read
Altimeter——Set with local QNH
EDM——Check cooling rate
MSA——Checked
Fuel——Check Sufficient
Mixtures——Enrich with Descent
PWR Setting——Reduce as Required
Cowl Flaps——Closed
Engine & Associated Instruments——Check
Icing——Check

APPROACH CHECKLIST

Radio/Nav Equipment——Set / Identified
H.S.I./R.M.I & Compass——Cross Checked
Altimeters——Set/Cross Checked
Approach Briefing——Completed
Minimums——Set MFD

PRE LANDING CHECKLIST

Seats/Seat Belts——Erect/Secure
Fuel Selectors——ON
Rudder——Neutral
Flaps——-Set
Cowl Flaps——Open
Mixtures——Rich
Propellers——2450 RPM
Brakes——Off
Landing Gear——Down / below 129 KIAS
(three green one on the Mirror)
A/P——OFF
Landing Lights——ON

FINAL VITAL ITEMS

Mixtures ("Reds")——Full Rich
Propellers ("Blues")——Full Forward
Undercarriage——3 Greens

AFTER LDG CHECKLIST

Landing Time——Noted
Flaps——Up
Transponder——STBY
Pitot Heat——Off
Recognition Lights——Off
Landing Lights——As Required
Propeller De-Ice——Off
Air Intake——Open
Heater/Fan Switch——Fan
Defroster——As Required

Trimmers——Neutral
Cowl Flaps——Open
Radio / Nav Equipment——As Required

SHUTDOWN CHECKIST

Parking Brake——ON
Throttles——1200 RPM
Avionics & Avionics Master Switch——OFF
Heater / Fan——2 min then OFF
Ammeters——Check (Less Than 10 AMPS)
Exterior Lights - except ACL (Fin) Light——OFF
Check ——3 Mins Have Elapsed Since Landing
Mixtures——I.C.O
Magnetos——OFF
Anti Collission Light (Fin)——OFF
Interior Lights——All OFF
Battery & Alternators——OFF
Control Wheels——Secure With Seat Strap

DURING CLIMB IN HOT WEATHER CONDITIONS, IT MAY BE NECESSARY TO USE LO AUXILIARY FUEL PUMP FOR VAPOR SUPPRESSION

AVOID CONTINUOUS GROUND OPERATION BETWEEN 1700 - 2100 RPM IN CROSS / TAIL WIND OVER 10 KT

AVOID CONTINUOUS OPERATIONS BETWEEN 2000 RPM and 2200 RPM ABOVE 32" MP

*** PFD default units:**
- **Alt/Vs - feet**
- **Spd -kts**
- **Nav angle –magnetic**
- **Distance - Nm**

V-speeds for SENECA II

Vso	61 KTS
Vs1	63 KTS
Vmca	66 KTS
Vr (Short Field)	71 KTS
Vr (Normal)	80 KTS
Vx	76 KTS
Vy	89 KTS
Vyse	89 KTS
Vsse	76 KTS
Cruise Climb	32' / 2450rpm ... 110 KTS
Holding speed	120 KTS
Downwind 10° Flap & Gear down	100 KTS
Base 25° Flap	95 KTS
Final 40° Flap	85 KTS
Intermediate Apch Segment	120-100 KTS
Final Apch Segment 25° Flap	95 KTS
Vne	195 KTS
Vno	163 KTS
Va	135 at 4407 lbs / 121 KTS at 3068 lbs
Vfe 10°	138 KTS
Vfe 25°	121 KTS
Vfe 40°	107 KTS
Vle	129 KTS
Vlo Extending	129 KTS
Vlo Retracting	107 KTS
Demonstrated X-WIND	17 KTS

STARTING ENGINE WHEN FLOODED

Mixture---------- –Iddle Cut Off

Throttle——FULLY FORWARD
PROPELLER——FORWARD
Master Switch——ON
Magnetos——ON
Auxiliary Fuel Pump——OFF
Propeller Area——Clear
Starter——Engage
When Engine start:
Throttle——retard
Mixture——Advance slowly

STARTING ENGINE IN COLD WEATHER

Props——Turn through by hand (3 times)
Fuel Selector——ON
Mixture——Full RICH
Throttle——full FORWARD
Propeller Control——full FORWARD
Master Switch——ON
Magnetos——ON
Auxiliary Fuel Pump——On low boost
Starter——Engage
Primer——On for 3 seconds
Throttle——full FORWARD to full AFT
Primer——ON & OFF every 3 sec.

STARTING ENGINE WITH EXTERNAL POWER SOURCE

Master Switch——OFF
All electrical equipment——OFF
Terminals——Connect
External Power plug——Insert in Fuselage

Proceed with normal start:
Throttles——lowest possible RPM
External power plug——disconnect from fuselage
Master Switch——ON (Check ammeter)
Oil Pressure——Check

PART B SECTION 3 **ANNEX B**

EUROPEAN PILOT ACADEMY

ABNORMAL/EMERGENCY CKL
9H-AEB PA-34 SENECA II

Version 1.4
March 2016

ENGINE FIRE ON GROUND

If Engine has Not Started:
Mixture---------- I.C.O
Throttle---------- Open Fully
Starter---------- Operate
If Engine Has Started:
Engine---------- Keep Running
If Fire Continues, After A Few Seconds
Throttles---------- Closed
Mixtures---------- I.C.O.
Fuel Pumps---------- Off
Fuel Selectors---------- Off
Magnetos---------- Off
Brakes---------- Set
Battery Master Switch---------- Off

ENGINE FIRE IN FLIGHT

Affected Engine:
Fuel Selector---------- Off
Throttle---------- Close
Propeller---------- Feather
Mixture---------- I.C.O.
Heater---------- Off
Defroster---------- Off
If fire continues and terrain permits----------
---------- Land Immediately
Note : DO NOT Attempt A Restart Following An Engine Fire

ENGINE FAILURE MEMORY ITEMS

AUTOPILOT .....DISCONNECT
FLY THE AEROPLANE.....PITCH FOR BLUE LINE
.....PUSH RUDDER TO MAINTAIN HEADING
.....(and some aileron to same side)
POWER-UP.....MIXTURES FULL RICH
.....PROPELLERS FULL FORWARD
.....THROTTLES ADVANCE, Max 40"
CLEAN-UP (minimise drag).....LDG GEAR UP
.....FLAPS RETRACT
IDENTIFY.....DEAD FOOT is DEAD ENGINE
VERIFY.....THROTTLE DEAD ENGINE CLOSE
FEATHER (restart not feasible or when failed)
.....PROPELLER DEAD ENGINE FULL FEATHER
MIXTURE DEAD ENGINE.....IDLE CUT-OFF

SECURE DEAD ENGINE AFTER FEATHERING

Fuel Selector Dead Engine.....SHUT OFF
Mixture Dead Engine.....(Verify) I.C.O.
Cowl Flap Dead Engine.....CLOSE
Magnetos Dead Engine ..... OFF
Alternator Dead Engine.....OFF
Fuel Pump Dead Engine.....(Verify) OFF
Engine Instruments Live Engine.....CHECK
Cowl Flap Live Engine .....OPEN
Electrical Load .....REDUCE
Power Live Engine .....when feasible 32" / 2450 RPM
Gyro Pressure .....CHECK
Fuel Selector Live Engine ....Consider CROSS-FEED

ENGINE FAILURE DURING FLIGHT

Airspeed---------- 89KTS Minimum (Blue Line)
Trim—adjust 5° bank toward operative engine
Memory items---------- Completed

Before feathering & securing Inop. Engine:
Fuel Flow ---------- Check
(If deficient press.)—Aux.Fuel Pump HI BOOST
(If power is not restored)- Aux. Fuel Pump OFF
Fuel Quantity---------- Check
Alternate Air---------- ON
Mixture, T & Ps and Magnetos ---------Check
Re-start---------- Try

Below 66 Kts
Rudder -apply to maintain heading / against turn
Throttles (both engines)-----retard to stop turn
Pitch down--- to increase speed above 66 Kts
Above 66 Kts (pitch to maintain > 66 Kts)
Operative engine—increase pwr as required
Airspeed---------pitch for Blue Line (89 kts)
Drag ---------- minimise (Ldg Gear / Flaps)
If Altitude permits a restart may be attempted
If restart fails or altitude does not permit:
Inop. Eng. Prop---------- Feather
Inop. Eng---------- Complete Eng. Sec. Proc.
Cowl Flaps (Operative Engine.) —as required

UNFEATHERING PROCEDURE AND STARTING CHECKLIST

Fuel Selector (inop engine)---------- ON
Throttle---------- Set ¼ " Open
Propeller Control--forward to cruise RPM pos.
Mixture---------- Rich
Auxiliary Fuel Pump (inop engine) --------OFF
Magneto Switches---------- ON
Starter---------- engage until prop. Wingmills
Throttle----reduce power until engine is warm
Alternator---------- ON
If engine does not start—— prime as required

ELECTRICAL FAILURES

Double Alternator Failure

Field Circuit Breakers---------- Check/Reset
Alternator Switches Off (both) then turn ON
one at a time while observing ammeter
Alternator showing Least (but NOT ZERO)
amps. And turn it switch ON
If power is not restored: Check circuit breakers
And reset once if required.
Electrical Load---------- As Required
If Output Not Restored:
Battery Master Switch--------Off For 6 Sec
Min
If Failure Persists Battery Only Remains Max.
Of 30 Mins. Land ASAP.
Extend Gear By Emergency System.

Single Alternator Failure

Field Circuit Breaker---------Check/Reset
Ammeter/Warning Light----------Check
Alternator Switch---------- Cycle

If Output Restored:
Electrical Load---------- As Required

EMERGENCY GEAR EXTENSION

Check Before Extending gear manually:
Battery Master Switch ---------- ON
Circuit Breakers---------- IN
Alternator Output---------- NORMAL
Navigation Lights ---------- OFF (Daytime)
Airspeed---------- Below 85 KTS
Gear Selector---------- GEAR DOWN
Gear Emergency Knob-Release Guard & Pull
Gear Indicator Lights---------Check 3 Greens
Red Unsafe Light Out
Nose Wheel Position Check by the Mirror

EMERGENCY DESCENT

Throttles---------- Closed
Propellers---------- Full Forward
Mixture——As Required for smooth operation
Landing Gear---------- Extend
Flaps ---------- As required
Cowl Flaps---------- As required

TRIM RUNAWAY

Autopilot ---------- Disconnect
Trim ---------- Disconnect
Trim and Autopilot circuit breaker---------OFF
Re-Trim ---------- manually

PROCEDURES IN ICING CONDITIONS

Pitot Heater---------- Confirm On
Windshield Heat---------- On
Propeller De-Icer---------- On
Windshield Defroster---------- On
Select Air Intake ---------- OPEN
Heat / Fan Switch ---------- HEAT
Thermostat Control ---------- Hot
Defrost Switch ---------- ON
De-Icing Boots---------On ¼ - ½ " Ice Build

If Required:

Alternate Air Controls---------- ON
Alternate Static Source---------- Select

SINGLE ENGINE LANDING

Approach speed---------- 95 KTS
Mixture ---------- Full Rich
Inop. Engine propeller---------- Feather
Landing Gear---------- Down
Flaps ---------- Max 25°
RudderTrim---------- Set Neutral

When certain of making field:

Flaps 40° ---------- if required

Appendix 2

EASA, Research project EASA.2012/1, Principles and guidelines relative to the design and checklists and working methods in the cockpit, Appendix 1and Appendix 4
https://www.easa.europa.eu/en/document-library/research-reports/easa20121

Notes and Comments.

Piper Aircraft: Comment 1: Piper provides the required FAA approved manuals to all of its owners and operators following the guidelines that the FAA has provided.

Piper Aircraft: Comment 2: The narrative section of the report should make clear who the author is of the subject checklist that was being used (appendix 1), which I assume is European Pilot Academy.