



STANDARD OPERATING PROCEDURES MICROLIGHT AIRCRAFT ZEN AIR CH-701 STOL



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FOREWORD

1. These Standard Operating Procedures (SOPs) have been written to standardise the basic operating and flying procedures for Zen Air Microlight aircraft flying in the NCC.
2. Only standard terminology has been used throughout the SOP. All users are advised to use correct terms at all times.
3. The procedures have been devised for an average ab-initio learner and Flight Safety considerations have been kept in mind all along. Also, **a measure of standardisation in respect of presentation has been maintained so that the SOPs look like those of any other training type ac in service.** *For this reason, the SOPs are certainly not the simplest or the bare minimum required.*
4. Where specific orders or instructions are issued in variance with these SOPs to enhance safety, they shall be binding for all operators.
5. These SOPs are to be read in conjunction with Pilot's notes, Operating Data Manuals (ODMs), AP3456, Standing Orders for Flying in the IAF, Station Standing Orders and Pilot Orders.
6. These SOPs are not to be used as a substitute for briefings. However, it is hoped that briefing time would be reduced considerably if these SOPs are made available to all operators and referred to frequently.
7. Users must understand that Operating Procedures are derived from experience and may need to be modified from time to time. In order to help this process of evolution, Cos (and other senior operators, where available) may, with the concurrence of this HQ, try out their procedures for suitability before recommending them for incorporation in the SOP.
8. Pilots and supervisors are reminded that operating procedures can be defined only up to a certain extent and within certain parameters. There are bound to be occasions where pilots will be faced with situations, which are outside the scope of these SOPs. Under such circumstances, situational awareness, good leadership, good airmanship, judicious application based on experience and dictates of common sense must prevail.
9. It is mandatory to follow these procedures in letter and spirit. These SOPs come to force immediately on receipt.

AMMENDMENT RECORD SHEET

Any amendments to these SOPs are to be recorded with reference to the authority and date duly authenticated by appropriate authority.

[illegible]

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CHAPTER - I

FLIGHT AND MAINTENANCE SAFETY CONSIDERATIONS

ZENAIR CH 701 STOL

1. Inverted flight, spinning and aerobatics are prohibited on this aircraft.
2. Flying operation on this aircraft should be carried out in daylight under VFR conditions only.
3. To eliminate risk of injury or damage, ensure loose equipment, if any, is properly secured before starting the engine.
4. Unless in a run up area, while on ground, never run the engine with propeller turning.
5. Do not run the engine with bystanders standing close.
6. Never leave the aircraft unattended with the engine running.
7. Aircraft/engine servicing and maintenance is to be carried by authorised technical personnel only.
8. Always use only the recommended tools for any maintenance activity on the aircraft.
9. Always use the correct and recommended grade fuel, oils, lubricants and coolant to prolong engine life and health.
10. Do not operate in strong wind or turbulent conditions.
11. Never operate the aircraft in rain or moist weather conditions to prevent damage to wooden propeller.
12. Do not refuel in strong head winds to prevent hazing of windscreen due to fumes coming in contact with the Perspex.
13. Carry out a thorough FOD parade before commencing operations / ground run.
14. Periodic varnishing of propeller is recommended to conserve propeller life.
15. Strictly adhere to torque limits for tightening of screws and nuts. Once loosened. Always renew self-securing nuts.

16. Never clean air filters with gasoline, steam, caustic liquids, detergents or high pressure cleaning.
17. Always remove IGNITION KEY from the slot after switching off the engine.
18. Never open radiator cap when cooling system is hot.
19. Never accelerate the engine when it is below the recommended oil temperature.
20. For longer flights, always replenish engine oil to MAX mark.
21. On change of spark plugs, always renew both spark plugs of a cylinder. Never interchange spark plugs between cylinders.
22. Never exceed the maximum rated engine RPM.
23. Always allow the engine to cool for several minutes before switch off.
24. Never operate the engine with the coolant/oil levels below the specified quantities.
25. Do not operate under sustained negative G (more than 5 seconds) conditions.
26. Any other safety consideration depending on local conditions must be incorporated in the accident prevention and flight safety plan.

CHAPTER - II
TECHNICAL DETAILS: ZENAIR CH 701 STOL AC
LEADING PARTICULARS

Length:	20 feet
Height:	11 feet±
Wing Span	27 feet
Wing Area	127 Sq.ft
Tail plane span	87.5 inches
Main plane chord	58.9 inches
Wheel track	68.8 inches
Wheel base	57.5 inches
Empty weight	209 Kg (460 lb.)
Gross weight	436 Kg (960 lb.)
Useful load	227 Kg (500 lb)
Wing loading	37 Kg/sq.m (7.5 psi)
Fuel capacity (standard tank)	42 Lt
Fuel capacity (Wing tank)	22 Lt. Each
Inside cabin width	42 inches
Aileron deflection	15 deg Up/Dn ±1 deg
Flaps deflection	26 deg Up/Dn ±2 deg
Elevator deflection - Up	32 to 35 deg
Elevator deflection-Dn	28 to 30 deg
Rudder deflection Lt/Rt	23±2 deg

AIRCRAFT PERFORMANCE

Limit Load Factor ~Flaps Up	+4 G to -2 G
Limit Load Factor-Flaps Dn	+2 G
Design Load Factor	+6G to -3G
Stalling speed ~Flaps	30 mph
Stalling speed-Flaps Up	35 mph
Flaps extended speed range	30 to 60 mph
Never exceed speed with flaps down	60 mph
Normal operating speed range	35 to 85 mph
Caution speed range	85 to 110 mph
Never exceed speed (VNE)	110 mph
Take Off speed	40 mph
Best Rate of Climb speed	35 mph (flaps down)
Best Angle of climb speed	40 mph (flaps up)
Best Rate of Descent speed	40 mph (flaps up)
Cruise speed	80 mph
Cross wind limit	15 mph
Service ceiling	14000 feet Density Altitude

ENGINE PERFORMANCE

General Description

Rotax 912 A is a four stroke, four cylinder, horizontally opposed, spark ignition 80 BHP engine. The cylinder heads are liquid cooled and cylinders are ram-air cooled. Lubrication system is Dry Sump Forced Lubrication type. It incorporates Dual Breaker-less Capacitor Discharge Ignition (CDI). It has two Constant Depression carburetors and a mechanical fuel pump. Propeller drive is via a reduction gear with integrated shock absorber and overload clutch. The electrical system constitutes an electric starter and an integrated AC generator with external rectifier- regulator (12 V 20 A DC). The cylinder bore of the engine is 79.5 mm with a stroke of 61 mm. The displacement is 1211 cu cm with a compression ratio of 9:1. The dry weight of the engine is 57.1 kg (126 lb). The crankshaft to propeller shaft reduction ratio is 2.27:1

Operating Parameters and Limitations

(a) **Operating RPMs & Limits**

Take-Off RPM	5500/min (max 05 minutes only)
Max Continuous RPM	5300/min
Idle RPM	1400/min in ISA conditions

(b) **Acceleration**

Limit of engine operation at zero G and negative G: max 05 seconds at max - 0.5 G

(c) **Oil Pressure**

Minimum	-	12 PSI below 3500 RPM
Normal	-	29 to 73 PSI above 3500 RPM
Maximum	-	101.5 PSI. (Admissible for a short period during cold start only)

(d) **Oil Temperature**

Minimum	-	50°C
Normal	-	90°C to 110°C
Maximum	-	140°C

Note: The dry sump lubrication system provides lubrication in all flight conditions up to a maximum bank angle of 40 degrees.

(e) **Cylinder Head (coolant) Temperature**

Minimum	-	50°C
Normal recommended	-	50°C to 110°C
Maximum	-	150°C

(f) **Engine Start Operating Temperature**

Minimum	-	- 25°C
Maximum	-	50°C

(g) **Fuel Pressure**

Minimum	-	2.2 PSI
Maximum	-	5.8 PSI

(h) **Coolant Mixing Ratio.** 50% antifreeze coolant with 50% distilled water.(j) **Oil Capacity**

Maximum	-	3.0 litre (min 2 ltr must be maintained)
Maximum Oil consumption	-	0.1 litre/h

(k) **Fuel consumption**

At take-off rating	-	24.0 litre/h
At max continuous rating	-	22.6 litre/h
At 75% continuous rating	-	16.2 litre/h

(l) **Ignition Circuit**

Magneto drop (at 4000 RPM)	-	300 RPM
Max difference in mag drops	-	120 RPM

CHAPTER - III

STANDARD GROUND HANDLING PROCEDURES

1. Parking & Picketing

- Park the aircraft on hard and level ground, nose facing into the wind.
- Ensure that the surrounding area is free from obstructions and foreign objects.
- Place chocks on main wheels.
- Ensure cabin doors are closed and locked.

2. Storage and Picketing

- Aircraft must be picketed inside the hanger only.
- Adequate clearance must be available
- Picketing point must be hard, level and free from obstructions and foreign objects.
- Ensure chocks are in position.
- Put the aircraft covers on.

3. Towing Procedure

- Ensure the aircraft is fit for towing, undercarriage is serviceable and tyre pressure is correct.
- Ensure adequate wing tip and overhead clearance.
- Ensure wing tip walkers are positioned on either side to give wing tip clearance.
- Ensure propeller position is parallel to the ground.
- Hold the propeller mounting firmly.
- Place the nose wheel on the marked line.
- Pull the aircraft gently and cautiously.
- Park the aircraft on hard and level ground.
- Position the wheel chocks.

4. **Refuelling**

- Cover the windscreen Perspex with waterproof cover to prevent hazing and corrosion.
- Use clean container and funnel with chamois leather.
- Carry out contamination check and check for presence of water.
- Avoid spillage of fuel while refuelling.
- Do not carry out refuelling in windy conditions.

5. **Occasions for Ground Run**

- Carry out ground run at least once a week in case aircraft is not flying.
- Carry out ground run on completion of servicing schedule or engine snag rectification.
- Carry out ground run after engine oil and oil filter change.
- Carry out ground run on out of phase servicing/repair/rectification of any engine component or accessory.

CHAPTER - IV

CHECK LIST

SAFETY CHECKS BEFORE COMMENCING EXTERNAL CHECKS

Before commencing external checks ensure the following:-

- Master OFF.
- Battery OFF.
- Ignition OFF. Ignition key on instrument combing.

PRE-FLIGHT EXTERNAL CHECKS

Checks after Opening Cowling Cover

The respective tradesman would normally carry out the checks involving opening of cowling cover. However, in case of pilot TRS, the pilot will carry out the checks:-

- *Fuel cap secure.*
- *Coolant level in over flow bottle, cap secure.*
- *Hoses for leaks.*
- *Spark plugs caps secure.*
- *Remove oil cap, rotate propeller until murmur sound is heard from oil tank.*
- *Engine oil level. Ensure filler cap secure.*
- *Carburettor and air filter- locking, mounting, and manifold.*
- *Security of engine mounting bolts (Four). Check split pins secure.*
- *Fuel filter and fuel lines.*
- *Starter, solenoid and rectifier.*
- *Throttle cable.*
- *Exhaust manifolds (right & left) for damage and leakage.*
- *Electrical cables.*
- *Nose wheel Bungee Chord.*

- *Fuel drain nut.*
- *Mounting of oil cooler and coolant radiator.*

The Checks mentioned in subsequent paras are to be carried out by pilots.

EXTERNAL CHECKS

- Cowl fasteners for security and not loose.
- Nose wheel section:-
 - All bolts.
 - Locking wire.
 - Wheel mounting.
 - Tyre for cuts, creep and pressure.
- Security of propeller locking bolts.
- Propeller for nicks and cuts.
- Right wing mounting and strut bolts.
- Right slat mounting bolts.
- Right wing tip for damage.
- Security of split pins of right flaperon attachments.
- Full and free movement of right aileron and condition of aileron cable.
- Star board under carriage:-
 - Check bolts, wheel assembly and split pins.
 - Check brake assembly and brake hose.
 - Check tyre for cuts creep and pressure.
- Fuselage surface for warping, buckling and security of rivets.
- Full and free movement of elevator.
- Condition and security of elevator and rudder cables.
- Repeat same as the star board checks on the port side.
- Remove pitot cover and check tube for blockage/foreign object.

INTERNAL CHECKS

- Fasten seat belts and ensure that extra portion of belt is tucked inside the lap. Wear Head Set and adjust volume.
- Check ignition key removed and placed on instrument panel combing.
- Throttle at idle. Check friction nut tight.
- Choke off.
- Check Compass for condition and reading parking heading.
- Check Clock condition and Time set correctly (if fitted on aircraft).
- ASI - check condition and marking.
- Altimeter - check condition, move +/- 100 ft, select to airfield elevation.
- All engine instruments for condition and marking.
- RPM gauge condition.
- Fuel contents gauge condition and marking. Select Battery ON. Check fuel contents sufficient for sortie.
- Check Voltmeter for condition and marking. Check voltmeter above 14 volts.
- Check control column for full and free movement in clockwise and anti-clockwise directions. During this, check controls moving in correct sense and no grinding or fouling noise.
- Select RT ON. Check RT volume satisfactory. Check RT freq correct. Obtain start up clearance.

START UP PROCEDURE

Cold Start

- Fuel cock open, Choke ON, Throttle to idle.
- Check prop area clear. Obtain clearance from ground crew.
- Master ON, Battery ON

- Take ignition key and move it through LEFT, RIGHT, BOTH to START position to actuate starter. As the engine picks up, release key to stop cranking. The key will automatically come to BOTH positions as it is spring loaded. Select Choke OFF.
- Select Instrument switch ON. Check oil pressure rises within 10 seconds to Min 30 psi.
- Check idling RPM correct.

Note. The ignition key can be held in START position to max 10 Sec in case of no start. Allow 2 min cooling before attempting next start.

Warm Start

- Fuel cock open. Choke OFF. Throttle to idle.
- Check prop area clear. Obtain clearance from ground crew.
- Master ON, Battery ON.
- Take ignition key and move it through LEFT, RIGHT, BOTH and to START position to actuate starter. As the engine picks up, release key to stop cranking. The key will automatically come to BOTH position.
- Select Instrument switch ON. Check oil pressure rises within 10 seconds to min 30 psi.
- Check idling RPM correct.

Warm Up Procedure

- Smoothly increase RPM to 2000 or slightly higher (to eliminate vibrations) and note time.
- After 02 minutes, increase RPM to 2500 and wait until oil temperature reaches 50° C.
- Check oil temperature, oil pressure and CHT are in green sector.

Ignition/Magneto Check

- Hold aircraft on brakes.
- Check throttle friction nut loose. Signal to ground crew and smoothly increase RPM to 4000.
- Select ignition key to LEFT. Call out RPM drop ----. Select it to BOTH. Check RPM regains.
- Select ignition key to RIGHT (through LEFT position). Call out RPM drop ----. Select it to BOTH. Check RPM regains.
- Check individual RPM drop not more than 300 RPM and difference in drops is not more than 120 RPM.
- Throttle to idle.

TAXIING**Checks Before Taxy**

- Check Oil Pressure, Oil Temp and CHT in green sector.
- Check doors closed, harness tight (confirm from co-pilot).
- Check taxi path ahead clear.
- Give RT call for taxi and obtain RT clearance from ATC.
- Set altimeter to QNH.

Taxy Procedure

- Ensure throttle to idle. Hold aircraft on brakes.
- Wave off chocks. Look outside and ensure ac not moving forward.
- Check taxi path clear. Increase RPM to 1800 and release brakes.
- As aircraft moves forward, close throttle, check brakes serviceable.
- Reopen throttle to 1800 RPM and taxi forward.

Airmanship & Engine Handling Points

- Do not use brakes against power.
- Do not exceed speed of slow walking pace in dispersal and fast walking pace at other places.
- In case of prolonged taxing, check Oil Pressure, Oil Temp and CHT in green sector and serviceability of brakes every 200 m.

TAKE OFF

Vital Actions before TAKE OFF. Approaching, V/A Point, close throttle and stop the aircraft at V/A point. Check aircraft not moving forward and call out checks prefixing with mnemonic.

- T - Throttle** friction nut loose.
- T - Trim** neutral. Check light indication.
- F - Fuel** Cock ON. Fuel Contents (call out) sufficient for sortie.
- F - Flaps** UP, check visually on both sides, Confirm lever UP from LH pilot.
- I - Instruments**
 - Altimeter set to AF elevation. Call out correction.
 - Oil temp, Oil pressure, CHT in green sector (call out readings).
 - Battery charging. Voltmeter reading --- volts.
 - Compass reading parking heading -----
- I - Ignition** on to BOTH
- H - Harness** tight, Confirm from other pilot.
- H - Hood** - door closed. Confirm from other pilot.

W - Winds (call out clock code and strength)

T - Time - call out.

C - Controls. Check full and free movement of controls (except rudder) in clockwise and anti-clockwise directions. During this, check controls moving in correct sense and no grinding or fouling noise.

- After V/A, call out pre-take-off brief.

Pre Take Off Brief. I / you will have controls for take-off. In case of engine failure after take-off, I will retain / you will take over controls. Height below 200ft, runway length remaining, we shall land straight ahead. Above 200~ and no RW remaining, we shall select a field between 11 to 1O clock, make gentle turns, use flaps as required and land.

- Check Base leg, Approach path and Runway clear and give RT call for Line UP to ATC.

Checks after Line Up

- Ensure throttle at idle, aircraft held on brakes, not moving forward.
- Magnetic compass indicating runway heading.
- Oil Temp, Oil Pressure and CHT in green sector
- Stick slightly aft of neutral and into wind.
- Take ~ off-path clear of birds and other aircraft.
- Obtain RT clearance for take-off.

Checks after Take Off (At 300' AGL)

- Apply brakes to stop wheels rotating.
- Reduce RPM to 5000.
- Check speed 60 mph.
- Check oil temperature, oil pressure and CHT in green sector.

Note. In case of prolonged climb, check and call out oil temp, pressure and CHT in green sector and Fuel contents every 500 feet and ensure that you are flying in the allotted sector.

CHECKS BEFORE STALL

Internal Checks. To be carried out with wings level in level flight/climb.

- H** - **Height** sufficient (dual 2500 ft AGL & solo 3000 ft AGL).
- A** - **Airframe** clean. Select flaps prior to entering stall if required.
- S** - **Security**. Check no loose articles in the cockpit, Confirm harness tight, Doors closed and locked.
- E** - **Engine**. Check oil temp. Oil pressure, CHT in green sector. Fuel contents sufficient.
- L** - **Location**. Sufficient sector length available to carry out stall & recovery.

External Checks. (Carry Out In a Turn)

- Flying in local flying area and allotted sector.
- Not over populated, prohibited area or large expanse of water.
- Area around clear of birds, other aircraft and clouds especially below.
- Select a point of reference and orientation.

Checks after Recovery from Stall

- Check oil temp, oil pressure, CHT in green sector. Fuel contents sufficient.
- Flaps UP, check flap lever UP, check visually flaps UP.
- Orientate and give an :Operations normal~ call to ATC.

DOWNWIND VITAL ACTIONS

Settled on downwind, Check height, speed, direction, power, trim and displacement.
Carry out D/W vital actions.

- S** - **Speed** 60 - 70 mph.
- B** - **Brakes**. Check serviceability), visually check floor for any leaks.
- E** - **Engine**. Check oil temp, oil press and CHT in green sector.

F - **Fuel.** Check Fuel contents sufficient.

F - **Flaps** as required (Call out attitude change and power increment).

Abeam landing dumbbell give Downwind RT call with intention (roller/full-stop).

FINAL APPROACH

- Check approach perspective correct, speed 60 mph
- RPM as per winds, but not below 3000
- Flaps as required. Call out position.

CHECKS AFTER LANDING

After Landing Checks

- Throttle to idle. Hold aircraft on brakes. Check aircraft not moving forward.
- Select Flaps UP (if lowered).
- Check oil temp, oil pressure and CHT in green sector.

Switch Off Procedure

- Throttle to idle. Hold aircraft on brakes, check aircraft not moving forward.
- Give thumbs up to ground crew to place chocks. Time out.
- Check oil temp, oil pressure and CHT in green sector.
- Check fuel contents.
- Allow the engine to idle for two minutes.
- Select instrument switch OFF.
- Ignition OFF (in one motion), remove ignition key and place it on combing.
- RT OFF, Battery OFF, Master OFF.
- Remove headsets and Unstrap.
- After vacating the aircraft, go around and carry out a visual check of the aircraft.

CHAPTER-V

NORMAL OPERATING DRILLS

LINE UP AND TAKE-OFF PROCEDURE

1. After getting clearance for :Line Up~from ATC, carry out Line Up. Open power and taxi forward. Before entering runway, once again check, base leg, approach and runway is clear. Bodily entering runway, commence turn. Look at the far end of runway, adjust turn and roll out on centre line of runway. Reduce throttle to idle, roll forward to straighten nose wheel and stop the aircraft on centre line. Carry out checks after Line Up. After obtaining RT clearance for Take-off, once again ensure runway and take-off path clear of birds and other aircraft. Ensure control column to slightly aft of neutral position and into wind (by an amount depending upon wind strength). Slide feet down from the brakes. Look at the far end of runway and smoothly open full throttle. The ac nose may turn to left with opening of power and hence apply right rudder when this happens, to maintain runway centreline. Control direction with rudder all through. During the T/O roll,

- At full throttle, check engine RPM is 5400.
- Glance and check oil temp, oil pressure and CHT are in green sector.

2. Speed approaching 45 mph, apply gentle backward pressure to smoothly rotate nose up and unstick at 50 mph. Initially maintain shallow climbing attitude to accelerate to 60 mph. Thereafter, readjust attitude to maintain 60 mph.

NORMAL CIRCUIT AND LANDING

Introduction

3. The normal circuit is flown at 700 feet AGL at speeds between 60 - 70 mph. The RPM required for maintaining this speed and height is about 4600 ~ 4800 RPM. The RPM varies with the total weight of the aircraft and airfield elevation. The suggested power settings should therefore be applied with due consideration to the All Up Weight (AUW) of the aircraft, ambient air temperature and airfield elevation. Primarily, the circuit pattern is flown in relation to the runway. However, prominent ground features may be used judiciously to maintain the correct circuit pattern. In this SOP, actions for a **Right Hand Circuit Pattern are enumerated.** For Left Hand circuits, the actions will be a mirror image.

Execution

4. **Take-off leg.** After unstick, maintain shallow climbing attitude until speed reaches 60 mph. Approaching 60 mph, raise nose slightly to maintain 60 mph. Choose a point ahead and ensure that T/O direction is maintained. In case of cross winds, offset nose to maintain direction. At 300 ft AGL, apply brakes to stop wheels rotating, reduce RPM to 5000, check speed 60 mph and check oil temperature, oil pressure and CHT are in green sector. Climb straight ahead on T/O leg. Approaching 450~check left/front/right clear and commence a climbing turn to right with 10 to 15 Angle of Bank (AOB) to turn on to cross leg.

5. **Crosswind Leg.** Crosswind leg is flown at 90 degrees to the runway. Roll out 90 to the runway and fly for about 10 sec and turn onto downwind with 15 degrees AOB. In case of crosswinds, offset nose to follow correct pattern. Crosscheck direction from compass. As altimeter approaches 700~AGL, lower nose gently to level out and reduce RPM to 4600 ~ 4800 RPM to fly at speed between 60 ~ 70 mph. As landing dumbbell approaches, 5.30 ~ 5 o'clock code. Commence a level turn on to Downwind.

6. **Downwind Leg.** Downwind leg is flown parallel to the runway in the opposite direction to T/O leg. Roll out on downwind direction. Apply drift in case of crosswinds to fly a path parallel to the runway. Settle down on downwind and check height, speed, direction, power and trim are correct. Carry out downwind vital actions. During vital actions, ensure that attention to maintain flying parameters is not lost. Abeam the landing dumbbell, give an RT call with intention (roller/overshoot/full stop. Recheck height, speed, direction, power and trim are correct. When the runway appears about 5.30 ~ 5 o'clock code, commence a level turn on to Base leg with about 15 deg AOB.

7. **Base Leg and Final Approach.** Base Leg is flown 90 deg to the runway. Roll out on base leg, offset for winds, if required. Reduce 400 ~ 500 RPM depending on winds to lose 150 ft on base leg and 50 feet on turn to finals. Maintain speed 60 mph. As landing dumbbell approaches, 1.30 o clock code, commence a level turn onto finals. During the turn, ensure speed 60 mph, ball in centre and RPM as per selection. Look at the far end of the runway and roll out on finals along the extended centreline. After rolling out on finals, at the correct perspective, reduce RPM to 3500 for calm winds. The selected rpm in case of strong winds will be higher (as rough guide 200 RPM per 5 Kts or 100 RPM for each 5Km/h wind speed). Maintain speed 60 mph throughout the approach. During approach, ensure that speed is 60 mph, alignment correct and bodily going to the threshold. At 100 feet to go, notice the speed and RPM as it will assist you to assess the float period after flare.

Note. Do not reduce RPM below 3000 on finals. In case there is a requirement because the approach is very steep/overshooting, abandon approach and go around.

8. **Flare out and Touchdown.** Prior to flare (flare height will be shown by the instructor) ensure nose straight, no drift. Gently rotate the nose up to reduce the rate of descent. As the speed reduces, sink will be felt. Arrest sink by raising nose progressively to touchdown on main-wheels. After the aircraft is firmly on main wheels, lower nose wheel and close throttle fully. Commence deceleration with increasing brake pressure with reduction of speed.

Note.

- (a) Adequate elevator control is available after flare-out, even at low speeds, to affect a controlled nose up landing. Presence of slats ensures lower stalling speed.
- (b) There should be no hurry to reduce the rpm to idle after flare. Close throttle only after all the three wheels are firmly on ground.
- (c) The rotating propeller acts like a gyro. Variation in attitude/power produces yaw due to gyroscopic precession of the propeller disc. During landing, this effect can lead to departure of aircraft from the intended path and therefore needs to be countered with rudder application.
- (d) In crosswinds, during flare, straightening of nose (by rudder) will lead to drift. This needs to be countered by application of opposite aileron. Hence, the touchdown will be the wheel of the lowered wing, followed by the wheel of the raised wing.

SLOW SPEED HANDLING

9. Zen air is capable of sustaining level flight at very low speeds due to the presence of slats. Flight at low speeds is characterised by very high nose up attitude. In extreme cases, if the speed is allowed to decay to a very low value (25 to 30mph), the aircraft will enter the regime of reverse command, which would necessitate that the nose of the aircraft is lowered and speed built up at the cost of height. This should be demonstrated by showing level flight at various speeds viz, cruise setting, low speed on the positive side of drag curve and lower speed (even low speed) in the regime of reverse command. The demo should be terminated by showing how the aircraft can fly at two speeds for the same power setting to drive home the aspect of reverse command regime.

STALL AND RECOVERY**Introduction**

10. Stall occurs when the Angle Of Attack (AOA) is increased beyond the critical AOA. The airflow on top surface of wing breaks up and turbulent flow spreads from leading edge to trailing edge and the Centre of Pressure (CP) moves back. The nose drops, inspite stick being fully back and there would be sudden loss of height. Stall and recovery are practiced to familiarise pilots with conditions leading to stall, symptoms of stall, aircraft behaviour during stall and most importantly, the recovery actions if the aircraft stalls.

11. As the speed is reduced, response to control inputs becomes sluggish and high nose up attitude will be required for level flight. At stall, the nose of aircraft drops due to positive stability. The recovery is to be affected with minimum height loss. For recovery, the stick is moved forward to decrease the AOA to un-stall the aircraft and throttle is opened fully as power minimises height loss. It is possible that the wings of the aircraft may stall differentially resulting in one of the wings dropping. This could happen due to the inherent aerodynamic characteristics of an aircraft or as a result of mishandling of controls at the point of stall. In case of wing drop, the recovery action is to apply opposite rudder to pick up the dropped wing.

12. The low speed regime is encountered during take-off and landing, which are the most critical phases of flight. Stall, which will lead to loss of height, in these critical phases, could lead to serious consequences. Actions for recovery of aircraft from stall using the standard method of recovery must be drilled into the mind of each pilot and all pilots must be proficient to execute a recovery with minimum height loss. During practice stall and recovery, height is noted before entering stall and after recovery to note the height loss.

Execution

13. **Stall Entry (With Flaps Up).** Entry to stall should not be carried out below 3000~AGL for solo and 2500~AGL for dual. Carry out internal checks and external checks before stall. Internal checks are to be carried out with wings level in level flight/climb and external checks during the last 90 degrees of a turn. Proceed as follows:-

- Level out at cruise setting (4600 ~ 4800 RPM), ensure flying straight and level with ball in centre, and select a feature ahead to maintain direction. Note and call out height.
- Smoothly bring throttle to idle. Maintain direction, ball in centre.
- As speed reduces, nose has to be raised progressively to maintain height. Note attitude at 40 mph.
- Close to the stalling speed, the stick has to be brought fully back. In spite of the stick fully back, the nose drops, denoting stall. Note speed, this is stalling speed.
- As the aircraft stalls, take recovery action.

14. **Recovery from Stall (With Flaps up).** The recovery actions can be broadly divided into three parts as follows:-

(a) **Recovery without Power.** For recovery without power proceed as follows:-

- Lower the nose to recovery attitude - horizon cutting the wind shield half way.
- Speed crossing 40 mph, smoothly open full throttle and simultaneously raise the nose to climbing attitude. As altimeter registers gain of height, note height loss. Carry out checks after stall.

(b) **Standard Recovery without Wing Drop.** The Standard Recovery action is aimed at un-stalling the aircraft and minimising height loss and must be used at all times. In standard recovery, the recovery actions are initiated near simultaneously at the point of stall to recover promptly and minimise height loss. The recovery actions in case there is no wing drop will be **Stick- Throttle**. These actions are:-

- Ease the stick forward to un-stall the aircraft - lower nose to have the horizon cutting 1/3rd way up the windshield.
- Smoothly open full throttle in single smooth forward motion.
- As speed crosses 40 mph, raise the nose to climbing attitude. As altimeter registers gain of height, note height loss. Carry out checks after stall.

(c) **Standard Recovery in Case of Wing Drop.** The flaperons in Zen air have been drooped to ensure that the wing roots stall first. Hence occurrences of wing drop will be remote. However, in the unlikely event of a wing drop during stall, aileron should not be applied to pick up the dropped wing as this might aggravate it further. Opposite rudder should be applied to pick up the dropped wing. The recovery actions during stall in case of wing drop are **Rudder – Stick - Throttle**. In case of wing drop, the standard recovery actions are, which are near simultaneous are:-

- Apply opposite rudder.
- Ease the stick forward to un-stall the aircraft - lower nose to have the horizon cutting 1/3rd way up the wind shield.
- Smoothly open full throttle in single forward motion.
- As speed crosses 40 mph, raise the nose to climbing attitude. As altimeter registers gain of height, note height loss. Carry out checks after stall.

15. **Stall and Recovery With Flaps Lowered.** This exercise is also called stall in landing configuration. The aim of practising this exercise is to familiarise with the differences between a stall with flaps up and that in landing configuration. Lowering/raising of flaps has a significant effect on the lift and drag profiles of the aircraft. At times there could be appreciable variation between the stall characteristics of the aircraft in these two configurations and the same must be known. In executing

this exercise, only the standard method of recovery is to be adopted i.e. **Stick-Throttle or Rudder – Stick –Throttle**, as applicable. The procedure for stall and recovery with flaps down is essentially the same as for stall and recovery with flaps except for the following differences:-

- (a) **Entry.** After internal and external checks level out with speed 55 mph (max speed with flaps lowered is 60 mph). Lower flaps to T/O. Allow the nose to go down slightly to maintain level flight (attitude for level flight with flaps lowered is relatively nose down) and open power to 4800 RPM to cater for extra drag. Trim the aircraft and ensure speed below 60 mph. Now lower full flaps. Allow the nose to down further, increase power to prevent speed decay and trim (depending upon height, there may be a requirement to open full throttle). Thereafter, proceed for stall as laid down for stall with flaps up. With flaps lowered, the rate of wash-off of speed will be greater and so anticipate raising of nose to maintain level attitude.
- (b) **Recovery.** Recover using the standard method of recovery. The recovery attitude after easing the stick forward will be horizon cutting half way of windshield. After noting height loss, raise flaps in stages to take off and then fully up. Carry out checks after stall.

16. **Differences in Stall Characteristics Between Stall with Flaps Up and Flaps Down.** Compared to stall and recovery with flaps up, the stall and recovery characteristics with flaps down are as follows:-

- Attitude for corresponding speeds is lower with flaps lowered.
- Faster decay of speed.
- Lower attitude at the point of stall.
- Hardly any judder before stall.
- Lower stalling speed.
- Steeper recovery attitude (windshield cutting horizon half way).
- Slower build-up of speed during recovery.
- Greater height loss.

Note. The exercise of lowering and raising flaps in stages while maintaining height and speed requires changes in attitude and power variations. This requires understanding, skill and practice. Pupil pilots are likely to take time to learn this.

FORCED LANDING PROCEDURE

Introduction

17. A forced landing would be required to be executed in the event of an engine failure. The engine failure may be due to mechanical reasons, fuel starvation or intentional engine switch off following a fire. Propeller flying off is another eventuality when force landing would be required. Although it is preferable to land into wind on runway and in conformity with the circuit pattern, in actual case, a landing may be carried out in any direction using any circuit pattern (left/right) or even on a suitable stretch of flat ground of the size of a football field.

Planning

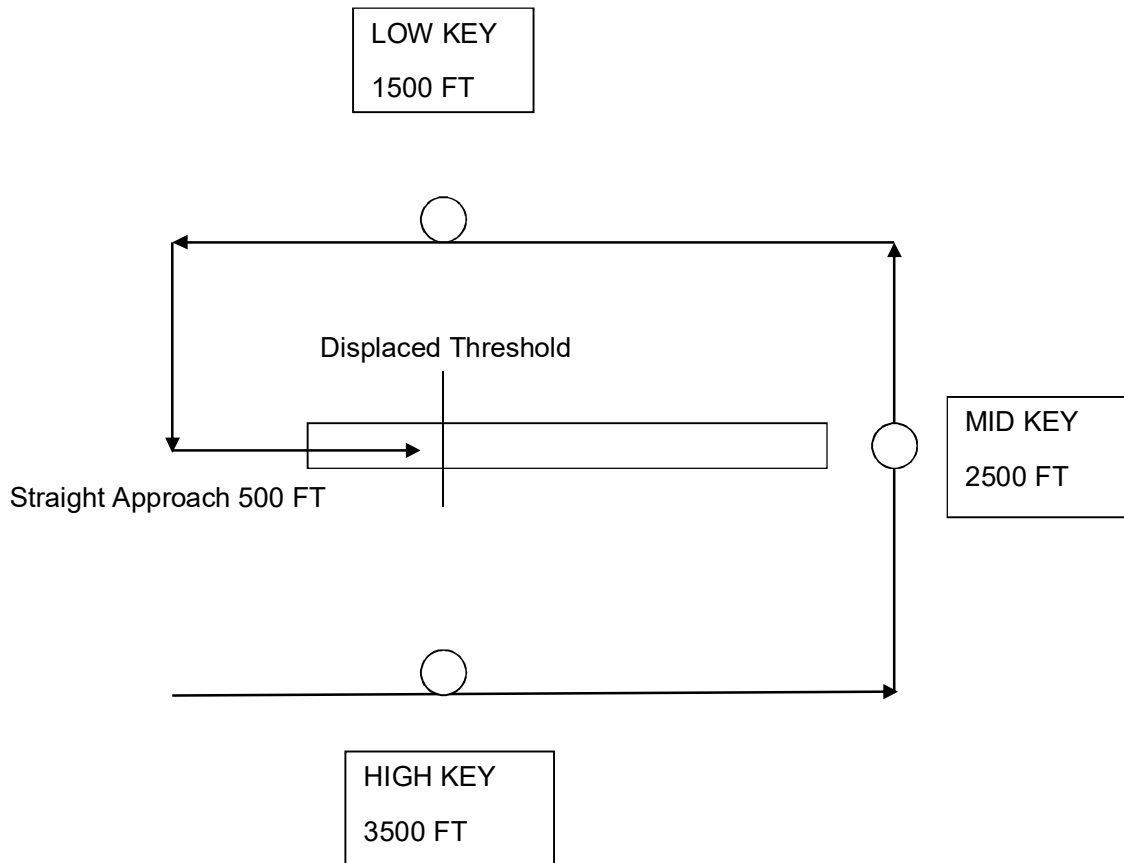
18. **Height Loss during Manoeuvres.** The glide ratio of Zen Air is 7.8: 1. Zen Air loses 450 feet for one kilometre forward travel without bank and the height loss is 250 feet for a 90-degree turn. These ballpark figures are used to plan and execute a forced landing.

19. **Flying Pattern.** A descending box pattern is flown to make the intended landing point. The threshold will be displaced 1/3rd way up the runway for forced landing, whether for practice or in actual case, due to safety reasons. In the box pattern, the aim is to make certain key points depending on availability of height. The key points are designated in relation to the aircraft position with respect to threshold. High Key is located on the dead side abeam the threshold at 3500 feet AGL. Mid Key is in line with the threshold at 2500 feet AGL and Low Key is located on the live side abeam the threshold at 1500 feet AGL. The lateral displacement of the forced landing box pattern with respect to runway is much closer than the normal displacement used for circuit approach and landing. Depending upon the height available and distance from runway/landing field, the pilot is to plan a pattern using the knowledge of descent profile to intercept any of the key points to execute a force landing. The pattern of an ideally executed forced landing procedure is shown in the figure below.

Execution

20. **Immediate and Initial Actions.** The immediate actions are to gain height with extra speed, reducing speed to 45 mph, Check flaps UP, Throttle to Idle and Trim aircraft. Identify the emergency and take immediate actions. Check position and height and select a suitable forced landing field. Give RT call.

Diagram of a Typical Forced Landing Pattern



21. **Planning & Execution.** Based on height available, distance/turns involved and winds, calculate the height loss expected and feed into the forced landing pattern to intercept the appropriate "key point". Remember that the threshold is displaced 1/3rd way up the runway. Make use of the second pilot, if available, for planning and selection of force landing field. While flying the pattern, carry out actions as demanded by the emergency. Relighting is to be attempted if the emergency actions dictate till "low key" position. After Low Key, do not attempt to relight. Assess winds and factor it in the execution. Height is an advantage and do not be in a hurry to lose height early. In the box pattern, height can be lost by use of flaps or carrying out S turns. In case height is less, cut corners. Carry out Downwind Vital actions on the "Low Key" leg. Aim to have 500 feet of straight approach on finals.

22. **Approach and Touchdown.** Ensure speed 60 mph. Remember the "Rate of Descent" (ROD) is higher with engine off/throttle closed and hence initiate flare slightly earlier. Also the rate of flare is to be so adjusted, commensurate with the ROD. Ensure nose straight and no drift during flare and touchdown. After the main wheels touchdown, lower nose gently and use rudders to control direction. After aircraft comes to a stop, give RT call, carry out switch "off" procedure and await assistance.

CHAPTER - VI**EMERGENCY PROCEDURES****1. ENGINE FIRE ON GROUND, BEFORE ENGINE START**

- Continue cranking the engine
- Shut off fuel cock
- Open full throttle as soon as engine starts to blow out the fire
- Operate fire extinguisher in case fire tends to spread
- Check all switches OFF
- Unstrap and vacate cockpit
- Walk upwind of the aircraft

2. ENGINE FIRE ON GROUND, ENGINE RUNNING

- Shut off fuel cock
- Open throttle to blow fire out
- Operate fire extinguisher in case fire tends to spread
- Check all switches OFF
- Unstrap and vacate cockpit
- Walk upwind of the aircraft

3. ENGINE FIRE IN AIR

- Shut off fuel cock
- Ignition OFF
- All electricals OFF
- Do not attempt to restart the engine.
- Carry out a forced landing.

4. **BRAKE FAILURE WHILE TAXYING**

Symptoms. Brake pedals spongy. No deceleration with brake application.

Actions.

- Check throttle to idle
- Pump brake pedals to build up pressure
- Ignition off
- Control direction with rudder and avoid obstructions
- Once the aircraft comes to a stop, give RT call
- Carry out complete switch off drill
- Await assistance

5. **BRAKE FAILURE IN AIR**

Symptoms. Brake pedals spongy (Downwind checks), Brake fluid leak visible on floor.

Actions.

- Inform ATC.
- Land at the beginning of runway at correct speed of 60 mph.
- Once all three wheels are firmly on ground, ensure throttle is closed and switch ignition OFF.
- Maintain direction with rudder.
- Pump brakes to revive them.
- Once the aircraft comes to stop, RT call and carry out complete switch off procedure.
- Await assistance.

6. FIRE IN COCKPIT

Symptoms. Presence of smoke and/or burning smell.

Actions.

- All electrical switches OFF
- If fire persists, use fire extinguisher.
- Carry out immediate precautionary landing.

7. RESTART PROCEDURE IN FLIGHT (AFTER FUEL STARVATION)

- Operate choke lever
- Check throttle at idle position
- Actuate starter switch
- Push choke lever in as the engine starts up
- Check engine parameters and smoothly open throttle as required.

8. PROPELLER FAILURE

Symptoms. Engine over-speeding (loud whining noise and high RPM if the prop files off), High frequency vibrations on the airframe if only one or part of blade has flown off.

Actions.

- Close throttle immediately.
- Ignition OFF
- Fuel OFF
- Force land.

Note. With the propeller disc missing the drag would be lesser resulting in lower rate of descent during the pattern in comparison with a wind-milling propeller.

9. **EMERGENCY LANDING**

- Trim aircraft for 45 mph to obtain best L/D.
- Check Flaps UP.
- Identify forced landing field and feed into forced landing pattern
- Attempt to restart the engine if emergency dictates.
- At 'Low Key', shut off fuel and ignition.
- Carry out glide approach and landing.

CHAPTER - VII
DI / FSS / LFS SCHEDULES

1. **ENGINE**

- Check Battery OFF, Master Switch OFF, Ignition OFF.
- Verify coolant level in expansion tank; replenish (max 2/3 level in expansion tank). Level in overflow bottle should be between Max and Min Level. Check coolant hoses for security and leaks. Check Expansion Tank cap secured.
- Remove Oil Cap. Hand crank propeller till murmur sound is heard (to ensure that all the oil from the engine and pipelines are transferred to the oil tank. Check oil level with dipstick. Ensure oil level between Max and Min mark. Replenish as required. Check oil tank cap secured.
- Notice for any unusual resistance or noise while hand cranking the propeller.
- Remove Fuel Cap. Check fuel level with the help of dipstick. Ensure minimum 25 litres of fuel in tank. Replenish as required. Ensure Fuel Cap is secured.
- Check Fuel Filter for security and leaks. Check fuel pipelines for condition, leaks and butting.
- Check carburettor and Air Filter for secure mounting. Check for full and free movement of throttle cable.
- Check Starter, Solenoid and Rectifier for secure mounting.
- Check Exhaust Manifolds (left and right) for damage, leaks and general condition.
- Check spark plug caps secured properly.
- Check FOUR BOLTS of Engine Mounting. Check all split pins are secure.
- Check Engine Cowl and inspection fairing secured with lock nuts. RED MARKS on each nut IN LINE.
- Check fuel drain nut secured.
- Check for tell-tale signs of engine overheating, oil/fuel and exhaust gas leaks.

2. AIRFRAME

- Check nose wheel bungee rope for fraying, condition and security.
- Check cabin door hinges secure. Check security of quarter pins (port and starboard).
- Check fuel cap secure. Check nose wheel section for security of bolts, locking wires and wheel mounting. Check tyre for cut creep and pressure.
- Check security of propeller locking bolts. Check propeller for nicks, cuts, cracks or any visible physical damage
- Check starboard wing mounting and jury strut bolts secured.
- Check slat mounting bolts secured.
- Check wing tip for damage.
- Check flap attachment for condition and security of lock nuts and split pins.
- Check full and free movement of aileron and aileron cable.
- Check starboard under carriage for security of bolts, condition of under carriage strut, wheel assembly lock nut and split pin. Check tyre for cut creep and pressure.
- Check condition of brake assembly and brake hose. Check for hydraulic fluid leaks or tell-tale signs of overheating of brakes.
- Check starboard wing (top and bottom surface) and fuselage for excessive pillowing of skin and security of rivets.
- Check full and free movement of elevator and rudder. Check condition of attachment hinges and security of split pins. Check condition of Pitot tube. Check for any visible signs of blockage (**Do not blow into the Pitot tube to remove blockage**).

3. **INSTRUMENTS AND ELECTRICALS**

- Check Battery OFF, Master OFF, Ignition OFF, Ignition key removed and placed on top of instrument panel.
- Check condition of instruments for security and any visible damage.
- Check 01 & 05 Amp CBs pushed IN.
- Check no loose wires below the instrument panel.
- Check battery compartment for security of battery, spillage of electrolyte and signs of corrosion.
- Check drainage pipe for visible signs of blockage.
- Ensure battery compartment inspection fairing closed and fasteners secured.

DGNCC SYLLABUS ZEN AIR: NCC AIR WING CADETS

Sortie	Profile	Duration	
		Dual	Solo
1	Air Experience	0:30	
2	LFA familiarisation and effect of primary controls	0:45	
3	Demo Take-Off Climb Climbing Turns Level Out, Practice Effect of Controls	0:45	
4	Take-Off, Climb, Climbing Turns Level-off, Effect of flaps, Effect of Slipstream and Airstream Effect of Power Straight and Level flying at High Speed Straight and Level flying at Low Speed Even Low Speed and Two Speed for same power	0:45	
5	Take-Off, Climb and Turns Level-Off, LMT, faults in MLT Demo including turns Level-off, Descend Demo - Circuit, Approach and Landing (w/o flaps)	0:45	
6	Take-Off, Climb, Climbing turns LMT, Descending Turns, level-Off Demo - Spiral Descent Demo - Circuit, Approach and Landing (with and w/o flaps)	0:45	
7	Take-Off, Climb, Climbing Turns, LMT Descent / Descending Turns Demo - PFL Practice Circuit, Approach and Landing	0:45	
8	Same as above. Emphasis on PFL, Cct, App and Ldg	0:45	
9	Same as above. Emphasis on Cct, App and Ldg	0:45	
10	Circuit, Approach and Landing with and w/o flaps	0:30	
	Total	07:00	

DGNCC CONVERSION SYLLABUS (LHS): ZEN AIR 701

Sortie	Profile	Duration	
		Dual	Solo
1	Start up Taxy - Demo and Practice Climb and Climbing Turns - Demo and Practice Level-Off, Straight and Level flight at various speeds Medium Turns - demo and Practice Rejoin, Circuit and Landing	0:45	
2	Start up, Taxy, Line Up and Take-Off - Practice Climb and Climbing Turns - Practice Level-Off, Straight and Level flight at various speeds Medium Turns - Practice Stall with Flaps - Demo and Practice Slow Speed handling Practice Force landing - Demo Circuit and Landing - Demo Glide Approach	0:45	
3	Start up, Taxy, Line Up and Take-Off Climb and Climbing Turns Level-Off, Straight and Level flight at various speeds Medium Turns Stall with Flaps Slow Speed handling Practice Force landing Circuit and Landing	0:45	
4	Start up, Taxy, Take-Off Circuit and Landing (Flapless, with Flaps, Glide Approach)	0:45	
5	Same as sortie no 4	0:30	
6	First Solo - Profile same as first sortie		0:45
7	Same as sortie no 3 with roller practice	0:30	
8	Second Solo - Same as first sortie.		0:45
9	Third Solo - Same as first sortie.		0:45
10	Same as sortie no 3 with emphasis on rollers	1:00	
11	Same as sortie no 3 - Practice rollers if cleared		1:00
12	Same as sortie no 3 - Practice rollers if cleared		1:00
13	Circuits and Landing with roller take-Off		0:45
	Total	5:00	5:00

Note: Sorties 12 and 13 are intended for Rotary Wing Pilots. Fixed Wing Pilots may be asked to fly these sorties at the discretion of the instructor. M/S Agni Aero Sports also to follow the above syllabus.

DGNCC CONVERSION SYLLABUS (RHS): ZEN AIR 701

Sortie	Profile	Duration	
		Dual	Solo
1	Start up Taxy - Demo and Practice Climb and Climbing Turns - Demo and Practice Level-Off, Straight and Level flight at various speeds Medium Turns - demo and Practice Rejoin, Circuit and Landing	1:00	
2	Start up, Taxy, Line Up and Take-Off - Practice Climb and Climbing Turns - Practice Level-Off, Straight and Level flight at various speeds Medium Turns - Practice Stall with Flaps - Demo and Practice Slow Speed handling Practice Force landing - Demo Circuit and Landing - Demo Glide Approach	1:00	
3	Start up, Taxy, Line Up and Take-Off Climb and Climbing Turns Level-Off, Straight and Level flight at various speeds Medium Turns Stall with Flaps Slow Speed handling Practice Force landing Circuit and Landing		1:00
4	Start up, Taxy, Line Up and Take-Off Climb and Climbing Turns Level-Off, Straight and Level flight at various speeds Medium Turns Stall with Flaps Slow Speed handling Practice Force landing Circuit and Landing		1:00
5	Start up, Taxy, Line Up and Take-Off Climb and Climbing Turns Level-Off, Straight and Level flight at various speeds Medium Turns Stall with Flaps Slow Speed handling Practice Force landing Circuit and Landing with emphasis on rollers	1:00	
6	Start up, Taxy, Line Up and Take-Off Climb and Climbing Turns Level-Off, Straight and Level flight at various speeds Medium Turns Stall with Flaps Slow Speed handling Practice Force landing Circuit and Landing, Roller take-Off if cleared		1:00

7	Circuit and Landing		0:45
8	Circuit and Landing		0:45
9	Same as sortie no 1 with AIT	1:00	
10	Same as sortie no 2 with AIT	1:00	
11	Same as sortie no 3 with AIT		1:00
12	Same as sortie no 4 with AIT		1:00
13	Same as sortie no 5 with AIT	1:00	
14	Same as sortie no 6 with AIT		1:00
15	Same as sortie no 7 with AIT		0:45
16	Same as sortie no 8 with AIT		0:45
17	Clearance for Instructional Flying	1:00	
	Total	7:00	9:00

Note: M/S Agni Aero Sports also to follow the above syllabus.

CONTINUITY AND CURRENCY TRAINING SYLLABUS FOR PILOTS

ZEN AIR CH-701

1. All pilots are to fly a minimum of two hours per month to maintain currency. Sorties flown towards Air Experience / Training of NCC cadets are counted towards continuity training.
2. A dual flying check is mandatory in case of a break in flying. The dual check is to be carried out by a QFI / RHS specifically cleared by HQ DG NCC. The pilot under check is to fly from the LHS only. The syllabus is as follows:

- (a) For break in flying more than two months.

Sortie	Profile	Duration	
		Dual	Solo
1	Take-Off, Climb, Climbing Turns, Level-Out, Level Turns Stall and Recovery, PFL, Circuits and Landings	1:00	
2	Same as above (To be flown under supervision of a QFI / RHS only)		1:00
	Total	1:00	1:00

- (b) For break in flying more than six months.

Sortie	Profile	Duration	
		Dual	Solo
1	Take-Off, Climb, Climbing Turns, Level-Out, Level Turns Descent, Descending Turns, Circuits and Landings	0:45	
2	Take-Off, general handling, Stall and Recovery, PFL, Circuits and Landings	0:45	
3	Solo Check	0:30	
4	GH, Circuits and Landings		0:45
5	GH, Circuits and Landings		0:45
6	Proficiency Check	0:30	
	Total	2:30	1:30

CIRCUIT PATTERN – ZEN AIR

