FINAL INVESTIGATION REPORT ON FATAL ACCIDENT TO ZENAIR STOL CH 701 MICROLIGHT AIRCRAFT VT-USO BELONGING TO TWO STAKEHOLDERS AT BEGURKOLI, COORG DISTRICT ON 02.05.2015

Capt. Pavan Varma
Member, Committee of Inquiry VT-USO

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Foreword

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts examination of various components. The investigation has been carried out in accordance with Annex 13 to the convention on International Civil Aviation and under Rule 11 of Aircraft (Investigation of Accidents and Incidents), Rules 2012 of India. The investigation is conducted not to apportion blame or to assess individual or collective responsibility. The sole objective is to draw lessons from this accident which may help to prevent such future accidents & incidents.

INDEX

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1.	Aircraft	Type	Microlight Zenair STOL
		Model	CH 701
		Nationality	Indian
		Registration	VT-USO
2.	Owner		Under the name of two stakeholders (Hobby fliers)
3.	Operator		Under the name of two stakeholders (Hobby fliers)
4.	Pilot – in –Command		SPL Holder
	Extent of injuries		Fatal
5.	Date & Time of accident		02-05-2015; 0830 UTC.
6.	Place of accident		Begurkolli, Coorg
7.	Co-ordinates of accident Site		$12^{o}06'$ 00" N, 75^{o} 56' 45" E
8.	Last point of Departure		Begurkolli grass strip
9.	Intended landing place		Begurkolli grass strip
10.	No. of Passengers on board		01
	Extent of injuries		Serious
11.	Type of Operation		Joyride
12.	Phase of Operation		Touchdown and subsequently go around
13.	Type of accident		Fatal; Microlight stalled after initiating Go Around.

(All timings in this report are in UTC unless otherwise specified)

SYNOPSIS:

On 02.05.2015 Zenair STOL CH 701 Microlight aircraft VT-USO belonging to two stakeholders was involved in a fatal accident at Begurkoli, Coorg district. The aircraft was under the command of a pilot having SPL (Student Pilot License), with 01 passenger on board.

The pilot took-off from Jakkur Aerodrome, Bengaluru for a cross country flight to Begurkoli, Coorg district. The microlight was under VFR flight. The microlight landed on Begurkoli grass strip heading runway 31. Thereafter the pilot called up his friend and planned for a local sortie over Coorg along with his friend and took off from Begurkoli runway 31. After completing the local sortie for about 1 hour 15 minutes the microlight returned and made a straight in approach to the grass strip heading runway 13. The pilot made a delayed touch down and the microlight did not stop until end of runway. The pilot then decided to go around opened power and took off. During take-off the pilot pulled the microlight at a very steep angle climbed to about 40 to 50 feet when it suddenly lost lift (stalled) turned left and impacted ground on its nose. Both the pilot and his friend were rescued by the security personal manning the airfield. They were immediately shifted to nearby hospital for initial medical assessment and then to Mysore for further medical treatment. The pilot and the passenger received serious injuries. However, the pilot while undergoing treatment in hospital succumbed to the injuries and was declared dead on 03.05.2015. The microlight was substantially damaged. There was no fire.

Ministry of Civil Aviation constituted a committee of inquiry to investigate the causes of the accident under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2012 comprising of Sh. K Ramachandran, Air Safety Officer, AAIB as Chairman and Capt. Pavan Varma as Operational member vide Gazette Notification No. AV-15018/207/2015- DG.

1. FACTUAL INFORMATION:

1.1 History of Flight:

Zenair STOL CH 701 Microlight aircraft VT-USO belonging to two stakeholders was involved in a fatal accident at Begurkoli, Coorg district on 02.05.2015 at around 0830 UTC. The microlight was under the command of pilot holding SPL (Student Pilot License) who was co-owner of the microlight, with 01 passenger on board.

On 30th April 2015 the pilot called up his friend in Coorg who used to maintain the grass strip at Begurkoli and informed him about his arrival on 02.05.2015. Accordingly his friend deputed a security personal for manning the grass strip for arrival of the flight. The pilot filed a flight plan at Bengaluru ATC for a cross country flight from Jakkur Aerodrome, Bengaluru to a private air strip (grass strip) at Begurkoli, Coorg for 02.05.2015. The aircraft was under VFR flight. As planned, the pilot took-off from Jakkur aerodrome and after a flight of about 02 hours 15 minutes landed on grass strip at Begurkoli heading runway 31 at around 0500 UTC. The flight was uneventful. As per the statement of the passenger, who was a local resident, the pilot after parking the microlight called him and both of them went out for some time. They returned to Begurkoli airfield by 0615 UTC and thereafter the pilot planned for a local sortie (joy ride) over Coorg along with the passenger. The pilot along with the passenger took off from Begurkoli at around 0715 UTC from runway 31. The microlight flew over Brahmagiri Hills, Coorg. The Brahmagiri hills are approximately 5,300 feet MSL (Mean Sea Level) and about 3000 feet AGL (Above Ground Level). After completing the sortie of about 01 hour 15 minutes the microlight returned at around 0830 UTC and approached the Begurkoli grass strip heading runway 13. The pilot made a delayed touch down on grass strip at around 3/4th of grass strip length and the microlight did not stop until almost end of grass strip. The pilot then decided to go around, opened power and took off. The microlight took-off and climbed at a steep angle to about 40 to 50 feet when it suddenly lost lift (stalled) turned left and impacted the ground on its nose. The security personal who was manning the airfield rushed to the spot and found both pilot and the passenger injured. As per the statement of the security personal, he called pilot's friend who maintains the airfield and informed him about the accident. The friend rushed to the accident site and thereafter along with the security personal rescued the pilot and passenger

from the microlight and took them to nearby hospital. Both were then shifted to Mysore for further medical treatment. On 03.05.2015, the pilot while undergoing treatment in the hospital succumbed to the injuries sustained during the accident. The passenger had received serious injuries and undergone treatment in hospital at Mysore for few days and was later discharged from hospital. There was no fire during the accident.

The pilot's friend who used to maintain the grass strip stated that after the accident the microlight wreckage was shifted to the temporary hanger beside the grass strip with the help of personnel from M/s Agni Aerosports Adventure Academy Pvt. Ltd.

Google Earth Map of the airfield and the accident Site

1.2 Injuries to Persons :

Injuries	Crew	Passengers	Others
Fatal	01	NIL	NIL
Serious	NIL	01	NIL
Minor/None	NIL	NIL	

1.3 Damage to Microlight Aircraft:

The microlight sustained substantial damages during the accident.

Following main damages were observed on the microlight:-

1. The nose and the front portion of the cockpit were completely destroyed.

2. The cockpit windshields were found crushed.
3. All the 03 propeller blades were sheared off from the hub and found delaminated into two halves.

4. The engine was found intact with its mounting, however its base was found partially disengaged from airframe.

5. The engine cowling was damaged and found disengaged from the airframe.
6. The cockpit instrument panel was substantially damaged.
7. The front portion of the fuselage was found compressed due high impact with ground.

8. Many dents and wrinkles were found at various locations along the length of the fuselage.
9. Many dents and wrinkles were observed along the span of the LH and RH wing.
10. The LH wing sustained more damages. The tip section of the LH wing was found crushed.
11. The leading edge of both the wings was found teared at various span wise locations.
12. The LH inboard flap was found disengaged from root section.

13. The nose landing gear strut was found damaged and bent towards right.
14. The nose landing gear wheel was jammed due to impact with ground.
15. No damages were observed on vertical and horizontal tails.

1.4 Other Damages : Nil

1.5 Personnel Information:

1.5.1 Pilot- in- Command

AGE	54 Yrs 04 Months
License	Student Pilot License
Date of License Issue and Valid up to	03/05/2010 and 02/05/2015*
Category	Microlight
Class	Zen Air CH-701
Instrument Rating	NIL
Total flying Experience on type	300 Hrs (Approx.)**
Last flown on type	02/05/2015

The pilot was the co-owner of the microlight aircraft and majority of the flying on this microlight was carried out by him. All the other information regarding the pilot could not be ascertained as all the records pertaining to the pilot like his personal log book, medical, training records, etc. were not available with the committee.

* The accident date 02.05.2015 was the last day of the validity of his license. The pilot was scheduled to return to Bengaluru on 03.05.2015.

** As per the records available and since the majority of the flying on this aircraft was carried out by the pilot himself, as on date of the accident i.e. 02.05.2015 the aircraft had flown approximately 414:33 hours.

1.6 Aircraft Information:

1.6.1 General Description

Zen Air STOL CH 701 microlight aircraft VT-USO is a single engine aircraft manufactured by Zenair/M/s Agni Aerosports Adventure Academy Pvt. Ltd., Bengaluru. The microlight is certified in Sports & Adventure category, for day operation under VFR. The maximum operating altitude of this microlight is 14,000 feet density altitude at gross weight and maximum take-off weight is 450 Kgs. Microlight length is 6.1 meters and wing span is

8.22 meters, height of this microlight is 2.35 meters. The standard microlight seating configuration is 01 Pilot and 01 passenger.

Construction:

STOL CH 701 is a side-by-side two place, strut-braced high wing monoplane with all-metal structure construction, stressed skin, single curvature metal skins riveted to stiffeners.

Airframe:

Construction is of 6061-T6 aluminium sheet metal riveted to aluminium angles with Avex rivets.

Wings:

The wing has a high lift airfoil with full-span fixed leading edge slats (bolted to the wing's leading edge), "Junker" type (separate airfoil) full-span trailing edge flaperons (combination of flaps & ailerons) and Hoerner wing tips to maximize the STOL CH 701 effective wingspan. The Mean Aerodynamic Chord is 1.43 meter with wing area 11.33 m^2 and wing loading of 39.7 kg/m^2. The wings are braced by dual steel wing struts, and are bolted to the fuselage at the cabin frame with four bolts for easy wing attachment and removal.

Flight Controls:

The STOL CH 701 is equipped with a dual flight control stick between the pilot and passenger which branches in the form of a Y handle. The rudder pedals, connected to a large-diameter steerable nose wheel for ground handling, are equipped with toe-brake hydraulic pedals on the pilot side for effective ground steering. The vertical tail is all moving to provide maximum crosswind capabilities. The trim-control on the elevator is electrically operated from the switch on control stick)

The Flap control is located on the floor, pilot's side. Maximum permissible flaps extended speed is 55 kts.

Instrument panel:

Instrument panel is situated in front of pilot and includes instruments for control of the flight and engine. The aircraft is fitted with these instruments:

Control of flight an airspeed indicator

an altimeter

a magnetic direction indicator

slip indicator (ball)

Control of engine rpm indicator

a fuel quantity indicator

a fuel quantity indicator for each tank

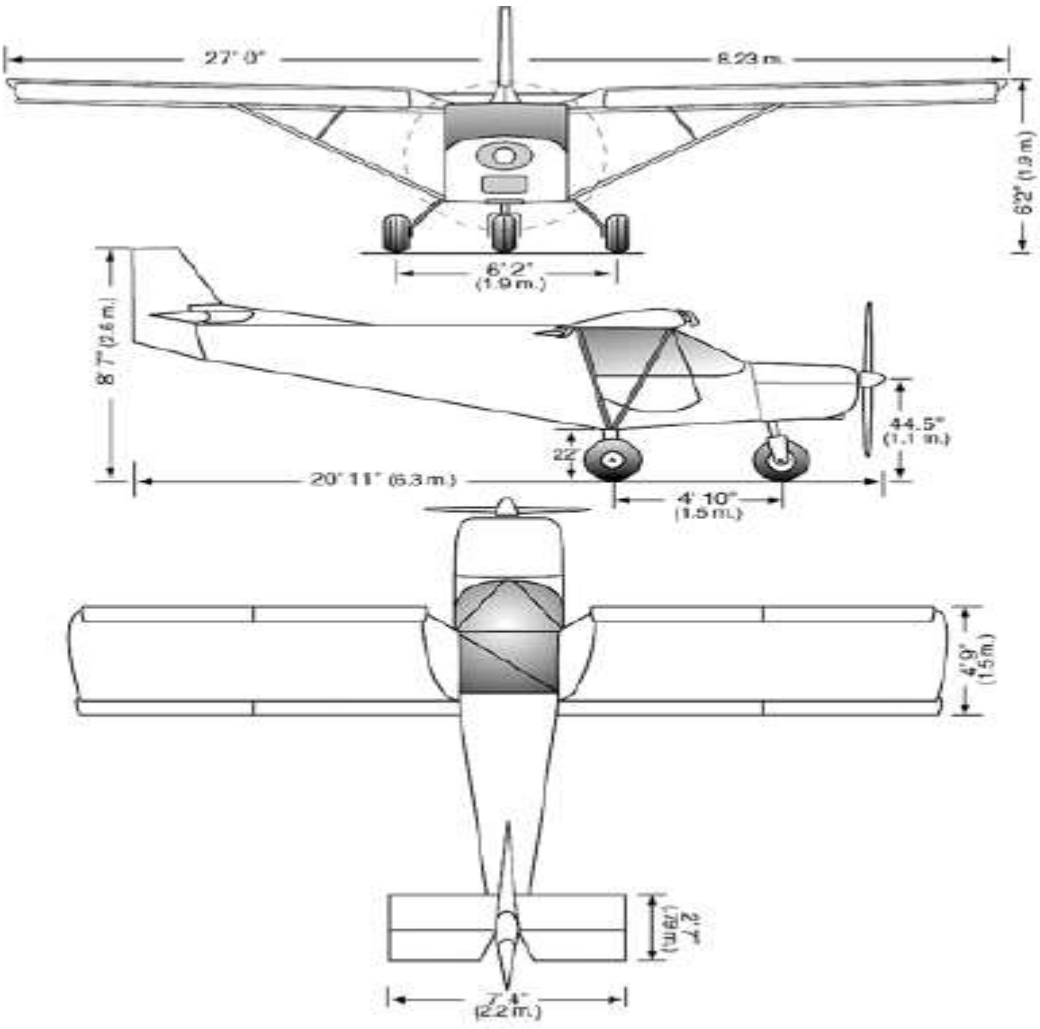
an oil pressure indicator

an oil temperature indicator

a cylinder head temperature

a coolant temperature

an oil quantity indicator - dipstick - located in the engine compartment



Three- view drawing of Microlight STOL CH 701

Microlight STOL CH 701 is powered by a single piston engine power plant manufactured by Rotax with model 912 UL, 4-cylinder, 4-stroke, opposed cylinders. The engine has maximum take–off power 100 HP and maximum continuous power of 82 HP. Maximum Engine RPM, take-off is 5800 and continuous is 5500. There are three propeller blades of composite with propeller diameter of 1.7 meters.

1.6.2 Microlight Information

STOL CH 701 microlight VT-USO, S/No. AGNI/701/055/10-2006 was manufactured in June 2006. The microlight was originally owned and operated by M/s Agni Aero Sports Adventure Academy Pvt. Ltd which was later bought by two stakeholders (hobby fliers) including the deceased pilot. Certificate of Registration No.UL-87/2, under Category 'A' was initially issued in the name of M/s Agni Aero Sports Adventure Academy Pvt. Ltd. on 13-11-2006. Later, on 02.05.2013, the C of R was re-issued in the name of the two stakeholders.

The Permit to fly Number PFL – 81/2 was issued with purpose of flying as "Sports and Adventure Flying" by DGCA on 30-10-2014 with specifying minimum crew as one and maximum number of occupants including crew 02. The permit to fly was valid up to 29.10.2015.

As on 30.10.2014 i.e. date of last Permit to Fly issued, the microlight VT-USO had flown 380:15 Hrs. Last major inspection 100 Hrs/06 months Inspection schedule was carried out at 379:30 A/F Hrs on 26-09-2014 at Bengaluru for issue of Permit to Fly which was issued on 30.10.2014. As per the data obtained from hand held GPS used by the pilot as on 02.05.2015 the microlight had flown about 34:18 hrs since the issue of last permit to fly on 30.10.2014. Hence, the aircraft had flown about 414:33 hrs since new.

The microlight was last weighed on 09-06-2012 at Jakkur, Bengaluru and the weight schedule was duly approved by O/o DDG, DGCA, Bengaluru. As per the approved weight schedule the Empty weight is 279 Kgs. Maximum Fuel capacity is 75 ltrs (54 Kgs). Maximum permissible load with 1 Pilot, Fuel and Oil tank full is 42 Kgs. Empty weight CG is 440.6 mm aft of datum (leading edge of the slats).

Due to non-availability of maintenance records of the microlight aircraft the information regarding the maintenance action/ modifications carried out after issue of last Permit to Fly on 30.10.2014 could not be ascertained. As per the available records, the last Inspection/maintenance on the microlight VT-USO was carried out by M/s Agni Aero Sports Adventure Academy Pvt. Ltd as per approved Inspection/maintenance schedule.

ENGINE

The Zen Air STOL CH 701 microlight VT-USO is fitted with single Rotax 912 UL engine manufactured by Rotax having Engine S/No. 4407909. As on 30.10.2014 this Engine had logged 380:15 Engine Hrs since new. The Rotax 912 UL engine is fitted with 03 WOODCOMP propeller blades with S/N 7097683 and as on 30.10.2014 had 12:35 Hrs since new.

1.7 Meteorological Information:

There was no Meteorological Office situated in Begurkoli, Coorg. The Pilot could have taken MET information from Mysore. There was no watch hour during that day at Mysore and current MET recordings were done for records. The MET records between 0600 UTC to 0800 UTC is as follows.

Time (UTC)	**Winds**	**Visibility (Meters)**	**Temp/Dew point** (in ^{o}C)	**QNH**
0600	230^{o}/07 Kts	10000	31/20	1015
0630	270^{o}/05 Kts	10000	31/19	1014
0700	240^{o}/06 Kts	10000	32/20	1014
0730	260^{o}/05 Kts	10000	32/19	1013
0800	270^{o}/08 Kts	10000	32/19	1013

1.8 Aids to Navigation:

The microlight is only VFR cleared and is not equipped with any navigational aid. The pilot was flying a local sortie over Coorg using Ground references and hand held GPS.

1.9 Communication:

The Microlight aircraft was not in contact with any ATC as it was not in range of any ATC while flying over Coorg. There is no ATC at private grass strip at Begurkoli, Coorg hence at the time of accident the microlight was not in contact with any ATC.

1.10 Aerodrome Information:

The Runway at Begurkoli, Coorg from where the microlight VT-USO operated on the day of accident is a wet marsh grass strip which was temporarily made especially for these kinds of aircraft which used to operate there for joyrides. The strip is made on a grass field which is a property of a local resident. The grass strip was maintained by one of the hobby flier who was a local resident. There is a small temporary hanger beside the grass strip for parking these types of aircraft. Generally whenever any information is received regarding arrival of any aircraft the grass strip is manned by a security personal. As per the information given by local residents for most of the year the field is covered with water and is operational during summers only.

Following salient observations were made during inspection of airstrip after the accident:

- The strip is an uncontrolled grass strip.
- No navigational or landing aids were available including wind sock.
- The grass strip orientation is 13/31.
- The grass strip dimension was measured and it was approximately 450 meters long and 22.4 meters wide which is sufficient for this type of microlight operation.
- There were no markings on the grass strip.
- There were two parallel running high tension electric wiring lines at around 150 meters from runway 31 end.

1.11 Flight Recorders:

Cockpit Voice Recorder (CVR) and Digital Flight Data Recorder (DFDR) were neither fitted on microlight and nor required as per existing Civil Aviation Requirements.

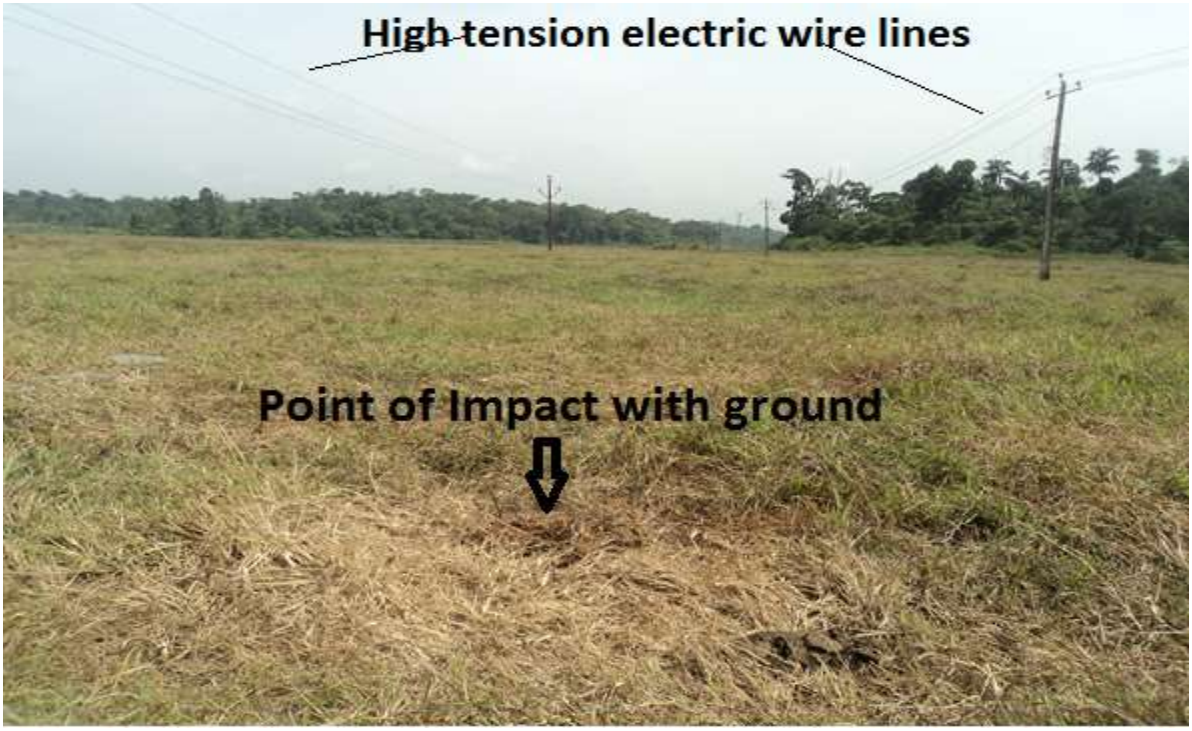
1.12 Wreckage & Impact Information:

The pilot after making delayed touchdown on grass strip subsequently initiated go around and took-off. During take-off it climbed to about 40 to 50 feet at a steep angle when it suddenly lost lift turned left and impacted ground on its nose. The final resting position of microlight wreckage (Point of Impact with ground) was at a radial distance of 167 meters from runway 31 end. The microlight was resting on its nose into the soft ground with tail up. There was no evidence of disintegration of any part of the microlight in air.

Final position of the microlight wreckage resting on its nose with tail up.

During onsite preliminary investigation carried out on 06.05.2015, it was found that the wreckage of the accident microlight was shifted from the accident site to a temporary hanger which was located beside the grass strip. On inquiring, the pilot's friend who maintains the grass field stated that the wreckage was shifted, as the accident site was not cordoned – off properly and in order to prevent interference by the local crowd. He further stated that the

wreckage was shifted to the temporary hanger with the help of personnel from M/s Agni Aero Sports Adventure Academy Pvt. Ltd. However on visiting the accident site the point of impact of the microlight with the ground was identified. There were few broken parts like propeller hub cover, broken propeller blade, cracked windshield pieces etc. found at the accident site. The accident site (final resting position of the microlight on ground) was in between two parallel running high tension electric lines passing through the field. However, there was no evidence of microlight coming in contact with these wires.



On examination of the wreckage which was shifted to the temporary hanger some of the observations made are as follows:

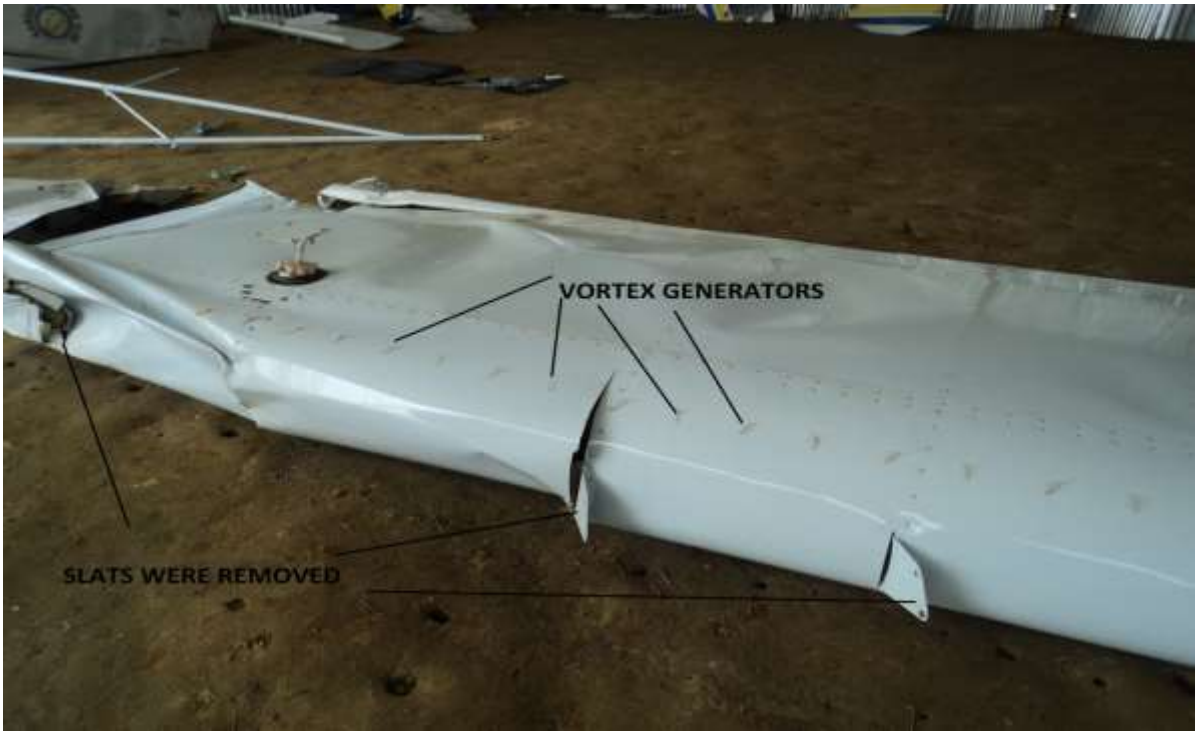
1. Before shifting the wreckage both the wings along with horizontal and vertical tails were dismantled from the microlight wreckage. The doors were also removed.

Wings along with Vertical & Horizontal Tails removed before shifting the wreckage.

2. The nose portion and front panel of the cockpit were compressed and crushed due microlight heavily impacting the ground on its nose. The fuselage front portion was also compressed due high impact and in many places the skin was found teared.

3. The engine along with nose portion was found resting on top of the fuselage, this was probably done during shifting of the wreckage.

4. The Zenair STOL CH 701 microlight aircraft is equipped with fixed leading edge slats on both the wings, however on examining the wreckage both the slats were found missing and its attachment brackets were found bent due impact.
5. Small vortex generators were found installed at various positions all along the span of the wing.



6. Since the wings and the tail plane were dismantled, the serviceability of the control surfaces could not be established. However the continuity of the control cables were checked by operation of pedals and flaps and found intact.
7. The control stick was bent and jammed due heavy impact with ground.

8. The actual position of the cockpit instruments could not be identified as they were disturbed during shifting of the wreckage. Moreover most of the instruments such as Radio, Magnetic Direction Indicator etc. were found kept beside the aircraft wreckage in the temporary hanger (Shed).

Altimeter Reading

Air Speed Indicator reading

9. Few of the instruments were intact with the panel. Instrument readings were taken, the needle of air speed indicator was pointing at 0 (zero) and the Altimeter reading was showing approx. 133 feet (1015 milibar).

10. All the switches in the cockpit except the master switch were found in ON position.
11. No damage was observed on the horizontal and vertical tails.
12. No fuel was available on both the wings, which probably might have drained post-accident.
13. No on board documents were found either on accident site or inside the cockpit. A fire extinguisher and an Emergency Medical Kit were found in the baggage area of the microlight.

1.13 Medical & Pathological Information:

No records were available for pre-flight BA test carried out by pilot as per CAR requirements.

The pilot received serious injuries during the accident. The pilot was immediately shifted to the local hospital and was then taken to Mysore for further treatment. As per the post mortem report, the pilot received fractures on his chest walls, ribs, right and left knee. His left lung was collapsed due acute respiratory distress syndrome. Blood clots were present in the heart with endocardial hemorrhage on left side of the heart. The pilot had also suffered brain hemorrhage. The cause of death was due to shock and hemorrhage, as a result of multiple injuries sustained by the pilot.

1.14 Fire:

There was no pre or post impact fire.

1.15 Survival Aspects:

The accident was not survivable.

1.16 Test and Research: Nil

1.17. Organizational & Management Information:

The microlight aircraft was owned and operated by two stakeholders who were also hobby fliers. Previously the microlight was owned and operated by M/s Agni Aero Sports Adventure Academy Pvt. Ltd., Bengaluru. The deceased pilot along with some hobby fliers formed a group and named the company as Bangalore Flying Club. They then bought this microlight VT-USO from M/s Agni Aero Sports Adventure Academy Pvt. Ltd. The microlight VT-USO was then registered under the ownership of the deceased pilot and another pilot who was holding a pilot license endorsed on type. The majority of the flying on the subject microlight was carried out by the deceased pilot. The deceased pilot was a hobby flier and the microlight was mostly used for hobby flying only. The subject microlight was based in Jakkur Aerodrome. All the liaising regarding renewal/issue of flying permits of the microlight were carried out by the deceased pilot. The maintenance/inspections on the microlight were carried out by M/s Agni Aero Sports Adventure Academy Pvt. Ltd.

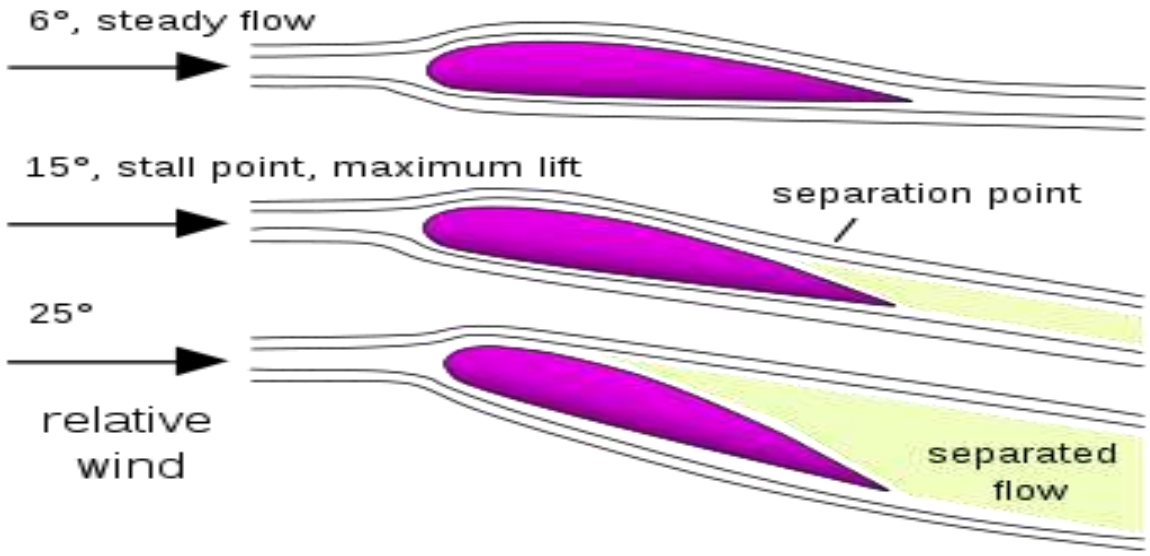
1.18 Additional Information:

1.18.1 Aircraft Stall and stalling Angle

Stall

Stall in fixed-wing flight are often experienced as a sudden reduction in lift as the pilot increases the wing's angle of attack and exceeds its critical angle of attack (Stalling Angle of attack) which may be due to slowing down below a certain speed which is defined as stall speed in level flight. This critical angle is dependent upon the profile of the wing, its planform, its aspect ratio, and other factors, but is typically in the range of 15^{o} to 20^{o} relative to the incoming wind for most airfoils of plane wing. The critical angle of attack (Stalling Angle of attack) is the angle of attack at which the maximum lift coefficient occurs

and increasing the angle of attack beyond this angle results into sudden loss of lift. Flow separation begins to occur at small angles of attack while attached flow over the wing is still dominant. As angle of attack increases, the separated regions on the top of the wing increase in size and hinder the wing's ability to create lift. At the critical angle of attack, separated flow is so dominant that further increases in angle of attack produce less lift and vastly more drag.

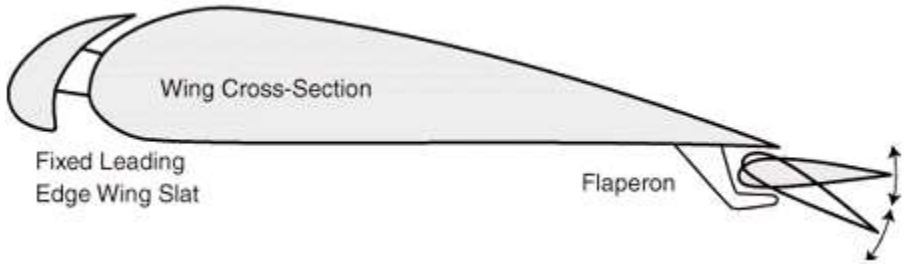


A fixed-wing aircraft can stall in any pitch attitude or bank angle at any airspeed but commonly occurs while reducing the speed to the un-accelerated stall speed. Un-accelerated (1g) stall speed varies on different fixed-wing aircraft. The pilot will notice the flight controls have become less responsive and may also notice some buffeting, a result of the turbulent air separated from the wing hitting the tail of the aircraft. In most light aircraft, as the stall is reached, the aircraft will start to descend because the wing is no longer producing enough lift to support the aircraft's weight and the nose will pitch down.

1.18.2 High Lift Wing Design.

A short take-off and landing (STOL) aircraft must be able to fly at low controlled speeds, yet it must also offer acceptable cross-country (cruise) performance. Hence the wing is designed with a high lift coefficient so that the wing area is as small as possible, while allowing for take-off and landing speeds that are as low as possible. Short wings make the aircraft easier to taxi, especially when operating in an off-airport environment with

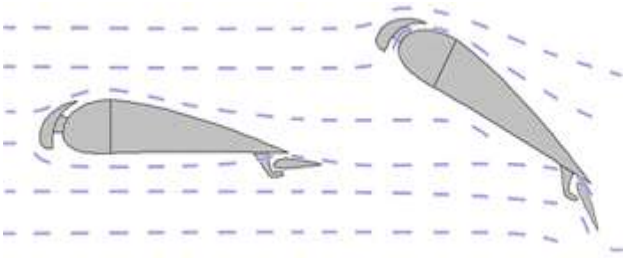
obstructions. They also allow for better visibility, and require less space for hangaring, while also being easier to build and stronger (less weight and wing span to support).

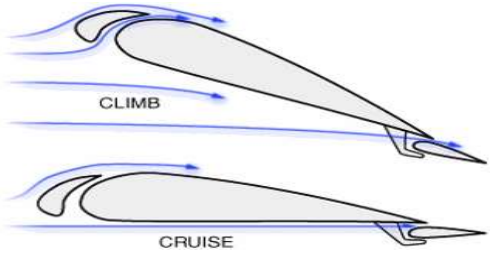


The STOL CH 701 uses a special airfoil design In order to achieve very high lift, low stall speeds, and high strength. A thick wing, full-length leading-edge slats and trailing edge 'junker' type flaperons may develop a maximum wing lift coefficient of up to 3.3, while maintaining a short wing-span – for maximum strength and ground maneuverability.

Fixed Leading-Edge Wing Slats:

The leading edge slats allow the aircraft to fly at a high angle of attack (lower speed) and prevent the stall up to approximately 30^{o} incidence (angle of attack). This is achieved by picking up a lot of air from below, where the slot is large and accelerating the air in the funnel shaped slot (venturi effect) and blowing this fast air tangentially on the upper wing surface through the much smaller slot. This effectively "pulls" the air around the leading edge, thus energizing the airflow over upper surface of the wing and preventing the stall up to a much higher angle of incidence and lift coefficient. The leading edge slats allow for steep climb angles of up to 30^{o}. The leading edge slats are engineered to remain in a fixed position in all flight attitudes, and do not retract (in level flight, the fixed leading edge slats have minimal effect on cruise).



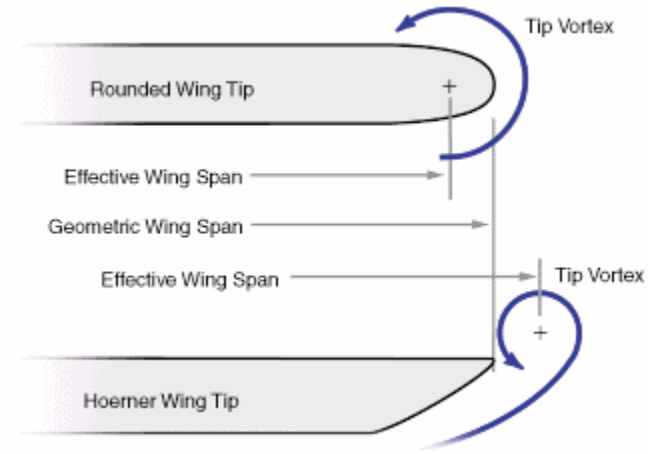


The Flaperons:

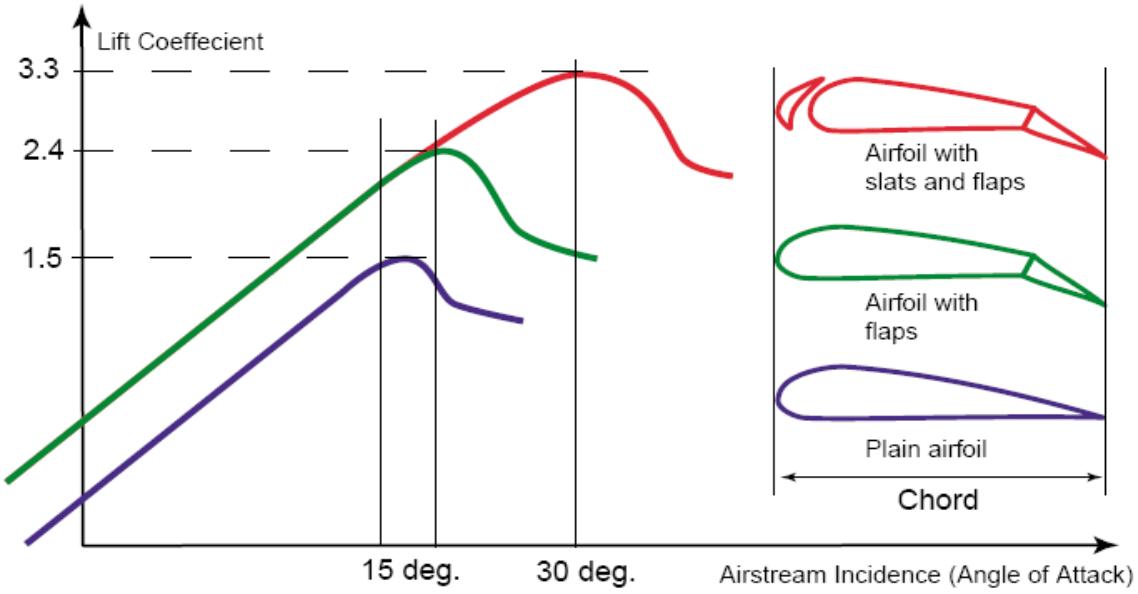
The full-length flaperons act as both full-span ailerons and full-span flaps. The flaperons have their own airfoil, and are hung below the wing trailing edge to supply them with fresh undisturbed air for maximum control effectiveness even at low speeds. The trailing edge flaps increase the effective chord length and as well as increases the camber of the airfoil

Hoerner Wing Tip

At the wing tip, the STOL CH 701 design utilizes 'Hoerner' tips to maximize the wing's effective lift area and to minimize wing tips vortices. Hoerner wing tips provide the largest effective span for a given geometric span or a given wing weight.



As mentioned above the stall of the wing occurs at the highest lift coefficient on an airfoil, when the airflow can no longer go around the airfoil's nose (leading edge) and separates from the upper wing surface. Conventional trailing-edge wing flaps help delay the stall to a higher lift coefficient, but only with limited effectiveness. However, by combining the use of trailing-edge flaps with leading-edge slats, the wing's maximum lift coefficient can be effectively doubled if used on the full span of the wing.

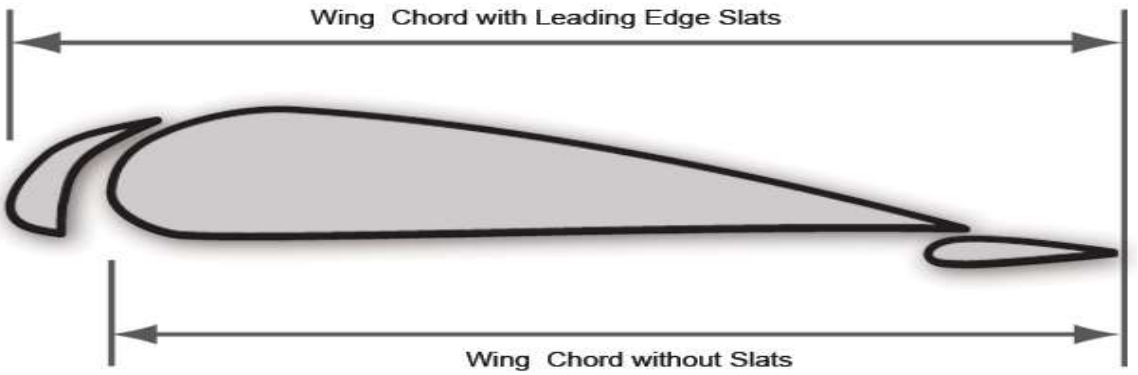


Lift Co-efficient Vs Angle of Attack Graph for plain airfoil, with flaps and with flaps & Slats

1.18.3 Replacing Wing leading edge slats with Vortex Generators:

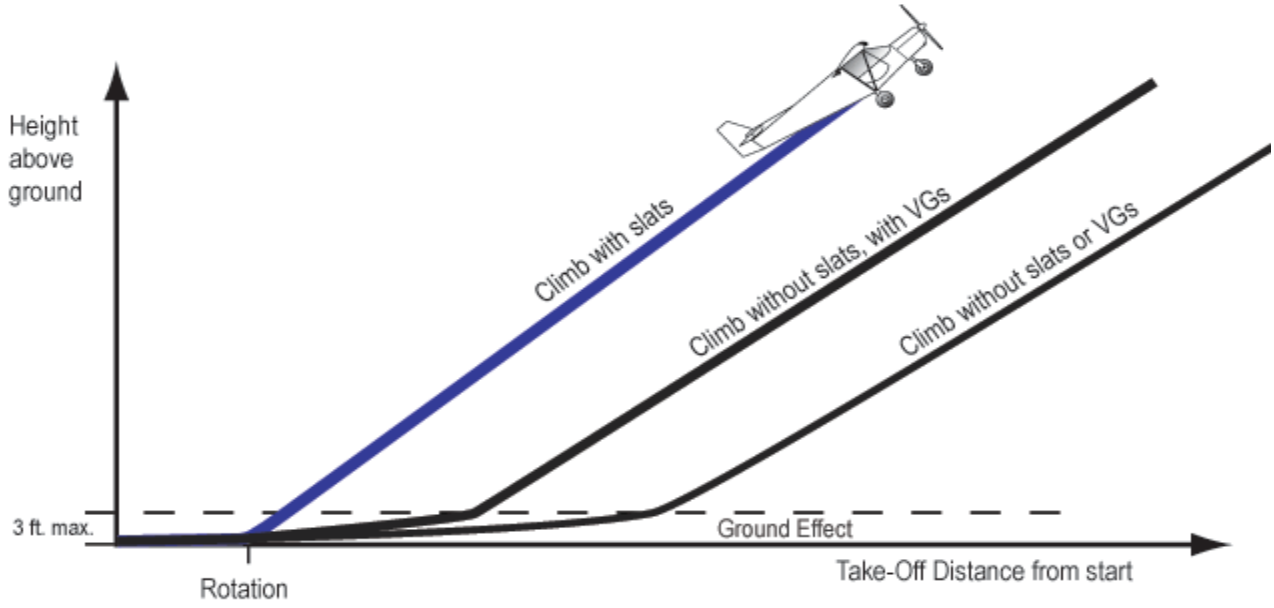
The use of vortex generators when used properly, may improve the stall on small leading edge radius airfoils (so-called laminar airfoils) by "pumping" energy from the free airstream into the boundary layer which will energize the airflow over wings and resulting in separation of boundary layer at a higher angle of attack, and the airfoil will have a larger maximum lift coefficient, thus reducing the stall speed.

However, when the wing's leading-edge slats are removed, the wing chord is decreased. This increases the wing loading as well as the aspect ratio:



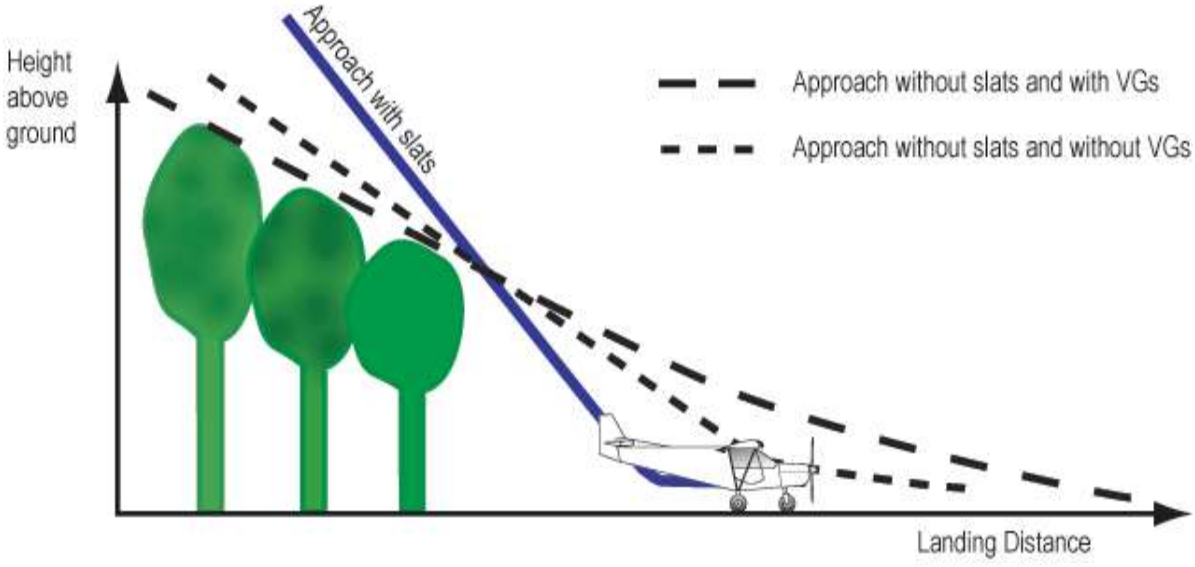
- An increased wing loading will need a higher lift coefficient for the same flying speed (resulting in a higher angle of attack and thus limiting forward visibility).
- A larger aspect ratio will slightly decrease the induced drag of the wing but very small as in cruise the wing drag is only a part of the total airplane drag and the stall speed will be higher.

The airfoil of Zen Air CH 701 STOL airplanes is relatively thick with an unusually large leading edge radius. On this type of airfoil, vortex generators (also called micro-vortex generators, or VGs) add very little improvement with respect to the maximum lift coefficient (or stall speed). Without slats the high lift coefficient allowing take-offs is only achieved in ground effect (it is when the wheels are only 2 to 3 feet above the runway) so microlight has to accelerate at this low height before it can climb safely, but with leading edge slats microlight can climb immediately after rotation thereby maximizing the short field capability of the aircraft.



The same is also true when landing the aircraft:

The high sink rate (or lower glide ratio) of a STOL airplane allows it to land in a smaller area. This is best achieved with the leading edge wing slats:



A higher glide ratio increases the area required to land an aircraft in, and thus diminishes the STOL capability of a microlight aircraft.

The removal of the leading edge slats and replacing them with VGs will increase the take-off distance and the initial climb rate will not be as good (nor the approaches over trees be as steep), and the cruise speed will only increase slightly. The designs are made for short take-offs and landings (STOL) and replacing the slats with VGs diminishes the STOL capability of these designs.

1.18.4 Privileges of Student Pilot License (Microlight Aircraft).

Para 5, Section C of Schedule II issued by DGCA gives the privileges of Student Pilot's License (Microlight Aircraft). Following are the few excerpts from the same:

Privileges— Subject to the validity of aircraft rating in the license, and compliance with relevant provisions of Rules 39B, 39C and 42, the privileges of the holder of a Student Pilot's License (Microlight) shall be to fly within the Indian Territory only, as Pilot in Command of any microlight aircraft entered in the aircraft rating of his license:

Provided that:

(a) he shall fly at all times under the authority and supervision of a flight Instructor or an Examiner approved by the Director-General.

(b) he shall fly under visual Flight Rules only.

(c) he shall not carry passengers, animals and goods or fly for hire, reward or remuneration of any kind;

(d) a pilot who has not been exempted from the provisions of Clause (c) of paragraph-1, shall not undertake cross-country flights unless he has a minimum of ten hours of solo flight time on microlight aircraft and has passed the examinations in Air Navigation and Aviation Meteorology.

1.18.5 Pilot flying from his base and other airfield:

The microlight was based in Jakkur aerodrome, Bengaluru and the pilot used to carry out most of the flying from Jakkur airstrip which has dimensions of 900 meters (length) by 20 meters (width). The Zenair CH 701 microlight with slats requires approximately 50 to 60 meters of the landing run to stop. Hence, even if a pilot makes a delayed touch down on the airstrip there is sufficient runway available for the microlight to stop. However when a pilot is operating from a shorter, not so familiar airstrip which is a grass strip with no navigational aids including wind sock and making an approach over mountains with no slats requires relatively more landing run for the microlight to stop. As a regular practice when a pilot is operating a microlight from such an airfield he should carry out a circuit before landing. While doing so the pilot is able to judge the actual distance to the airstrip (especially if it is a grass strip), the wind conditions, obstructions on the airfield and is able to judge the landing threshold.

1.18.6 Non-reporting of the Accident and shifting of the wreckage.

Rule 4 of Aircraft (investigation of Accidents & incidents) Rules 2012 gives the obligation of an owner/operator of aircraft to notify the accident or incident to AAIB & DGCA. It states that:

Notification — (1) Where an accident or an incident occurs to an aircraft covered under sub-rule (2) of rule 1, then the pilot-in-command of the aircraft or, if he be killed or incapacitated, the owner, the operator, the hirer or other person on whose behalf he was in command of the aircraft, or any relevant person, as the case may be, shall, as soon as is

reasonably practicable but in any case not later than 24 hours after he becomes aware of the accident or the incident —

(a) send notice thereof to the Aircraft Accident Investigation Bureau and Director General of Civil Aviation by the quickest means of communication available; and

(b) in the case of an accident occurring in India, give information to the District Magistrate and the Officer-in-charge of the nearest Police Station of the accident and of the place where it occurred.

However, the subject accident was not reported to AAIB or DGCA by anyone as stated above. The information about the accident was known through media only.

Rule 7 of Aircraft (investigation of Accidents & incidents) Rules 2012 which states that.

Protection of evidence, custody, removal and preservation of damaged aircraft — (1) In the case of an accident or a serious incident, which is required to be notified under rule 4, the aircraft shall not, except by a person under the authority of the Bureau, be removed or otherwise interfered with:

Provided that —

(a) the aircraft or any parts or contents thereof may be removed or interfered with so far as may be necessary by persons authorized to conduct search and rescue operations for the purpose of extricating persons or animals dead or alive, or preventing the destruction of the aircraft and its contents by fire or other cause or of preventing any damage or obstruction to the public or to air navigation or to other transport;

(b) if the aircraft is wrecked on water, the aircraft or any parts or contents thereof may be removed to such extent as may be necessary for bringing it or them to a place of safety by persons authorised to conduct search and rescue operations;

(c) goods may be removed from the aircraft under the supervision and with the concurrence of an officer of the Bureau or a person authorised by the Bureau;

(d) personal luggage of passengers' and crews' may be removed from the aircraft under the supervision of a Police Officer, a Magistrate, an Officer of the Bureau or a person authorised by the Bureau; and

(e) mails may be removed under the supervision of a Police Officer, a Magistrate, an Officer of the Department of Posts and Telegraphs or an Officer of the Bureau or a person authorised by the Bureau.

After the accident the microlight wreckage was shifted to a temporary hanger beside the grass strip and before shifting of the wreckage the wings along with vertical & horizontal tails were dismantled without any permission from DGCA or AAIB.

1.18.7 Civil Aviation Requirements (Microlight)

As per Para 4, Section 2, Series 'F', Part XIV of the then existing CAR on microlights:

Permission to Fly the Microlight Aircraft:

- *Pursuant to provisions of Rule 15 and Rule 49 of the aircraft Rules, DGCA may issue a "Permit to Fly" in respect of the microlight aircraft in lieu of the type certificate and the certificate of Airworthiness. Such permit shall enable the operator to fly the specified microlight aircraft within the union of India without a certificate of Airworthiness subject to the conditions given therein.*
- *The 'Permit to Fly' shall be valid for one year unless cancelled or withdrawn by the DGCA. The permit may be renewed for a further period of one year at a time by the DGCA representatives on the recommendations of any licensed AME or by a person authorized by the DGCA.*

The accident microlight was owned and operated by two stake holders who were hobby fliers. The deceased pilot was the co-owner of the microlight and the only active member of the group who used to fly this microlight on regular basis. As per the above CAR on microlight the owner/operator is required to have a certificate of registration and a permit to fly to operate the microlight. There is no requirement of any organizational setup or safety setup to operate a microlight aircraft.

1.19 Useful and Effective Techniques: NIL

2. ANALYSIS:

2.1 Serviceability of Microlight Aircraft

As on 30.10.2014 i.e. date of last Permit to Fly issued, the microlight VT-USO had flown 380:15 Hrs. As per the records available, last major inspection 100 Hrs/06 months Inspection schedule was carried out at 379:30 A/F Hrs on 26-09-2014 at Bengaluru for issue of Permit to Fly. The permit to fly was issued on 30.10.2014 and was valid up to 29.05.2015. The microlight was last weighed on 09-06-2012 at Jakkur, Bengaluru and the weight schedule was duly approved by the O/o DDG, DGCA, Bengaluru.

Due to non-availability of maintenance records of the microlight aircraft the information regarding the maintenance action/ modifications carried out after issuance of last Permit to Fly i.e. after 30.10.2014 could not be ascertained.

On visual examination of the accident microlight engine and analyzing the pattern of damages sustained by the propeller blades, it is evident that the engine at the time of accident was running.

The Zenair STOL CH 701 microlight aircraft is installed with fixed full span leading edge slats on both the wings, however on examining the wreckage both the slats were found missing and its attachment brackets were bent due impact with ground. It is therefore quite evident that the slats were removed earlier and the pilot was flying the microlight without slats. It was also observed that the slats were replaced by Vortex Generators and were fixed all along the wing span at various positions. The removal of slats hampers the performance of the microlight aircraft especially during take-off and landing. It drastically reduces the stalling angle of attack and increases the stalling speed thereby diminishing the STOL capability of the microlight.

In view of the above it is inferred that the modification carried out on the microlight i.e. replacing leading edge slats with vortex generators was a contributory factor to the accident.

2.2 Weather

There is no MET office available at Begurkoli, Coorg. The current weather was taken from MET office, Mysore. The weather during the time of accident was reported to be fine with clear skies and visibility about 10,000 meters. Hence, weather was not a contributory factor to the accident.

2.3 Pilot factor:

2.3.1 Aerodrome Factor and pilot handling the microlight.

The microlight was based in Jakkur aerodrome, Bengaluru and the pilot was used to flying from Jakkur aerodrome, Bengaluru on an airstrip which is 900 meters long. The microlight aircraft being an STOL (Short take-off and landing) and with slats requires only small landing run (Approximately 50 to 60 meters) for the microlight to stop. Hence, if a pilot makes a delayed touchdown while landing there is still sufficient length of runway available for the microlight to stop. Since, the pilot had carried out most of the flying from Jakkur aerodrome, he may had a practice of making delayed touch down as the airstrip at Jakkur aerodrome is long enough for the microlight aircraft to stop.

The grass strip at Begurkoli, Coorg is about 450 meters long which is sufficient for this type of microlight operation. The pilot was not very familiar with the airfield and after completing the local sortie over Coorg the approach made by the pilot at grass strip was over mountains which are about 3000 feet AGL and from a distance of about 15 Miles. The pilot carried out a straight in approach which may have resulted into him, not able to judge the actual distance to the grass strip, the wind conditions, and judge his landing threshold properly. The pilot carried out a straight in landing heading runway 13 and without slats which resulted into delayed touchdown at about $3/4^{th}$ of the grass strip. Hence, the microlight did not stop until end of runway which made pilot to initiate go around and pulled the aircraft at a steep angle in order to avoid electric wires and subsequently resulted into the accident.

In view of the above the pilot making a delayed touchdown on a grass strip which resulted into pilot initiating a go around and climb at a steep angle is a contributory factor to the accident.

2.3.2 Pilot Qualification

The pilot was holding a student pilot license which was valid at the time of accident. The validity of his license was up to 02.05.2015 i.e. the day of accident. He was the co-owner of the accident microlight VT-USO. Most of the flying on the accident microlight was carried out by the deceased pilot. The pilot was qualified to carry out a solo cross country flight. On the day of accident the pilot did a cross country flight from Jakkur aerodrome to Coorg and subsequently went for a local sortie over Coorg carrying a passenger along with him. Both of these flights were not carried out under the authority and supervision of a flight Instructor or an Examiner approved by the Director-General as per the privileges of student pilot license (Microlight). Also, pilot carrying a passenger for a local sortie over Coorg did not adhere to the privileges of student pilot license (Microlight) and the regulations for microlight operations.

2.4 Non-reporting, tampering the evidences and safety aspects of flying.

The subject accident was not reported to AAIB or DGCA by the operator or the personnel concerned. The information about the accident was known through media. Due to non-reporting of the accident the investigating team could not reach the accident site in time for preliminary investigation. Also, the wreckage of the accident microlight was shifted to the temporary hanger beside airstrip without any intimation to AAIB/DGCA. The wreckage was dismantled before shifting thereby tampering the evidences as the serviceability and continuity of the control surfaces and other parts could not be established.

The accident microlight was owned and operated by a group of hobby fliers. The deceased pilot was the co-owner of the microlight and the only active member of the group who used to fly this microlight on regular basis. As per the CAR on microlight the owner/operator is required to have a certificate of registration and a permit to fly to conduct the microlight operations. There is no requirement of any organizational setup or safety setup to operate a microlight aircraft. Hence, the only time an owner/operator liaison with DGCA is during the issue/re-issue of permit to fly and during the issue/renewal of the pilot license. This is the case with most of the microlight operations as most of Microlight flying is done by the pilots who own the aircraft and does not always fly under the supervision or instruction of

an instructor/examiner or in a Club where an Instructor is present. This may lead to most of the pilot flying as hobby fliers not to have the proper understanding of the existing rules and the safety aspects of operating an aircraft.

2.5 Circumstances leading to the accident.

After doing a local sortie of about 01 hour 15 minutes with a passenger over Brahmagiri hills which is 3000 feet AGL, the pilot carried out a straight in approach to the grass strip. This may have resulted into him, not able to judge the actual distance to the grass strip, the wind conditions, and to judge his landing threshold properly. The pilot carried out a straight in landing heading runway 13 and in the absence of leading edge slats resulted into delayed touchdown at about 3/4th of the grass strip. Hence, the microlight did not stop until end of runway. The pilot thereafter initiated go around, opened power and took-off. During take-off the pilot may have not seen the high tension electric wires in front until he was very close to it and pulled the microlight at a very steep angle. The pilot did not realize that he was flying the microlight without slats which caused the angle of attack to exceed the critical (stalling) angle of attack. This caused the microlight to stall (sudden loss of lift) & subsequently resulted into the accident.

3. CONCLUSION :

3.1 Findings :

1. The Certificate of Registration & Permit to Fly for the microlight was valid on the date of accident.
2. The microlight was manufactured by Zenair/M/s Agni Aero Sports Adventure Academy Private Limited.
3. The microlight was first registered under the ownership of M/s Agni Aero Sports Adventure Academy Private Limited and was later bought by two stakeholders (including the deceased pilot).
4. The microlight and its engine were maintained by M/s Agni Aero Sports Adventure Academy Private Limited.
5. The pilot was holding a student pilot license. The license was valid till 02.05.2015 i.e. the day of accident.

6. The accident was not reported by the owner/operator and manufacturer of the aircraft or by local authorities to AAIB or DGCA. The information about the accident was known through media.
7. On arrival at the site it was found that the wreckage of the accident microlight was shifted from the accident site to a temporary shed which was located beside the grass strip without informing/obtaining permission from DGCA or AAIB.
8. The wreckage was shifted to the shed by a local resident who used to maintain the grass strip with the help of personnel from M/s Agni Aero Sports Adventure Academy Private Limited.
9. Before shifting the wreckage both the wings along with horizontal and vertical tail were dismantled from the aircraft wreckage.
10. The microlight is equipped with fixed leading edge slats on both the wings, however on examining the wreckage both the slats were found missing.
11. The pilot was flying the microlight without the leading edge slats.
12. The slats were replaced by number of small Vortex Generators placed at various positions all along the wing span.
13. A fire extinguisher and an Emergency Medical Kit were found in the baggage area of the microlight.
14. The grass strip at Begurkoli, Coorg is an uncontrolled airfield with no markings and no navigational aids including wind sock.
15. The runway length was measured and was approximately 450 meters which is sufficient for this type of microlight operation.
16. There were two parallel running high tension electric wire lines at a radial distance of about 160 meters from runway 31 end.
17. The aircraft was based in Jakkur Aerodrome and most of the flying by the pilot on the microlight was carried out from Jakkur.
18. The pilot filed a flight plan to ATC, Bengaluru for a cross country flight from Jakkur Aerodrome, Bengaluru to Coorg.
19. The pilot took-off from Jakkur Aerodrome, Bengaluru and landed at Begurkoli, Coorg on a grass strip heading 310. The duration of flight was 02 hours 15 minutes and the flight was uneventful.

20. The pilot subsequently went for a local sortie over Coorg along with a passenger.
21. Both these flights were not carried out under the authority and supervision of a flight Instructor or an Examiner approved by the Director-General.
22. After completing a local sortie of about 01 hour 15 minutes over Brahmagiri Hills which are 300 ft AGL, the pilot returned to Begurkoli and made a straight in landing to grass strip heading 130.
23. The pilot made a delayed touchdown at about 3/4th of the grass strip.
24. The microlight did not stop until end of runway and thereafter the pilot initiated go around, increased power and took-off.
25. During take-off the pilot probably did not see the high tension electric wires in front until he came very close to it and pulled up the microlight at a very steep angle not realizing that he was flying the microlight without leading edge slats.
26. The microlight stalled and impacted ground on its nose.
27. The pilot received fatal injuries and was declared dead on 03.05.2015 while undergoing treatment in hospital. The passenger received serious injuries
28. There was no fire during the accident.
29. The microlight was substantially damaged during the accident.
30. The weather at the time of accident was reported to be fine.

3.2 Probable Cause of the accident :

The pilot while initiating go around took-off, pulled the microlight at a very steep angle which caused the microlight to stall and eventually resulted into the accident.

Contributory factors:

- The modifications made in the microlight i.e. removing leading edge slats and replacing them with vortex generators.

- The pilot making a delayed touch down on the grass strip.

4. Safety Recommendations :

1. DGCA may carry out one time inspection of all the organizations that operates Zenair and other microlights for any unauthorized modifications on the aircraft.

2. DGCA may evolve a regulation covering all aspects of microlight flying. Possibility of association of local administration may be explored to ensure that the flying is undertaking only with valid C of R/Permit to fly/licenses and the accidents/incidents like these are reported to AAIB/DGCA in time.

(Capt. Pavan Varma)
Member, CoI

(K. Ramachandran)
Air Safety Officer (E), AAI
Chairman, CoI

Date: 18th May 2017
Place: New Delhi