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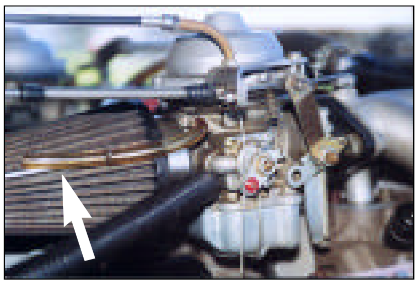
Aviation Safety

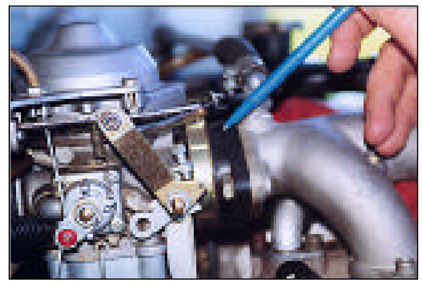
Ultralight and Balloon

Learn from the mistakes of others and avoid making them yourself . . . Issue 1/2000

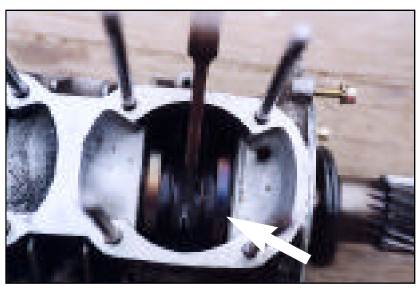
Some Tips on Ultralight Pre-flight/Maintenance



A well-maintained Rotax carburetor system can often have unexpected visitors; note the open vent line (arrow). Although necessary for correct operation of the carburetor, this is an inviting place for a worm or insect to nest. If one of these critters gets in there it can shut off the carburetor air balance and stop the engine. This is an important area to check during a pre-flight if the aircraft has not flown for an extended period.



The pencil points to the rubber collar on the Rotax 912 carburetor attachment. This collar should be inspected frequently for cracks as it must be in good condition to seal the mixture flowing to the engine. Any cracks will allow air to suck through and lean the mixture, with corresponding engine performance degradation.



Additionally, the seal or collar on a two-stroke Rotax must be fastened securely because it holds the entire carburetor in position. Although many ultralights have two carburetors, both are required to balance the fuel flow to the cylinders. A failed carburetor on a two-stroke engine can starve half the engine of oil, as in this case, where a bearing failure in flight occurred (arrow points to bearing failure). In addition, the lean fuel/oil mixture causes an immediate rise in cylinder head temperature and often leads to piston seizure.

Cracks in the exhaust system become "breakaway components" very quickly during flight, and this can play havoc with the propeller if the aircraft is a pusher type. Always conduct a careful pre-flight for such indications. Note the finger pointing to a crack initiation.

Brake disc fasteners left unlocked can work out and damage the brake-puck housing. If you are unable to use lockwire, use star washers or some other locking device. ***Remember: if it can come out, it will come out.***

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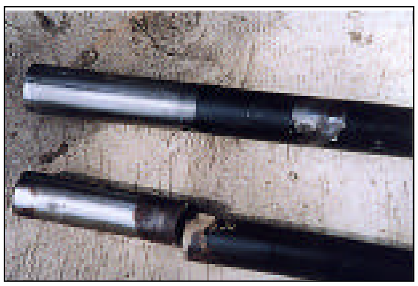
Some ultralight kits were delivered with very light aluminum alloy wheels to save weight. These types often fail in sideloads, so they must be monitored for signs of pre-cracking, particularly if operating off rough fields. The catastrophic failure of a wheel or axle usually results in severe damage to the undercarriage and a wing.



Speaking of broken axles or undercarriage legs, as this photo indicates, they can, and do, break from metal fatigue, particularly on rough-field operations and under conditions of excessive flexing over a period of time.

Letters to the Editor

As a result of a caption mix-up, corrected by a separate mailing, many of you wrote to express various opinions about the sideslip, among other topics. You provided some interesting analysis and comments, some of which appear below.

Mr. Alan Stewart, Transport Canada, Continuing Airworthiness, writes:

When referring to approaches, the terms *crab, sideslip*, *forward slip*, *cross-controlled*, etc., create inordinate confusion in our hangar flying. Fortunately, most of us get it right in the air because the seat of our pants does not care what terminology is used for the approach we want. However, proper understanding of different crosswind approach techniques can improve our flying skills if the definitions are understood first.

In the crab approach, the nose of the aircraft points slightly upwind but the ground track is straight down the runway. Depending on the undercarriage design and the amount of crosswind, this aircraft attitude can sometimes be maintained all the way to touchdown. Some amount of sideways lurch can be expected; this serves to align the aircraft with the runway but does not change the velocity vector. However, for most of us, the crab is best minimized or removed at touchdown. For many light aircraft, a healthy rudder kick just prior to touchdown serves the trick.

Now on to the slipping approaches. A sideslip occurs when the rudder is displaced opposite to the ailerons. It is used to increase the descent rate without building up speed. It will not compensate for drift, although it may give the illusion of doing so. On most aircraft, slips can be done left or right equally well. Depending on the control authority of the aircraft, a great deal of sideslip is often available. Typically, only a small amount of sideslip is used to align your nose with the runway in a cross-wind landing.

Imagine you are established on final approach with a wind from the left. In co-ordinated flight, the nose of your aircraft will be to the left of the runway heading with your ground track down the centreline. To transition to a sideslip approach you push the right rudder and the stick left. Now both your ground track and the aircraft nose are pointing down the runway. The left wing will be low such that the left main wheel should touch down first. A very graceful and smooth landing can be accomplished in this manner with the right wheel only touching down after the aircraft has slowed a bit.

The gotcha described in “Improper Crosswind Correction” in *Aviation Safety Ultralight and Balloon* 2/99 is that the pilot used the wrong direction of sideslip. Although it seems obvious that we should kick rudder to align the aircraft with the runway, the brain and eyeball can play tricks on us. While established in a crab approach (wind from the left) the pilot may desire to steepen the approach with sideslip. Because the aircraft nose is already pointing left, the subconscious thinks a sideslip is already established; the pilot may think he should increase it to steepen the approach. Thus, he applies more left rudder and the result is what was described in Ultralight and Balloon 2/99. If left uncorrected at touchdown, the aircraft nose will be even further into wind relative to the centreline than with a crab approach. You would experience severe lurch or a ground loop or perhaps worse. What is surprising is that about 1 in 4 pilots were noticed using the same approach technique. This clearly points to a lack of knowledge and/or training of cross-wind techniques. The ultralight community is particularly vulnerable in this regard as the crab angle for a particular crosswind will be larger than for faster aircraft. Perversely, a decent ultralight pilot may well be far better at crosswind approaches than faster pilots for the same reasons.

Here is a recent report and example of improperly dealing with a crosswind:

“The Wagaero home-built aircraft departed Guelph, Ontario, under visual flight rules (VFR) destined for Chatham. The flight was uneventful until the pilot attempted to land on Runway 23 at Chatham. Directional control of the aircraft was lost because of

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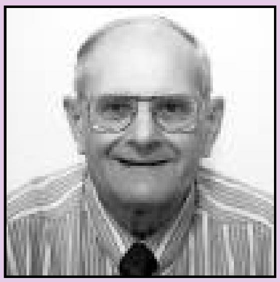

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a crosswind that was reported to be from 360°M at 15 kt. The aircraft drifted off the left side of the runway, damaging the spinner and propeller as it nosed down into the snow-covered area adjacent to the runway."

Mr. Vern Rees, an ultralight instructor from Saskatoon, writes (I have edited some points related to the sideslip error since a correction was mailed to all recipients):

I find your newsletter very informative and helpful to ultralight pilots, especially articles like the one on the front page of issue 2/99 that stress the importance of dual training on types that are new to the pilot. Many types of aircraft are described by pilots as "easy to fly." Unfortunately, many pilots find out too late that the aircraft described are only easy to fly for those who already know how to fly them.

With regard to your sideslip article, I have always avoided using the terms *forward slip* and *sideslip* to avoid this confusion. I just call them slips for use in increasing descent rate on an approach or for compensating for drift in a cross-wind landing or a combination thereof. The reason the accident depicted in the article took place appears to be because a less-skilled pilot tried to imitate what he saw other pilots doing because he saw how effective it was to turn the nose into a crosswind and lower the wing at the runway and thus lose altitude like going down in an elevator. Unfortunately, I speculate that he did not realize how much skill it would take to go from being cross-controlled in one direction to being cross-controlled in the other direction for the cross-wind landing. Indeed it is very effective to lose altitude quickly in this fashion without gaining airspeed while travelling very little toward the runway. I only instruct other ultralight instructors or experienced pilots on this manoeuvre.

My intention is not to be critical of your publication, only to assist you in making ultralight flying even safer.

On the subject of ***forced landings,*** *Dr. André C. Paris writes about his experience:*

First, I would like to congratulate you for your publication on ultralights. It is very interesting and educational and it attains its goal of making us learn from the mistakes of others. Well done!

I would like to share with you and perhaps the readers (if you think it is a good idea) an adventure I had in September 1999. I have had my student pilot permit for ultralight aircraft for two years (35 hours flight time) and when the weather's good, I can't resist the urge to take a short trip, whether it be very early in the morning or at the end of the day.

On this evening in September, the ceiling was particularly low and to have good visibility I had to maintain an altitude of between 500 and 800 ft AGL. Since I was continuously flying over fields where it was possible to land at any time, there was not much risk. During this flight, which lasted approximately two hours, I practiced five or six failure simulations (throttle closed but engine idling) until the final approach, when I opened the throttle. It went well; it was good practice, I thought.

On my return circuit, the engine stopped completely without any warning. At 500 ft AGL you have to react quickly. While remaining very calm, having chosen my landing area, I visualized my approach and landing. It all seemed very easy. Nevertheless, during a simulation of a failure with a propeller still turning you have a certain propulsion that you do not have during a real failure. With a tail wind, I realized that I had to shorten my circuit because I wouldn't have enough power to enter final approach where I had

cont. on p. 6

Balloon Safety

Grass Fires Destroy the Eagle and Mountie Balloons

Both the Eagle and the Mountie on Horseback balloon envelopes, shown in the accompanying photos, were destroyed by a grass fire that was inadvertently set during the landing drag. The Mountie incident happened near Dallas, Texas, in October 1999. Apparently, the balloon landed normally, but during the drag a spark or residual flame from the propane burner ignited the dry grass along the landing path. Despite efforts to control the fire, both with the help of crew and bystanders stomping the flames and the pilot with the balloon's hand-held fire extinguisher, the fire destroyed the envelope. The crew managed to save the basket by unhooking it and dragging it clear of the flames.

The special shape Eagle balloon was similarly destroyed in a grass fire about two years ago in Australia. The balloon was flown by an American pilot and, as it dragged through long dry grass, the pilot light, which remained on, apparently ignited the surrounding grass. The fire spread rapidly to encompass the envelope and efforts to save it were fruitless. The envelope for the Eagle was replaced.

It is ironic that two famous special shape balloons should have their envelopes destroyed by grass fires they inadvertently set upon landing. *This is something to think about, particularly when landing in fields with dry, tall grass. The grass can ignite from the burner passing close to the ground. Since the wind is always astern during a drag landing, if a grass fire ignites, the wind helps it overtake the balloon. As well, the fire can be missed by the pilot because it is may be starting behind him/her and out of his/her immediate vision. In both these cases, the fire got a head start and the pilots were unable to control the situation. There were no injuries reported in either incident. —Ed.*

Photo credits: Dave Gleed

Three Accidents, Three Lessons

The following accidents reported by the U.S. National Transportation Safety Board (NTSB) are reviewed for the benefit of the ballooning community in Canada and to emphasize the importance of pre-flight checking/maintenance of balloon control lines, the increased risk of prolonging flight after any indication of high-wind conditions that can result in a high-wind landing and the ever present danger of power lines. —Ed.

On August 11, 1999, a **Balloon Works Firefly 9** sustained minor damage during a landing near Hartsel, Colorado. The commercial pilot and five passengers were not injured. The pilot reported that he flared the balloon and pulled the deflation line as he approached the touchdown point. The line broke and fell into the basket. Unable to deflate the balloon because the line had broken approximately 5 ft down from the parachute harness and 40 ft up from the skirt inside the envelope, the pilot radioed his ground crew for assistance. The balloon was secured long enough for the passengers to exit, then the wind velocity increased. The balloon broke free and dragged across the ground until it was caught and held so holes could be cut in the middle portion of the envelope to help deflate the envelope.

The pilot took the balloon to a repair station for repairs. The station owner was concerned about the mode of failure of the deflation line and, being familiar with the requirement to notify the NTSB Office in cases of control failure, he did this promptly.

The deflation line was sent to the NTSB's materials laboratory for examination; the following points were noted:

1. glazing damage to the outer cover, typical of heat damage;
2. unravelled and missing outer cover, exposing the Kevlar inner core;
3. longitudinal compression of the outer cover;
4. discoloration of the outer cover, ranging from light to severe; and
5. the fracture, exposing fraying and unwinding of the Kevlar inner core fiber bundle.

Light discoloration of the deflation line is typical of normal use. Two areas of moderate and severe discoloration "showed no signs of heat damage. The discoloration did not extend completely around the circumference of the line." According to Balloon Works, the Kevlar braided inner core chars at 890°F. The nylon or polyester braided outer covering has a stick point of 430°F and a melting point of 492°F. A new line has a nominal strength of 4000 lb.

On August 19, 1999, a **Firefly 11 balloon** landed hard in open desert terrain in Cave Creek, Arizona. Of the 13 souls on board, 2 passengers sustained serious injuries while the pilot and the remaining 10 persons received minor injuries. A company pilot in another balloon reported that the balloon encountered a sudden microburst, resulting in an inadvertent hard landing. The pilot reported that he was en route to the targeted landing site at 3000 ft MSL when he was advised that surface winds had increased to 12 kt. Because of the wind conditions, the pilot selected an alternate landing site and briefed his passengers on high-wind landing procedures. After descending through 500 ft AGL, the balloon's vertical sink rate suddenly increased and the pilot turned his attention to task of landing. Prior to touchdown he shut off the fuel to the burner and prepared to open the parachute valve upon contact with the ground. With the increased rate of descent, the balloon landed hard and short of the intended site and skidded before coming to a stop.

On April 9, 2000, a **Balloon Works Firefly** sustained substantial damage at Anthony, New Mexico, when it drifted into power lines following landing. According to the pilot, the balloon was struck by a light wind gust following landing and the envelope drifted into a power line. Several panels of the envelope were burned but, fortunately, no one was injured.

Some Recent Ultralight Accidents

The pilot reported that he was flying his **Team** ultralight aircraft over the frozen surface of a bay when he lost control of the aircraft, descended and struck the frozen surface of the bay. The aircraft's right wing and right main landing gear were damaged. The pilot injured his arm, but the passenger on board was not injured. *The ultralight aircraft was not registered, and the pilot did not hold any license or permit to fly the aircraft.*

During approach to land in his **Blue Yonder E-Z Flyer** ultralight at the private ranch air strip, the pilot encountered a sudden wind shear or downdraught just prior to touchdown. This caused the ultralight to land hard and bounce several times while veering to the left off the strip. After leaving the runway, the ultralight travelled about 400 ft and struck trees. The pilot was seriously injured; the passenger was not injured, and the aircraft was substantially damaged.

The pilot of an **Epper Quicksilver MX** ultralight was performing manoeuvres that were described as whip stalls, which were not taught or authorized because of the excessive g forces they impose. An instructor had previously checked his machine and warned him of the dangers on the day of the accident. The pilot said he understood and would "watch it." Later that day he practiced similar manoeuvres again and the left wing detached with fatal results for the pilot.

The pilot of a **Birdman Chinook** suffered a minor injury during a controlled forced landing. There was damage to the propeller of the ultralight.

The pilot of a **Birdman Chinook 2E** advanced ultralight was on a local pleasure flight when the engine lost power. As a result, the aircraft landed in a farm field, but no information was provided as to the cause of the Rotax engine failure.

The **pilot of a Challenger ultralight** lost his life when, according to unconfirmed reports, the aircraft had crashed in the nose-down vertical position with some rotational action, suggesting a stall spin scenerio. Initial investigation by the TSB indicates that the aircraft had been seen doing hops into the air and carrying out sustained flight to a maximum height of several feet when it apparently pitched up suddenly then levelled off before disappearing from view. There is no evidence that the pilot had any formal powered aircraft training.

The **pilot of another Quad City Challenger II** spent the night in the wilderness after he became separated from a trio of Challengers while en route. A

The Challenger ultralight shown above is similar to the Challengers involved in the accidents mentioned. This is a unique aircraft designed specifically for very slow flight operation and, as such, it has unique flying and control characteristics. For your safety, obtain dual training and experience prior to attempting solo flight in this aircraft type.

SAR helicopter located the crash and picked up the uninjured pilot the next morning. The aircraft had crashed nose-first into trees and was wedged between two trees.

The pilot and passengers were fatally injured in an Ultralight Storm S280. The aircraft went missing after departing a farm strip in Alberta for a short local flight and was subsequently located with the help of radar data.

The **pilot of a Lil Buzzard ultralight** was landing on an airstrip in the Yukon when a gust of wind from the left blew the aircraft off the right side of the strip into the trees. There were no injuries, but the aircraft was substantially damaged.

Letters to the Editor *cont. from p. 3*

planned. I had to pitch forward with enough angle to avoid stalling. Even then, everything was going well, but the length of the field available for landing had decreased a lot. I had to touch the ground faster because there was a fence at the end of the field.

Nevertheless, in final approach, thermal turbulence (without a doubt) lifted me and made me rotate to the right. I was able to stabilize the aircraft, but this time the same thing happened on the left. I finally touched the ground but there was only about 200 ft of the field left and I finished my landing in the fence, incurring a couple thousand dollars of damage to my airplane. I was not hurt, but I learned a lot from this experience.

1. Someone had told me to try to land near a house after a failure; I think this could be dangerous.
2. I should have conducted my circuit in the other direction to find the most field available for landing.
3. I have been told that you shouldn't change your mind once you have made a decision. Nevertheless, noticing my lack of speed, I should have transitioned from my "tail-wind phase" to "final" and landing while moving away from the houses. It is certain that when this happens to someone for the first time, a lack of experience greatly influences the results.

A bit of advice: choose the longest possible landing area that allows you to avoid unexpected obstacles. Even if you have to walk 30 or even 60 min to find help, it is worth it. Remember, experience is acquired.

Pierrette Gilbert from the Beauce–Quebec area writes about the Rotax two-stroke engine (personal opinions and comparative costs of parts have been omitted since TC has no research to support or otherwise become involved in such controversy):

I am writing to you about a misfortune I had, luckily without any damage. After having spoken briefly with other owners of ultralights in my region, I have found three ultralight owners who have had the same experience. Therefore, I decided that it was worthwhile to share this story with your readers.

Rotax two-stroke engines have the quality or feature of being able to be installed with the pistons down and still function just as well. These engines vibrate strongly on start-up and shutdown. As well, the spark plugs for these engines must be changed regularly. Perhaps because of this vibration, the spark-plug cap becomes loose with time. Thus, it is not unusual for the spark-plug cap to detach from the spark plug while in flight, and we end up with only one functional cylinder as a result. At 1000 ft AGL, it is easy to land without incident, but at takeoff, the problem could be much more serious. We resolved this problem by attaching the spark-plug cap with a strip of fabric that is heat-resistant but is not an electrical conductor.

The designers of these engines could at least come up with an ignition system that is much more solid and safe and double it. It is clear that we are getting far less than our money's worth compared to dual ignition safety features of other aircraft engines.

As a safety officer, I agree with the author: ignition wires should have a fail-safe attachment at both the distributor and spark-plug ends. —Ed.

Is a Pilot Permit Required to Crow-hop?

The answer to the title question is yes. The law requires pilots to be in possession of proper qualifying documents to crow-hop or to perform any other activity where the aircraft becomes airborne. Part 101 of the *Canadian Aviation Regulations* (CARs) defines "flight time" as *the time from the moment an aircraft first moves under its own power for the purpose of taking off until the moment it comes to rest at the end of the flight* The pilot of an ultralight aircraft was reported as pilot-in-command in an accident in March 1999, at which time a passenger was on board. This pilot was also involved in a similar incident about three years ago.

According to a TSB report concerning the latest issue, the pilot was flying a Team 643 ultralight aircraft and performing short hops, or *crow-hops*, as this manoeuvre is commonly known in the ultralight community. During one of these hops, he realized that he did not have sufficient runway to land and decided to continue the flight and fly a circuit back to the runway. The pilot was unable to gain sufficient altitude and collided with trees off the end of the runway. The Team ultralight was substantially damaged when it came to rest above the ground in the trees, but, fortunately, the pilot was uninjured in the accident.

Some Avid Flyer Safety Tips

The Avid Flyer type aircraft (above) is widely in use throughout the world and in Canada. As with any aircraft type, as the numbers increase so do the accidents and incidents. I have compiled a synopsis of a number of cases for this article from various data bases, including those from Canada, the U.S. and New Zealand. Human factors appear to play a major role in both the maintenance and handling of the aircraft. As you read these incidents and comments, think of changes you can make in your maintenance and flight operation to avoid repeating past mistakes. Often, the engine type is not listed in the reports so it is difficult to find a pattern for the engine failures. It is also difficult to know whether the failures involve more than one type of engine. It is assumed that most of the Avid Flyers were equipped with Rotax engines. Some typical incident/accident descriptions follow, with safety points in **bold**:

Case 1: A total loss of power occurred while the aircraft was 5 mi. back on final. The pilot was injured in the crash when he **allowed the aircraft to stall during a 180° turn in gusty wind conditions while manoeuvring** to avoid a river on his approach path. The engine failure was probably caused by a loose right magneto contacting the flywheel magnet and shorting the electrical system. Although not stated, the engine was probably a Rotax model.

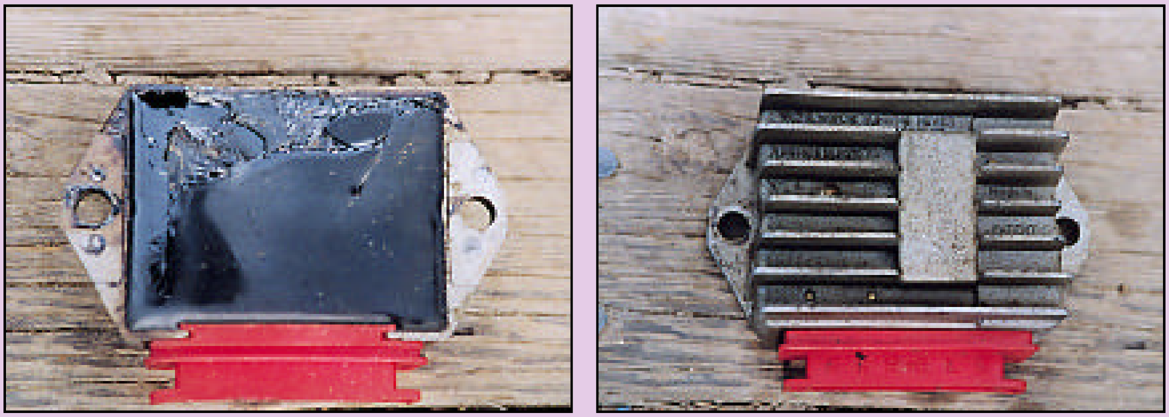
Case 2: During **takeoff in gusty weather conditions**, the engine lost total power after reaching an altitude of about 200 ft. The airplane collided with trees and a power line during the forced landing. The engine "test ran" successfully, but further examination revealed some **galling and scoring of the internal forward cylinder wall**. Although not stated, the engine was probably a Rotax model.

Case 3: Witnesses reported that the Avid Flyer's engine lost power during a turn onto base leg. The aircraft then manoeuvred in a 360° turn, as if to land in a field. **During the manoeuvre, it entered a steep descent and impacted the ground** with fatal consequences for two persons.

Post-accident **examination of the engine revealed that both carburetors were loose**. Each carburetor was required to be secured with two clamps; however, only three of the four clamps were located. The home-built aircraft was on its third flight when the accident occurred. The engine failure probably resulted from loose carburetor(s) caused by improper installation and maintenance, resulting in fuel starvation. Failure of the pilot to maintain adequate airspeed **while manoeuvring for a forced landing resulted in an inadvertent stall** and subsequent fatal impact with ground.

Case 4: Following a touch-and-go landing at about 200 ft AGL the engine quit and the pilot **allowed the aircraft to descend into the ground** off to the side of the runway. Post-accident inspection of the engine revealed a **propeller reduction gear failure caused the loss of thrust**. The pilot stated that he had had **previous trouble** with this type of propeller reduction planetary gear system because of the binding of the planetary gears.

Dealing with Smoke in the Cockpit

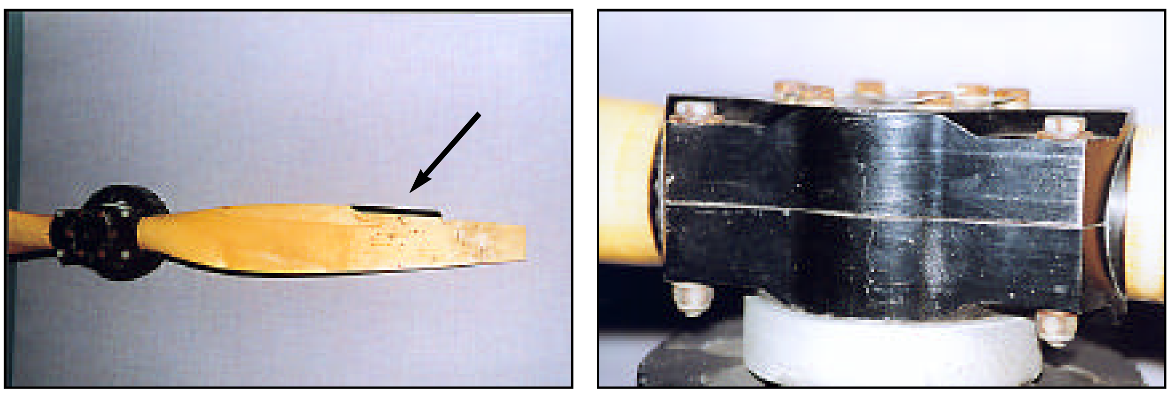


Bottom side of burned-out rectifier (left) with the type of rectifier identified in a top view (right).

Occasionally an ultralight or advanced ultralight pilot may be confronted with unexpected smoke in the cockpit. If the smoke has an acrid smell and other characteristics of an electrical fire, the problem may be the rectifier/voltage regulator self-destructing. This component is found in most ultralight or advanced ultralight aircraft equipped with Rotax engines. It does not have a service life so may be just getting old when it fails or it could be a faulty unit.

The pilot in this instance reported considerable acrid smoke but found no need for panic. He correctly assessed the problem, returned to the airport and landed the aircraft safely after the unit burned itself out, as shown in the photos.

Challenger Force-lands Successfully



Evidence of blade strike (left) and the noted lack of clearance between hub halves (right). The manufacturer states that after the blades are torqued there should be some clearance between the hub halves for effective clamping of the blades.

This propeller was damaged during flight from striking something, as can be clearly seen at the indentation on the blade (arrow). Whatever hit the propeller split sections off both blades, making it impossible to provide thrust and sustain flight. Fortunately, the pilot was able to make a successful forced landing on a road without further damage to the aircraft.

An interesting point arises as a result of this incident. According to the manufacturer, this propeller hub requires some clearance between the hub halves after the blades have been torqued in place. The specified torque value is 75 in./lb, never to exceed 100in./lb. There appears to be no clearance visible on either side of this hub, so it can be concluded that either incorrect torque has been applied or the hub has been modified. Although this is not a factor in the broken blade, the fact that the hub halves may be incorrectly installed or torqued could have resulted in loss of a blade in flight.

TSB Ultralight/Advanced Ultralight Statistics, 1999

	Ultralight	Advanced Ultralight
Total accidents	28	09
Fatal accidents	09	03
Fatalities	14	05
Serious injuries	8	0