

## Reflex-profile paragliders: **Facts** and **Myths**.

Reflex profile paragliders (RPP) have been produced for several years now. There must be a dozen thousands of them flying in the skies, and the number of flights absolved must be a seven-digit one. With growing confidence more and more pilots go flying in difficult conditions, yet there are no reports of accidents allegedly caused by reflex-profile characteristics.

How is it then that so many pilots still consider reflex wings to be evil and traitorous? Popular meaning says they are docile in easy weather, but can get really nasty when struck by some bad mood. As usual, fear is a child of ignorance. And when there is no knowledge around, myths come in handy.

That's why we decided to give short shrift to several most persisting of them, which grew over years.

### **Myth #1:** *"It is hard to take off on a reflex wing"*

A reflex-profile paraglider (RPP) takes off **differently** than a **Classic paraglider (CP)**. RPP needs to be launched with one smooth pull, quickly arriving over pilot's head. You can't pull up the wing too slow or have a break in-between, as many pilots do. According to their CP experience they think it is safer to pull it up reluctantly than to go with full zeal and then brake it when it wants to overtake the pilot. This is all wrong – with RPP there is no possibility of overshooting: once the canopy is filled up and remains in the airflow (be it because of the wind or pilot's movement), RPP firmly stays overhead and simply waits for you to take-off. This is one of its fundamental advantages.

Is such a start a difficult procedure? Well, it depends. To be frank, pilots who learned from the scratch on RPPs under guidance of an instructor conscious of reflex technology have a lot less problems than seasoned classic wings pilots, who just took a change over.

**Fact:** A reflex-profile paraglider takes off differently than a classic paraglider. Problems can be caused by handling a RPP with CP habits, or by misjudging trim settings (in relation to wind speed). Pilots who do it properly have no problems with taking off on a reflex wing.

### **Myth #2:** *"It is hard to steer a reflex wing"*

It's a fact that a RPP can be hard to steer, especially at higher speeds, when it is designed with technologies similar to CP (this was a common feature in the first days of RPP evolution). By the way harder handling is not exclusively connected with reflex profile peculiarity; it also strongly influenced with simple fact that RPP fly faster (steering a classic wing at 60 km/h would require a lot of strength too).

Still, ongoing design improvements finally worked out solutions that practically exclude this problem. In latest wings brakes act more "pulling in" than "pulling down", bringing comfort to steering RPP at low speeds. At high speeds (open trimmers + speedbar) there is additional set of steering handles connected to wingtips (TST - Tip Steering Toggles), allowing for easy and effortless handling.

**Fact:** Modern RPP design features more effective classic steering techniques at lower speeds, and alternative handles set (TST) for higher speeds.

### **Myth #3:** *"Dynamic RPPs reactions to collapses induced by test-pilots prove that such paragliders can be very dangerous when flown in turbulence."*

Test pilots are forcing collapses (frontstall, 50% asymmetric, 74% asymmetric) by pulling A-row lines or risers. Because CPs are pretty vulnerable to collapses, test pilots have no problem to cause

them. Slight pull on A risers is enough to create an impressive frontstall, especially with speed-system engaged.

Now in case of RPPs and their considerable resistance to collapses, test-pilot has to pull the risers really strong and for several seconds. Meanwhile already fast-flying RPP accelerates even more, as pulling A-row diminishes wings' angle of attack. At last collapse occurs, reopened spontaneously and dynamically by the paraglider on its own. Unassisted reinflation is a welcomed behaviour, but dynamic exit is regarded as a sign of instability of the wing.

Such judgement is wrong for two reasons:

First: any wing (including those considered very safe) flying at 50 or 60 km/h will exit the collapse dynamically, therefore gaining considerably worse marks – even as it would be still the same, safe wing.

Second: in real flying a collapse is caused by a stream of sinking air (turbulence) entered by a paraglider. Even at hypothetic 35 km/h speed (and RPPs fly much faster) and theoretic maximal chord of 3.5 m (in reality much less, especially at wingtips) we have only 1/3 of a second between moment of leading edge entry in turbulence and the moment when entire wing has flown into it. It means that in real life turbulence is acting on the leading edge for tenths of a second only, since covering more than just a leading edge it is more likely to rock the wing than collapse it. And it is worth remembering that a reflex-profile is trying to cope with occurring instability in real-time.

**Fact:** RPP's reaction to collapses induced by test-pilots during certification procedures or SIV courses does not reflect real behaviour of the paraglider. A wing of fully reflexed profile will acknowledge even strong turbulence by slight acceleration and upsurge (when faced head-on) or a swing and slight turn when it is hit distinctly on a side.

*Attention: another situation occurs when a paraglider enters rising air. Violent turbulence when rising can stop a paraglider in flight and bring it to parachutal stall. Testing such a case would require simulating it on high AoA (slowest trim setting). All in all, certificating of modern RPPs is a broad topic which deserves an article of its own, or even several of them.*

**Myth #4:** "All RPPs behave exactly the same"

Each year the offer of RPPs is getting broader. Each year new designers come to try the reflex-wing concept, bringing their own ideas and experiences to it. "Old" designers test new trends. In effect we have several types of reflex-profile paragliders:

- fully reflexed wings,
- "half-reflexed" paragliders (i.e. with profile showing limited reflex behaviour),
- semi-stable paragliders (i.e. with profile displaying only some features of typical reflex-profile)
- partly reflexed paragliders (for example with reflex profile only in central part of the canopy).

When additionally we'll take into consideration changes brought to profile by trimmers and speed system, we will have:

- reflex behaviour in full speed range,
- reflex behaviour at middle and high speeds.

To sum it up, we arrive at quite a number of possible RPPs. All these wings can (and usually do) behave differently, depending on their design and current trim/speed system configuration. Fully reflexed profile is hardest to exploit, but it is the one most welcomed by pilots wishing to fly as fast and safe as possible. Compromises offering limited reflexivity bring some features typical for classic paragliders (lower speeds or easier handling), but it is invariably with a loss of several welcomed reflex-profile features.

**Fact:** All RPPs flying in full-reflex mode feature increasing stability with increasing speed. But not

all RPPs available are fully reflexed at all trim/speed system settings and that's why they can behave differently.

**Myth #5:** *"Reflex-profile paragliders are said to be immune to turbulences."*

RPP is not a flying broom nor does it possess any magic powers of casting spells on weather. Turbulences won't disappear simply because the flight is done on a RPP. Pilot will experience them as sequence of jolts, felt harder with increasing speed.

The truth is, a RPP is very resistant to turbulence-induced collapses. That's why their pilots have considerable less work to do (if any at all) when controlling stability of the wing flown through rough air areas. And as we already know the faster he flies, less troubling it will be.

**Fact:** RPP does not erase unpleasant feelings in turbulence, but it is very resistant to turbulence-induced collapses.

**Myth #6:** *"Reflex-profile paragliders can be flown only by experienced pilots."*

We have to discern two notions: experience and education. The first is gained through practice, the latter by training. Pilot with considerable airtime gathered exclusively on classic wings can experience difficulties when he starts flying RPPs, thus perceiving them as potentially dangerous. Flying with brakes slightly pulled in is by far not the only one, but decidedly most widespread example. As (hopefully ☺) known, this technique while perfectly suited to CP will cause an unpleasant feeling of instability when applied to RPP.

Speaking generally, RPP's range looks pretty similar to CPs: there are competition wings with high aspect ratio and sophisticated trimming as well as recreational wings. Competition wings require much experience, while recreational ones can be flown much easier. Still flying both of them it is absolutely necessary to know and understand peculiarities of reflex-profile wing operation. There are following points to be learned:

- influence of brakes, trim and speed system on flight parameters and safety
- take-off and landing techniques, applicable trim settings and landing approach calculation
- handling of a paraglider in specific flight stages.

**Fact:** Flying a RPP absolutely requires knowledge and understanding of its specific demands (besides all general paragliding knowledge of course). An educated pilot even with negligible experience will be perfectly right on his recreational RPP.

As you can see after this remarks, most of the myths concerning RPP has its roots in treating RPPs from classic paragliders point of view. It his highest time to underline that reflex profile paragliders are different than their classic counterparts! The difference is important enough to justify additional training before flying a RPP. Be it brief, but in its crucial points it is indispensable.

To simplify the matter: it is better to think of a reflex-profile paraglider as of a paraglider with several features of an aeroplane. And conscious RPP pilot must learn these "aeroplane" characteristics of his wing, for otherwise he will be restricted to... mythology.

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