

# CABRI® G2

## SERVICE LETTER 12-001

### Yaw control in approach

*It is recommended to keep this letter with the Flight Manual.*

*It is recommended to instructors that they insist on following matter during training and that they check it periodically.*

The Cabri G2 comprises a shrouded tail rotor, usually referred to as a “Fenestron”<sup>(\*)</sup> that was proven to provide excellent maneuverability in every flight condition, in every direction of flight up to 40 kt at least.

However, two recent incidents involving a loss of control in yaw, both with pilots with no previous flight experience in a Fenestron-equipped helicopter, lead Hélicoptères Guimbal to issue this Service Letter in order to point out some specific characteristics of such tail rotors. These characteristics are common to all helicopters equipped with a Fenestron, and are covered by several publications, including Eurocopter Service Letters N°1673-67-04 (CW rotors) and 1692-67-04 (CCW rotors).

### Important notes :

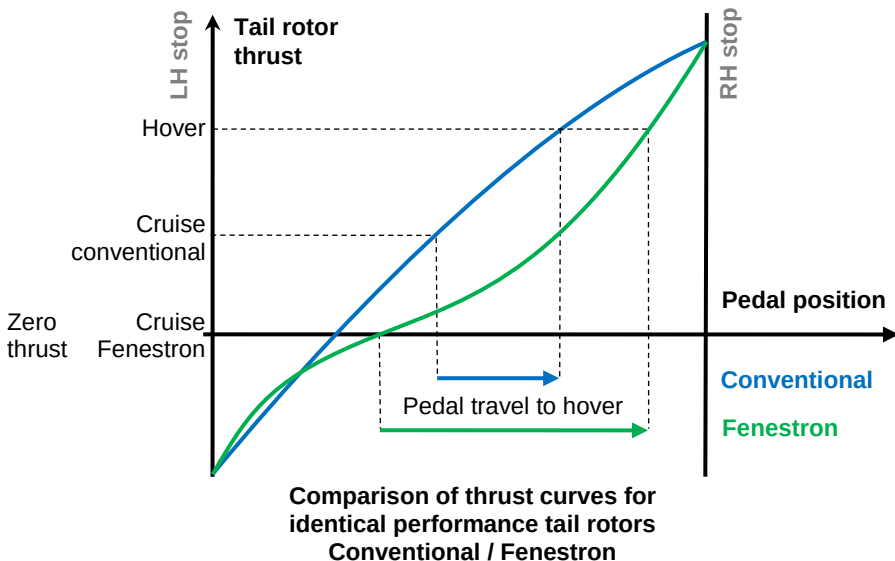
- Spinning at the high rates that can be achieved in both directions by applying and maintaining full pedal, can be very uncomfortable and disorienting for the pilot, and thus very dangerous at low height. Avoid high rate of yaw when close to the ground.
- Extensive flight testing of the Cabri G2 and of other helicopters equipped with a Fenestron have shown that such tail rotor, combining a large shroud and a relatively high disk loading, **is immune to stall and to vortex-ring state commonly referred to as LTE (Loss of Tail rotor Efficiency).**

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<sup>(\*)</sup> “Fenestron” is a registered trade mark of Eurocopter

#### **4. Specific characteristics of the Fenestron**

Compared to conventional tail rotors as fitted to most small helicopters, the Cabri G2 Fenestron features a higher disk loading and a shroud that allow a high thrust capability, but with different shape of the curve Pedals position / Tail rotor thrust :



The helicopter also features a large, airfoil-shaped vertical fin.

→ The primary purpose of this fin is to provide adequate stability in yaw in forward flight.

→ It is also set at an angle of attack to the left, thus producing most of the thrust required in forward flight to counter the main rotor torque, and increasing overall efficiency. This also permits safe powered flight in case of a tail rotor or transmission failure.

→ This implies that this lift is unwanted in autorotation, requiring the pilot to apply significant left pedal for symmetrical flight. However, unsymmetrical flight is not dangerous; it should be corrected for best gliding ratio, and before touchdown.

→ The tail rotor thrust is null when the left pedal is about 3 cm forward (6 cm between the two pedals).

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## **5. Typical situations**

### **Shallow approach (see sketches on following pages)**

A very common situation is a rather shallow approach to a landing spot. Say indicated power is 30 - 40% with an airspeed of 30 - 60 kt, and the string is centered. The left pedal is forward by about 2 - 4 cm. The vertical fin produces most of the antitorque force.

When getting closer to the ground, if the pilot does not control sideslip, the reduction of airspeed causes the tail fin to increase its angle of attack to maintain the torque / antitorque balance : the helicopter nose moves to the left progressively as the airspeed is reduced.

A significant aggravating factor is crosswind coming from the right : the described yawing to the left and corresponding right-hand sideslip can be hidden to the pilot, because the helicopter line of flight is centered on the approach axis.

Then during the flare, the pilot faces in a few seconds, and simultaneously :

- A rapid increase in main rotor power, thus in the requirement for anti-torque thrust,
- A rapid decrease in the tail fin lift, the angle of attack of which is at its maximum and cannot compensate anymore the loss of airspeed.

They tend to provoke a departure in yaw to the left, requiring a quick and large right pedal input.

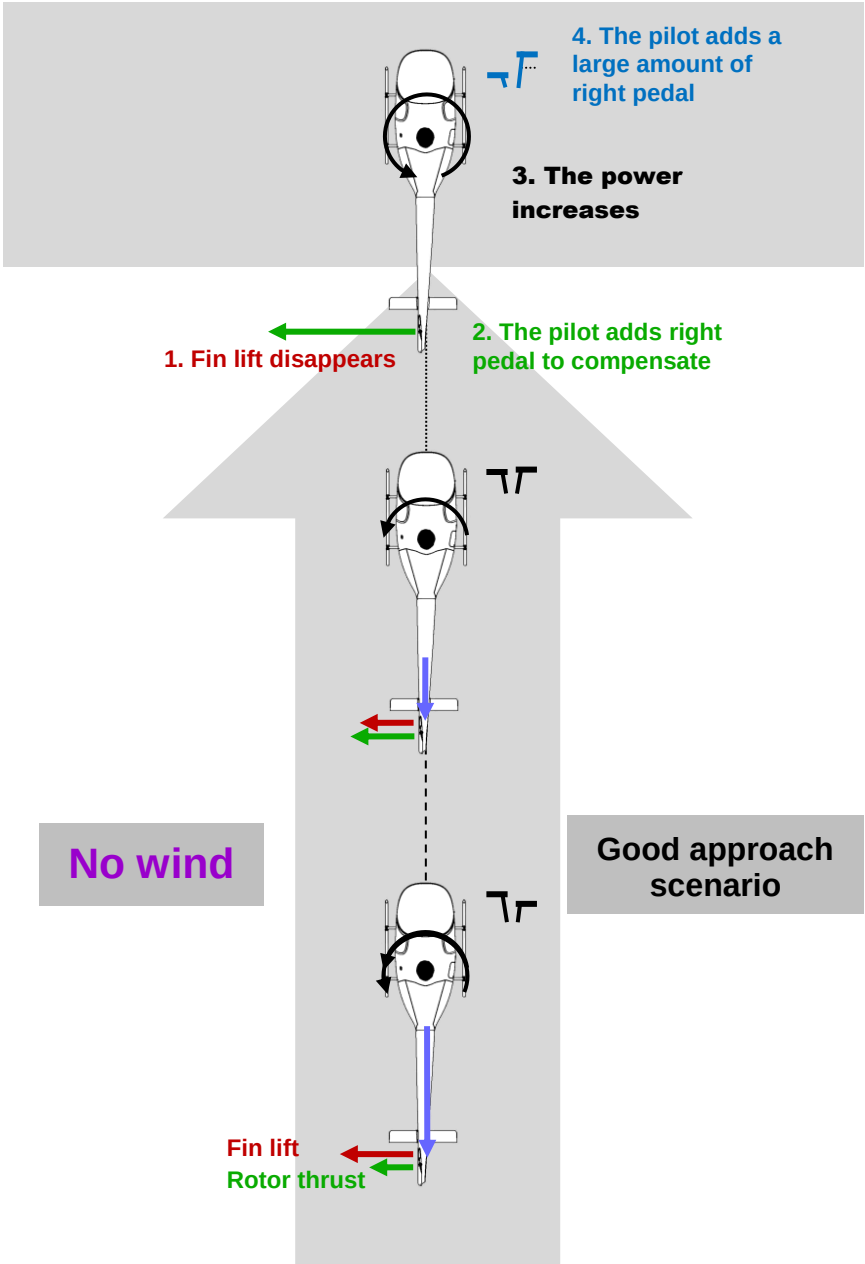
Moreover, three additional factors may increase this effect :

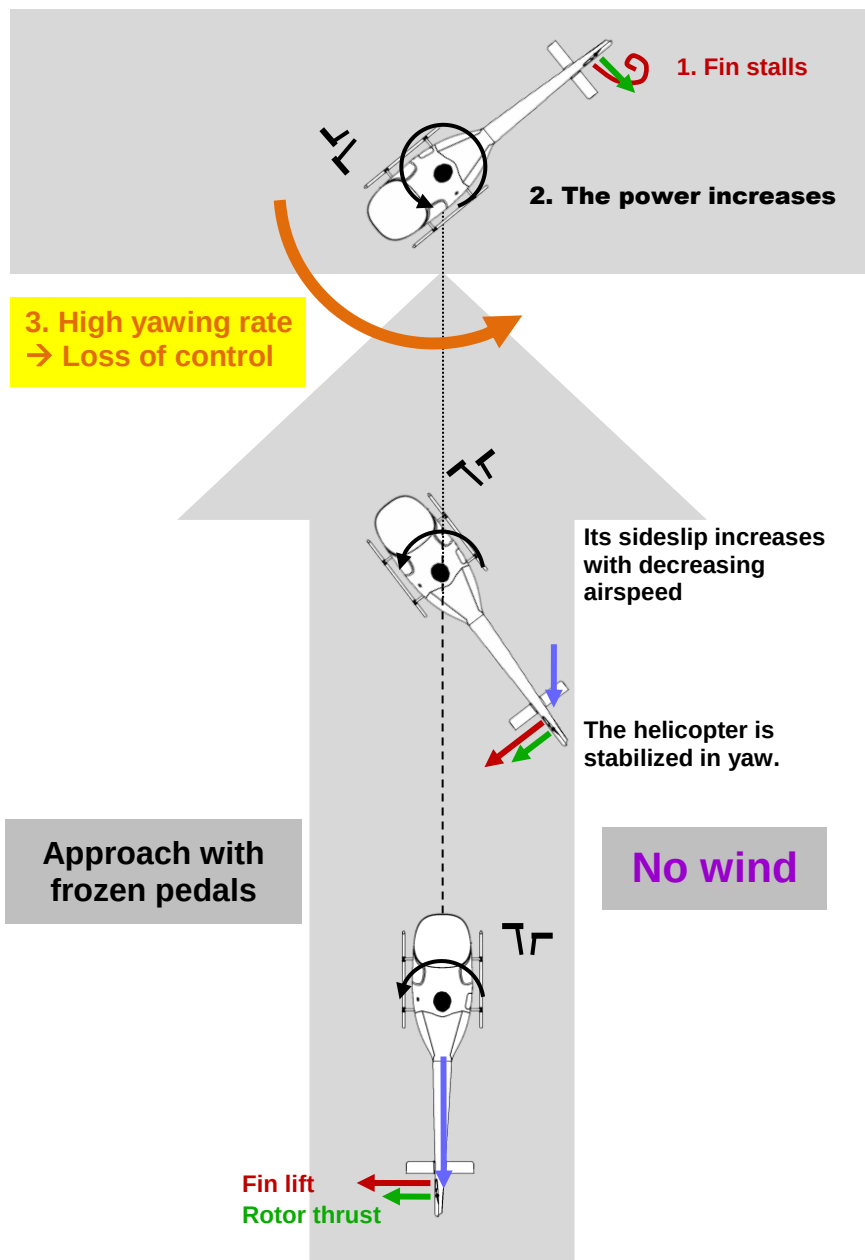
- If the pilot is surprised by the departure in yaw, he will instinctively raise the collective, thus accelerating the yaw to the left.
- If the wind comes from the right, and the pilot is slow to react, allowing the helicopter to depart in yaw to the left, the yaw will accelerate as the helicopter's tail passes through the wind due to the windvane effect (can be compared to a jibe).
- If the helicopter is landing close to IGE hover ceiling, over the transition altitude (3800 ft ISA), full power will be obtained with full throttle (100% FLO on MLI). If collective is increased too much, the rotor speed will decrease, reducing tail rotor thrust and increasing yaw to the left.

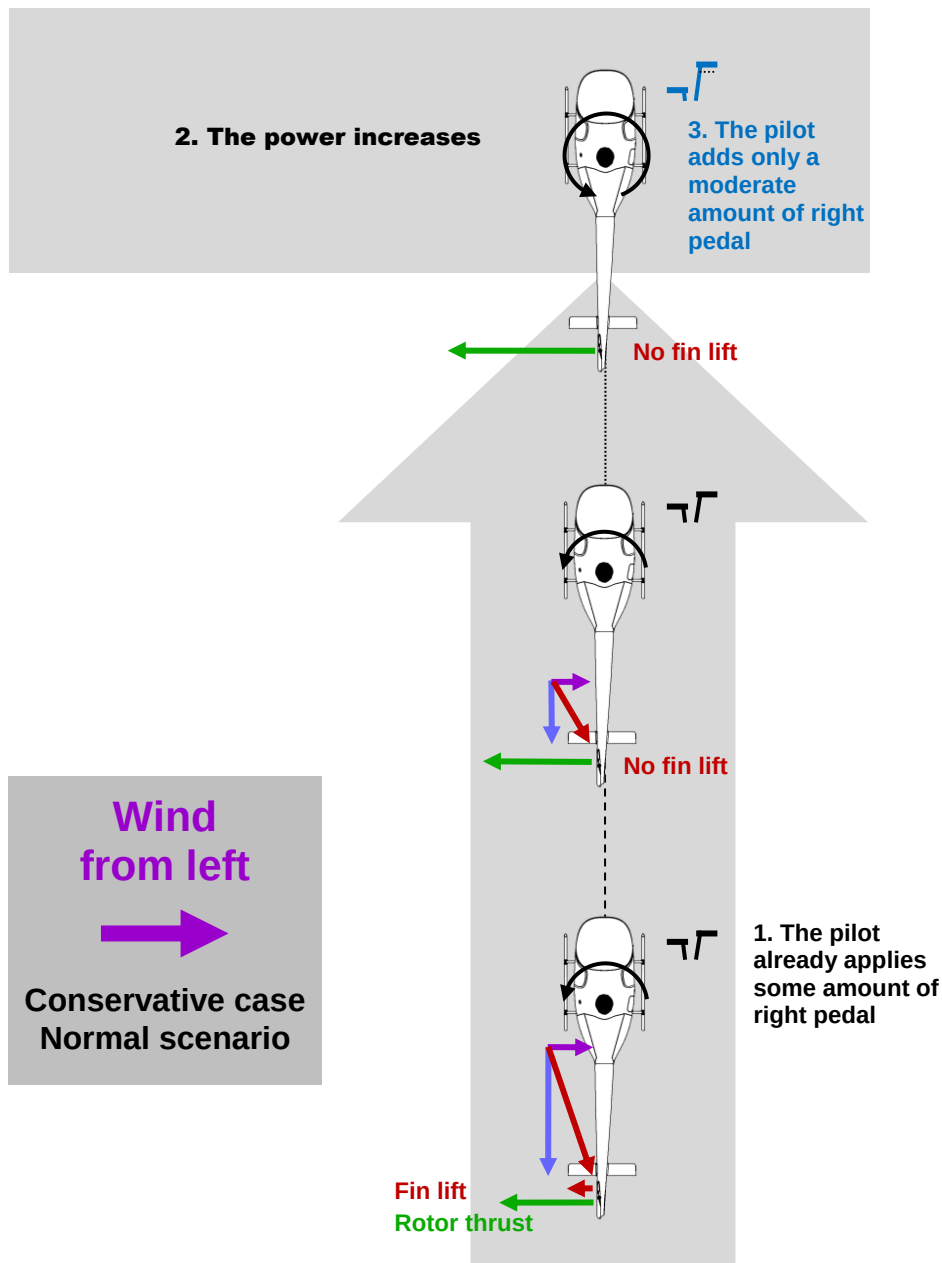
The combination of all these factors can provoke a mild to severe departure in yaw to the left if the pilot fails to apply enough right pedal to prevent it.

This departure **can always be controlled by full right pedal**.









**Note 1 :** Though it has been shown that an approach with right-hand wind requires more awareness, it gives a small benefit in terms of hovering performance. It may thus be preferred.

**Note 2 :** The more aggressive the approach, the higher the pilot workload. This is particularly true for :

- “quick-stops”,
  - Power recovery into hover following an idled engine approach.
- Prefer smooth transitions.

### **Spot-turn in ground effect**

During a spot-turn close to the ground, the pilot will almost always react to any unexpected issue, by raising the collective to increase the ground clearance. This will result in a yawing acceleration to the left.

When the spot-turn is to the left, the instinctive reaction will increase the yawing rate and could disorient the pilot.

When the spot-turn is to the right, this instinctive reaction will stop the yaw.

### **CCW-rotors and CW-rotors**

Note that described scenarios are exactly the same with CW-rotating rotors and CCW-rotating ones. Only the directions change, including the critical wind, which is from the left instead. However, **a pilot with most experience with CCW-rotating rotors** in our case is a significant aggravating factor, because the pilot is used to apply left pedal rather than right, regardless how good his training was, thus accelerating yaw motion rather than stopping it.

## **6. Conclusion**

**Advice 1** : The main lesson drawn from the above analysis is :

**Never wait to correct a sideslip** – and particularly to the left –

when approaching for a standard landing (30-60 kt approach).

Use adequate pedal input without any hesitation.

If there is a known cross wind, and particularly from the right hand, pay even more attention to keep the helicopter centerline aligned with the path and be prepared to large pedals input.

**Advice 2** : **Never hesitate to apply full right pedal**

to correct a yawing to the left before it gets faster.

Keep the pedal to its stop, until the rotation stops completely.

**Advice 3** : When practicing spot-turns at low height above the ground,

**always do it “on the power pedal”**

– to the right in the Cabri G2 case.

Then raising the collective in case of problem will stop the spin.

**Advice 4** : When aiming at a landing site close to helicopter IGE hover ceiling above the power transition (3800 ft ISA), pay specific attention to smooth piloting to prevent reaching 100% FLO and thus possible rotor speed decay.

Note that the recovery process consists in lowering slightly the collective, thus increasing sink rate before recovering the rotor speed.

Following these simple advices will prove the Fenestron the most predictable and responsive anti-torque device.