

Task VII.G: Forward Slip to Landing

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Lesson Overview

Objective

To teach the pilot proper procedures and technique for performing a forward slip to a landing in order to lose excess altitude quickly.

Reference

- Airplane Flying Handbook - Chapter 8
- Aircraft Flight Manual / Pilot's Operating Handbook
- Note aircraft placards relating to slip limitations

Elements

1. Maintain Ground Track
2. Steeper the bank angle, Steeper the descent
3. Smooth recovery

Schedule

1. Discuss Objectives
2. Review material
3. Development
4. Conclusion

Equipment

1. White board and markers
2. References

IP Actions

1. Discuss lesson objectives
2. Present Lecture
3. Ask and Answer Questions
4. Assign homework

SP Actions

1. Participate in discussion
2. Take notes
3. Ask and respond to questions

Completion Standards

The lesson is complete when the instructor determines that the student understands the forward slip maneuver and its uses and can execute the procedure by giving an oral or written exam and by having the student perform the maneuver properly in flight.

Instructor Notes

Attention

Today we get to learn how to make the plane drop out of the sky - in a controlled way.

Overview

Review Objectives and Elements/Key ideas

What

A slip occurs when the bank angle of an airplane is too steep for the rate of turn. The airplane is in essence flying sideways, increasing drag and therefore increasing the rate of descent without increasing the airspeed.

Why

Intentional slips are used to dissipate altitude without increasing airspeed, and/or adjust airplane ground track during a crosswind. Intentional slips are useful in forced landings and in situations where obstacles must be cleared during approaches to confined areas. A slip can also be used as an emergency means of rapidly reducing airspeed in situations where wing flaps are not available.

Lesson Details

A slip is a combination of forward movement and sideward movement. The airplane is, in fact, flying sideways resulting in a change in the direction of the relative wind striking the aircraft. This produces a pronounced increase in drag and allows the aircraft to descend rapidly without an increase in speed. A slip also can result in a decrease in airplane climb, cruise, and glide performance.

Most airplanes exhibit the characteristic of positive static directional stability and therefore have a

natural tendency to compensate for slipping. An intentional slip, therefore, requires deliberately cross-controlling the ailerons and rudder throughout the maneuver to maintain the sideslip.

An easy way to remember the difference between the two slips is

- **Side Slips** are used for slipping sideways through the air during a crosswind landing
- **Forward Slips** are used to lose altitude quickly and take you forward towards the runway (presumably, or whatever else you are trying to lose altitude to get down to).

Forward Slip

The forward slip is used to steepen the descent angle without excessively increasing the airspeed. This is a descent with one wing lowered and the airplane's longitudinal axis at an angle to the flight path. The flight path should remain the same as before the slip was initiated.

Entering

1. Checklists should be used as is normally done
2. The aircraft will need to be established on a higher final
 - a. This is because the slip will result in a steeper than normal descent so to demonstrate the slip more starting altitude is required.
3. Reduce power to idle
 - a. There is no logic in slipping to lose altitude with power applied! But keep a hand on the throttle in case there becomes an immediate need to go around.
4. Extend the flaps as necessary
5. The wing on the side toward which the slip is to be made should be lowered by use of the ailerons.
 - a. Slip into the wind if a crosswind exists.
6. Simultaneously, the airplane's nose must be yawed in the opposite direction by applying opposite rudder so that the airplane's longitudinal axis is at an angle to its original flight path.
 - a. If rudder deflection is delayed the airplane will turn in the direction of the lowered wing.
7. The nose of the airplane should be raised to prevent the airspeed from increasing.

Stabilized Approach

1. The amount of slip, and therefore the sink rate, is determined by the bank angle
2. The steeper the bank, the steeper the descent. In most light planes the steepness of a slip is limited by the amount of rudder travel available.
3. The degree to which the nose is yawed in the opposite direction should be just enough that the airplane maintains a precise ground track over the extended centerline of the runway

Discontinuing the Slip

1. The longitudinal axis of the airplane must be realigned with the runway just prior to

touchdown.

- a. Ultimately the airplane needs to be aligned with the direction it is moving. Failure to do so can result in significant side loads on the landing gear, and the potential to have a ground loop.
2. Level the wings and simultaneously release the rudder pressure while readjusting the pitch attitude to the normal glide attitude
 - a. Recovery should be smooth, and if the rudder is release abruptly the nose will swing too quickly into line and the airplane will tend to acquire excess speed. Momentum can also carry the nose past straight ahead.

Sideslip

From an aerodynamic perspective the sideslip is identical to the forward slip. The difference in these maneuvers is their purpose. A forward slip is used to steepen the descent angle without excessively increasing the airspeed. A sideslip is used to correct for and land in a crosswind. One wing is lowered (to compensate for the wind) and the rudder is used to align the airplane's longitudinal axis with the runway. On touchdown the upwind main wheel will touch down first, then the downwind wheel, then the nosewheel.

Entering

1. Checklists should be used as is normally done
2. The aircraft will need to be established on a higher final, or anticipate a higher power setting to compensate for the increased drag.
 - a. This is because the slip will result in a steeper than normal descent so to demonstrate the slip more starting altitude is required.
3. Maintain power setting
 - a. Keep a hand on the throttle in case there becomes an immediate need to go around.
4. Extend the flaps as necessary
5. The wing on the side toward which the slip is to be made should be lowered by use of the ailerons.
 - a. Slip into the crosswind applying enough aileron to keep the aircraft on the runway extended centerline, and enough rudder to keep the aircraft longitudinally parallel with the runway.
6. The nose of the airplane should be raised to prevent the airspeed from increasing.

Stabilized Approach

1. The rate of descent is controlled by power adjustments
 - a. This is the same as a crosswind approach and landing - pitch for airspeed and power for altitude.
2. Establish a pitch attitude and maintain a normal approach speed.
3. Fly a precise ground track using the ailerons to keep the airplane over the runway centerline,

while rudder is used to align the longitudinal axis with the flight path.

Discontinuing (landing in) a Sideslip

1. When landing in a sideslip, to not level the wings
2. Keep the upwind wing down through the roundout and touchdown, touching down on the upwind wheel first.
 - a. Removing the sideslip will result in the aircraft drifting due to the crosswind. This can result in a severe side load on the gear or the aircraft being pushed off the runway entirely.

Practical Slip Limit

In both the sideslip and the forward slip the point may be reached when full rudder input is required to maintain heading even though ailerons are capable of a steeper bank. This is the practical slip limit, and any additional bank will cause the airplane to turn even though full opposite rudder is being applied.

If there is a need to descend faster even though the practical slip limit has been reached, the nose can be lowered. This will, however, increase the airspeed. The increase in airspeed increases the rudder effectiveness permitting a steeper slip. Conversely, when the nose is raised rudder effectiveness decreases and the bank angle must be reduced.

At some wind speeds and angles there may not be sufficient rudder authority to align the longitudinal axis with the runway. That is why there are crosswind limits in the aircraft POH. Do not exceed these limits as they have been identified for a reason.

Airspeed Indicator Errors

Due to the location of the pitot tube and static ports, airspeed indicators in some aircraft may have considerable error when the airplane is in a slip. The pilot must be aware of this possibility and recognize a properly flown slip by the attitude of the airplane, the sounds of the airflow, and the feel of the flight controls.

Stalls

If an airplane in a slip is caused to stall, it displays very little of the yawing tendency that causes a skidding stall to develop into a spin. The airplane in a slip may do little more than tend to roll into a wings level attitude. Stall characteristics may even be improved.

However, a cross-controlled stall can be entered in a slip. This can be extremely dangerous close to the ground, and the aircraft may have a tendency to roll over. Maintain approach airspeed and go around if the approach is not stable.

Common Errors

- Recovering by abruptly releasing rudder pressure, causing the nose to swing to quickly and

causing excessive airspeed

- Failing to control pitch resulting in excessive or insufficient airspeed
- Side slipping, resulting in drifting away from the ground track to the centerline of the runway

Conclusion

Slips are an important tool that every pilot should have in their toolbox. The ability to drop altitude without having to extend flaps can leave a lot of flexibility in the event of an emergency.