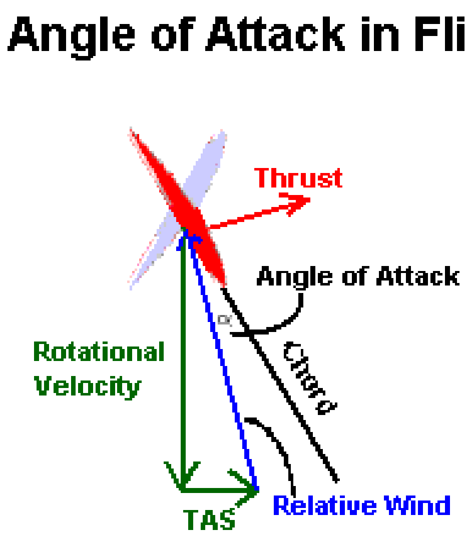
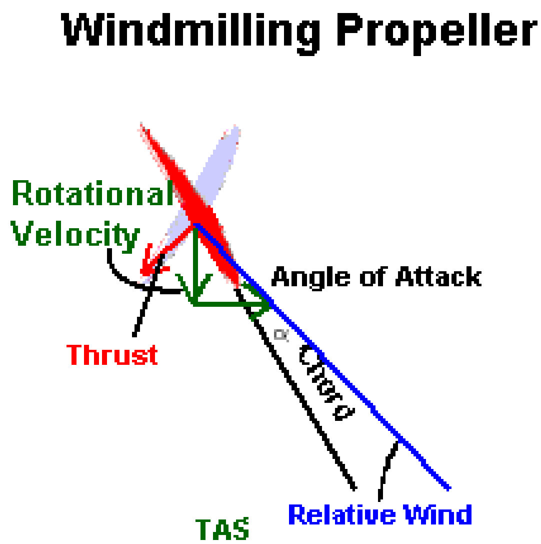




Forward thrust Rearward thrust

Turning tendencies of conventional twins

Asymmetrical thrust- Thrust on one side and drag on the other side causes a yawing toward the dead engine. Two ways too counter- 1. Feather inoperative prop 2.reduction of operative engine thrust

Loss of Induced airflow- Airflow over the wing dirctly behind an engine propeller exceeds 300 kts in most cases. This area is more than 30 percent of the total. Loss of this airflow reduces lift on that wing causing it to drop and roll toward inoperative engine. Raise the dead/ split the ball of the coordinator on the operative side

P-Factor- Left yawing force of right engine is greater than the right yawing force of th left engine because the thrust moment arm/ leverage is aprox 50% greater. The Left engine out causes more asymmetrical thrust. Forward cg and gross weight make this issue more pronounced. (increased AOA increases p- factor)

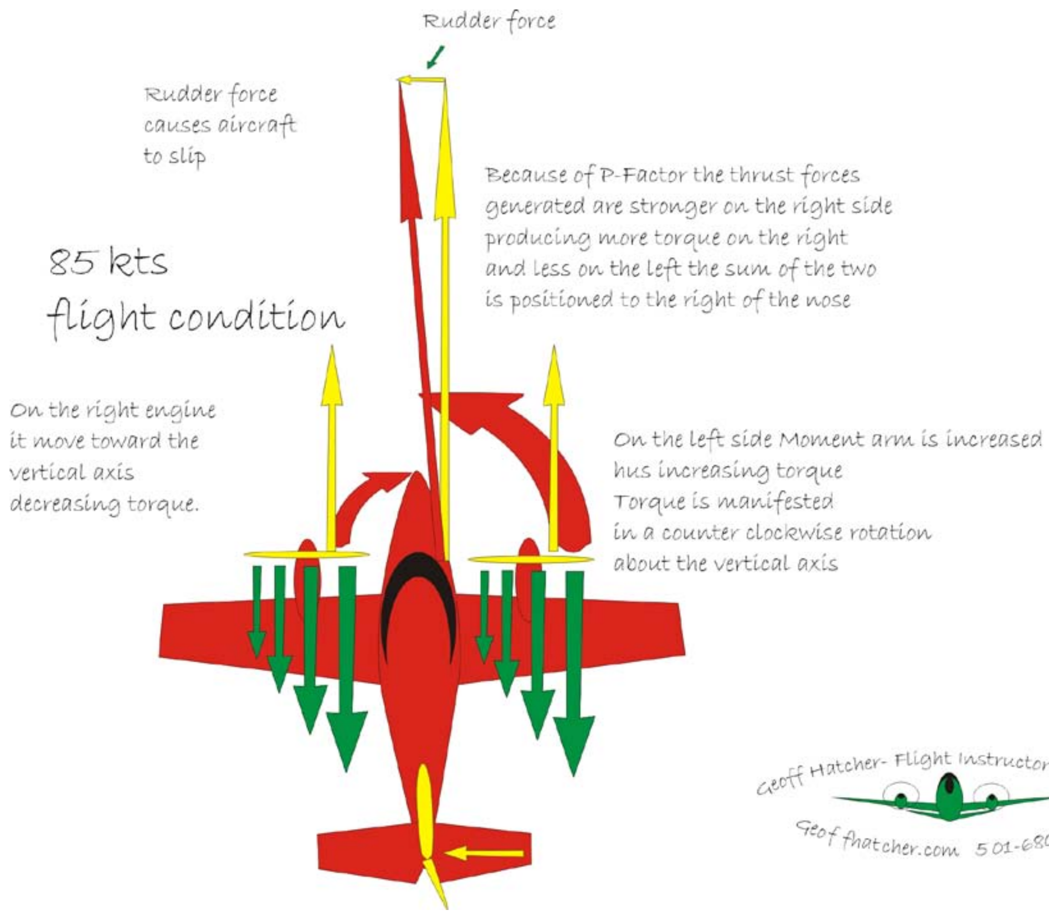
Torque- engines turn to the right causing the airplane to roll to the left-makes left engine more critical when coupled with the "loss of induced flow" rolling tendencies.

Spiraling slipstream-airflow pushes the vertical stabilizer on the left side yawing the aircraft further to the left.

Accelerated slipstream- the right side of the prop wash has greater induced flow velocity on both engines. This is due to the same propeller angle of attack phenomenon that causes p-factor. On the left engine side this induced flow is directed over the tail control surfaces more than on the right side. The left engine operating provides more rudder and elevator effectiveness.

Angle of attack increases P-factor

Drag slows the aircraft requires AOA and requires more power.



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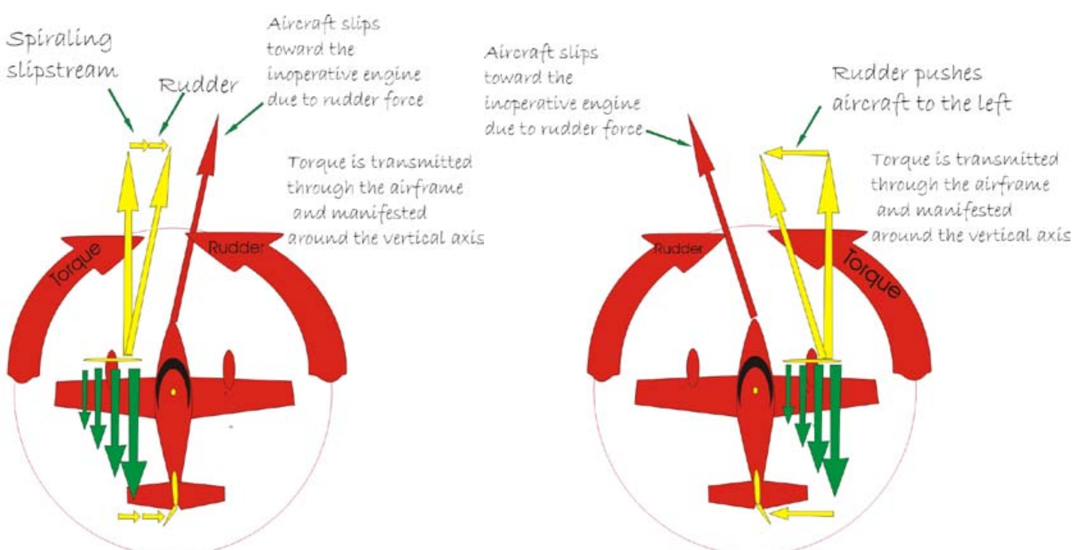
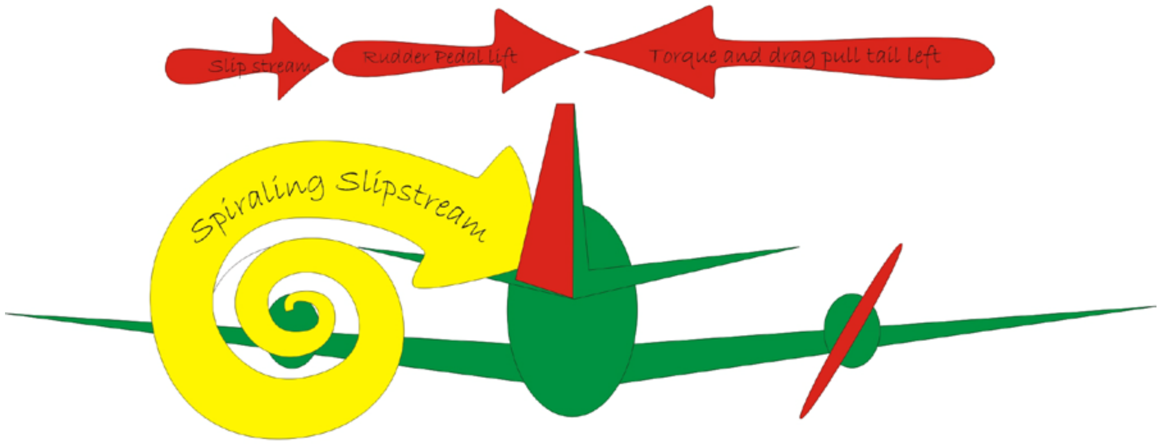


P-factor of the left engine shifts the thrust vector inboard toward the vertical axis in a conventional twin.
This decreases the moment arm thus decreasing torque.

P-factor of the right engine shifts the thrust vector outboard, away from the vertical axis in a conventional twin.
This increases the moment arm thus increasing torque.

Left engine (Critical) operating 85kts

Rotational forces about the vertical axis <u>referenced from the Tail</u>



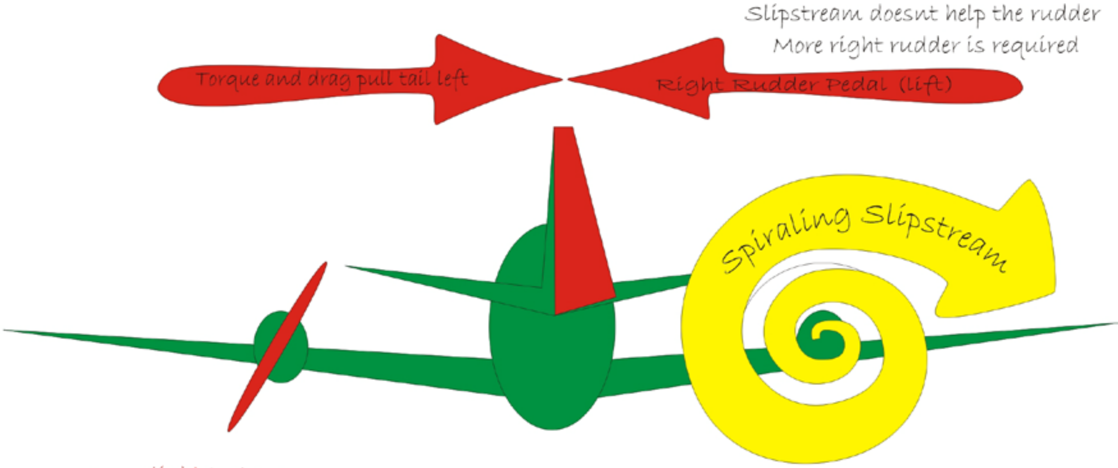
Spiraling slip stream

Pushes tail down and to right
and the nose up and to the left

Right engine operating 85kts

Rotational forces about the vertical axis <u>referenced from the Tail</u>

Slipstream doesnt help the rudder
More right rudder is required



Spiraling slip stream

Pushes tail up
and the nose down

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Know these factors they will be discussed on the oral. You will need to understand their connection to the various turning tendencies above.

Vmc Factors conventional twin

	AOA	Asymmetrical thrust	P factor thrust arm	Keel effect	Rudder arm
Max Weight	greater		to the right		
Out of Ground effect	greater		to the right		
Flaps Take off-up	greater		to the right		
Aft CG	decrease		To left		Less effective
Max hp	less	greater			
Landing gear retracted	less			yes	
Prop wind milling	greater	greater			
Sea level	less	greater	To the left		
Side slip	less		To the left		More effective
Left engine out		greater	Increase to the right		Less effective due to
Right engine out		less	To the left		
Cowl flaps	greater				

You loose 80% of the climb performance single engine out.

180hp left
+180hp right
360 hp total both engines
-140 hp required for straight and level flight
220hp extra for climb or speed
-180hp engine failure
40hp left for climb or speed (20% of what you had)
-50 hp (reality of an old rented engine that doesn't meet original factory specs) (your coming down about fifty feet per min.)

The pilot notices that the aircraft is yawing to the left. He/she will respond by applying right rudder.

The amount of rudder applied must be just enough to produce a yawing moment from the tail which is equal but opposite to the one produced by the right engine.

Rudder = torque

Once the correct amount of rudder has been applied the aircraft will stop yawing.

Sometimes pilots use the saying "step on the ball" in this situation, because the centripetal acceleration as the aircraft yaws will "throw" the ball out toward the good engine. Therefore, rudder will be required on the side of the ball in the inclinometer.

After the ball is centered another saying, "Dead foot Dead Engine" can be used to identify which engine is not working. IE. the foot not doing any work will be on the side of the dead engine.

Once the ball is centered, with the wings level and the aircraft once again flying straight, there must be a net side force generated by the rudder. This force will "push" the aircraft into a slip. The slip angle will increase until the lateral component of the drag vector offsets the side force from the tail. At this point the aircraft will be flying straight, the ball will be in the center but, the **aircraft will be slipping.**

Slipping is a very inefficient way to fly since the parasite drag will be greatly increased. The increased drag will be greatly reducing the performance, as we said on the previous page.