

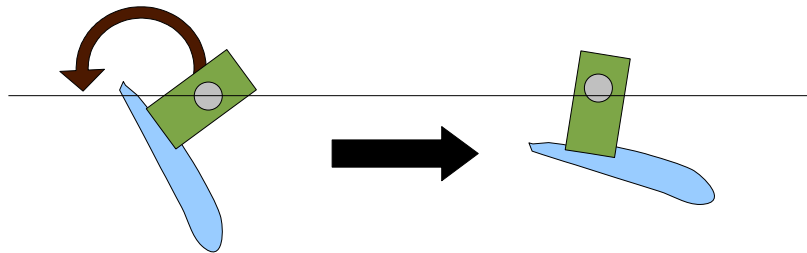
Multi Engine Ground Lesson Plan

General Aerodynamics

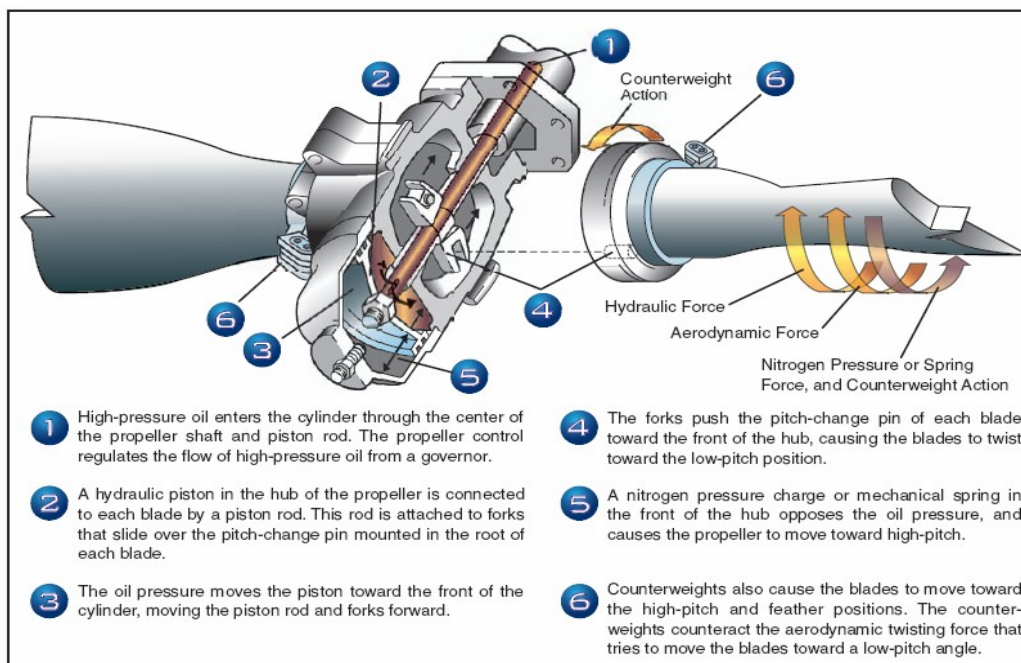
- Four forces acting on an airplane
 1. Thrust
 2. Lift
 3. Drag
 4. Weight
- Induced Airflow
 - Wing mounted engines move air over the wings and tail and creating an increase in airflow.
 - Quick reductions in power can reduce total lift. This can cause high sink rates
 - Adding power will increase airflow over the wings and can quickly stop a stall or high sink.
- Left turning tendencies
 - P-Factor
 - This is amplified since the uneven loading of the propeller can be further away from the longitudinal axis of the plane.
 - Torque
 - This is also amplified due to more engines and typically bigger engines
 - Gyroscopic Precession
 - Twisting Slip Stream
- Service Ceiling
 - 100 FPM with two engines
 - 50 FPM with one engine
- Absolute Ceiling
 - Highest altitude the aircraft can maintain
- Spin Recovery
 - Engines Idle
 - Lower the nose
 - Use opposite rudder
 - In some airplanes, it is recommended to increase power on the inside engine to stop the turns.

Systems

- Propeller
 - Unlike a single where engine oil pressure is used to move the prop to coarse pith, in multi engine aircrafts, engine oil pressure keeps the propeller from moving towards coarse pith. This will help in feathering of an inoperative engine.
 - Counter weights at the root of the prop are used to increase the tendency of a moving prop towards feathered position.



- Air works to move a turning prop towards fine pitch.
 - Sometimes a pneumatic system is also used to assist in moving the prop into feathered position.
- Engines
 - Electrical
 - Gear
 - Flaps
 - Static Ports
 - Heater
 - Oil



Engine Out Operations

- Loss of an engine reduces total available power by 50% but the performance is typically reduced by as much as 80%.
- FAA requires airplanes with MGW of 6000lb or V_{so} of 61Knts to have a positive single engine climb out at 5000MSL. Airplanes with lower MGW and lower stall speeds DO NOT need to have a positive single engine climb rate.
- Critical Engine
 - Why?
 - Left engine in aircrafts without counter rotating props
- VMC
 - What is it?
 - FAR Part 23 requires VMC to be determined by the manufacturer under the following conditions:
 1. Wing and cowl flaps in take off position
 2. Trimmed for takeoff
 3. Out of ground effect
 4. Propeller windmilling or feathered IF equipped with auto-feathering
 5. Gear Up
 6. Max Gross Weight
 7. CG in the most unfavorable position
 8. No more than 5deg bank towards the good engine.
 - Factors effecting VMC
 - VMC Increases as weight decreases
 - VMC Increases with a windmilling propeller
 - VMC Decreases when the gear is lowered
 - VMC Increases when flaps are lowered
 - VMC Increases when the CG is moved aft
 - VMC Decreases when altitude increases
 - The aircraft may stall before loosing directional control. This is very dangerous because if airplane stalls with asymmetrical thrust, the aircraft will most likely enter a spin!!
 - VMC Increases if the aircraft is not banked towards the good engine

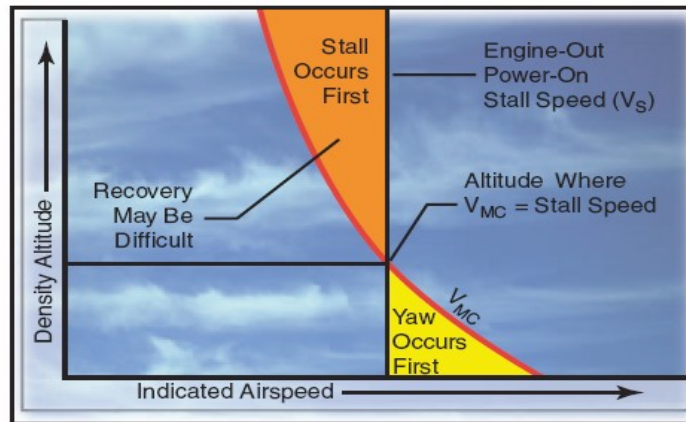


Figure 12-21. Graph depicting relationship of V_{MC} to V_S .

- Engine out procedure
 - Max Power
 - Max Prop
 - Gear and flaps up
 - Identify dead engine: dead-foot-dead-engine
 - Verify dead engine
 - Feather dead engine
 - Raise the dead 3-5 degrees. Ball should be 1 to $\frac{1}{2}$ width towards the good engine
 - Hold blue line
 - Secure the engine
- Accelerated Stop Distance