

24.1 The Exhaust System

- The exhaust system directs the hot gases from the turbine rearward to form the high-velocity jet that produces thrust.
- ☐ Components:
 - Exhaust Cone: A cone behind the turbine that smooths the gas flow and prevents turbulence.
 - Jet Pipe: The main duct carrying the gases to the nozzle.
 - Propelling Nozzle: A convergent nozzle at the end of the jet pipe that accelerates the exhaust gases to their final exit velocity.
- ☐ Choked Nozzle: In a pure turbo-jet, the exhaust gas velocity reaches the local speed of sound (Mach 1.0) at the nozzle exit at most power settings above idle. At this point, the nozzle is said to be choked, and the only way to further increase the exit velocity (and thus thrust) is to increase the temperature of the gas (e.g., by using afterburner/reheat).

24.2 Thrust Reversal

- Thrust reversers are used after landing to redirect the engine's thrust forward, providing a powerful braking force that reduces landing distance and saves wear on the wheel brakes.
- ☐ Types:
 - Clamshell or Bucket Doors: Used on pure jet or low by-pass engines, these doors swing into place to block the hot gas stream and deflect it forward through cascade vanes.
 - Cold Stream (Blocker) Reverser: Used on high by-pass turbofan engines. Blocker doors are deployed inside the fan duct to block the cold by-pass air and redirect it forward through cascade vanes on the side of the nacelle. The hot core exhaust is not affected.
- ☐ Safety: Thrust reversers have numerous safety interlocks. They can typically only be deployed when the throttles are at idle and when the aircraft's weight-on-wheels switches indicate it is on the ground.

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