

22.1 Purpose and Airflow

- The combustion chamber receives high-pressure air from the compressor, mixes it with fuel, and burns the mixture to add a massive amount of heat energy to the air, causing it to expand and accelerate rearwards towards the turbine.
- ☐ Airflow Distribution: Only about 20% of the air entering the combustion chamber is actually used for combustion. The rest is used for cooling and control.
- Primary Air (20%): Enters the front of the flame tube and is mixed with fuel for burning.
- Swirl vanes create a vortex to stabilize the flame.
- Secondary Air (20%): Enters through holes in the flame tube to form a region of low-velocity, recirculating air that anchors the flame and ensures complete combustion.
- Tertiary Air (60%): The largest portion of the air flows between the outer casing and the flame tube, providing a cooling film of air for the metal walls. It is then gradually mixed with the hot gases to cool them down from a peak of $\sim 2000^{\circ}\text{C}$ to a safe temperature for the turbine ($1000\text{-}1500^{\circ}\text{C}$).

22.2 Types of Combustion Chambers

- ☐ Multiple Can: A system of individual flame tubes, each in its own air casing, arranged around the engine. Flame propagates between the cans via interconnectors.
- ☐ Turbo-Annular (Can-Annular): A hybrid system with multiple individual flame tubes arranged within a single, common air casing.
- ☐ Annular: A single, continuous ring-shaped flame tube contained within a common air casing. This is the most modern and efficient design, offering the best combustion efficiency, temperature distribution, and a shorter engine length.

22.3 Combustion Stability and Relight

- ☐ Combustion Stability: The ability of the flame to remain alight over a wide range of engine

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- perating conditions. If the air/fuel ratio becomes too lean (e.g., during a rapid throttle
- reduction) or too rich, a flameout can occur.
- ☐ Relight Envelope: An engine can only be relit in flight within a specific range of altitudes
- and airspeeds, known as the relight envelope. Outside this envelope, the airflow may be too
- fast or the air density too low to support ignition.

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