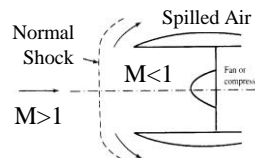
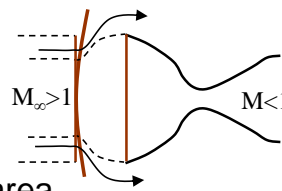


## Supersonic (Engine) Inlets

- For air-breathing engines on supersonic vehicles, usually want to slow flow down to subsonic speeds inside engine
  - need diffuser ( $M > 1 \rightarrow M < 1$ ) for engine inlet
  - exception: supersonic combustion (SCRAM jets)
- Goal
  - lowest  $p_o$  loss (highest thrust)
    - for flight  $M$  range
    - meet mass flow rate requirement (thrust)
  - stable operation (no drastic inlet property changes for small changes in flight conditions)

## Supersonic Inlet Types

- **Conv.-div. diffuser**
  - lowest potential  $p_o$  loss
  - but starting problem (overspeeding) and single design  $M_{flight}$  (or var. area throat)
  - *not used*
- **Normal shock diffuser**
  - uses external compression
  - highest  $p_o$  loss (strong shock)
  - not typically used



from Mattingly, *Elements of Gas Turbine Propulsion*

## Supersonic Inlet Types

- **Oblique shock diffuser**

- also uses external compression
- lower  $p_o$  loss
- works for range of  $M_{flight}$
- common

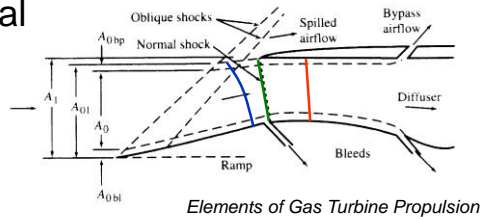


FIGURE 10-26

**Subcritical: spillage, buzz**

**Critical: optimum, not stable**

**Supercritical: higher  $p_o$  loss, stable**

## Two-D Mixed Compression Inlets

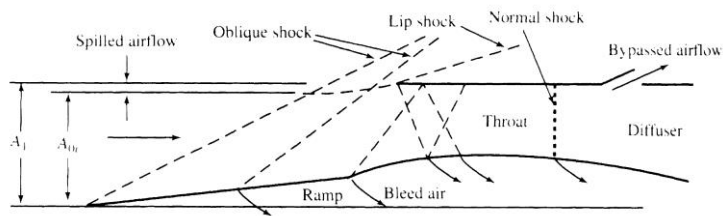


FIGURE 10-30

Mattingly, *Elements of Gas Turbine Propulsion*

- Needs fast reacting bypass doors
- Axisymmetric version (central spike) has weight advantage, but 2-d simpler and gives more variation in air flow

# Pressure Recovery Performance

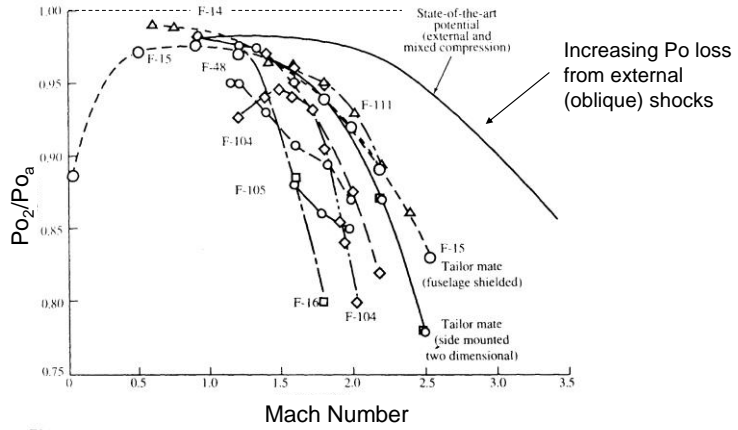


FIGURE 10-31

Mattingly, *Elements of Gas Turbine Propulsion*