

Thrust Vectoring

- Redirect propulsive power for directional and maneuver flight control. This usually can be achieved using mechanical vanes at the jet exhausted nozzle. Disadvantage: constantly exposure to hot exhausted gases shortens the life of thruster.

- Example:

[NASA Research Aircraft](#)

Pratt & Whitney
F-22 Raptor engine



- An innovative concept was developed by FAMU-FSU College of Engineering & University of Minnesota. It is called counterflow thrust vectoring flow control. Suction is applied to one side of the jet, the presence of reversing flow inside the nozzle enhances the flow mixing on one side, reducing its pressure and steers the jet for thrust vectoring. Advantage: cold air induced can provide a buffer layer to protect the mechanical surfaces.
- Example: [Fluid Mechanics Research Laboratory](#)

Counterflow Thrust Vectoring

Proposed CF-TVC Nozzle-Ejector Design

