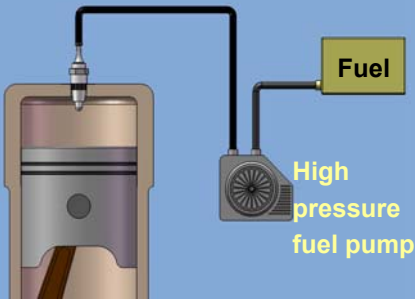


# USM ENGINES LAB

## DIRECT FUEL INJECTION (DI)

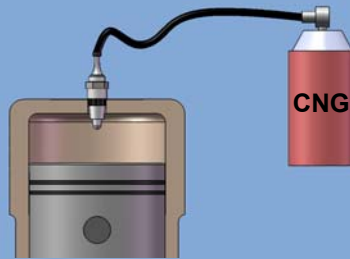
- Intake consists of air only (no pre-mixed fuel)
- Fuel is admitted directly into combustion chamber
- All diesel engines use some form of Direct Injection
- Direct Injection may be used on 2- or 4-stroke engines
- DI solves the major problems of 2-strokes engines

### VARIOUS DI TECHNIQUES



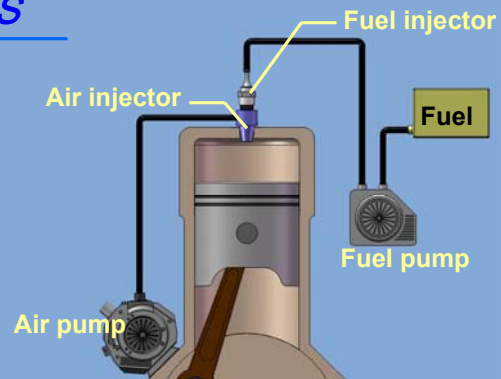
#### HIGH PRESSURE DI

Similar to diesel. Requires a High Pressure pump linked to the crankshaft.



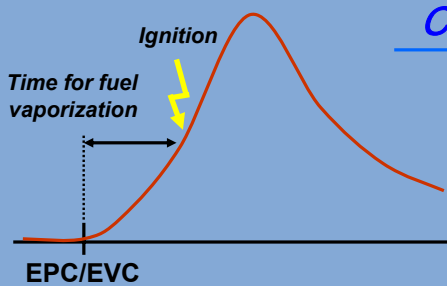
#### GASEOUS DI

Gaseous fuel is pressurized so no pump is needed, requires only 1 injector.



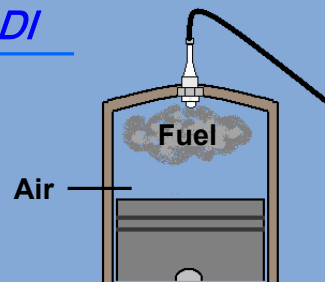
#### AIR-ASSISTED DI

Requires lower pressure fuel but additional air compressor and a 2<sup>nd</sup> injector.



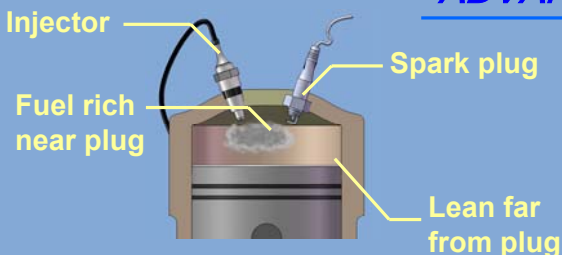
Liquid fuels have a very short time to vaporize so they must have small droplets (~10  $\mu\text{m}$  diameter)

### CHALLENGES OF DI

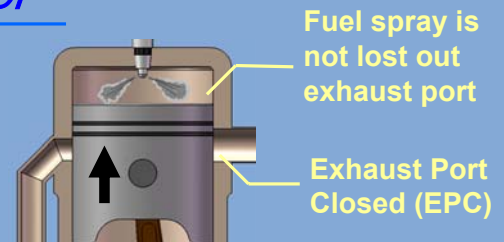


For good flame propagation the fuel must mix with the air. This requires vigorous mixing & turbulence inside the combustion chamber

### ADVANTAGES OF DI



For partial load conditions the engine may be run very lean by using a "Stratified charge". This makes a fuel rich mixture near the plug (easier to ignite) but lean further away. Running lean improves the efficiency.



In a 2-stroke engine fuel can be injected after EPC, eliminating fuel loss during scavenging. This improves efficiency and emissions.