# Engine Options

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EAA Chapter 81

# Background

- Builders have engine choices, and engine configuration choices
- Builders also can modify engines
- How to Choose?
  - Specific Performance or Desired Charactistic, find options?
    - Weight, size, power
  - Have a Budget, look for “best affordable”?
    - New, Used as-is, Salvaged/Rebuilt ?

# Kit Manufactuer Options

- RV6A Examples (per VANS website)
- These options suggest climb power is the only real differentiator

| **Gross Weight 1650 lbs** | **150 hp** | **160 hp** | **180 hp** |
|---|---|---|---|
| *Top Speed* | *195 mph* | *199 mph* | *207 mph* |
| *Cruise [75% @ 8000 ft]* | *184 mph* | *188 mph* | *196 mph* |
| *Cruise [55% @ 8000 ft]* | *166 mph* | *169 mph* | *176 mph* |
| *Stall Speed* | *55 mph* | *55 mph* | *55 mph* |
| *Takeoff Distance* | *560 ft* | *535 ft* | *485 ft* |
| *Landing Distance* | *500 ft* | *500 ft* | *500 ft* |
| *Rate of Climb* | *1,305 fpm* | *1,450 fpm* | *1,740 fpm* |

# Options for Sonex Aircraft

- Lots to choose from, large variation in price too!
  - AeroVee 2.1 80hp: $11,300
  - AeroVee Turbo 100hp: $15,000
  - Jabiru 2200
  - Jabiru 3300
  - UL260i 97hp: $33,640*
  - UL260iS 107hp: $34,280*
  - UL350i 118hp: $36,039*
  - UL350iS 130hp: $37,234*
  - Rotax 912
  - Rotax 914

# Engine Configuration Options

- Propeller
  - Fixed Pitch
  - Constant Speed
- Fuel System
  - Injected
  - Carbureted
  - Normally Aspirated
  - Boosted (usually Turbocharging)
- Ignition Systems
  - Magneto
  - Electronic Switched
  - Capacitive Discharge

# Fuel Injection Considerations

- While there is no “direct quoted” improvement from injection over carburation, it is a “facilitator”
  - Better mixture control at high density altitudes enables leaner operation and higher % of available power
  - Electronic fuel injection can provide “tuning” of fuel delivery to each cylinder from the cockpit
  - Elimination of carburetor ice risk
  - Potential induction system geometry improvement for another inch of MP (4% more hp)

# Mechanical Fuel Injection

- Bendix System from Twin Comanche IO-320
  - RSA-5AD1 Servo
  - Fuel Inector Nozzles
  - Fuel Flow Divider
  - Fuel Distribution Lines
  - 30 psi Fuel Pump
  - $750 on Ebay
  - Must add 30 psi Fuel Boost Pump, fuel filters, and high pressure gascolator

# Electronic Fuel Injection and Ignition

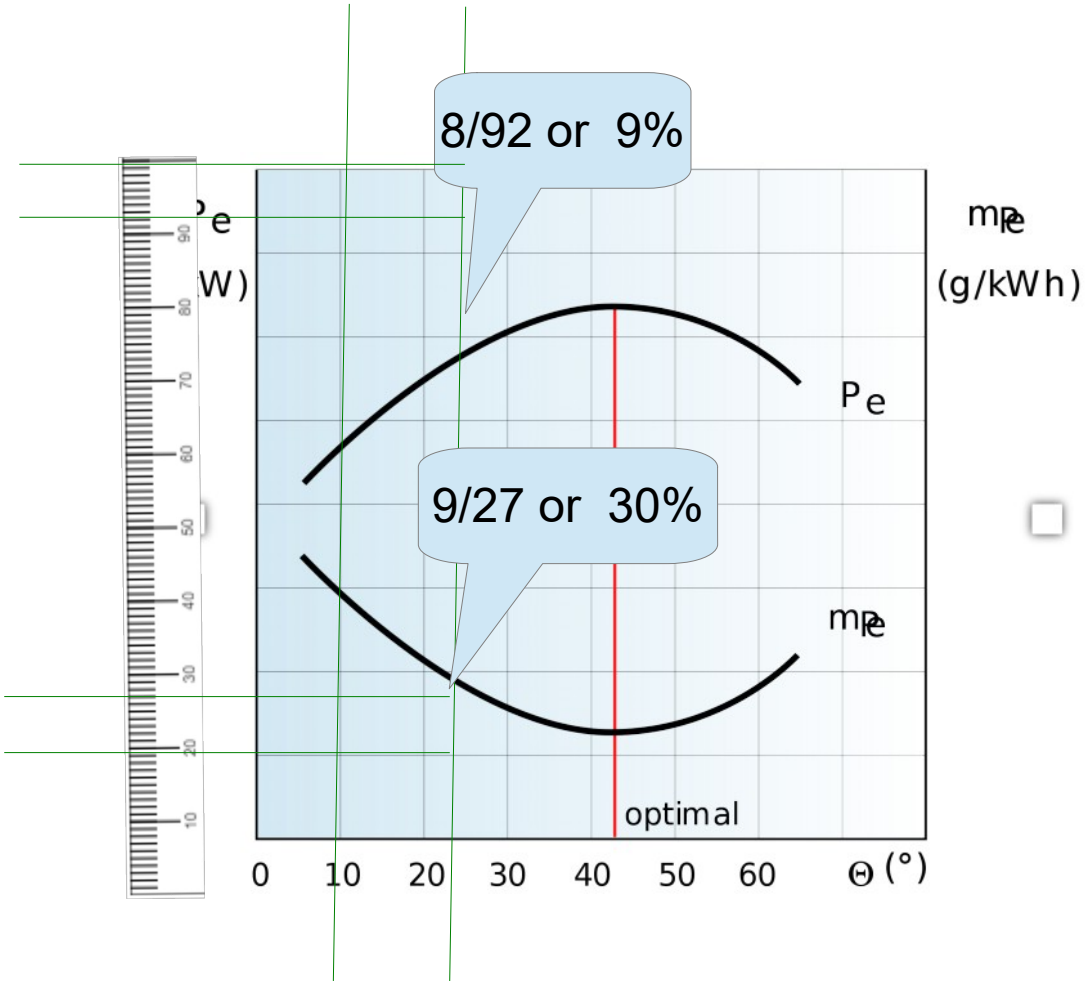
- FLY EFII system- fully redundant turnkey
  - $6,500, but Requires a redundant electrical system
  - Requires a fuel return to the tank

# Ignition System Considerations

- Magnetos are “reliable” but....
  - Can contribute to hard starting
  - Do not efficiently ignite a real lean mixture
  - Do not provide optimum ignition advance
    - Conservatively set to avoid detonation under all altitude, RPM, and throttle settings
  - Require periodic maintenance and overhaul
- Electronic Ignition addresses these issues
  - Provides higher energy at low cranking speeds
  - Provides higher energy with a larger spark gap for improved lean operation
  - Can include a “map” (adjustable in-flight) to increase timing advance under appropriate conditions of RPM and MP for 10% hp at altitude

# Effects of Ignition Advance

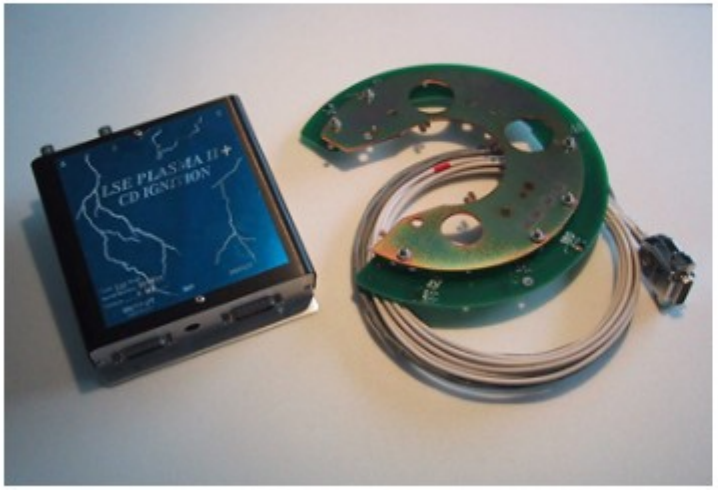
- Optimal Advance
  - more power
  - Lower specific fuel consumption



# Standalone Electronic Ignition

- Light Speed Engineering
  - Systems for single or dual operation, $1,200 to $3,500

**PLASMA II PLUS**
**CAPACITIVE DISCHARGE IGNITION SYSTEM**



Plasma II+ CDI with Direct Crank Sensor

Plasma II+ CDI with Hall Effect Module

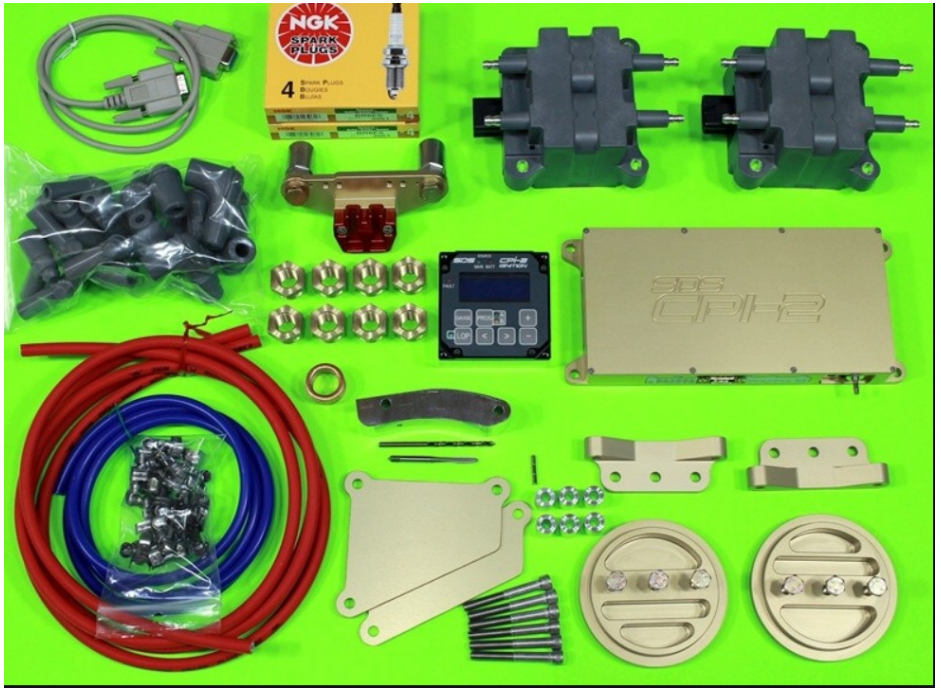
# Standalone Electronic Ignition

- E-Mag replaces one or both magnetos
  - Includes internal alternator, no power required when running. (Power needed for starting)
  - Manifold Pressure monitored, ignition advance adjustable, mapped

# Standalone Electronic Ignition

- “Surefly” replaces one (STC) or both magnetos (Experimental with alternate power available
- FAA Certified, can be used on most Lycoming or Continental engines in most certified aircraft as a single mag replacement
- STC prohibits auto fuel and turbo or supercharging, and requires CHT monitoring of all cylinders
- Variable max advance, manifold pressure monitored
- Utilizes existing Slick wiring harness

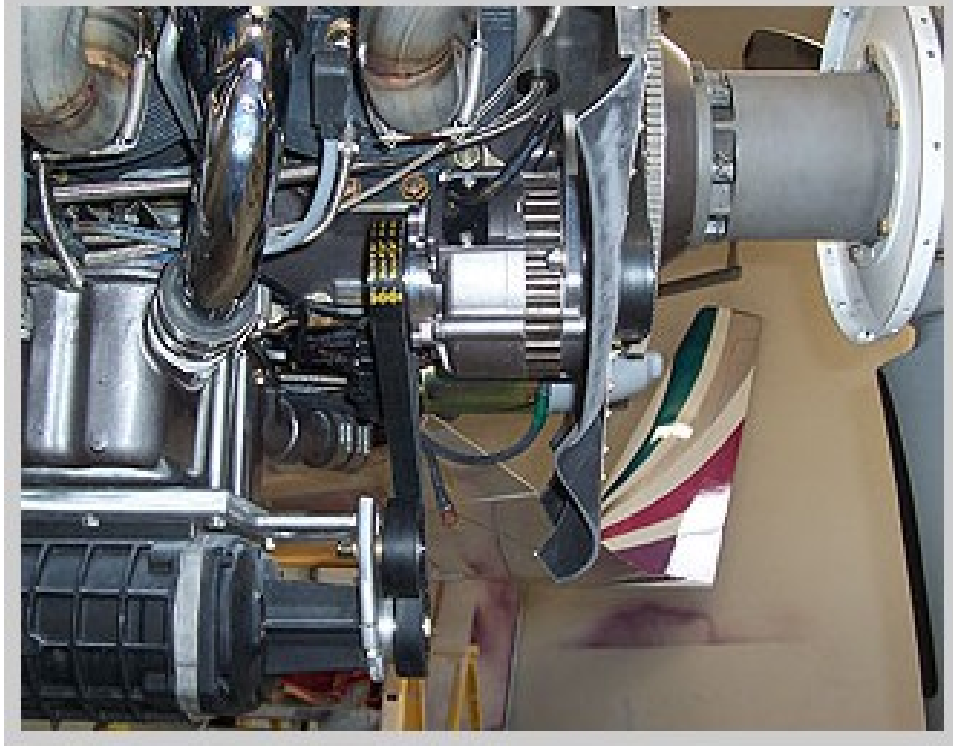
# SDS Ignition System




- One or Two channel
- Lots of history
  - (derived from car racing)
- Adjustable in-flight
- Automotive (NGK) plugs

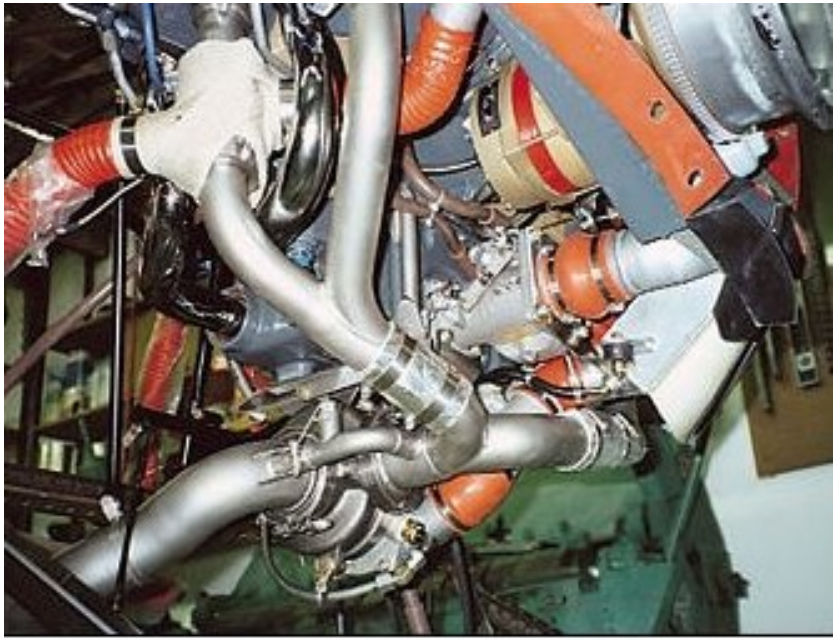
# Supercharging

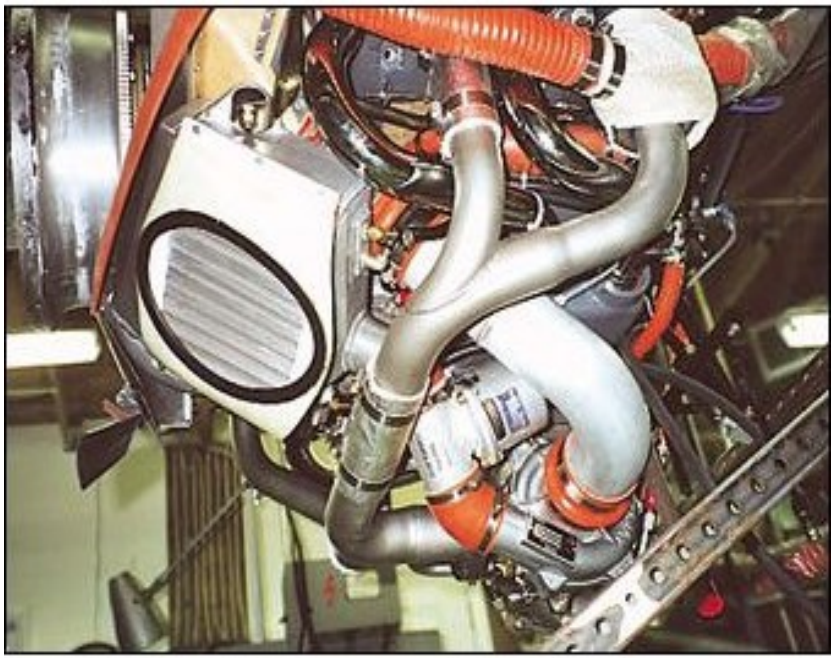
- Various options, starting at about $8,000
- Not very “turnkey”



# Turbocharging

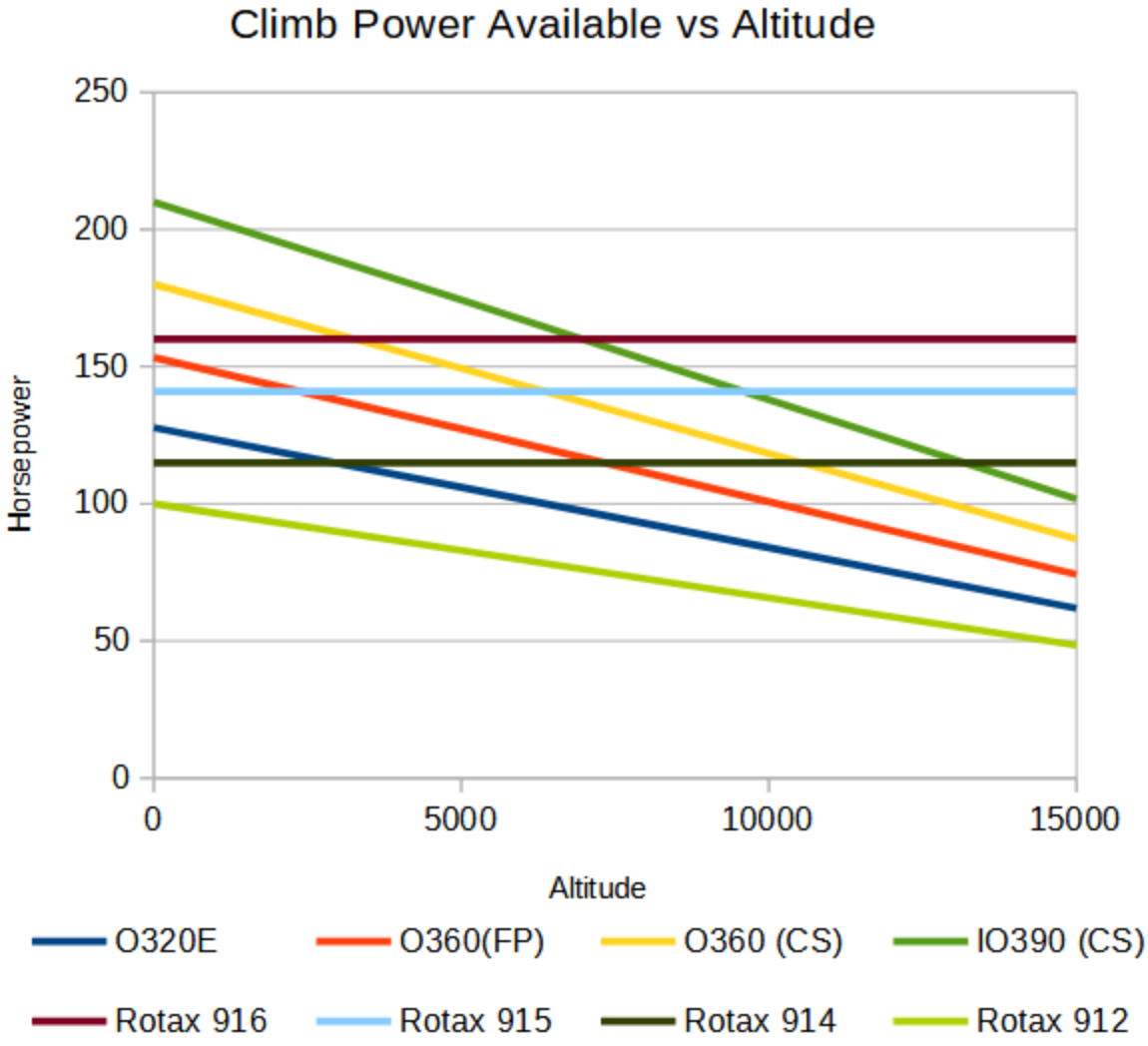
- Available kits for “turbo normalizing”
- Complex air and exhaust plumbing
- Critical thermal management under the cowl





# Pick a Motor By Performance

- Climb Performance
  - Note altitude performance of 914, 915, 916
  - Note Propeller difference between O360(FP) and O360(CS)
  - Note: The curves for O360(FP) and O360(CS) would be about the same for top speed



# Propeller Choices

- Variable
  - Ground Adjustable
  - Air Adjustable
    - Constant Speed (electric or hydraulic)
    - Manually Adjusted (electric or hydraulic)
- Fixed Pitch
  - Material
    - Wood – light weight, multiple laminations (.1 to .75 inch), some flex to adjust pitch under load
    - Aluminum – most common material, must be monitored for damage, some installations have vibration issues restricting operating RPM ranges
    - Composite – light weight, various materials (fiberglass, kevlar, carbon fiber)
- Number of Blades
  - 1 – optimal but no practical examples!
  - 2 – generally cheaper than 3!
  - 3 or more – generally better ground clearance, smoother operation, but lower top speed (more aero drag)