

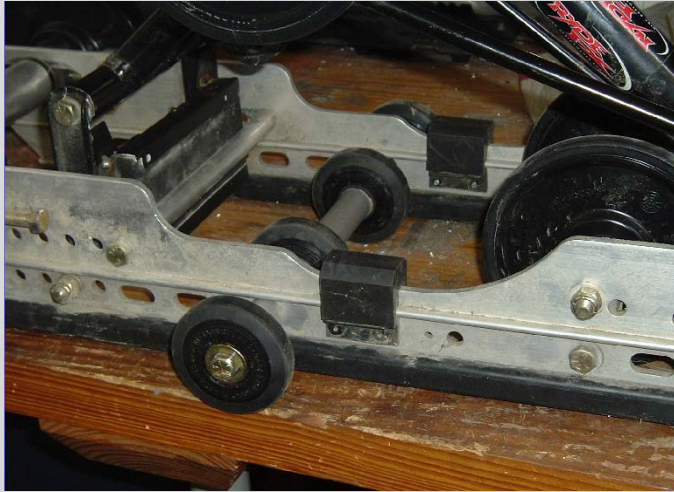


# **UNIVERSITY OF MAINE**

**2007 Clean Snowmobile**

**Modified 2003 Arctic Cat four-stroke**

# NOISE, VIBRATION, AND HARSHNESS



## Stock track suspension with Modifications

- High grade rubber for metal contact prevention
- 8 bogie style wheels for less slider contact



## In-house fabricated cowling:

- One air inlet
- Added insulation
- Spacious
- Uses stock headlight and windshield

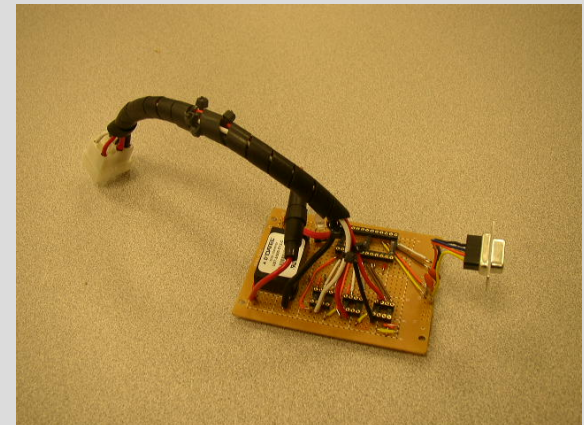
# EMISSIONS

## 2 ADDITIONAL COMPONENTS TO LOWER EMISSIONS



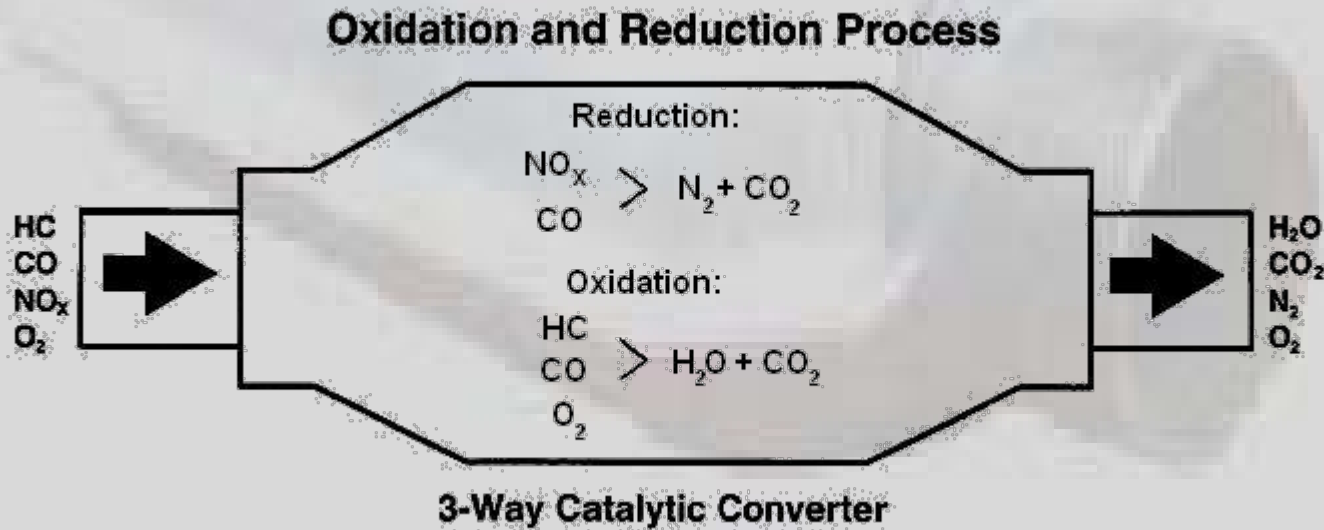
- 3-WAY CATALYTIC CONVERTER

- MICROCONTROLLER  
(PIGGYBACK)



# CATALYTIC CONVERTER

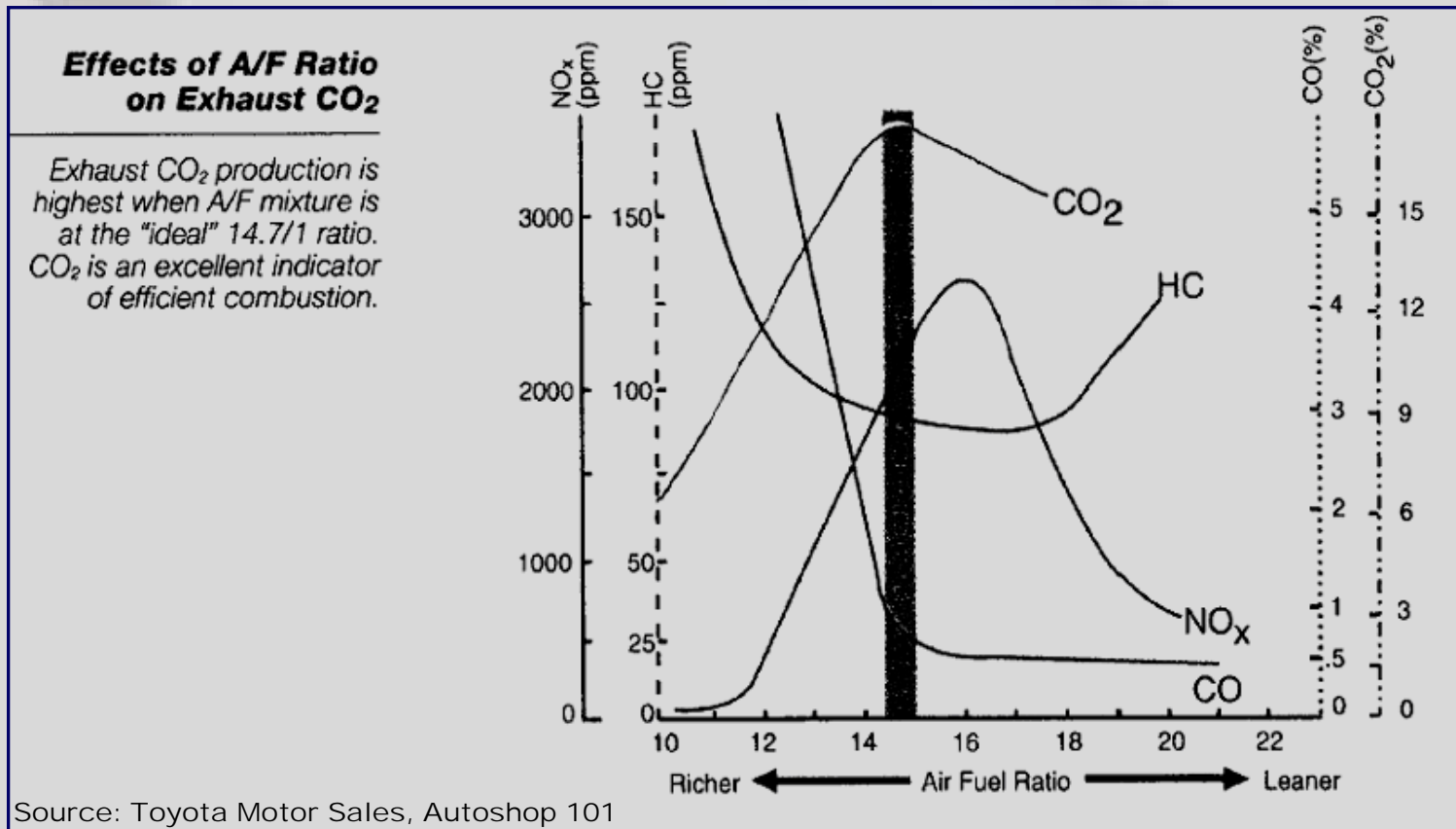
- Uses a catalysts to reduce emissions
- Reduces HydroCarbons (HC) significantly
- Works best with higher temperatures



Source: Toyota Motor Sales, Autoshop 101

# CATALYTIC CONVERTER

- HydroCarbons (HC) drop
- NO<sub>x</sub> values remain significant
- Shown by graph, lower Air Fuel Ratio (AFR) gives lower NO<sub>x</sub>



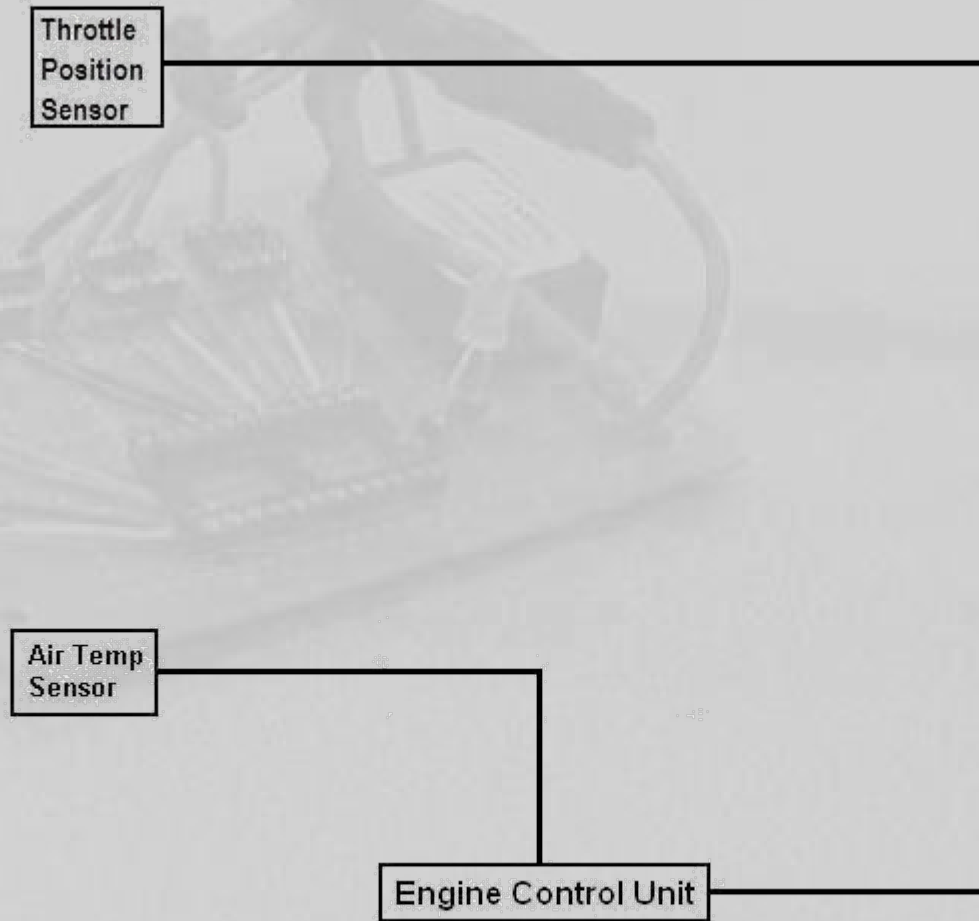
# PIGGYBACK

- **Best Adjustment for the Air Fuel Ratio uses the Air Inlet Temperature**
- **Interrupt Engine Sensor for Air Inlet temperature going to Engine Control Unit**
- **Adjust Voltage through the wire to adjust Air Inlet Temperature Reading by ECU**
- **ECU Computes Air Fuel Ratio based on the new higher or lower voltage**
- **Air Fuel Ratio is Decreased to obtain lower NO<sub>x</sub> Values**
- **Maintain a steady air fuel ratio through different Engine RPM**

**Take a look more in depth**

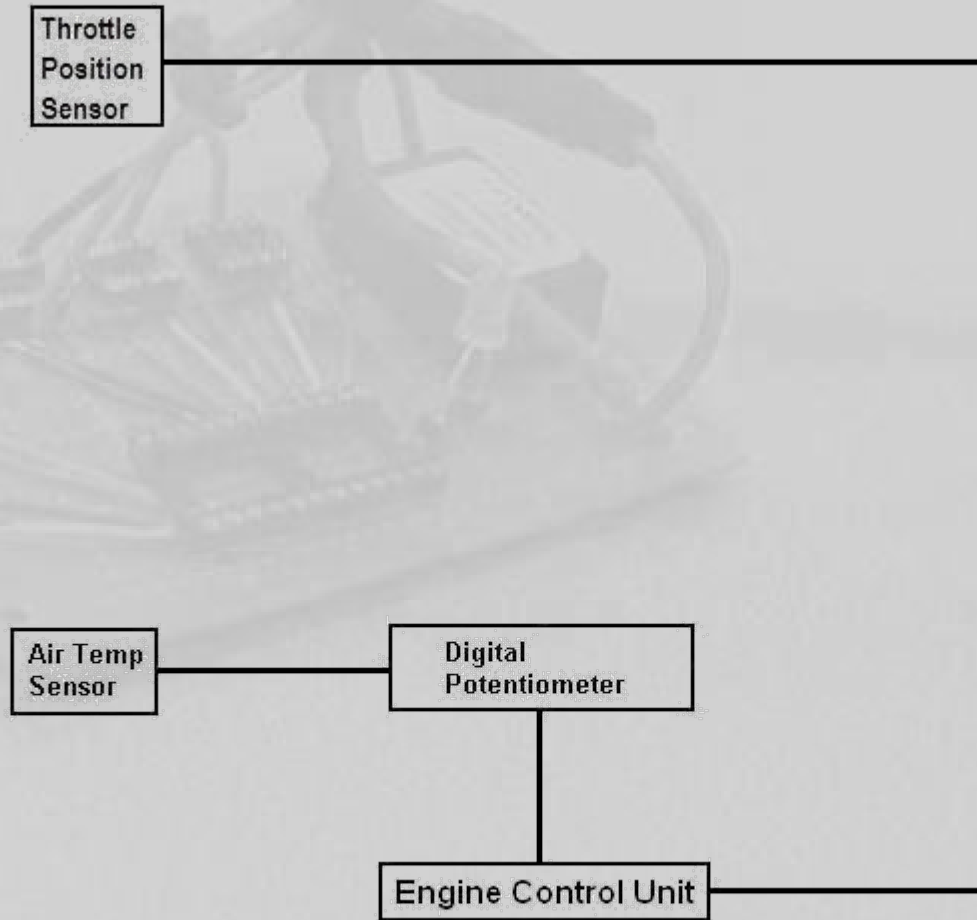
# PIGGYBACK

Design of microcontroller



# PIGGYBACK

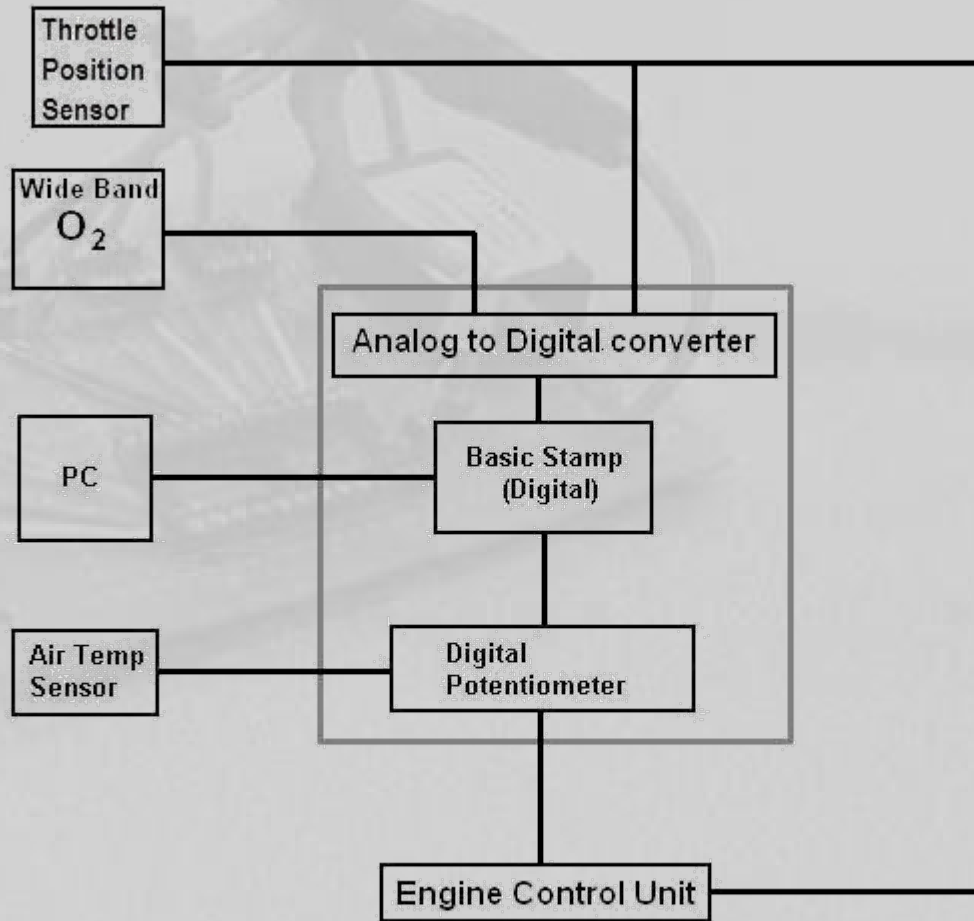
Design of microcontroller





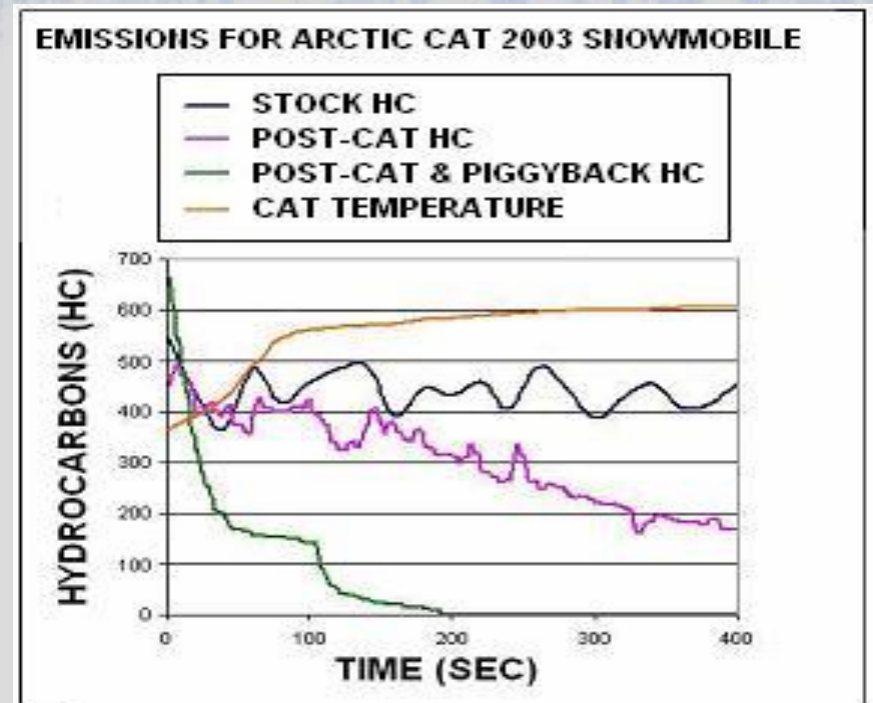
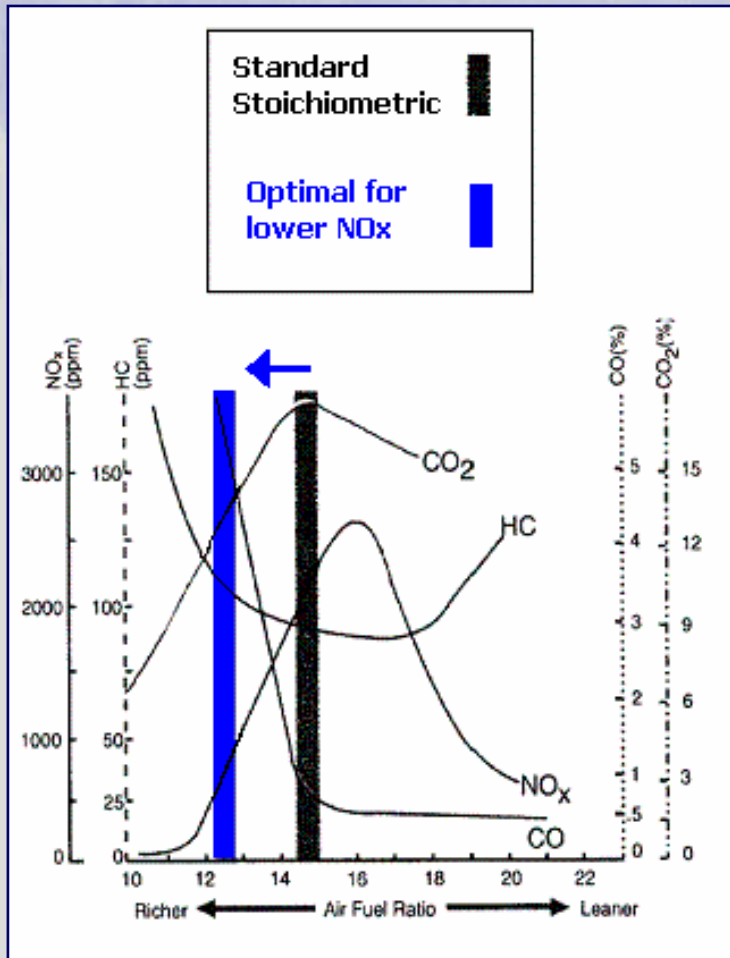
# PIGGYBACK

Design of microcontroller



\*Fail Safe – If Basic stamp fails, Potentiometer does not change resistance of signal

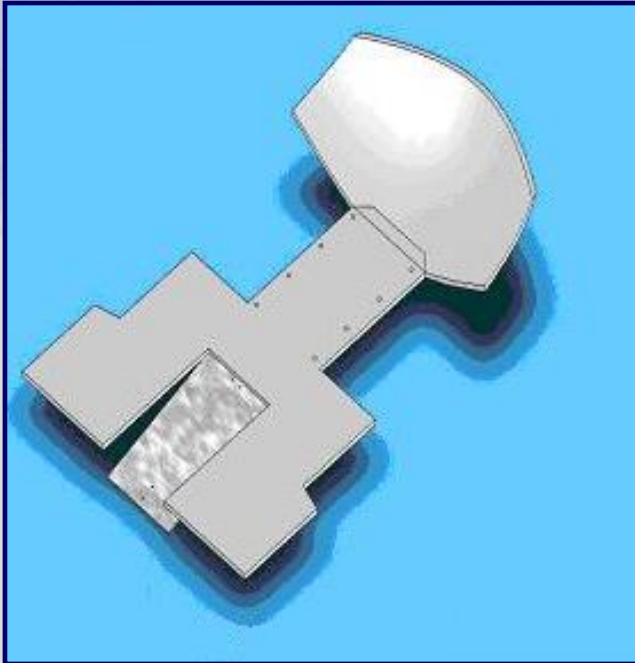
# EMISSIONS RESULTS



Source: Toyota Motor Sales, Autoshop 101

# ENGINE COOLING

2 ways to dissipate heat from the engine



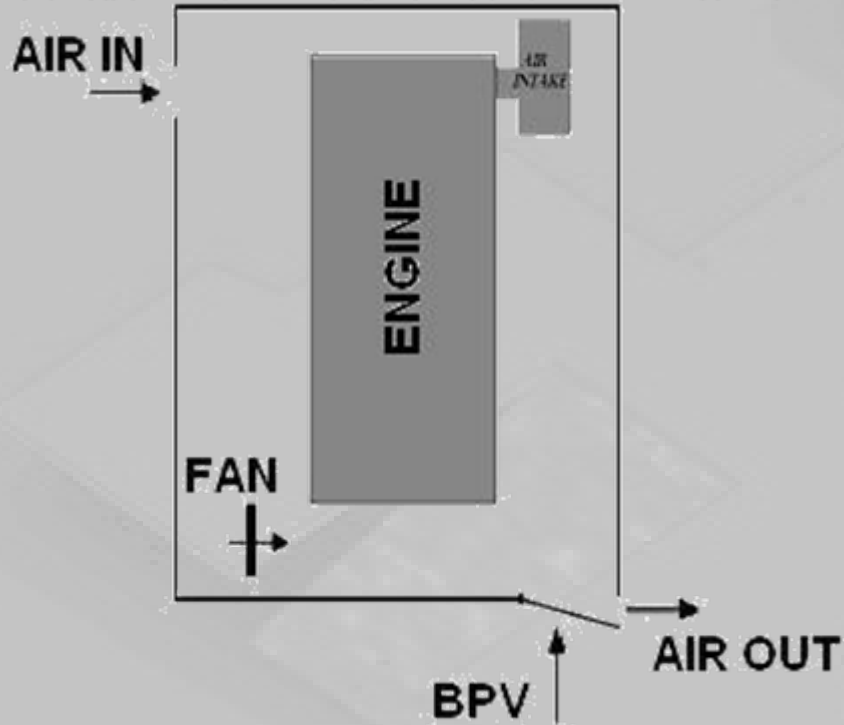
- Create strategic hot air exiting from engine compartment

- Add additional cooling through engine liquid cooling system

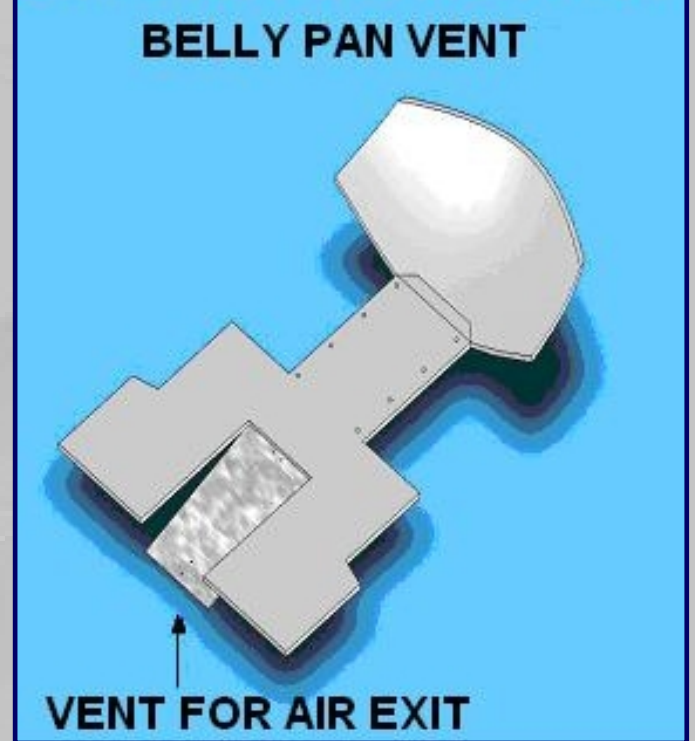


# ENGINE COOLING

IDEALIZED ENGINE COMPARTMENT



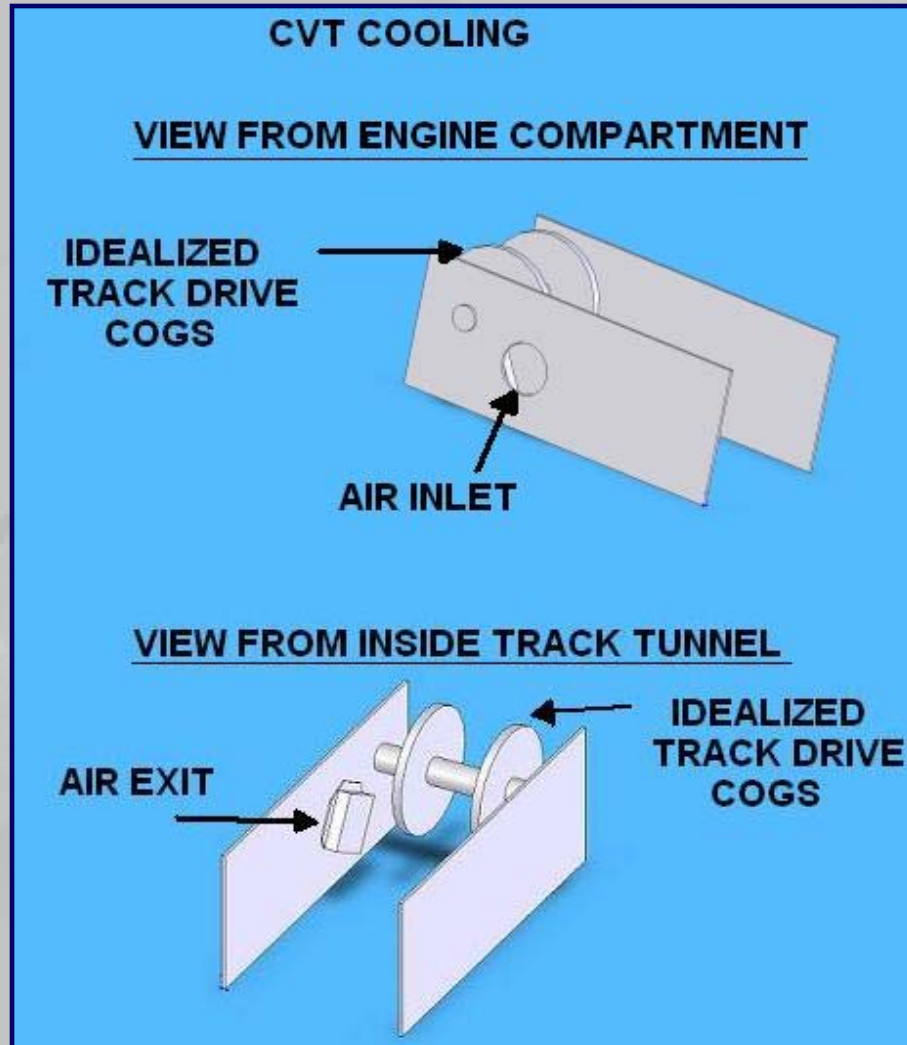
BELLY PAN WITH INSTALLED BELLY PAN VENT



This location is ideal for damping sound through the use of the rubber track as well as the snow in this vicinity.

# ENGINE COOLING

To allow for hot air escape near engine compartment, an additional fan is added

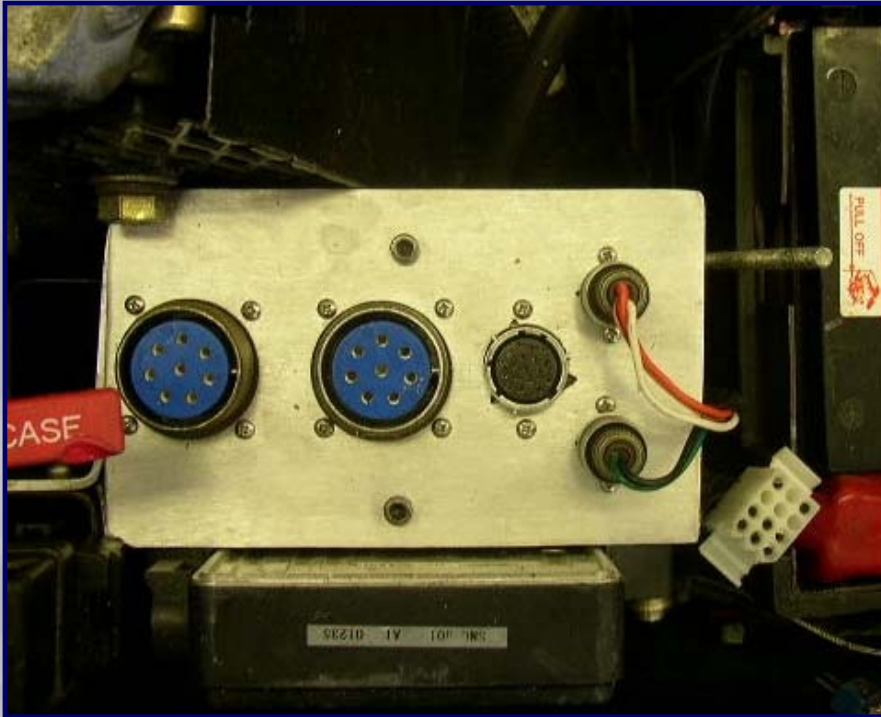


# ENGINE COOLING



- Easy installation
- 40° drop in engine coolant temperature
- Snow aids in cooling
- Fan forces more convection

# RELIABILITY



- Found poor ground
- New engine sensors
- New wires with separate harness for wire accessibility
- Quick disconnects for quick access
- Quick switch between stock ECU and piggyback with ECU

# CONCLUSION

