IPRO Projects Day *December 7, 2001*

Overview

- Team Members
- Project Purpose
- Background
- Funding
- Equipment
- Ethanol
- Experiment
- Results

Team Members

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Objectives

- To convert an ultralight aircraft's two stroke engine to run on ethanol fuel
- Prove aviation can rely on ethanol fuel
- Students to gain knowledge on aircraft systems integration, airframe maintenance, performance measurements, and operations

Background

- Ethanol projects at IIT
- Project started Spring 2001
  - Found an airport and instructor for the ultralight
  - Devised a way to mix the fuel and oil

Funding

- Funding Proposal
- Targeted sponsors
- Responses
- Budget Overview

The Aircraft

Length	**18.5 ft**
Wingspan	**32.6 ft**
Wing Area	**180 sq ft**
Seats	**2**
Empty Weight	**325 lbs**

The Engine

- Bombardier Rotax 503
  - Twin Cylinder
  - Two-Stroke
  - Fuel/Oil Lubrication
  - Air-Cooled
  - 500cc, 53 hp

The Two-Stroke Engine

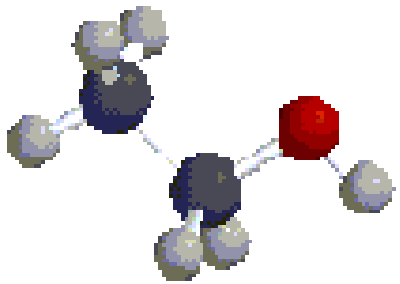
- Sources of Pollution
- Widely used in:
  - Ultralight Aircraft
  - Water Sport Vehicles (jet skis, PWC)
  - Snowmobiles
  - Outboard Engines

Why Ethanol?

- Cleaner Burning
- Less Volatile
- No Hazardous Vapors
- Essentially Non-Toxic
- High Octane Rating
  - Can be used to replace highly leaded aviation fuel
- Boosts Local Economy

What is Ethanol?

- Grain Alcohol
- Sources
  - Corn
  - Biomass (Garbage)
- E85
  - 85% denatured ethanol and 15% natural gasoline.
  - Gasoline added for improved cold-starting.



Challenges

- Limited Availability
- Difficult Cold Starts
- Determining Correct Fuel/Air Mixture
- Determine Engine's Compatibility
- Lubrication

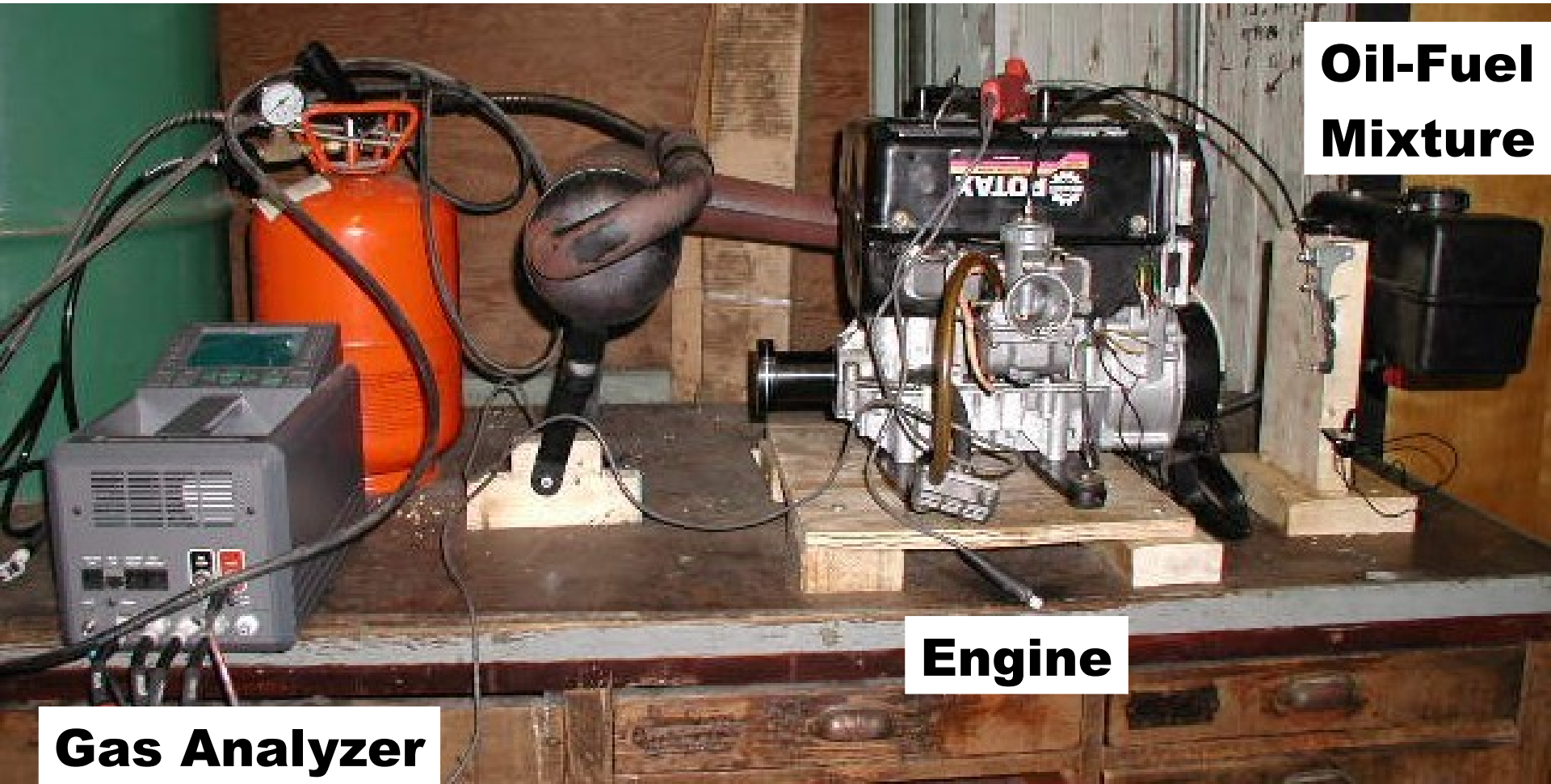
E85 vs. Gasoline

Issue	***Gasoline***	***E85***
Source	Oil (domestic and foreign)	Renewable agricultural crops and waste
Current Availability	High	Low
Supply	High, 500 million barrels in US reserve	Low, 2.7 gallons of E85 can be produced per bushel of corn.
Cost	$1.30-1.50 /gallon	Approx. $2.30 /gallon
Growth Opportunity	Negligible Increase dependence up or further oil drilling	High Market opportunity for agricultural crops.

E85 vs. Gasoline cont.

Issue	***Gasoline***	***E85***
Burning	Carbon from gasoline burning engines can form deposits.	E85 burns cleaner and at a cooler temperature
Octane	87-93	96
Tailpipe emissions	BASE	30 % less CO 12% less HC 3% less NOx
Range	BASE	Requires 1.4 volume
Air-to-Fuel	14.7:1	8.95:1
Formula	C_8H_{18}	C_2H_5OH

Experimental Setup



Results

- Trouble cold-starting
- Air/Fuel Ratio

Needle Position	Low	Medium	High
Air/Fuel Ratio	7.8:1	8.0:1	8.7:1

Thank You

Questions?