ethanol ultralight

ipro 317

IPRO Projects Day *May 3, 2002*

Overview

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

Objectives

- To convert an ultra light aircraft's two stroke engine to run on ethanol fuel
- Prove aviation can rely on ethanol fuel
- Obtain knowledge of aircraft systems
- Acquire adequate funding
- Modify structure of ultra light

Background

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

Funding

- Funding Proposal
- Targeted sponsors
- Responses

Quick Silver – MX2

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

FAA Regulations

- Certified instructor required
- Max empty weight: 496 pounds
- Max fuel capacity: 10 U.S. gallons
- Not capable of more than 75 knots airspeed at full power in level flight,
- Have a power-off stall speed that does not exceed 35 knots

The Engine

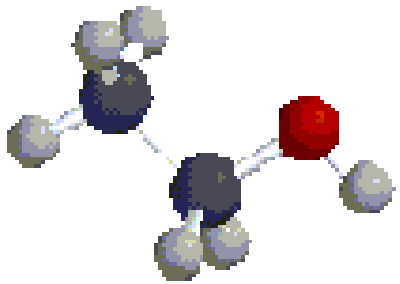
- Bombardier Rotax 503
  - Twin Cylinder
  - Two-Stroke
  - Fuel/Oil Lubrication
  - Air-Cooled
  - 500cc, 53 hp

The Two-Stroke Engine

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

What is Ethanol?

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



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

Challenges

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

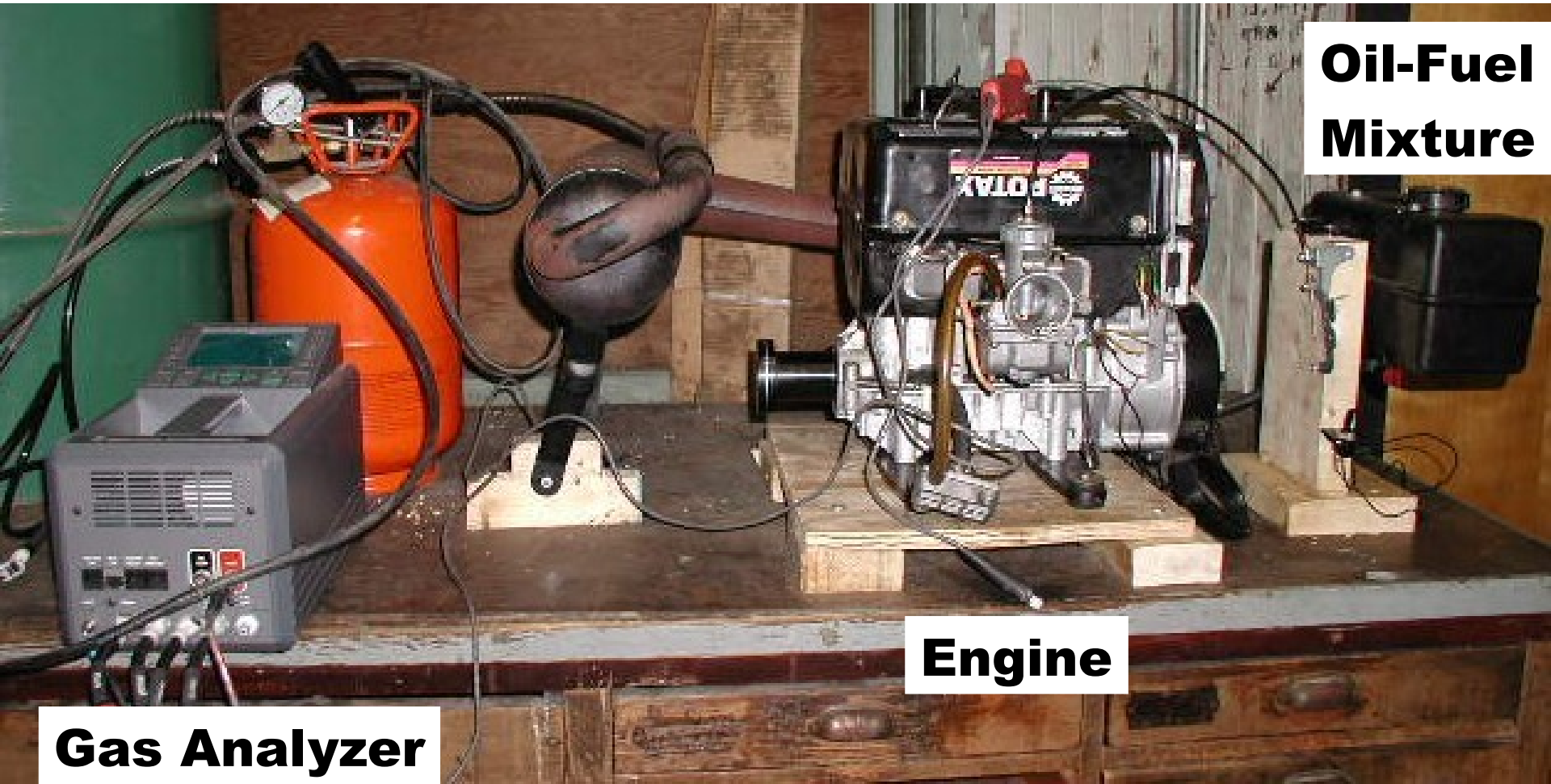
E85 vs. Gasoline

Issue	***Gasoline***	***E85***
Source	Oil	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	$1.35-1.70 /gallon	Approx. $1.47 /gallon
Growth Opportunity	Dependant on perspective	High potential

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
Formula	C_8H_{18}	C_2H_5OH
Tailpipe emissions	BASE	30 % less CO 12% less HC 3% less NOx
Consumption	BASE	40-45% more
Air-to-Fuel	14.7:1	8.95:1

Experimental Setup



Results

- Refastened to frame
- Engine range
- Air/Fuel Ratio

Needle Position	Low	Medium	High
Air/Fuel Ratio (gas)	14.0:1	14.2:1	14.7:1
Air/Fuel Ratio (E85)	7.8:1	8.0:1	8.7:1

Team Members

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Thank You

Questions?