Magnetic Technology Applied to Improve Combustion

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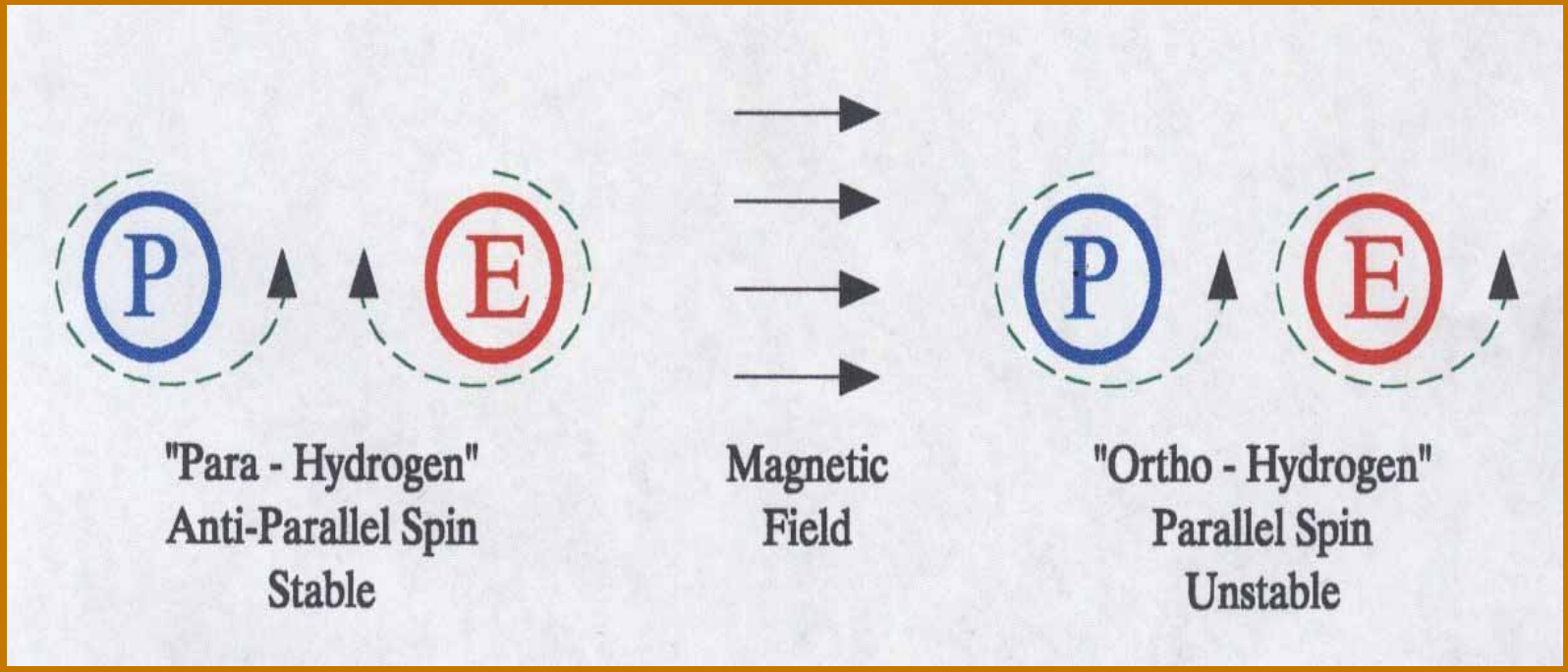
Multi-robot Operation

What were we trying to do?

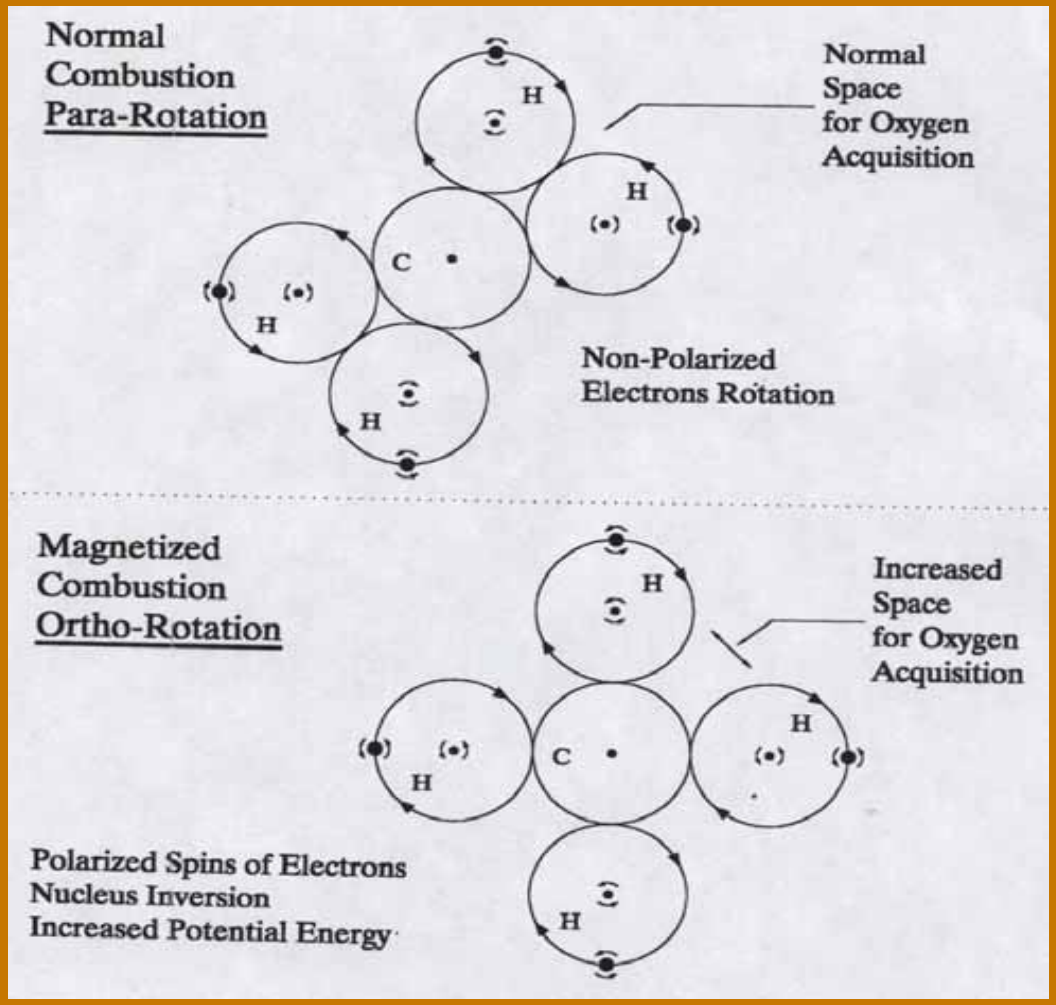
- Increase the range of our teleoperated machinery
  - Longer operating times
  - Less refueling time
  - Reduce emissions of diesel engines
  - Improve reliability
- We saw magnetization of diesel fuel as a potential interim solution to changing machine power plants to hybrid diesel electric or fuel cells

The Theory

Ruskins U.S. Patent # 3228868



The Outcome


Normal
Combustion
Para-Rotation
Normal
Space
for Oxygen
Acquisition
H
H
C
H
H
Non-Polarized
Electrons Rotation
Magnetized
Combustion
Ortho-Rotation
Increased
Space
for Oxygen
Acquisition
H
H
C
H
H
Polarized Spins of Electrons
Nucleus Inversion
Increased Potential Energy

Detroit Diesel 11.1 mine engine

	Without Magnetizers	With Magnetizers	% Magnetizer Effectiveness
Speed, rpm	1623	1623	Nil
Torque, ft.lb.	532	532	Nil
Power, hp	174	174	Nil
Fuel rate, lb/hr	61.9	61.9	Nil
CO, gr/hr	58	68	- 17.2 %
.CO_2 , gr/hr	80378	79253	1.4 %
NO, gr/hr	447	434	2.9 %
NO_2 , gr/hr	34	37	- 8.8 %
NOx , gr/hr	481	471	2.1 %
THC, gr/hr	34	27	20.6 %
DPM, gr/hr	8.4	7.5	10.7 %
EQI	55.6	53.7	3.4 %

Results

- The test showed that
  - Something significant was happening
    - Diesel Particulate Matter dropped by **10.7%**
    - Total Hydrocarbon production was reduced by **20.6%**
  - Some parameters CO and NO_2 increased due to the duration of the test
- This test yielded very interesting results that were inconclusive
- To investigate further we needed a large consumer of hydrocarbon fuel.
- A good candidate was a ventilation heater house.

- **Magnetizing the header in a heater house**

Data without Magnets - 2000-2001 Heating Season

Period	Number of Days	Degree Days	Gas Consumption (m^3)
Dec 2000	11	344	173,184
Jan 2001	30	884	390,024
Feb 2001	28	828	382,314
Mar 2001	31	706	247,332
April 2001	30	390	16,939
Total	**130**	**3151**	**1,209,279**

Average gas consumption without magnets 383.93 m^3/degree day

Data with Magnets - 2001-2002 Heating Season

Period	Number of Days	Degree Days	Gas Consumption (m^3)
Dec 2001	11	272	52,289
Jan 2002	30	805	320,448
Feb 2002	28	775	319,258
Mar 2002	31	790	293,279
April 2002	30	451	60,621
Total	**130**	**3094**	**1,045,895**

Average gas consumption with magnets 338.04 m^3/degree day

Magnetizing the header in a heater house

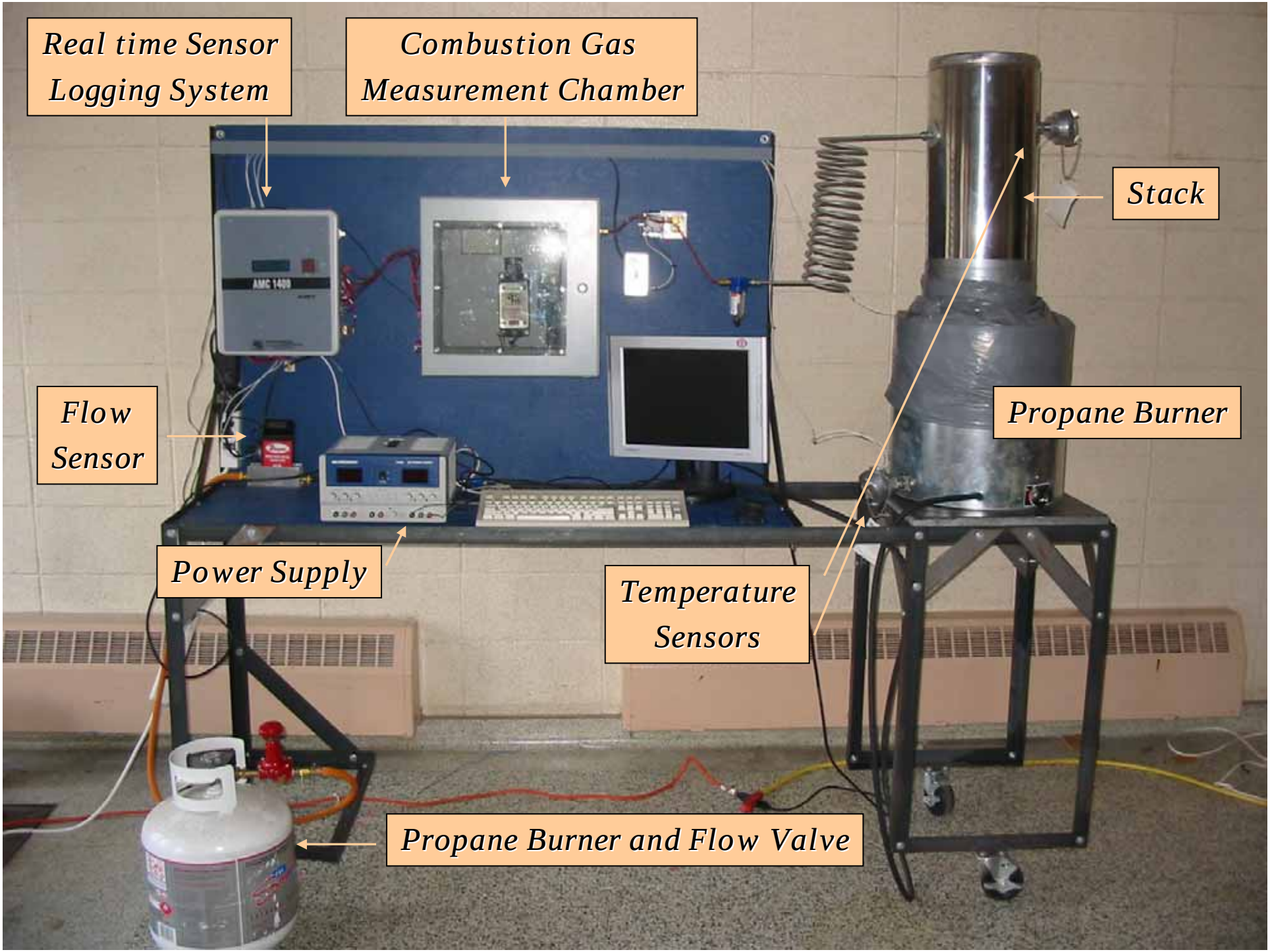
- Two year test period corrected for degree days
- A total of over 11.95% less gas was used from one year to the next.
- This result is based upon normalized temperature data collected at Environment Canada’s site.

Results-to-date

- Both Diesel and Heater House applications are antidotal results
- A more comprehensive scientific test needed to be defined
- In 2006 a test was formulated to prove or disprove the idea of magnetic fuel conditioning

Magnetic Combustion Test Goals

- Perform a physical experiment to determine if magnetic conditioning of hydrocarbon fuel would lead to more complete combustion
- Emulate and instrument a heating stack
  - Build a test apparatus
  - Build software monitoring system to accurately measure outcomes

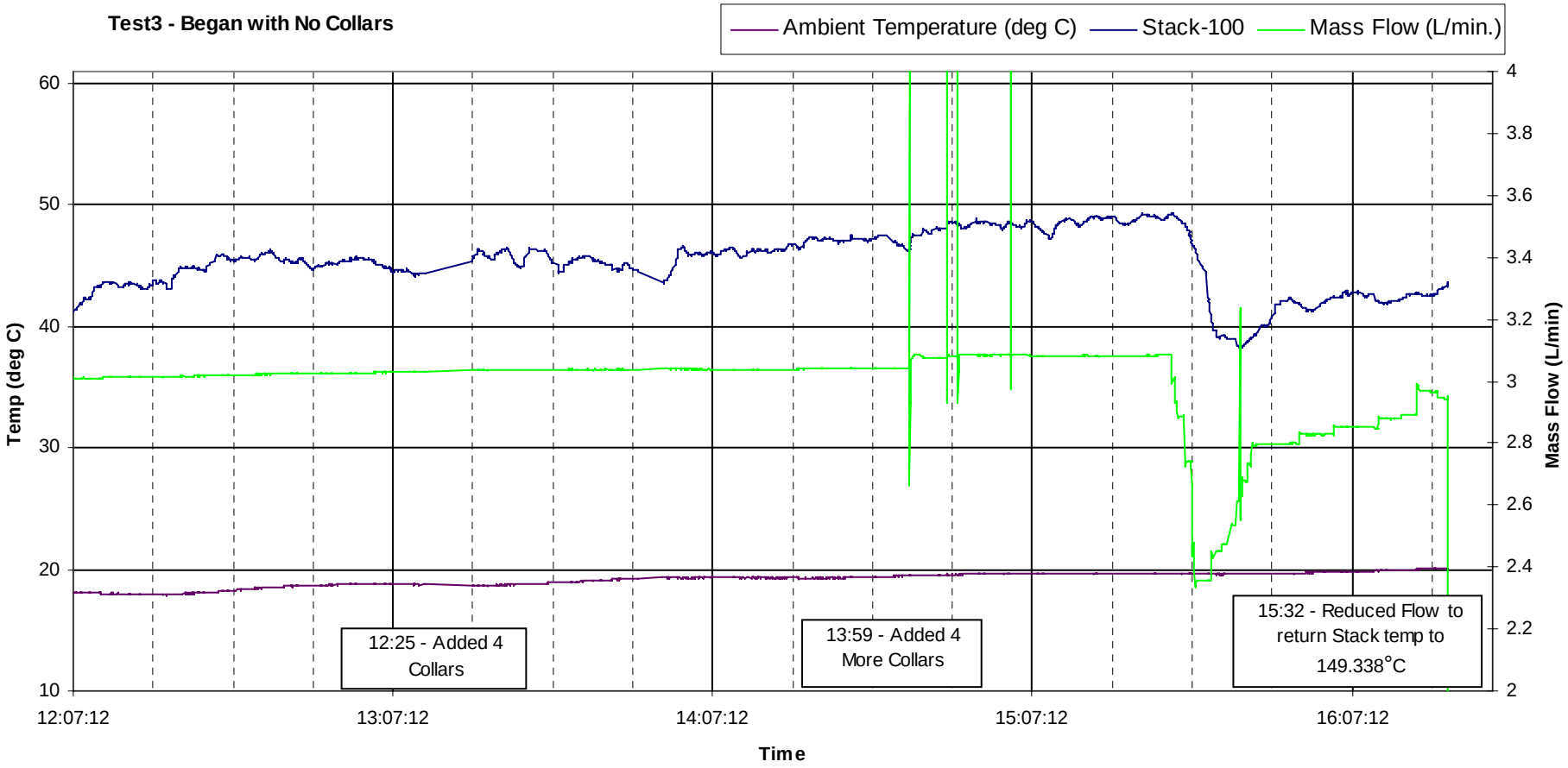

Real time Sensor Logging System
Combustion Gas Measurement Chamber
Stack
Flow Sensor
Propane Burner
Power Supply
Temperature Sensors
Propane Burner and Flow Valve

Magnetic Collar Addition

Magnet Addition

Test Procedure

- Ignite the Propane Burner in the Stack
- Allow 1 hour to reach steady state
- Add magnetic collars
- Wait for 1.5 hours until steady state is reached again
- Add another set of magnetic collars


Test3 - Began with No Collars
Ambient Temperature (deg C)
Stack-100
Mass Flow (L/min.)
Temp (deg C)
Mass Flow (L/min)
Time
60
50
40
30
20
10
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
12:07:12
13:07:12
14:07:12
15:07:12
16:07:12
12:25 - Added 4 Collars
13:59 - Added 4 More Collars
15:32 - Reduced Flow to return Stack temp to 149.338°C

Experimental Results

- Experimental system built for testing
- Real Time temperature measurement showed a temperature increase of 5 degrees Celsius following the addition of magnetic collars
- This temperature rise indicates more complete combustion
- The end of the experiment reduced the gas flow by 0.25 l/min providing an indication of fuel savings
- Combustion measurement was attempted however the resolution of the sensors was insufficient to support proper measurement

Benefits

- Hydrocarbon magnetization appears to improve combustion
  - Temperature increases as a result of fuel magnetization for the same fuel quantities
- Diesel engine operation
  - Reduced diesel particulate matter
  - Increased range between refueling
- Heater House
  - Reduced fuel consumption
  - Cleaner air

Summary

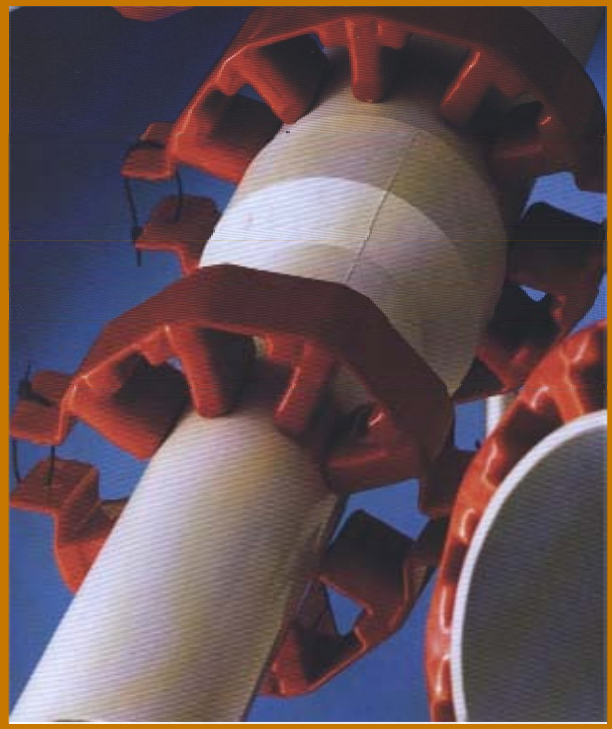
- Magnets applied to hydrocarbon fuel lines
  - Appears to reduce fuel consumption
  - Appears to improve emission quality due to more complete combustion
- Diesel engine operation will improve significantly
- Heater House operation improved resulting in an 11.95% reduction in Natural Gas consumed
- Experimental testing showed a 5 degree Celsius temperature rise or a 0.25 l/min fuel decrease

Future Work

- Continue the Research and Development experimentation to get more detailed information.
- Diesel Engine
  - Devise a further longer test to allow the diesel engine to reach steady state needs to be performed
- Further application to other processing operations
  - Various kilns (forestry, ceramic, mining, etc)

Avoca-Tec's Mono-Pole Magnet

- **Material** : Permanently magnetized ceramic alloys
- **Size:** Pipe sizes 1/4" to 12" in diameter
- **Installation:** No tools or plumbing modifications required



Electrons & Magnetism

- **Four Characteristics of an Electron :**
- Mass
- Charge
- Spin
  Electron’s ability to store up energy within itself similar to a flywheel
- Magnetism
  If electrons are provided with the precise amount of magnetic energy, the spinning electron will absorb that energy and flip into alignment

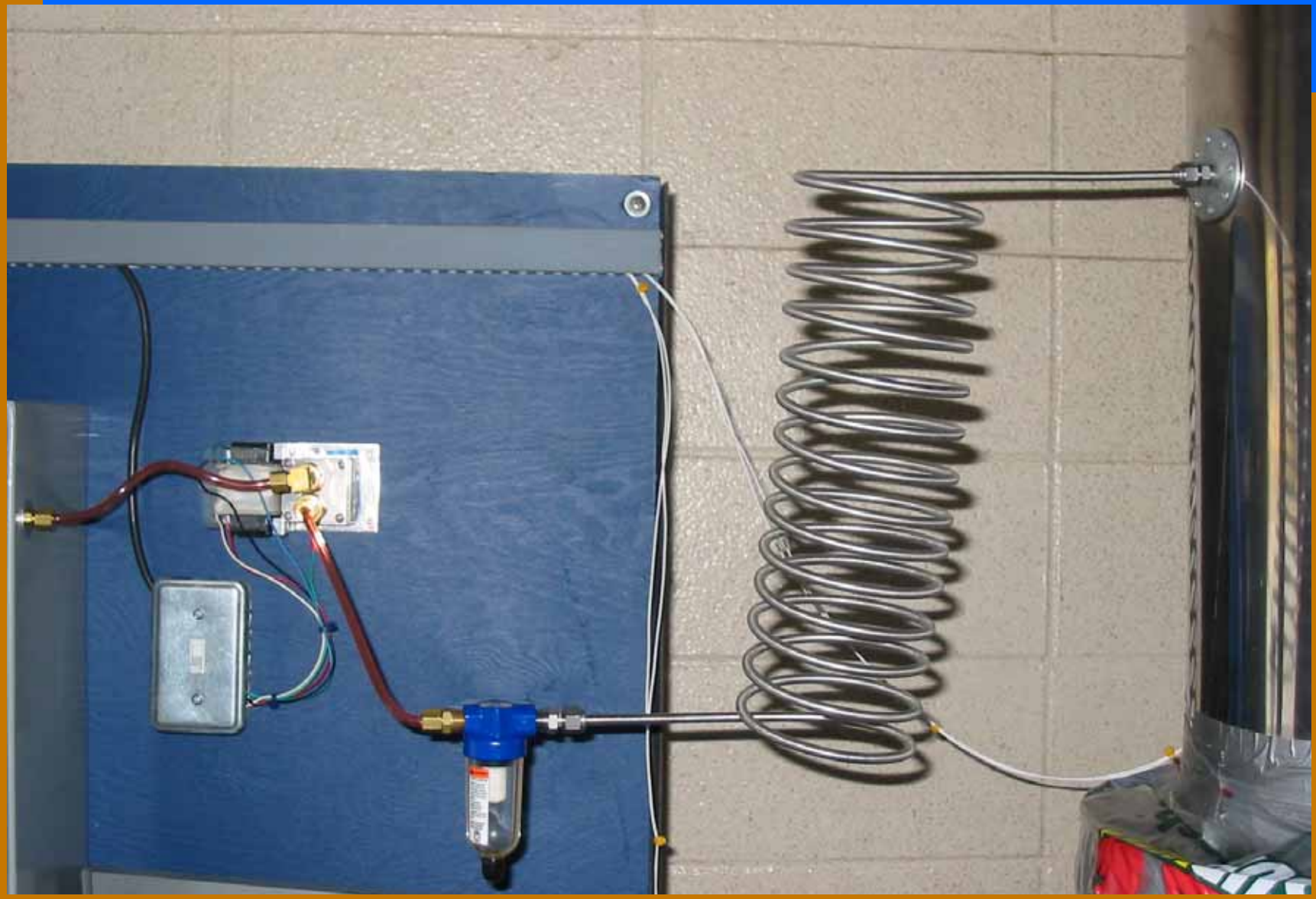
Magnetized Combustion

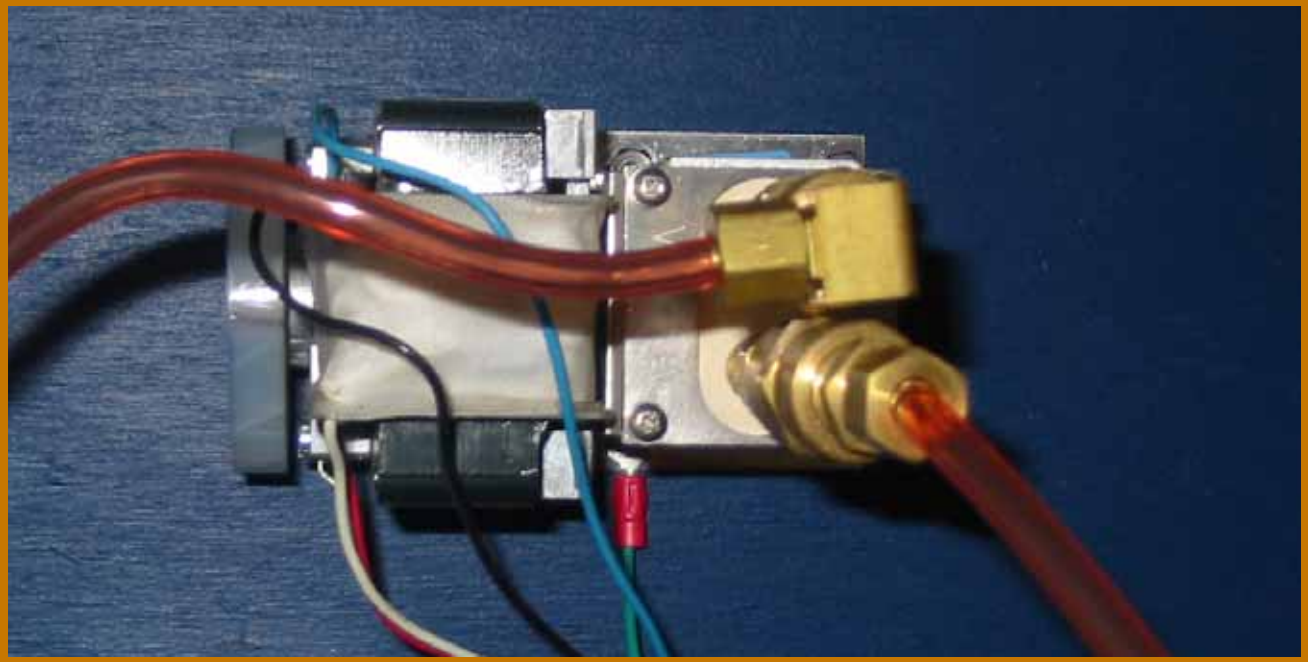
- Mono-Pole magnets creates a powerful magnetic field
- Focused magnetic field excites the electron activity
- The hydrocarbon molecule changes from its **PARA** state to higher energized **ORTHO** state
- The energized molecule with higher reactivity attracts additional oxygen
- Improved oxidation increases combustion efficiency


RENSEIGNEMENTS DE SÉCURITÉ IMPORTANTS


Dwyer
MASS FLOW METER
SERIES GFM
FLOW


1 2 3 4
A3
A2
A1
FAIL
AMC 1400
GAS MONITOR
acm
The armstrong
MONITORING CORPORATION



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Magnetic Technology

Some other applications that are present in industry.

Atmospheric Boilers