

## Off-Road Motorcycle, ATV, and Personal Watercraft Activity-Data Collection and Test Cycle Development



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**California Air Resources Board**

**EPA's 10th Annual  
Emission Inventory Conference**

# Recreational Vehicle Exhaust Emissions: Why the interest?

		HC	CO	Units
Motorycle/ATV	2-Stroke	24	32	g/mi
Motorycle/ATV	4-Stroke	2.4	51.2	g/mi
PWC	2-Stroke	144	263	g/bhp•h

[ARB Mail-out No. 93-54]



**171,890 Registered in California in 1999**  
**41 hrs/year/unit**

[California Department of Boating and Waterways], [ARB 1998]

**341,905 Registered in California in 1999**  
**120 hrs/year/unit (2-Stroke)**

**2,400 miles/year/unit (4-stroke)**

**7,000 miles/year/unit (ATV)**

[California Department of Motor Vehicles], [EPA420-F-00-051]

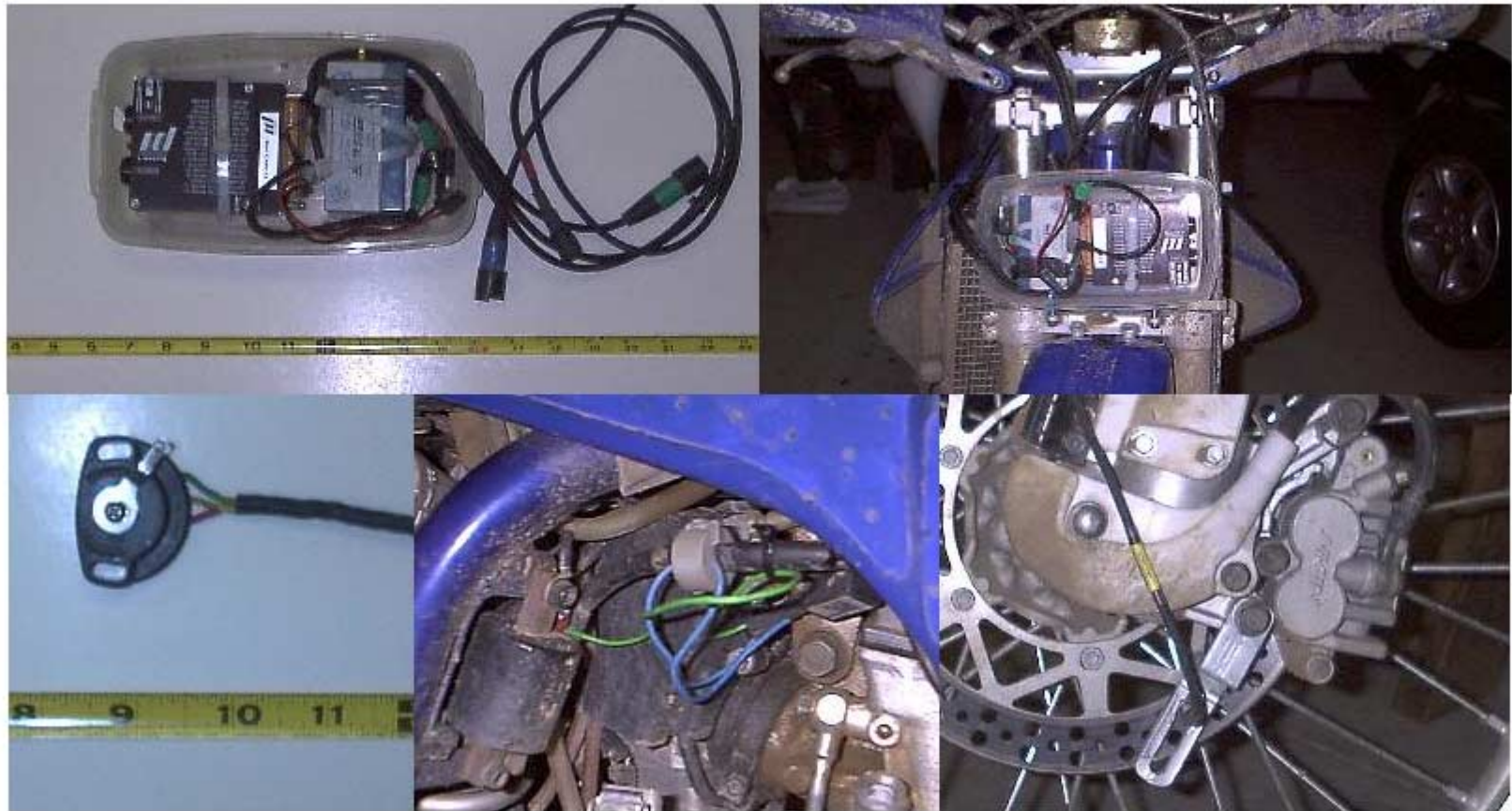
## The Path to Developing a Representative Duty Cycle

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- **Activity profiles**
  - Vehicle instrumentation
    - » Engine speed, Throttle position (PWC), Front and rear wheel speed (motorcycles and ATVs)
    - » PI Research System 1 Data logger - 5/10 Hz sample rate
      - Engine Speed - Digital TTL type Inductive pickup
      - Throttle Position - Analog rotary potentiometer
      - Wheel Speed - Digital TTL type and analog inductive sensors
- **Emissions test cycle development**
- **Emissions testing**
  - Engine dynamometer testing at California Environmental Engineering

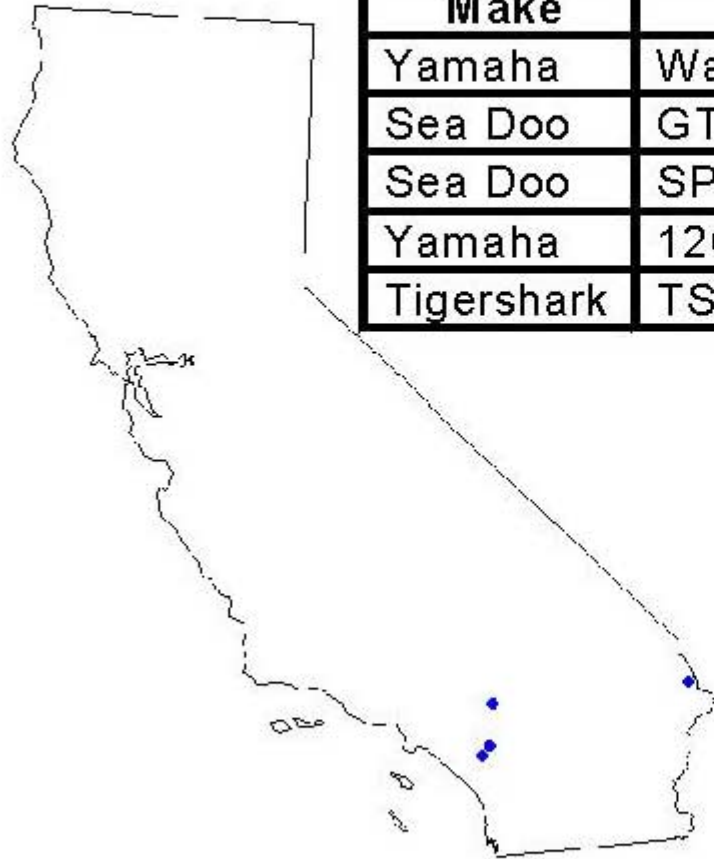


# Data Logger and Sensors Used in the Study



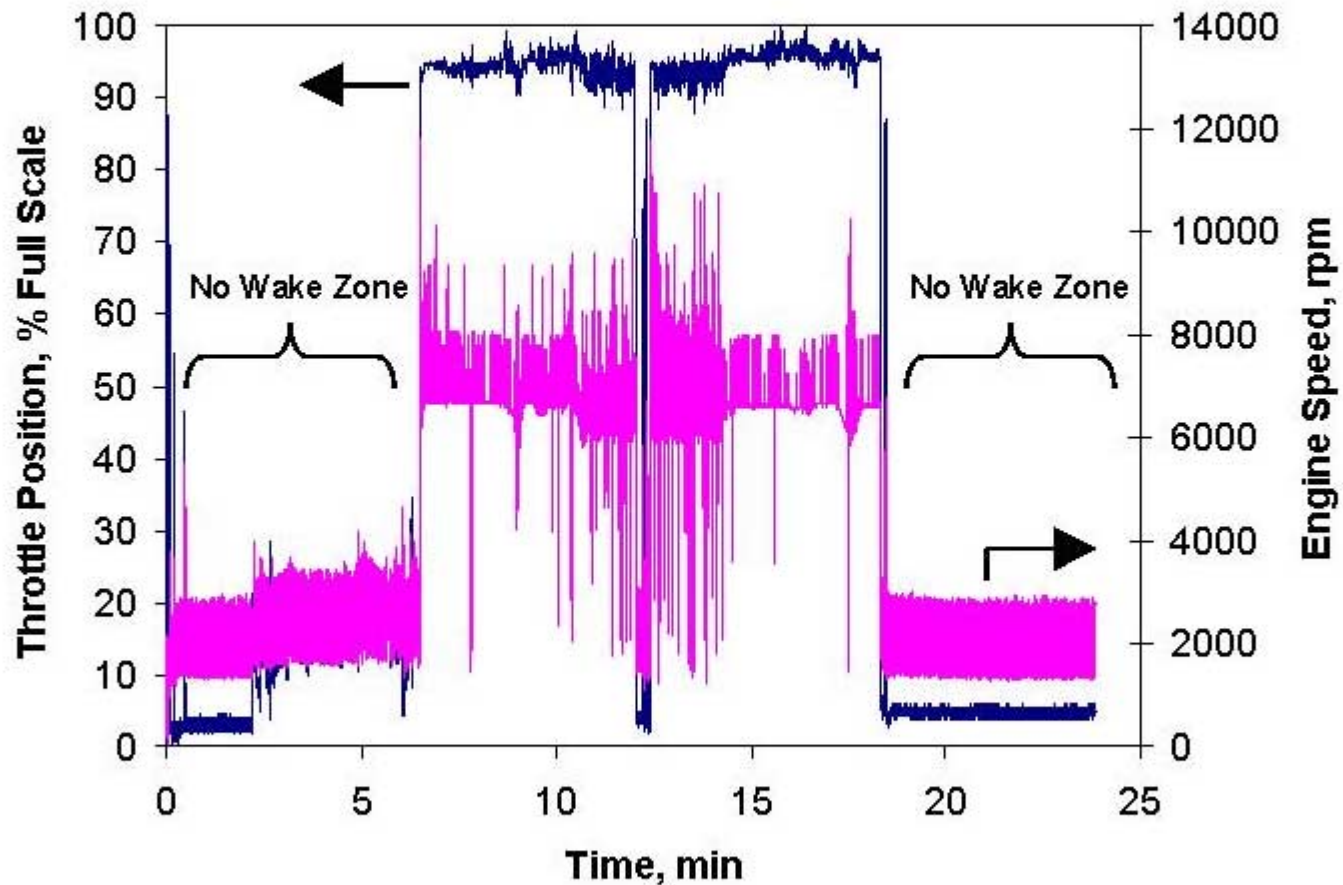
## Five PWCs Tested At Local Riding Areas

Make	Model	Year	HP
Yamaha	Waverunner	Pre 99 (1989)	< 50 (32)
Sea Doo	GTi	Pre 99 (1996)	60 to 100 (85)
Sea Doo	SP	99-00 (2000)	60 to 100 (85)
Yamaha	1200 Limited	99-00 (1999)	> 110 (155)
Tigershark	TS 1100 Li	99-00 (1999)	> 110 (155)

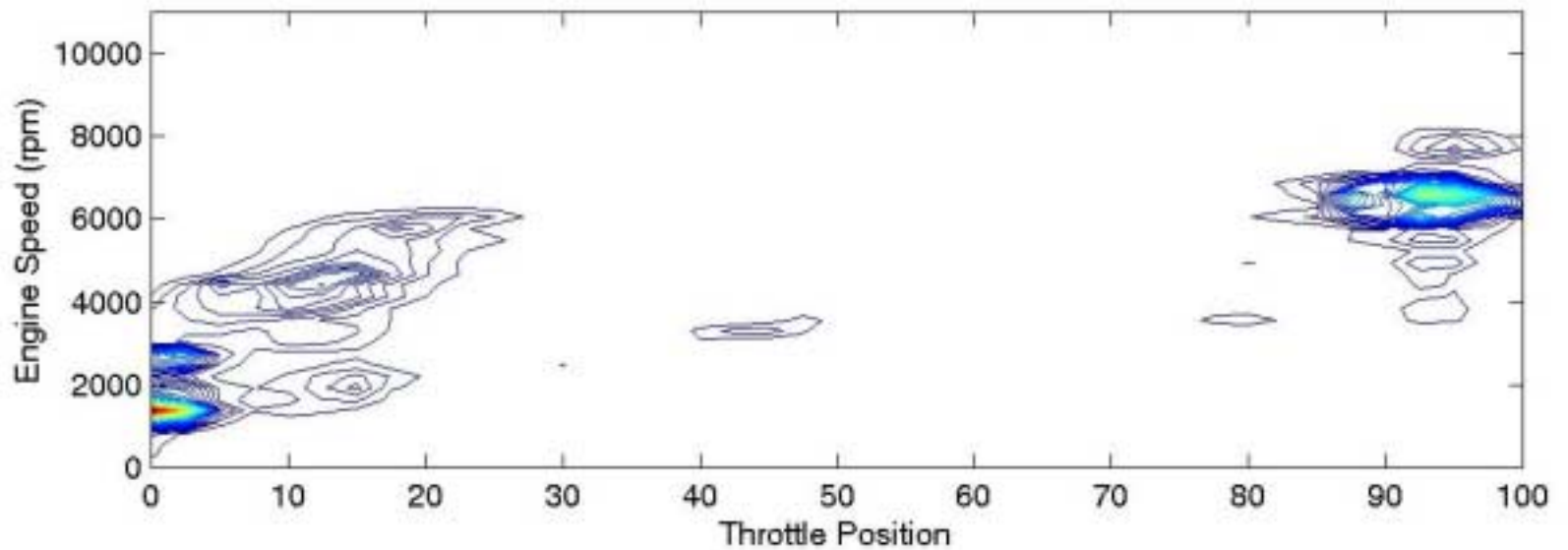
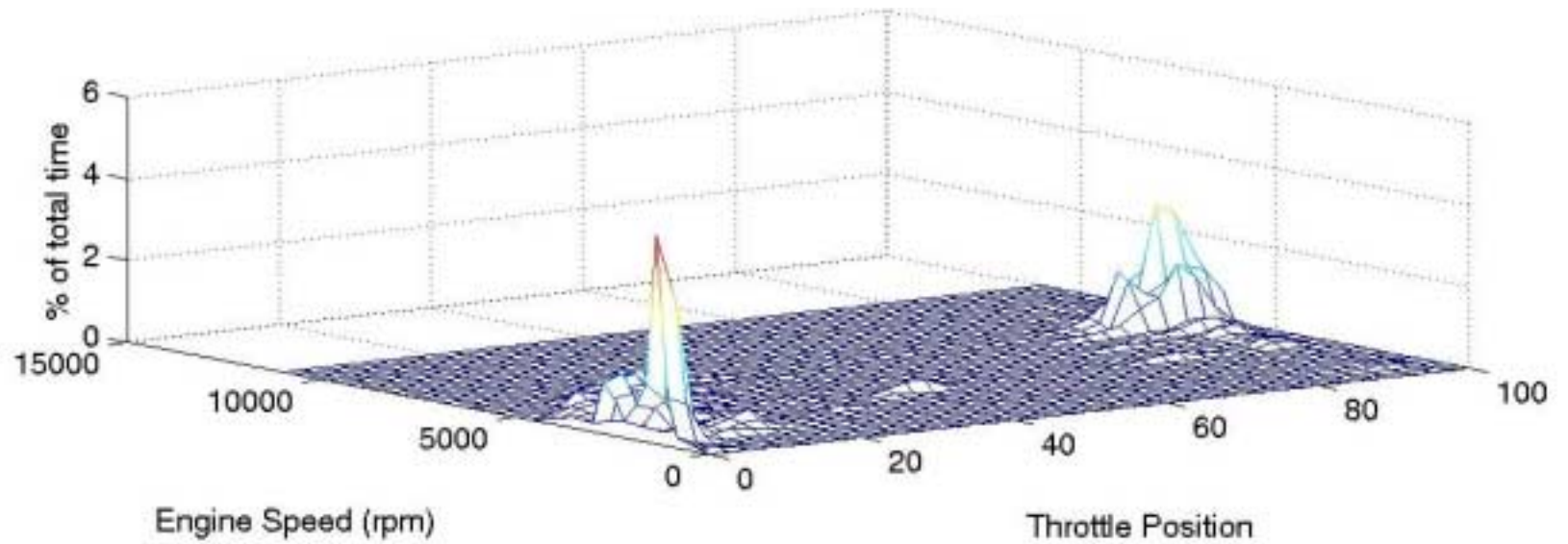


- $\geq 4$  tests per PWC

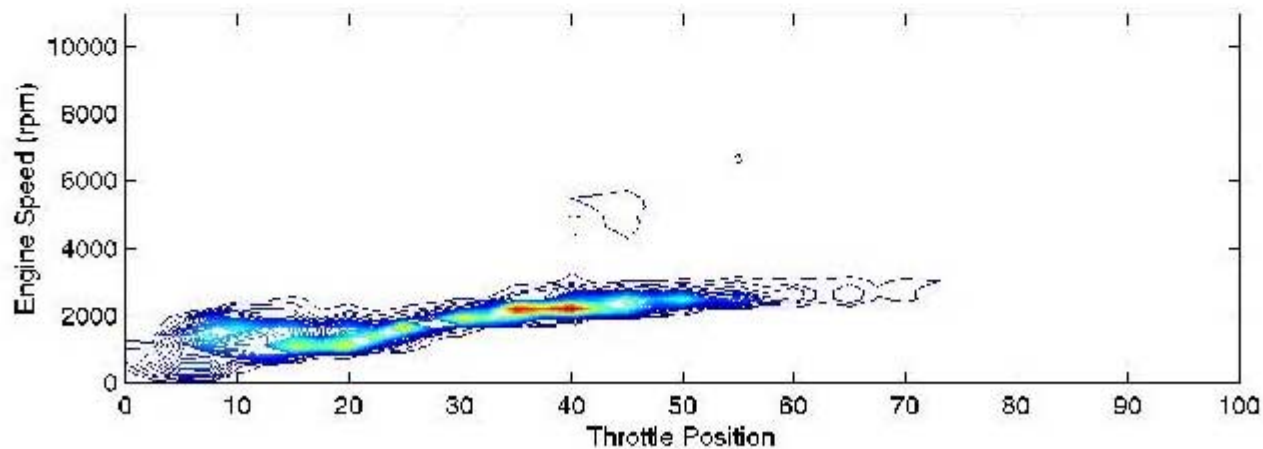
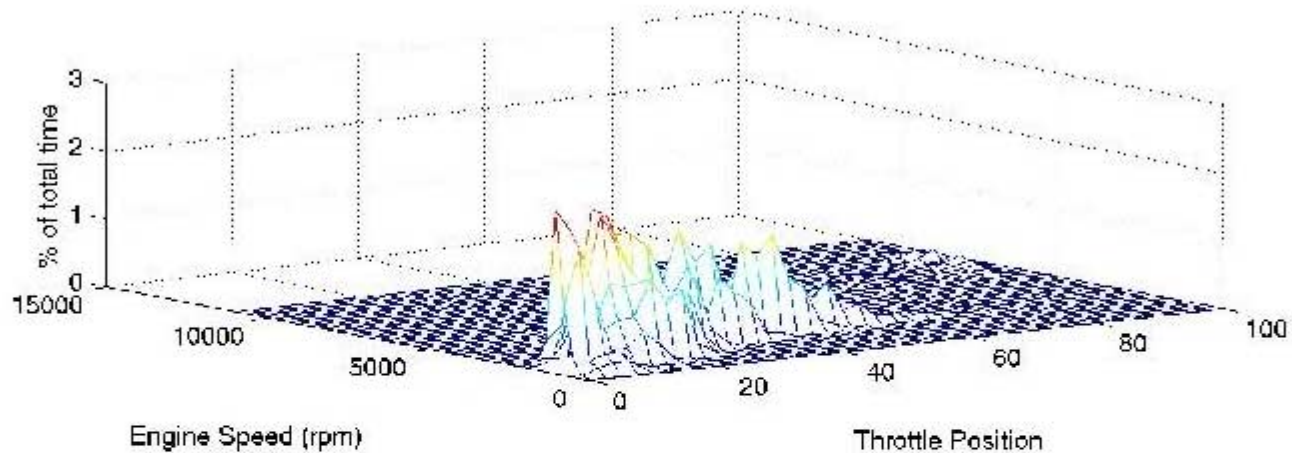
## Sample Activity Data: 2000 Sea Doo SP (85 Hp)



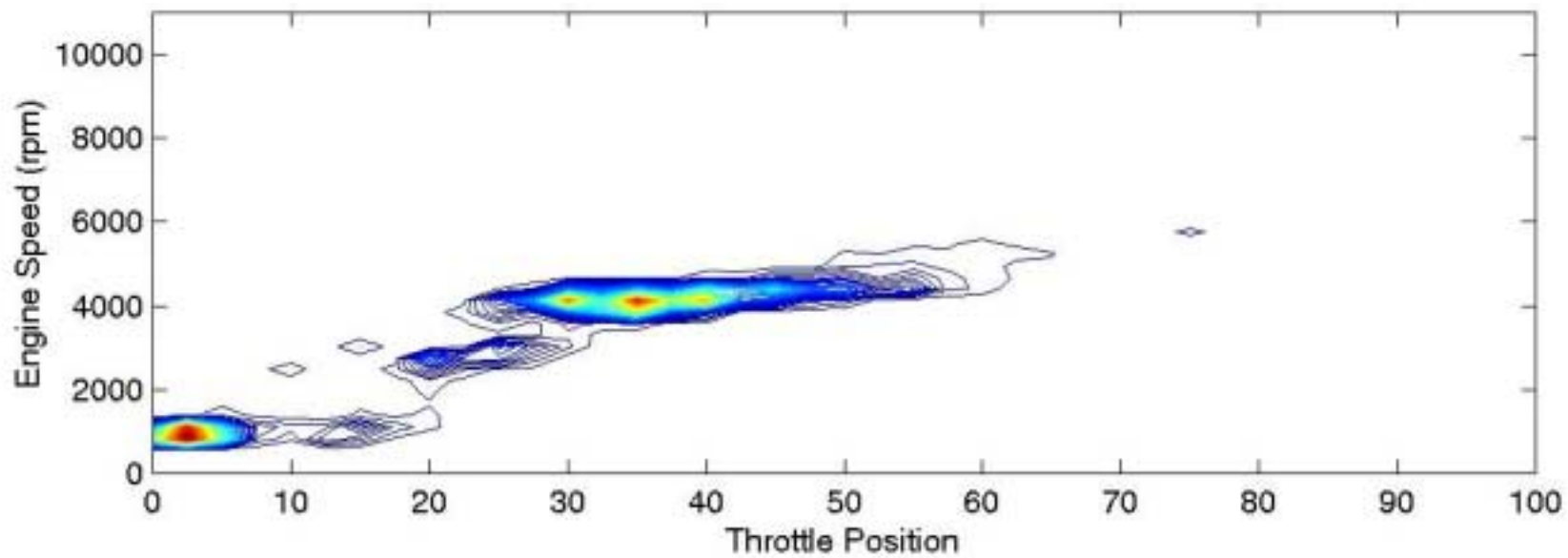


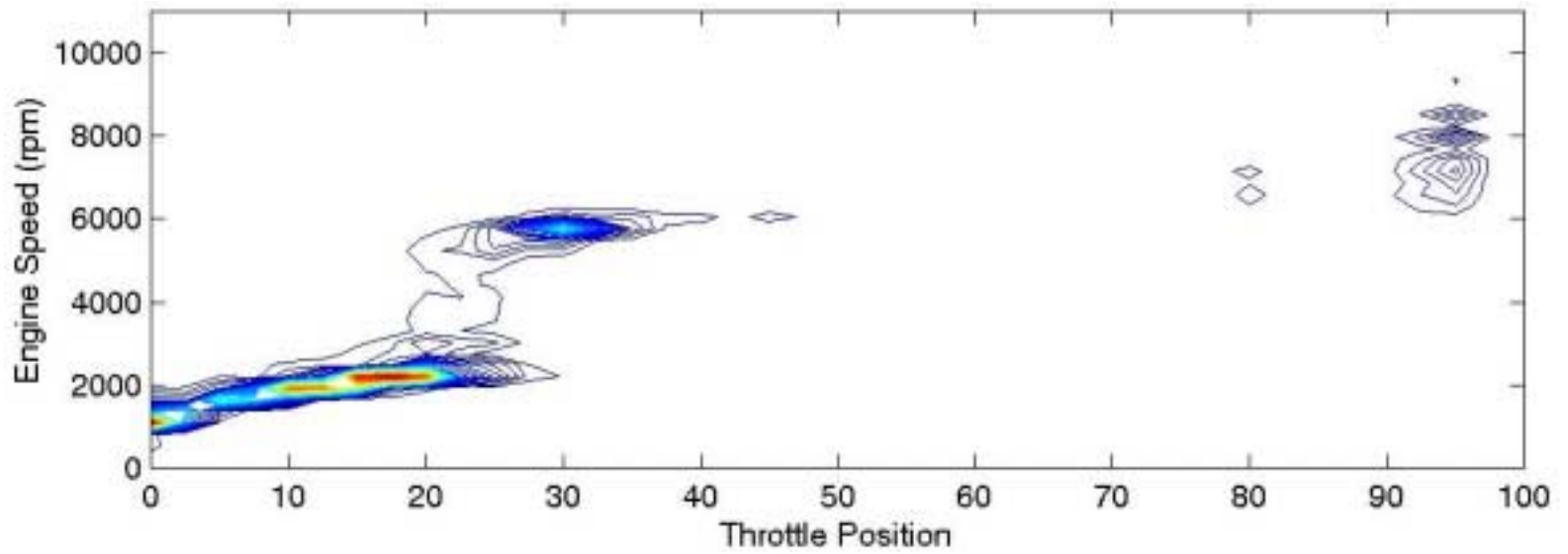


## Data From 155 Hp PWCs Show A Different Trend

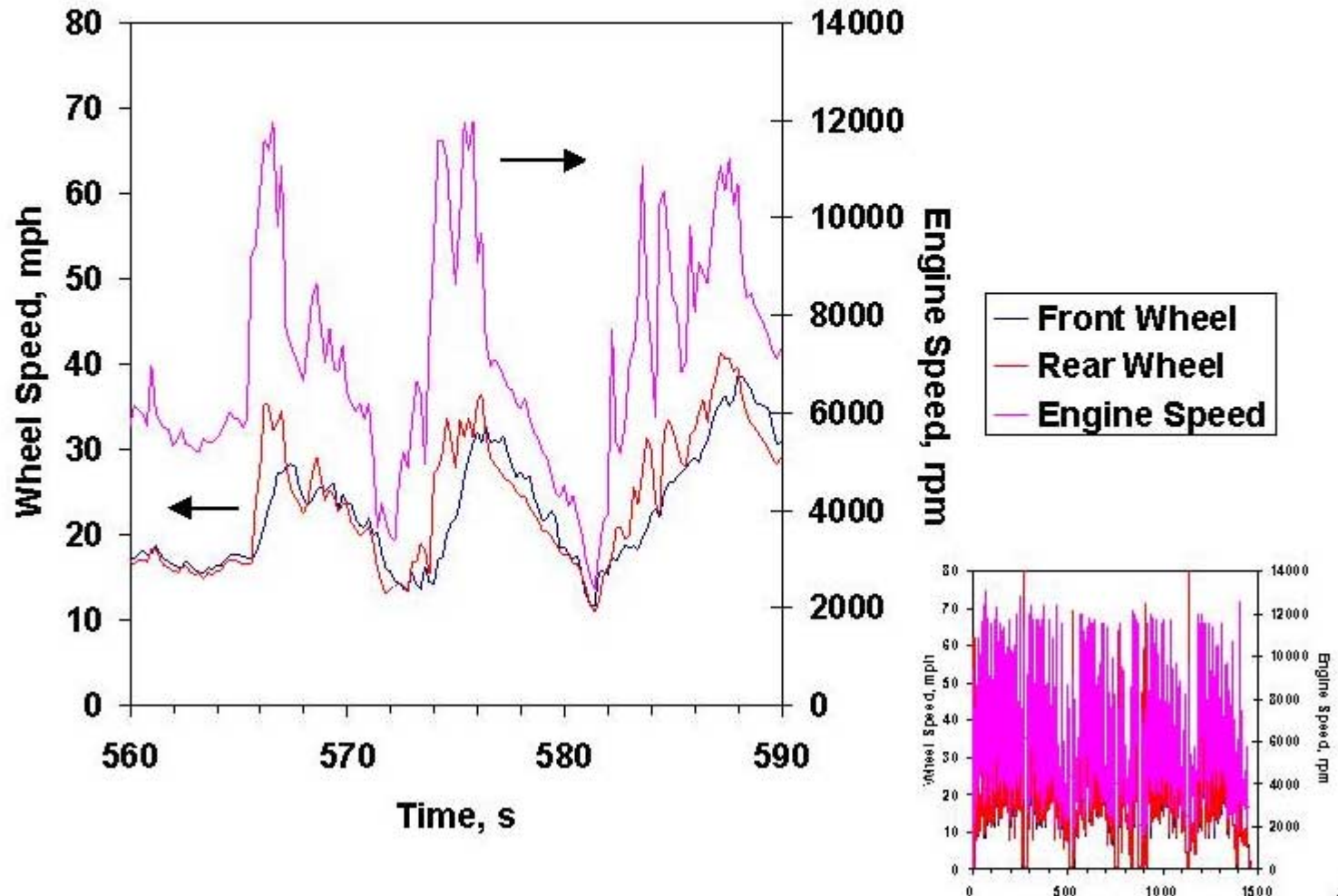








# 51 Off-Highway Vehicles Have Been Tested To Date





## **Conclusions**

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- **Recreational vehicle activity data will be useful in understanding the manner in which these vehicles are used.**
- **These data will assist in the development of a representative duty cycle for each of the recreational vehicle classes investigated.**