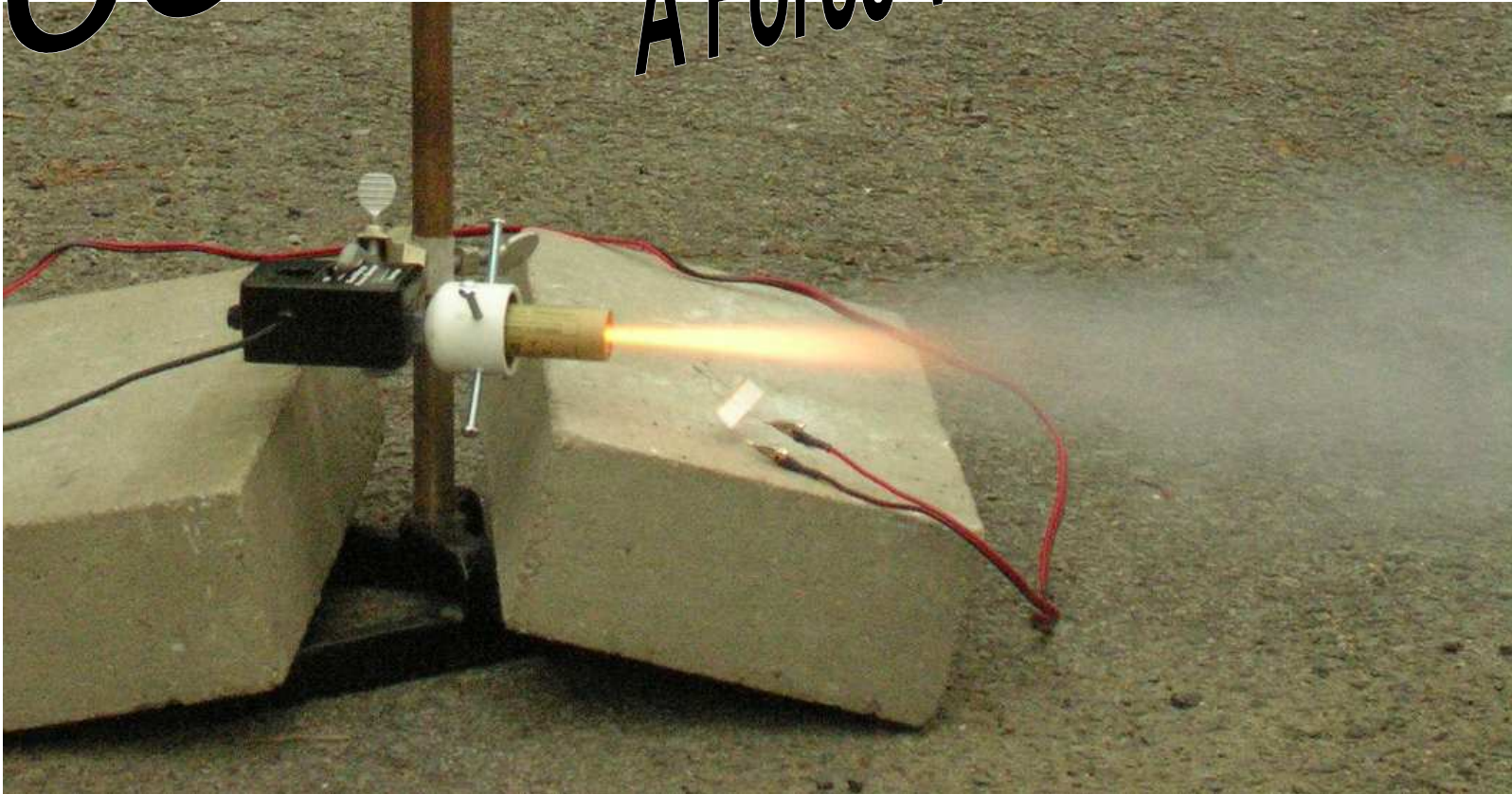


Rockets

A Force vs Time Lab



The University of Central Arkansas
Department of Physics & Astronomy

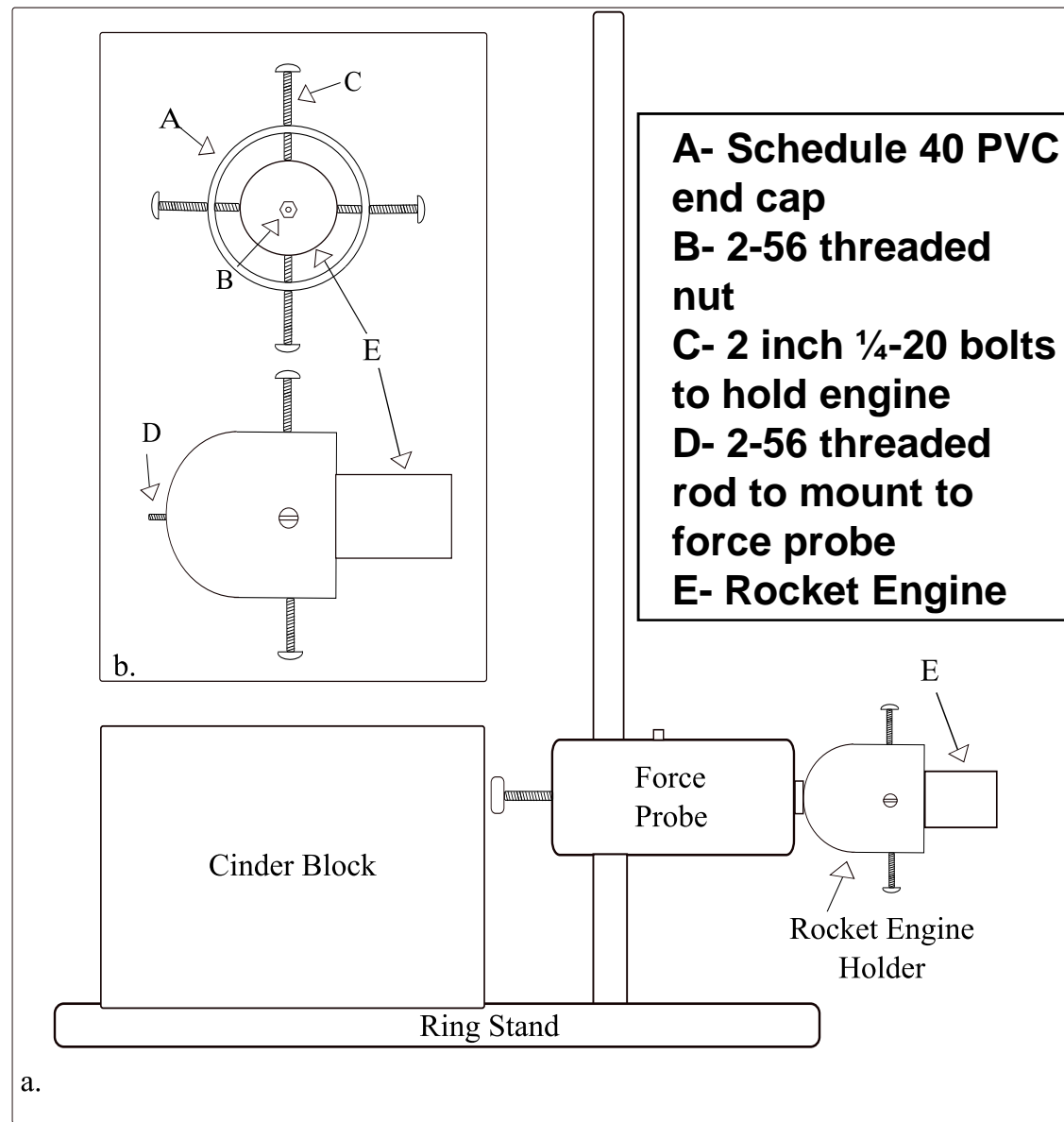
By Kim
Mason

Equipment

- LabPro
- Dual Range Force Sensor
- Estes rocket engines
- a mount to secure the rocket engine to the force probe



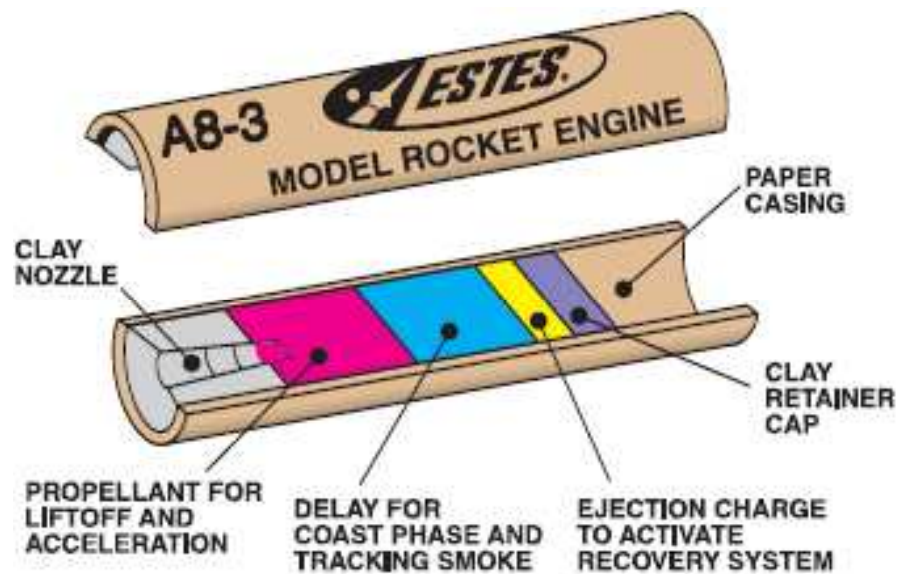
Rocket Engine Holder



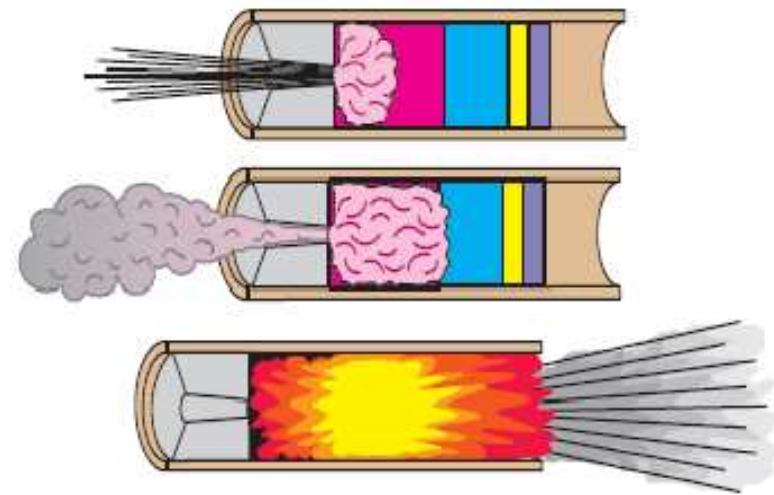
Rocket/Force Probe Set-up



How it works



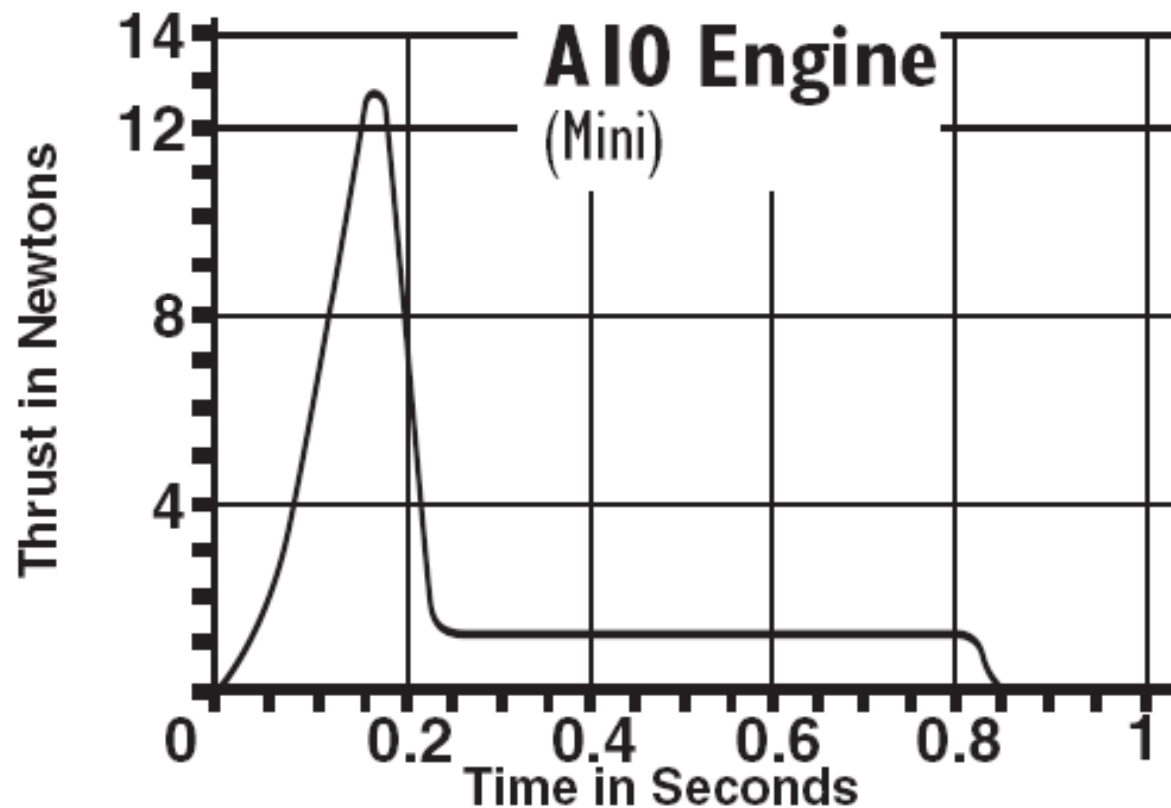
Photos from Estes Catalog



- 1st stage thrust
- 2nd stage tracking smoke
- 3rd stage deploys parachute

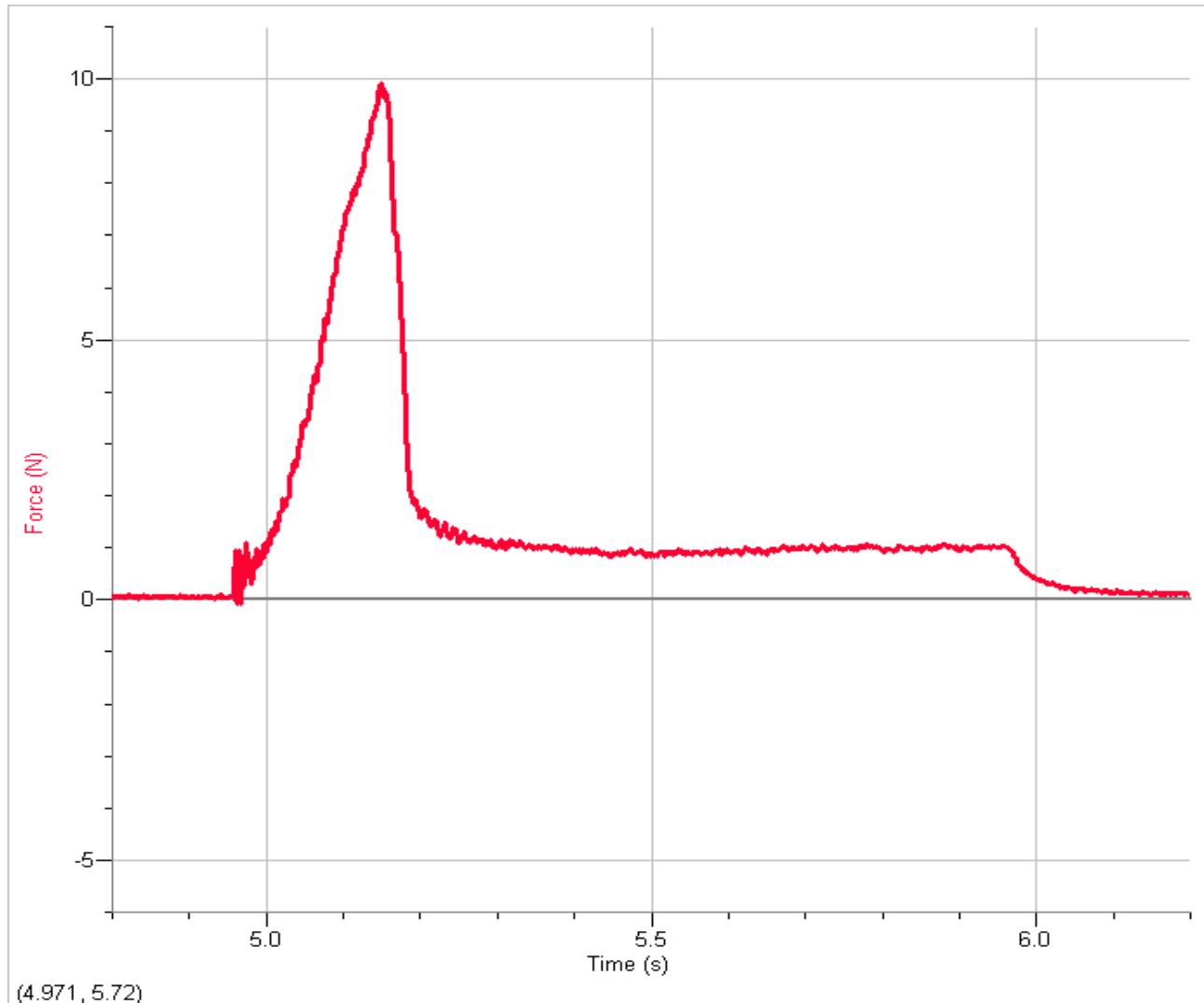


Estes thrust curve from Estes Catalog 2007



LoggerPro Data

Actual data using an A-10 model rocket engine (July 5, 2007)



$$\Delta P = \int F dt$$



Our Data

Engine Type	Total Impulse (N*s)	Max Thrust (N)
1/2A3	0.99 ±.05	7.95 ±1.24
A3-4T	2.01 ±.17	6.59 ±.14
A8-3	1.93 ±.15	8.40 ±.87
B4-4	4.02 .23	7.56 .38
B6-4	4.23 .11	10.50 .31
C6-5	8.07 .13	8.97 0.13
D12-3	16.31 .25	26.29 .45
E9-4	25.08 .46	20.78 .85

Engine Type	Total Impulse (N*s)	Max Thrust (N)
Our B6-4	4.23 ±.11	10.50 ±.31
Taitt B6-4 [1980]	4.3 + .3	10.9 +1.05
Estes B6-4 [1980]	4.32 .14	10.56 .90

Reasons for error:

- manufacturing differences
- shelf life
- imperfect leveling



Additional Information

- Vernier Website:
<http://www.vernier.com/>
- PASCO Website:
<http://www.pasco.com>
- Estes Catalog:
<http://www.estesrockets.com/assets/downloads/2007estescatalog.pdf>
- Henry A. Taitt and Charles E. Miller, Jr, "Impulse recorder for model rocket engines" *Phys. Teach.* **18**, 315-317 (April 1980)
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