E80 Rocket Course

Harvey Mudd College is proud of its two Astronauts—George "Pinky" Nelson '72 and Stan Love '87—as both flew in the Space Shuttle Program. Now we have a rocket course of our own. A key element of the philosophy of the Harvey Mudd College General Engineering education is that there are fundamental principles that are applicable to many engineering disciplines. Experimental Engineering (E80) is a sophomore-level, semester-long required course, which has striven to teach a large subset of these fundamental principles through multiple experiments in a number of engineering disciplines. We have redesigned the Experimental Engineering course to explicitly require learning in multiple engineering disciplines while directing all of the experiments to a final goal: to build, instrument, and fly a small rocket; and analyze and report on the data collected during the flight.

The project involves the creation of learning materials, teaching strategies, and equipment for a multidisciplinary experimental engineering course involving the instrumentation and testing of these small model rockets. The project includes the design, acquisition, and testing all of the pedagogy, hardware, and software necessary to implement the revised course. We are conducting the course several times with formal assessment, revising the course in response to that assessment, and are distributing the course plans, instrumentation requirements, and pedagogical results to the wider academic community.

The course, which is relevant to seven engineering disciplines (Chemical, Civil, Computer, Control Systems, Electrical, Mechanical, Structural), is complex and requires a significant amount of sophisticated materials and equipment to achieve the course goals and objectives. External support is required to meet this costly endeavor. The primary items still needed include:

- Wind Tunnel – large enough for a 4-foot long rocket and 400 MPH wind speed.
- Wind Tunnel Equipment – Pitot Tubes, pressure sensors, force sensors, torsion sensors, flow visualizers, other support equipment.
- Support table for custom turntable, 4-foot by 4-foot or larger, preferably granite top, but any rigid table (like optical table) would do.
- Environmental chamber large enough to hold a 4-foot rocket, –30°C to 50°C temperature range.
- Vacuum chamber large enough to hold a 4-foot rocket, pressure down to 0.1 bar or 100 torr, pressure must be stable, but not very low.
- 2 E-Z Ups or equivalent portable awnings.
- Portable generator such as the Honda EU2000iA.
- Outdoor public address system.
- Large Screen, outdoor visible, video monitor. Video processing/routing equipment. Several video cameras such as MiniDV, or HD hard-disk based, must have external NTSC SDTV (RS-170) input.
- 7 Laptop computers for outdoor field use and long battery life

Additional Components

Rouse-Tech, Aerotech, or Dr. Rocket RMS reusable motor casings (We believe Rouse-Tech is the only firm still making them) all with plugged ends

Qty	Size
40	29-100
60	29-120
20	29-180
20	29-240

Qty	Size
60	38-120
20	38-240
20	38-360

Analog Devices (The exact component depends on our final design)

Qty	Component
60	BF538
30	AD22280-R2
30	ADXRS610
60	AD7689

Qty	Component
250	AD8608
60	REF192
60	REF193
60	REF195

Freescale (The exact component depends on our final design)

Qty	Component
30	MPXV5050DP
30	MPXH6115A

uBlox

Qty	Component
30	NEO-4S

Texas Instruments

Qty	Component
60	CC1101

Small Thermistors with time constant of 1 second in still air or smaller (faster).

InvenSense

Qty	Component
60	IDG-300 or IDG-600

ST Microelectronics

Qty	Component
30	LIS344ALH

PNI Sensor Corporation

Qty	Component
30	MicroMag3 or Sen-XY + Sen-Z + ASIC

OEMCameras.com

Qty	Component
30	RHPC-2000

MicroCameras.com

Qty	Component
30	200mW 2.4GHz Audio/Video Transmitter with Receiver

Any source

Qty	Component
25	Kevlar-composite tube 2.152-inch ID, 1/32-inch wall, 4-foot length
25	Kevlar-composite tube 1.5-inch ID, 1/32-inch wall, 2-foot length
25	Graphite-composite sheet 6-inch by 6-inch, 1/16-inch thick

Public Missiles Limited

Qty	Component
30	PNC-2.1 Plastic Nosecone
10	PT-1.5 Phenolic Airframe Tubing

Please contact Professor Erik Spjut at 909-607-3890 if you have any questions concerning the equipment and components listed above.