2.00AJ / 16.00AJ Exploring Sea, Space, & Earth: Fundamentals of Engineering Design
Spring 2009

Design Notebook

*based on 2.009 & 2.007 Design Notebook requirements

Each class member is required to keep an up-to-date design notebook throughout the term. It is a good design practice to carefully document the history of your work. Also, notebooks are required in professional practice.

The design notebook contributes to a significant portion of your final grade. At the end of the semester, your design notebook should be a significant component of your final design portfolio. Examples from a previous 2.009 student's notebook are attached to this document. You can also access these examples on the course website.

Use your notebook to document all of your work and contributions towards your team's project. The design notebook should be in an 8.5 x 11 spiral bound format. Please be sure to write the date on each page when you make entries.

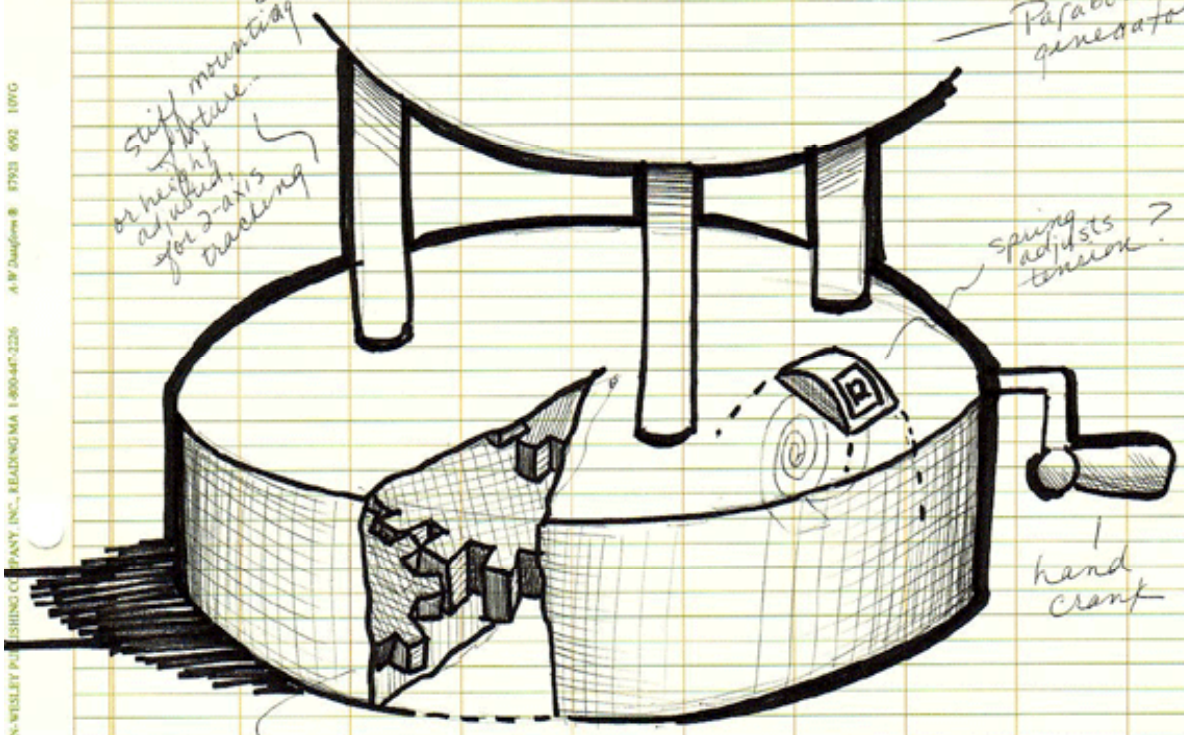
Your lab instructor will review your notebook periodically throughout the semester during lab, as indicated throughout the course schedule.

In practice, design notebooks are important legal documents, and they should be something of which you are proud—it should not resemble a trash bin. Illegible notebooks will receive a failing grade.

Mechanical Solar Positioner

9.27.04

for parabolic generator

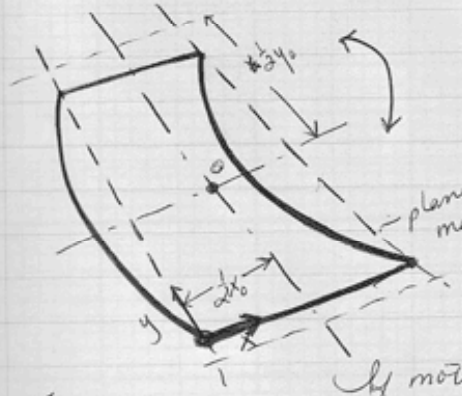


- Dial set to number of daylight hours, changing with season
- Hand crank winds up enough power to turn base automatically each day
- System of internal gears turns 180°, to follow sun, divided into the number of hours the sun moves.
- Benefits: More easily repaired by locals in case of sun and/or weather damage
  Possibly made locally, with local materials?
  Off Grid, low maintenence, reliable.
- Stable base beneath for power output, cords not being wrapped, intwined

Courtesy of Toni Ferreira. Used with permission.

10.1.04

Weight Load - Est 60-100kg



On the x-y plane (the fullest face of the parabola, corner to corner)

y_0 = Diagonal of frame = 103"

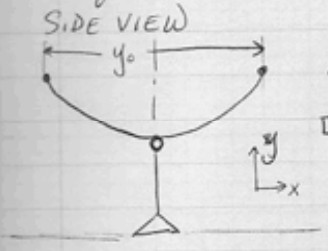
x_0 = width of panel = 51"

Weight load of bearing at $x = \frac{1}{2}x_0$ & $y = \frac{1}{2}y_0$

If motion is tracked on one axis...

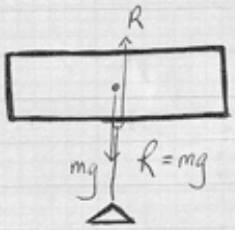
(i.e., rotated about point 0 ~~on~~ about the x axis only (at the point $y = \frac{1}{2}y_0$)

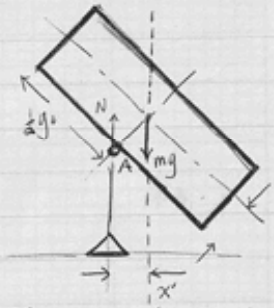
and assuming weight is evenly distributed over the length of the parabola...



approximate a block

symmetric about the $x = \frac{1}{2}x_0$ line



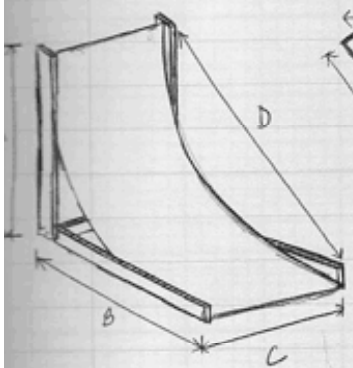


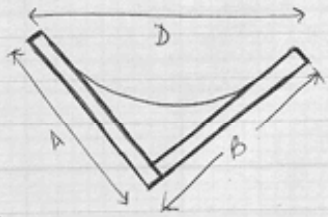
Max x' = ½ parabola height

Max moment about Point A -

$M_A = \frac{1}{2}(\text{parabola height})\,mg = 33" \cdot 80\,kg \cdot 9.8 = 0.8382m \cdot 9.8\frac{m}{s^2} \cdot 8$

$M_a =$





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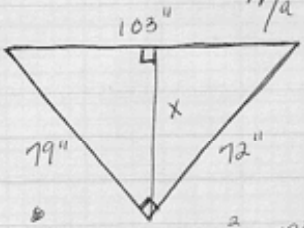


$103^2 = 79^2 + x^2$

$x^2 = 4368$

$x = \sqrt{4368}" \approx 66"$

A = 79"
B = 72"
C = 51"
D = 103"

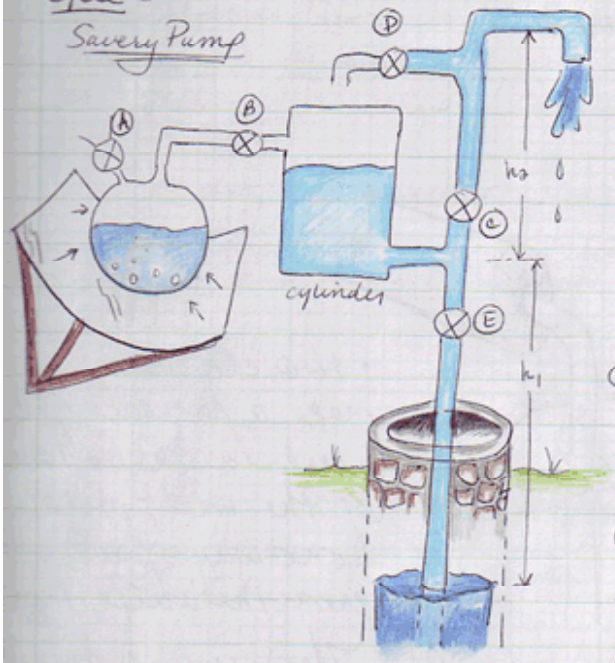
$\begin{array}{r} 103 \\ \times 103 \\ \hline 309 \\ 10300 \\ \hline 10609 \end{array}$ $\begin{array}{r} 79 \\ \times 79 \\ \hline 711 \\ 5530 \\ \hline 6241 \end{array}$ $\begin{array}{r} 10609 \\ -6241 \\ \hline 4368 \end{array}$

$\begin{array}{r} 2.54 \\ \times 33 \\ \hline 762 \\ +7620 \\ \hline 83.82cm \end{array} = 0.8382\,m$

Average est mass = $\frac{60+100\,kg}{2} = 80\,kg$

Nov 3rd 2004

Cycle -
Savery Pump



① Valve A is opened on boiler; known quantity of water is entered, to produce the amount of steam required to pump it's equal volume of water from the well

② Boiler heated by trough; produces steam @ a pressure GREATER than 1 ATM.

③ Open valves (B) + (C), close (A) (D) & (E)
The steam fills the boiler, the PRESSURE of the steam can pump the water in the cylinder out to height h_2.

④ Once the cylinder fills w/ steam, the valves (B) + (C) are closed. (A) Remains closed. (D) and (E) are opened, a small amount of the remaining water in the pipe comes out pipe (D) and cools the cylinder, compressing the vapor (steam) and creating a vacuum.
Water will then be raised to a height h_1, and proceed to fill the cylinder.

Repeating Process ① → ④ will pump water from the well out to height h_2. h_1 can be up to 34 ft

"Injector Pump" @ 60 Psi

① Huge trough required for 60 Psi
② 60 Psi - dangerous
③ Alternate energy source NOT IDEAL