

**Architecture 4.411**  
**Building Technology Laboratory**  
**Spring 2004**

**Assignment 3 Solar Heating and Building Thermal Dynamics**

**February 18 and 19, 2004**

The third phase of our first lab consists of six parts:

1. Submit your estimate of your elf-house temperatures for the first test period.
2. Download data. Please remove your Hobo loggers, download the data, and save them in a suitable format, for use in a spreadsheet or Matlab. Re-launch the loggers. Review the data and use this review as a basis for modifying your elf house. Your review should be as quantitative as possible. Note the mean indoor and outdoor temperatures as a method to judge the adequacy of your thermal resistance and solar gain. Try adjusting your model with the solar calculator to match your measurements, as a means of estimating the time constant.
3. Modify your elf house as needed to keep the indoor temperature closer to the target value of 20 °C. Modifications might include (but are not limited to) a simple rotation of the house to change the solar gain, covering part of a window, and addition or removal of thermal mass or insulating material. Please use either the first and/or second spreadsheet design tool (SolarCalculator 1 and SolarCalculator 2) as a guide to your modifications. Your lab report should document the calculations you made in support of changes to your house.
4. Re-install the Hobo loggers and again deploy your house on the roof . Your elf house should be deployed for a full week, starting no later than next Monday. Please contact the teaching assistant when your house is ready to go.
5. Estimate the impact of solar energy absorbed on walls and the roof. Here you will want to make use of SolarCalculator 2. Please use this spreadsheet in two ways, with and without the impact of absorbed solar energy, note the differences, and assess their significance.
6. Use Solar Calculator 2 to design a full-size dwelling (single room is fine), subject to the same goal of a constant 20 °C indoor temperature under February weather. Make use of night insulation on windows and day-time ventilation as desired. Real people, not mythical elves, can be asked to control their environment. The objective here is to get some feeling as to whether our target is easier to obtain at full scale, with some day-night adjustments.

Preview of next week's lab: For the second test week, you will again estimate the performance of your elfhouse and compare with your measurements. This time, you will make an estimate after the temperature data are collected, using measured solar and outdoor temperature data.