

MEEN 108 TERM PROJECT

Problem Definition:

One of the areas currently experiencing the largest growth in the field of heat transfer is that of the thermal management of electronics. A typical problem is that which is faced by PC manufacturers in maintaining a steady temperature of the chip TCP (tape carrier package) on a motherboard. As the competitive selling price of PCs drops, it becomes imperative to find new cost control measures. The elimination of non-value added components is a standard practice.

Assume that you are a thermal engineer working for Dell, and you are assigned the task of developing a method of cooling the chip in a new model of laptop computer. You are faced with several design constraints including, but not limited to:

- 1) *Space* – The smallest possible heat transfer method is preferred. In this case, the usual method is to employ a heat pipe. This type of heat exchanger is very compact and has no moving parts other than the fluid.
- 2) *Cost* – A fan, as used in most personal and laptop computers, is a costly item, typically around \$5 each. Elimination of such a component is a major cost savings and a great boost to your engineering career!
- 3) *Reliability* - Fans, like all mechanical items, may fail. As overheating is attributable to approximately 60% of all electronics failures, reliability is an additional concern. Selection of a cooling method that minimizes sources of failure is paramount.
- 4) *Weight* – Laptops are not meant for body building! Your thermal management system should be as light as possible.

Using the techniques learned in this course, design a thermal management system for the new Dell laptop that incorporates the best of the above features. There are numerous methods to use, again including, but not limited to, heat pipes, heat sinks, heat spreaders, vapor chambers and thermo-electric coolers. Your design criteria are:

- 1) Chip heat load is 50W on a single large chip that measures 2.5 cm X 2.5 cm.
- 2) Clearance over the maximum height of the TCP to the top of the case is 0.5 inches.
- 3) Chip operating temperature is to be maintained at 80°C.

Hints:

- Use the “El Compendex Plus Engineering Index” in the Science Library to find relevant sources of information.
- Good websites for heat pipe information are <http://www.thermacore.com/papers.htm> and <http://www.enertron-inc.com/library.htm>.
- You are not restricted to using only one mechanism. Multiple heat pipes or a combination of techniques may be necessary.
- You may assume other non-specified parameters such as ambient temperature. However, be sure to state your assumptions in your solution.