



Progress Report #2

Project

PC Performance Maximization through the use of Overclocking and Active Cooling

Supervisor

Warren Little, Electrical Engineering Department

Team Members

Dale Gagne, EE, ID# 9806915
Jason Vath, EE, ID# 9704365

Problem

With the advent of rising clock rates in personal computers, the requirement for improved thermal management of the microprocessor and other components becomes a necessity. Through improved thermal management, we strive to extend the boundaries of PC performance.

Objective

To understand the operational characteristics and limitations of an Intel based PC. Once limitations are understood the team will strive to maximize performance through active cooling methods on the microprocessor and chipset.

Scope

1. The relationship between computational performance and front side bus speed will be analyzed.
2. The correlation between increased front side bus speed and processor heat dissipation will be examined.
3. The relationship between processor temperature and operational stability will be characterized.
4. Alternative methods for active cooling of the processor and chipset will be studied and employed to further extend thermal stability limitations.
5. Temperature regulation of the processor and its feasibility will be investigated.
6. All designs will minimize the probability of condensation occurring within the PC.

Timetable

Feb 17. Second Progress Report:

- Cooling blocks completed for processor and chipset.
- Plans and partial completion of the cooling reservoir.
- Partial design of switching DC-DC power supply for powering the thermoelectric cooler.
- Water pump ordered and expected to arrive before Feb. 23.
- Website is active at www.engr.uvic.ca/~jvath/Liquid_Overdrive/index.html

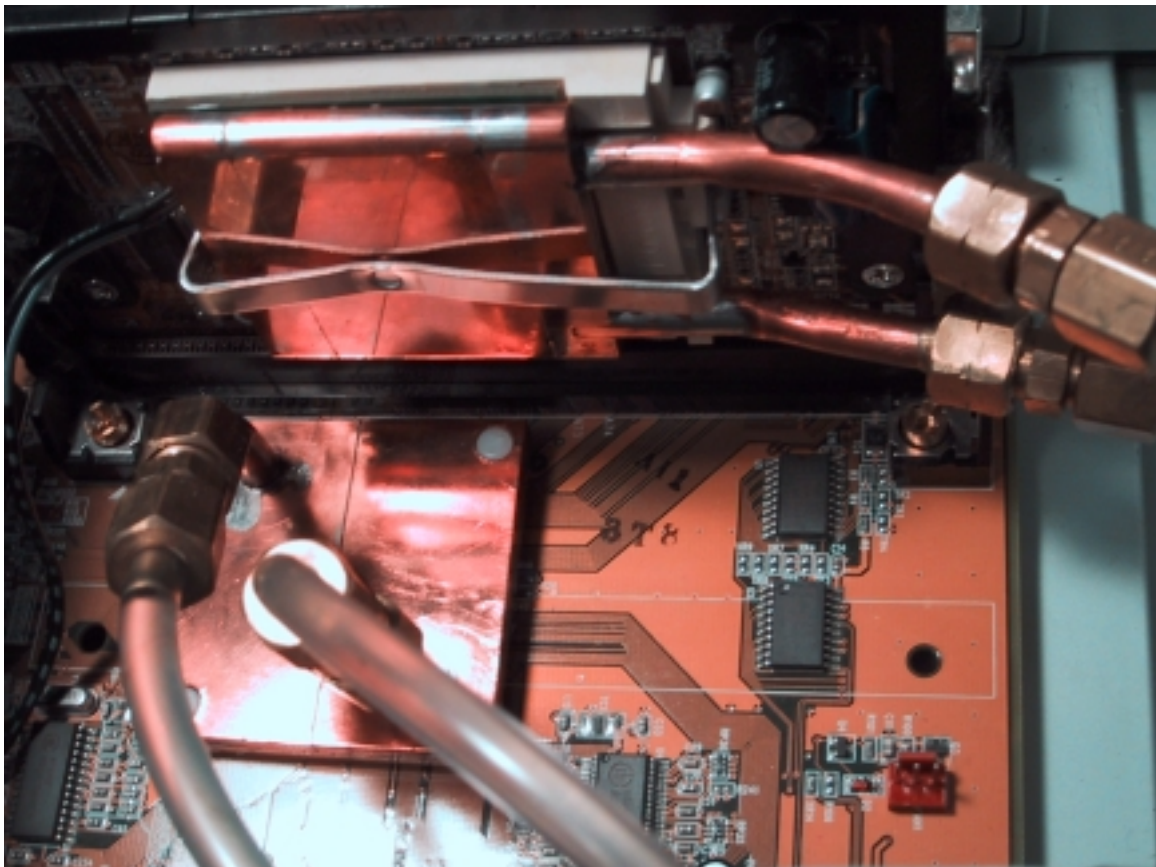
Cooling Blocks

The copper cooling blocks for the processor and chipset are built and pressure tested to 40 psi.

Cooling blocks are assembled from 2" x 1/4" copper bar. Inside the block a serpentine channel was drilled to allow for maximum cooling throughout the block. 1/4" copper pipe was soldered to 1/4" holes drilled into the copper block for external connections. Copper pipefittings and 1/4" poly tubing is used for fluid interconnections. Utility water is currently being used for cooling. The utility water will be disconnected and replaced by the cooling reservoir and pump upon completion.

Photos of the assembled cooling system are shown below.

Processor and Chipset Cooling Blocks



Processor and Chipset Cooling Blocks



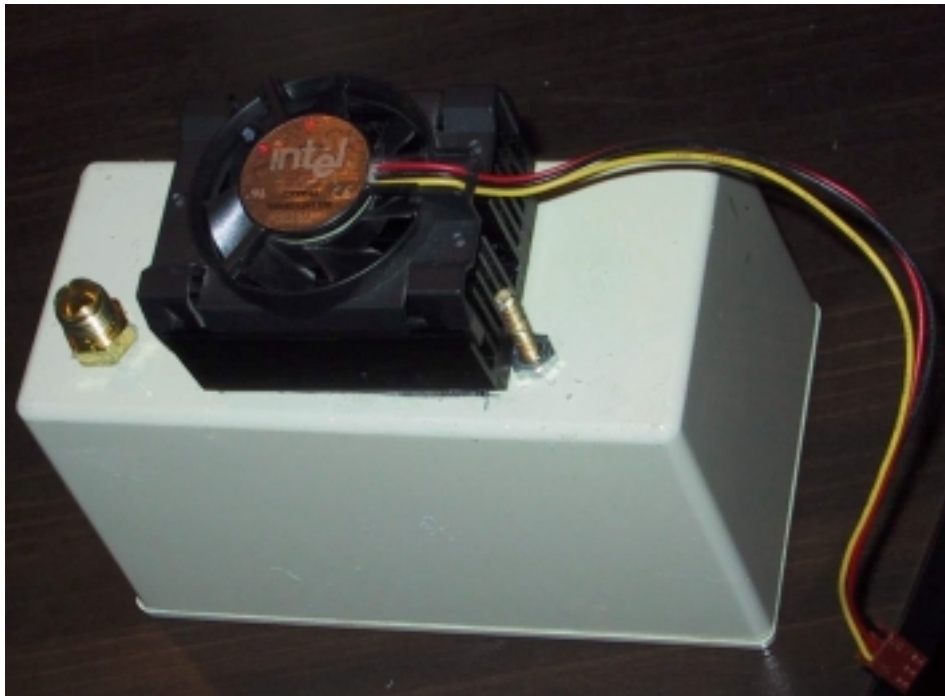
Cooling Reservoir

The cooling reservoir cannot be completed until we receive the water pump. I have confirmed with the supplier that it has been shipped and we should receive it before the end of next week.

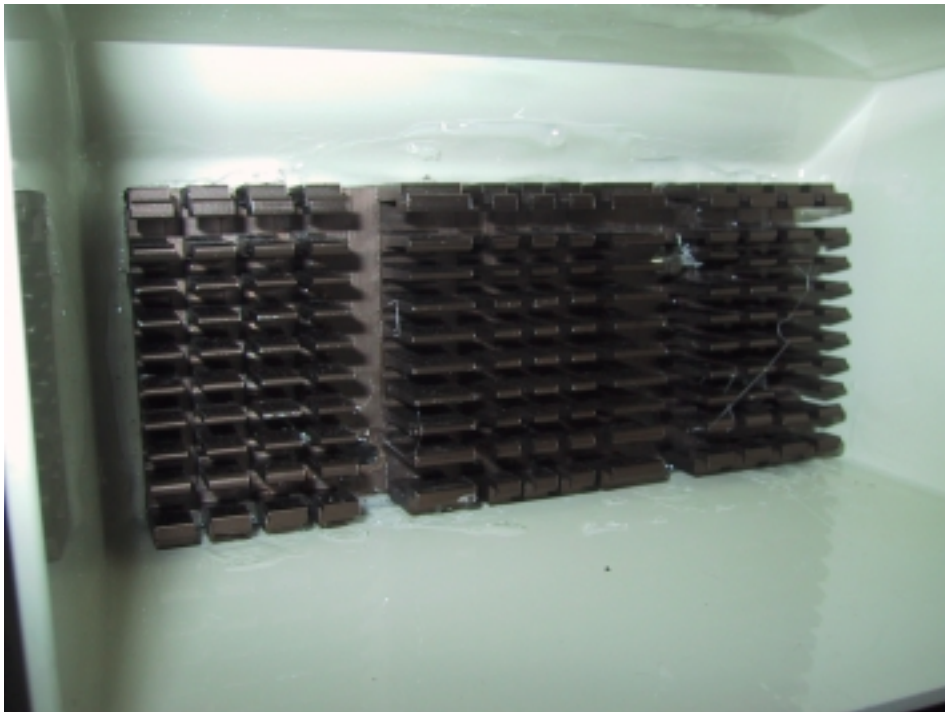
The cooling reservoir is composed of a plastic container, which has been fitted with an internal heatsink for cooling the water. The thermoelectric cooler is sandwiched between the internal heatsink and an external heatsink. The thermoelectric cooler produces a temperature differential across the junction when DC voltage is applied. To maximize the cooling of the water within the reservoir the hot side of the thermoelectric device must be kept as cool as possible. This is done through forced air cooling on the external heatsink. A stock Intel PIII heatsink and fan were used for this purpose.

Photos of the uncompleted cooling reservoir and the heat sink and fan are shown below.

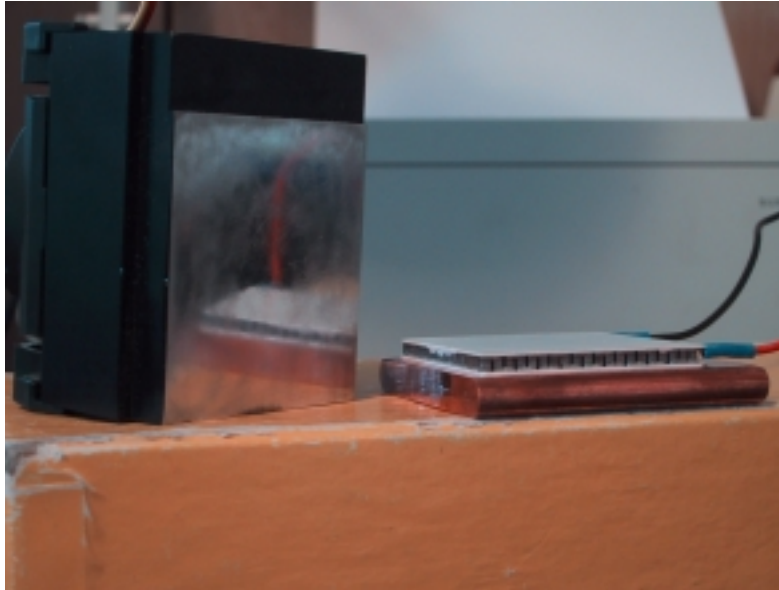
Cooling Reservoir with External Heatsink and Fan



Cooling Reservoir with Internal Heatsink



External Heatsink and Thermoelectric Cooler



DC-DC Switching Power Supply

A DC-DC switching power supply was designed to power the thermoelectric device. The power supply will use 12V input from the computer power supply and output a variable 0-16V to the thermoelectric device. Eventually closed loop temperature control will use the variable output of the power supply to adjust the water temperature.

A representative schematic is shown below.

