Good morning. We are the team responsible for the project CanACork. Today we will be reviewing and discussing the results obtained from our satellite's launch.
Our project's main idea was born out of the current need for sustainable and cost-effective upgrades to current satellites. The focus revolved around the CanSat's thermal management. Usually, the heat flows originated by electronic components are discarded into space to prevent the system from overheating. So, our interest lied on the potential use of this residual heat as a way of generating electrical power to feed in the main power system. How were we going to accomplish this?
Well, due to its accessibility and previous uses in spacecrafts we opted for a case made of cork, in place of the usual aluminium or plastic. Interestingly this material withstands incredibly high temperature conditions and is in fact an excellent thermal insulator. For this reason, it would retain the system's internal heat extremely well.
Now, part of its mission includes measuring and collecting data on the atmospheric pressure and temperature. Unfortunately, though the telemetry was fully functional for the 22 minutes that the Cansat was on, we were only able to collect data for the first 15s of flight. That being said, our graphical analysis will be complimented by the data obtained by our fellow team, HermesSat.
Firstly we graphed the time as a function of temperature. This figure shows how the temperaure varied the entire time our satellite was active. The expected temperature decrease is only perceptive at the end of the graph, since it corresponds to the time frame where the satellite was actually launched. In contrast, the increase visbible here is actually the wait time before the launch, where the sensors read the increase of internal heat. Now, looking at the figure from HermeSat, we can ascertain that the our data recovered from those 15 seconds coincides with the initial variation in their graph line.

Analogously, the data for atmospheric pressures, by the graph, indicates the expected linear decrease, down to approx 830 hPa in the initial 20 seconds. This is because the satellite is ascending, that is the altitude (obtained through pressure values) is increasing. Then, the pattern reverts when the Cansat reaches the apogene and starts descending, having the pressure reaching 1000 hpa in the end.
With this the altitude graph, we could calculate the terminal velocity, using the derivative of the function, in this time interval.
Secondary mission.
The notable element of our mission is the use of a thermoelectric generator (TEG), which is a device that generates energy through a temperature gradient, explained by the Seebeck effect. This gradient was attained using the CanSat's internal heat and the exterior's colder conditions. Theoretically, since the atmospheric temperature lowers with altitude and, simultaneously, the CanSat's internal heat increases, we would be able to generate more power as the satellite ascends. The data obtained allows to verify the power generated by the TEG and evaluate the efficiency of this mechanism.
As we will see now in the graphs, the energy generated by the TEG is clearly insufficient to potentially feed an entire electronical system.
The first graph shows the temperature variation as a function of generated power, calculated through the values in the datasheet of the generator we used. The relevant

range of temperature to be considered is (point), therefore implying already a low amount of generated power, which equates to a minimal production of energy. However, as is visible here, that is the values determined by the voltage and current measured by the multimeter in the Cansat, the results were much lower than expected, dare we say, even negligible.

Consequently, it becomes evident that the generated power is significantly inferior to the power consumed. The energy produced, calculated using the area of the graph, amounted to x.

Hence, the power yielded to 1.22 x 10-4%, which indicates clearly the inefficacy of this mechanism as a satellite's source of energy.

However as we didn't have data that corresponds to the maximum differential temperature, we decided to make an experiment with ice. In order to make this test, we froze a bottle of water in the fridge and put it in the cold side of the thermoelectric generator while our arduino was working. As you can see in these graphs, eventhough the bigger temperature gap, the power produced was still residual when compared to the power used. As before, the energy value is calculated through the area of the graphs of power over time which is 5.67 x10^6 microjoules of energy used by our electrical components and 4.49x10^2 microjoules of energy recovered by our thermoelectric generator. For instance, the yield of energy recovered in this test was 7.91x 10^-3 percent, which is still minimal eventhough there was a bigger temperature amplitude.

Therefore, for this percentages we came to the conclusion that the use of thermoelectric generators isn't viable to replace other methods of recovering energy such as solar panels.

Overall, from these experimental values, we can point out some flaws and problem with CanACork's model

On one hand, even though cork's thermal properties might seem an attractive choice to keep the heat needed in the system, this can easily backfire as the heat retention dramatically increases. Actually, this thermal mismanagement ended up compromising the function of our processor. Because we didn't account for unforeseen issues with delays in the launch, our CanSat was not ready to bear the amount of heat generated in those extra 20 minutes it was on. Hence, our processor overheated, and our sensors were not able to read the necessary data. This implies, perhaps, a more strategic and moderate use of this material in order to avoid this problem in the future.