

# **Anevas Tech. Portable Bench**

## **Post Mortem Analysis**

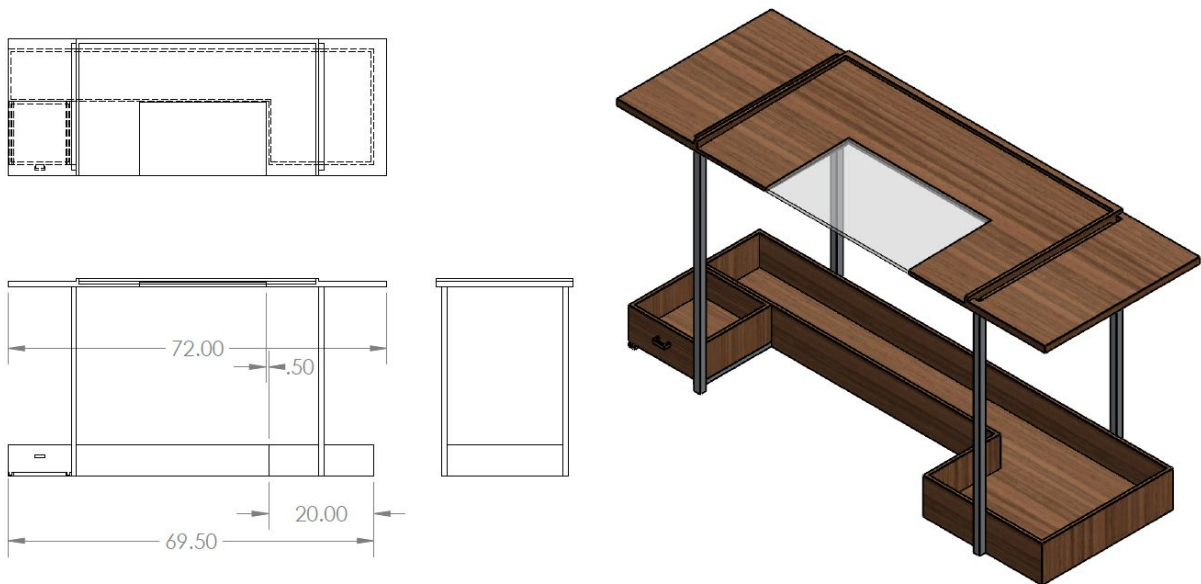
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**Introduction:** This analysis discusses the team’s progress of the portable bench project over the ME-476C course. It specifies the key contributions to the team’s success as well as what could have been improved upon. The team’s initial goals for the semester are evaluated along with regulations established in the charter. The team also reevaluates the negative aspects of their performance to establish more productive habits.

The Aneuvus Technologies Inc. (ATI) project tasks the team with the design and construction of a portable medical bench. The bench’s main functional requirements include transporting the medical devices used in the research of treating aneurysms, compatibility with fluoroscopic imaging, and shock absorption wheels. The project’s client wishes to replace the existing bench design with one that has more functions and makes the research process easier and more protective of the research devices. Upon completion of the bench, the project’s client will be able to transport medical devices in a safer and more effective manner. With the added requirements, the new design will offer more functionality than the previous. Although there is an existing bench design that is able to transport medical devices, an improvement is much needed, as it is not x-ray compatible and is only used for storage and transport, because it does not support the associated hood and air filter. With the addition of the concepts being considered in this project, the new design will be able to do the same functions as the old but will improve on these functions and add to them. The new design will secure the devices, be x-ray compatible, be constructed with shock absorbing tires, designed to prevent spills, and add storage space. These improvements will make the job of the project’s client easier and allow for more effective treatment for patients. The design resulting from the first semester, ME-476C, is shown in Figure 1. The tabletop has a polycarbonate workspace for x-ray compatibility, The tabletop is tilted forward to drain spills. The legs support the associated clean room hood by the corners of its frame, for maximum support and safety, and minimal bending. The storage allows space for sitting, so that the table can be used as a research desk, and includes a drawer for office supplies, as requested by the client. The frame provides additional central support to the storage area that will house the heavier research equipment. Polyurethane foam tires are attached to the bases of the legs for shock absorption. This selection was instructed from the client, as the polyurethane foam wheelbarrow tires will not deflate or flatten.



*Figure 1: Final Assembly SolidWorks Design*

### **Contributors to Project Success:**

As described in the charter, the purpose is designing and constructing a bench compatible with ATI's devices, procedures, and delicate brain blood flow model. The bench will be used to transport the experimental setup to adjacent buildings, in addition to the usual requirements - compatible with and non-intrusive of ATI's medical tests supportive of the setup's size and weight, and providing security of additional accessories and storage. A working portable bench will be tested, prototyped, and constructed by the end of the Capstone period. For the progress through the first semester, the team wanted to establish the design and material selection for the bench. Through prototyping, individual analysis, and research, the team was able to complete a design and decide upon the project's material. The team has successfully followed the purpose of the project. The goals outlined in the charter define the parameters that the bench design needs to follow for it to be successful and viable for its uses. In the process of developing the device, the team hopes to gain experience in working with project expectations and designing a functioning product that meets requirements and is of high quality. During the first semester, the team gained lots of experience working with changing expectations and developing a functioning product alongside the preferences of the client. The team wants to honor Aneuvus Technologies, Inc.'s mission to improve human healthcare by designing minimally invasive devices for treatment of vascular defects. Through the first semester, the team worked carefully with the preferences and requirements of the research laboratory to ensure the research would be carried out easily and effectively through the use of the medical bench. The team honored each of the requirements that the research laboratory indicated would be helpful to have as part of their bench. The goals also included creating a cost effective device and staying within budget, which the team has carefully planned out and has successfully plotted a way to stay within budget.

Some ground rules that the team established included meeting in person weekly in the engineering building, consistent communication with the project client and instructor, and respect given to all team members. The team did very well in keeping up with the scheduled meetings, this became essential to the project's success. Consistent communication with the project's client was at times difficult, a new form of communication other than email may be proposed to improve this. The team established an every other week meeting time with the client to discuss where the project stood and where it was heading. The team members all respected and supported each other throughout the semester.

Meeting often within the team encouraged quality submittals, because each assignment was edited by the by every team member according to the rubric. There were only a few times that an aspect of an assignment was missed because each member reviewed the assignments to account for quality. Though it made it more difficult to organize which responsibilities belonged to specifically which team member overall, having every team member help each other with tasks allowed for higher quality of each submittal. The team accounted for organizing responsibilities on an assignment-by-assignment basis, where each team member was given tasks for each assignment. Often, team members would help each other complete their tasks. A way to improve organization is to have more pre-defined roles and responsibilities for each team member to more uniformly follow throughout the semester.

Successful performance from the team was seen most when our artificial deadlines were followed and when a team member asked for help on a task early on in the assignment. The tools used during the semester included SolidWorks, which was explored by each of the team members through their self assignments, and individual analyses. The individual analyses regarded drainage, frame strength, and tabletop strength. Considering these aspects allowed the team to verify and expand on specific aspects of the project.

Some technical lessons that were learned were improving SolidWorks skills. Because an actual product will be made from this, GD&T had to be taken into account. Also, more time had to be brought into the

CAD because of the fact that the product will be manufactured, and considering someone would have to review the drawings in order to do so.

### **Opportunities/Areas for Improvement:**

The team overall has been successful regarding the purpose, and has stuck to the general purpose of helping ATI's research laboratory by frequently working alongside them to develop their bench. The goals have become more difficult to achieve as they continue to be detailed by the client. The final proposal design did not address an issue brought up by the client too late into the semester. The goals included parameters for the bench to be viable, and the proposed bench meets all of the goals presented in the team charter. Additional goals, however, were introduced to the project throughout the semester, and not all of those obstacles have been resolved at this time.

One major thing that could be improved upon would be client meetings. Meeting up with the client at times was difficult due to the client not being able to make meetings, or just not showing up at all. Because of this, the team could not get certain questions asked and answered at times and either had to wait until a later date or incorporate those specific ideas anyway and ask for feedback later.

Not much was negative about the team as a whole but one thing that could be improved upon would be time management. At times, it seemed like the team was scrapped for time. One example of this would be the final CAD. The team had some things that needed to be addressed with the client but was unable to until a date closer to the due date because of what was addressed above, client issues. This major design obstacle was discovered toward the end of the ME-476C course, when the client indicated that he wanted to be able to store the air filter in the bottom of the portable bench, a problem not previously explored. The issue is that the air filter's dimensions exactly match the top of the table's hood/ Both are heavy so the four corners of the hood should be directly supported by the table legs, achieved through locating the table legs directly beneath these four corners. Because the air filter's dimensions match the hood, there is insufficient room to store the hood horizontally beneath the tabletop. Storing the hood vertically may be an issue for the client, because it is heavy so maneuvering it to place sideways beneath the tabletop may be difficult, but the client was unable to meet to discuss solutions to this. This problem should be the starting point to the semester.

A way to improve the design of the bench would be to improve the SolidWorks model of the bench components. The team members all studied SolidWorks further for their self assignments, but the design of the bench still requires further SolidWorks development. This tool will increase the performance of the bench before it is constructed. An important technical lesson to learn will be for manufacturing the bench, specifically the steel frame. Welding will either need to be learned by a team member or will be outsourced, especially if fitting the air filter below the tabletop will require widening of the frame.

Some organizational actions that can be taken to improve performance is more defined roles. Being a small team, at times one member of the team had much more work to do than others because of roles constantly changing. The team is going to analyze defined roles to have a more balanced workload. Some of the problems that the team encountered was discussed above with client meetings, or lack thereof at times.