

ACTION ITEMS

TEAM: 23 Clean Room

Due Date:

Monday, April 22nd, 2019 5:00pm

The following are the Action Items from last week:

Team Member: Katie Hoffman

Action Item	Date Due	Date Completed	Result/Proof of Completion
Worked on Final Presentation	April 22, 2019	April 22, 2019	Worked on final presentation. Appx B
Worked on Poster	April 19, 2019	April 19, 2019	Edited and finished the UGRADs Poster. Submitted to bblearn. Appx D
Worked on Operations Manual	April 22, 2019	April 22, 2019	Added Troubleshooting sections and relocating instructions. Appx E

Team Member: Daniel Marquez

Action Item	Date Due	Date Completed	Result/Proof of Completion
Finished bottom Portion of room	Apr 22, 2019	Apr 19, 2019	Grinded and welded telescoping components of the room appendix A
Worked On poster as a team	Apr 22, 2019	Apr 19, 2019	Submitted to BBlearn
Contacted Becker	Apr 22, 2019	Apr 18, 2019	Emailed Becker on Pressure transducer testing Appendix C

Team Member: Hannah Reed

Action Item	Date Due	Date Completed	Result/Proof of Completion
Worked on the Operation Manual.	Apr. 26, 2019		Work was not completed.

Helped with and finished the Poster.	Apr. 19, 2019	Apr. 19, 2019	Did the overall formatting for the poster and edited the sections for grammar. completed with team, turned into bblearn and emailed. Ready for pick up. Appendix F.
Edits on Final Report	Apr. 29, 2019		Was not able to start editing the final report at this time.
UGRADS Presentation updates.	Apr. 25, 2019	Apr. 22, 2019	Work on and completed slides 1-7, formatted 8-12 and just need bullet editing. Appendix H shows a completed slide with guidelines for formatting
Finished the CAD for the Hood.	May. 3, 2019	Apr. 19, 2019	Removed the reference geometry that was viewable and updated corresponding photos. Appendix G.

The following are the Action Items for next week:

Team Member	Action Items	Date Due
Katie Hoffman	<ol style="list-style-type: none"> 1. Work on Operations Manual (approx 3 hours) 2. Edit Final Report (approx. 2 hour) 3. Work on UGRADS Presentation (approx. 3 hours) 	<ol style="list-style-type: none"> 1. April 26, 2019 2. April 29, 2019 3. April 25, 2019
Daniel Marquez	<ol style="list-style-type: none"> 1. Ugrads Presentation(3 Hr) 2. Finish Welding steel (5 hrs) 3. Work on FInal Operation Manual (3 hr) 4. Do Pressure Testing (3 hr) 	<ol style="list-style-type: none"> 1. Apr 29, 2019 2. Apr 29, 2019 3. Apr 29, 2019 4. Apr 29, 2019
Hannah Reed	<ol style="list-style-type: none"> 1. Work on the the Operation manual (3hr) 2. Make edits to the Final Report (1hr) 3. Work on UGRADS presentation and get performance ready. (3hr) 4. Start working on and compiling documents for the Website. (1hr) 	<ol style="list-style-type: none"> 1. Apr. 26, 2019 1. Apr. 29, 2019 2. Apr. 26, 2019 3. Apr. 29, 2019

Daniel Marquez <dam286@nau.edu>
to Timothy ▾

Fri, Apr 19, 10:34 AM (3 days ago) ☆ ↶ ⋮

Hi,

I was wondering if you were able to read my previous email, with the concerns on the pressure testing for the hood.

Thanks,
Clean Room Team

Timothy A. Becker
to Christopher, me ▾

Fri, Apr 19, 11:32 AM (3 days ago) ☆ ↶ ⋮

I think you should try our pressure transducer setup before you default to a purely qualitative result. We'll be around this afternoon.

Chris: can you show the clean-room team our pressure transducers, and how they could be setup in LabView? They could use one transducer and record pressures inside the hood, then again outside the hood.

DrB

Tim Becker, PhD
Associate Professor of Practice
Co-Director, Bioengineering PhD Program
Mechanical Engineering (ME)
PI-Bioengineering Devices Lab (BDL)
Center for Bioengineering Innovation (CBI)
College of Engineering, Informatics, and Applied Sciences (CEIAS)
Northern Arizona University (NAU)

Appendix D

NAU Anevas Technologies, Inc. Clean Hood
Katie Hoffman, Daniel Marquez, Hannah Reed
Department of Mechanical Engineering
Northern Arizona University, Flagstaff, AZ 86001

Abstract
The project proposed, by Anevas Technologies, Inc. was to design and build a portable clean hood and manufacture a portable frame for a clean room. The project was completed by the client's faculty advisor Dr. Timothy Becker. The clean hood and room will benefit the client in manufacturing and scientific research on microchips. The objective was for both units to maintain a positive pressure, be portable, and to produce an environment free of foreign particles.

Construction
Construction consisted of various steps. The team started with the hood first by cutting the aluminum frame, then allowing for Palomino Glass to cut the polycarbonate, and the work order for welding the aluminum frame was requested. While the aluminum frame was being welded the team sprayed the polycarbonate. The final steps in manufacturing the hood were to attach the door with hinges, add corner brackets to the polycarbonate for stability, a handle to open the door, a latch with magnets to hold the door open, and a rubber strip to seal the fan unit to the frame and polycarbonate.

Testing
Table 2 below displays all Engineering requirements that were tested.

Engineering Requirements	Head Range	Room Range	Results
Area (in ²)	< 5.531	< 3.82	Hood = 0.754
Pressure (Pa)	> 78006	> 78006	Hood = 80790.2
Cost (\$)	< 2000	< 9000	~\$2000
Weight (kg)	< 40.00	< 133.8	Hood: 29.11
Assembly Time (min)	< 10	< 30	Hood: 1.40
Power FFU (W)	320	1040	Hood: 320
Particle Count (per m ³)	< 100.10	< 100.10	Hood: 100.3
Velocity (in/s)	> 0.18	> 0.34	Hood: 0.58

Final Results
Figure 1: 3D CAD Model of Hood Frame
Figure 2: Hood Frame
Figure 3: Hood Frame
Figure 4: Hood Frame

Conclusion
Overall, the clean hood and room meet the customer's requirements and engineering requirements. Even though the initial budget was exceeded, it was a major learning outcome and in the end the client exceeded the limit on the budget. Both units meet the client's needs and are to their satisfaction.

References
1. "Fan Filter Unit, HEPA, 125x24x20in, 2 x 4", <https://www.mcmaster.com/990420000/>, accessed 24-Apr-2018.
2. "What is a Cleanroom?", Clean Air Technology Inc., [Online]. Available: <http://www.cleantechtechnology.com/cleanroom-classification-class.php>, [Accessed 25-Mar-2018].

Acknowledgments
• Zingoy Technology Inc.
• Dr. Timothy Becker
• Dr. Sarah Oman
• Mr. Jerry Wood
• Northern Arizona University
• Palomino Glass Inc.
• Maytag's Steel Inc.
• Mountain Sheep Custom Finishing
• Coconino HighSchool
• Mr. Craig Henscheidt

Appendix E

should be wiped down also.

7. Once the unit is cleaned the fan is ready to be turned on and used.
8. In order to relocate unit, disassemble it entirely by unplugging and removing the FFU first, then remove the aluminum frame, and lastly the polycarbonate. Once items are at desired relocation follow steps 1 through 7.

2.2 Maintenance

The maintenance for the hood will consist of checking hardware for signs of rust, in which case the hardware should be replaced. Checking the epoxied seams of the polycarbonate for wear or potential cracking, in which the epoxy should be repaired or in severe cases redone. The pre filter for the fan unit should be checked and replaced roughly every month. The HEPA filter for the fan unit will need to be replaced after the produced positive pressure has dropped half from the original use.

2.3 Troubleshooting

3. Clean Room

Appendix F

From: Edwin Roy Anderson <Ed.Anderson@nau.edu>
Date: April 22, 2019 at 9:32:01 AM MST
Subject: RE: UGRADS Poster

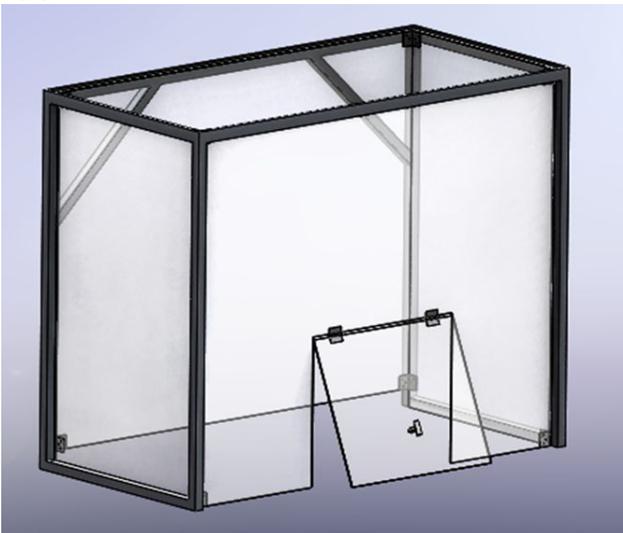
Hello,

Your UGRADS poster is ready for pickup from the Physics Office (Bldg. 19, Rm. 209, x2661), which is open 8am-5pm M-F.

NOTE: The ink on the poster will smear if it gets wet, including hand oil, so you don't want to flatten it out by running your hands over it when you put it up.

-- Ed

Appendix G



Appendix H

Footer 4/22/2019 3

PROJECT DESCRIPTION CONT.

- CLEAN HOOD DIMENSIONS 24" X 48" X 40"
 - WILL FIT OVER SMALL EQUIPMENT
 - OUTPUT A POSITIVE PRESSURE FLOW
- CLEAN ROOM FRAME DIMENSIONS 72" X 96" X 84"
 - CAN BE DISASSEMBLED AND REASSEMBLED
 - CARRIED BY 3 - 4 PEOPLE
- PROJECT WILL BENEFIT THE CLIENT'S RESEARCH AND PRODUCT MANUFACTURING