Boring Machine Anchoring and Alignment Device

Taylor Howard and T&K Utilities

Western Carolina University

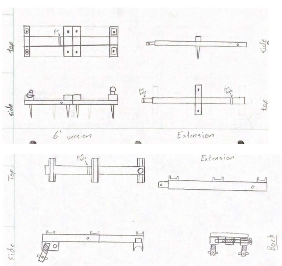
PROBLEM STATEMENT

The team was tasked with developing an apparatus that will anchor, level, and align a boring machine in the workspace.

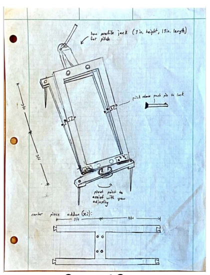
REQUIREMENTS

#	Description
1	Provide Pitch Adjustment
2	Provide Yaw Adjustment
3	Weigh Less Than 2000lb
4	Anchor the Machine
5	Fit Within 1 Foot of Original Footprint (Width)
6	Easily Placed and Removed from Workspace

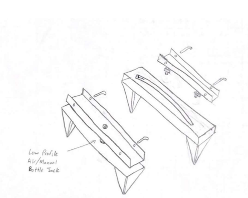
CONCEPTS



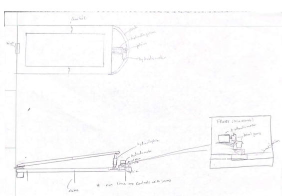
Concept 1



Concept 2



Concept 3



Concept 4

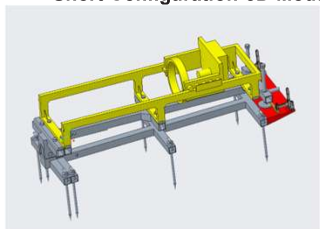
	Weight			
Requirements (1-bad, 3-good)	Concept 1	Concept 2	Concept 3	Concept 4
Yaw Adjustment (1-2-3)	3	3	2	3
Pitch Adjustment (1-2-3)	3	3	1	3
Cost (1-2-3)	2	2	3	1
Anchor/Stability(1-2-3)	3	2	2	1
Rigidity (1-2-3)	3	2	1	2
Ease of Use (1-2-3)	2	2	3	2
Extendibility (1-2-3)	3	1	2	1
Total	19	15	14	13

Decision Matrix

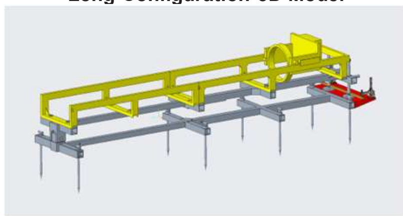
FINAL DESIGN, APPROACH, PLAN

Creo was used to model the device based on the decision matrix and any additions needed to meet the requirements.

Short Configuration 3D Model



Long Configuration 3D Model



Altair Inspire Finite Element analysis was conducted to iteratively optimize the design until the FOS was acceptable.

Short Configuration FEA Analysis

Long Configuration FEA Analysis

Bill of Materials

Vendor	Part number	Description	Length Required	Hyperlink or Auto/Bin Number	Quantity	Price (per unit)	Price for Quantity
Metals Depot	[illegible]	3 X 3 X 3/16 wall A500 Square Steel Tube	24'	[illegible]	2	[illegible]	[illegible]
Metals Depot	[illegible]	2-1/2 X 2-1/2 X 1/4 wall A500 Square Steel Tube	8'	[illegible]	2	[illegible]	[illegible]
Metals Depot	P12	1/2 inch THICK A36 Steel Plate	[illegible]	[illegible]	1	[illegible]	[illegible]
Metals Depot	[illegible]	Hot Rolled A36 Steel Square	[illegible]	[illegible]	1	[illegible]	[illegible]
Online Metals	[illegible]	2" Carbon Steel Square Bar 1018 Cold Finish	[illegible]	[illegible]	1	[illegible]	[illegible]
Online Metals	[illegible]	1" x 2" Carbon Steel Rectangle Bar A36 Hot Rolled	[illegible]	[illegible]	1	[illegible]	[illegible]
Online Metals	[illegible]	2" x 3" Carbon Steel Rectangle Bar A36 Hot Rolled	[illegible]	[illegible]	1	[illegible]	[illegible]
Online Metals	[illegible]	2.5" Carbon Steel Round Bar A36 Hot Rolled	[illegible]	[illegible]	1	[illegible]	[illegible]
Online Metals	[illegible]	1.75" Carbon Steel Round Bar 1018 Cold Finish	[illegible]	[illegible]	1	[illegible]	[illegible]
McMaster-Carr	[illegible]	Alloy Steel Acme Lead Screw, Right Hand, 1-1/2"-5 Thread Size, 3 Feet Long	[illegible]	[illegible]	1	[illegible]	[illegible]
McMaster-Carr	[illegible]	Swivel Leveling Mount, Black-Oxide Steel with 6" Long 5/8"-11 Threaded Stud	NA	[illegible]	2	[illegible]	[illegible]
McMaster-Carr	[illegible]	Hold-Down Toggle Clamp, Open Arm, Steel, 2070 lbs. Holding Capacity, 9-7/8" Overall Length	NA	[illegible]	2	[illegible]	[illegible]
McMaster-Carr	[illegible]	Zinc-Plated 1144 Carbon Steel	NA	[illegible]	2	[illegible]	[illegible]
McMASTER-CARR	[illegible]	Carbon Steel Acme Hex Nut, Right Hand, 1-1/2"-5 Thread Size	N/A	[illegible]	4	[illegible]	[illegible]
Amazon	[illegible]	0.25"x2.25" Lynch Pins Pack of 10	NA	[illegible]	1	[illegible]	[illegible]
						Estimated Shipping and Handling	[illegible]
						Total	$5,027.41

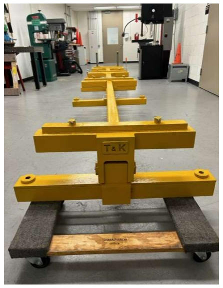
RESULTS

Team 13 designed and fabricated a device that met all the specified requirements. Pitch, yaw, weight and ease of movement all surpassed our original requirements. The footprint and anchoring met expectations. Overall, the Anchoring and Alignment device will serve its purpose well.

Assembly

Testing Pitch and Yaw

Final Version



SUMMARY AND CONCLUSIONS

Team 13 designed and developed a device that executed all the requirements set by the sponsor. In the process of this accomplishment, many lessons and skills were learned.

Skills Learned: Outsourcing (planning, communication, and technical relay of information with drawings), planning and tracking progress (spring journal, meeting minutes, task backlog)

Software's: Altair Inspire FEA, Creo modeling

Machines: Enclosed CNC milling, open CNC milling, waterjet cutting, lathe turning, grinding (bench grinder & angle grinder), welding (TIG, MIG, and stick), cutting metal (horizontal and veritical bandsaw, plasma cutter, oxy-acetylene torch), tapping and thread identifying

FUTURE WORK

A professional welder employed by T&K Utilities will weld lift points onto the frame of the device. Since these lift points are crucial for the safety of the employees around the device while its being lifted, a professional is needed for this task.

TEAM & ACKNOWLEDGEMENTS

- Team Members from Left to Right: Timothy Ray (ET), Crate Hall (BSEME), Carson Weathers (BSEME), Matthew Waid (BSEME)
- Sponsor: Taylor Howard – T&K Utilities
- Faculty Mentor: Dr. Martin Tanaka
- Rapid Center: Brett Banther, Shawn Lyvers, Monty Graham
- Machine Shop: Dylan Bortell and Tom Spendlove

T&K Utilities, Inc.

References

1. https://www.google.com/search?q=t+and+k+utilities&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjxudnOlc3-AhXeD1kFHd87A1IQ0pQJegQIAxAG&biw=1920&bih=937&dpr=2#imgrc=n4mNkEWvpkbw8M