HOLY GHOST PREP

REC Foundation

VEX Linear Actuator

By 242A

January 2019

VEX EDR

AUTODESK.

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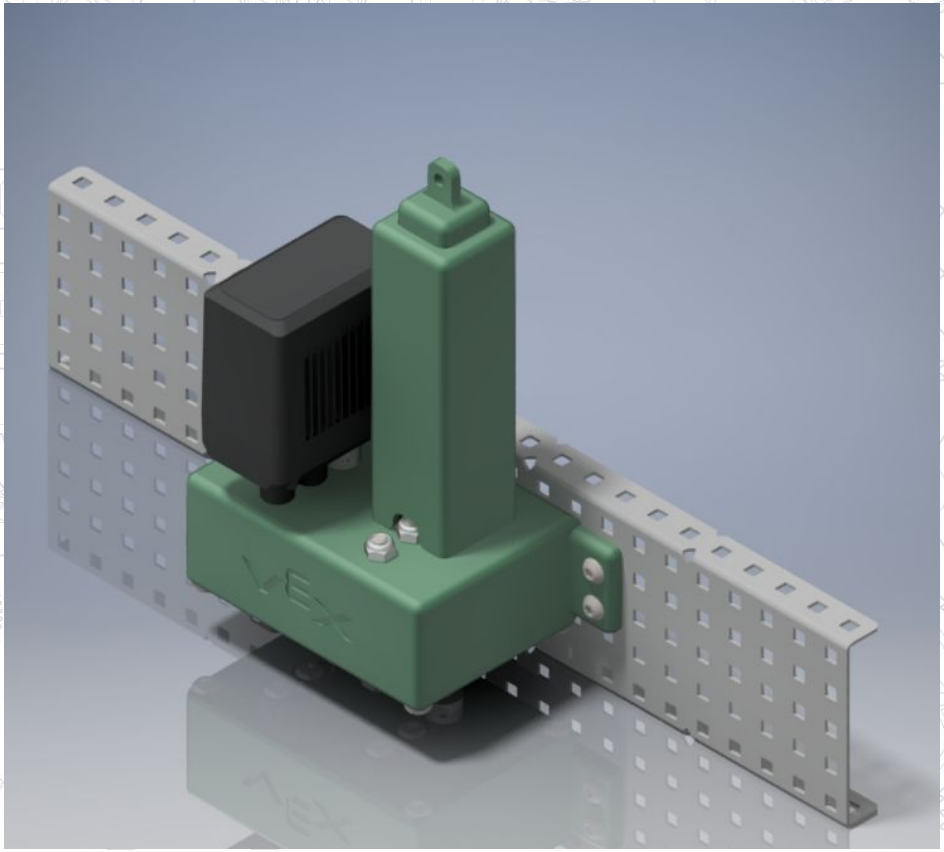
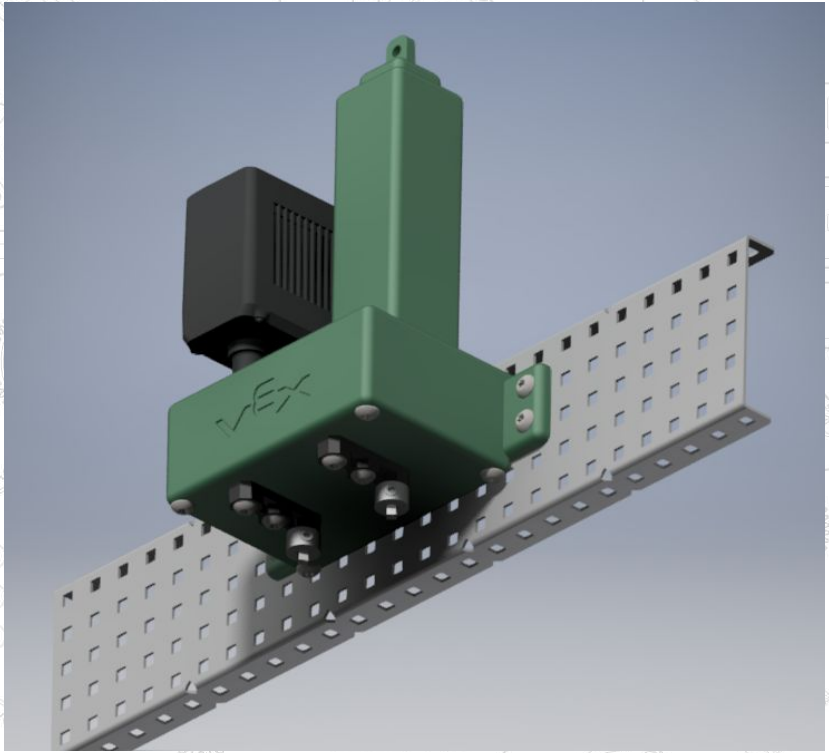
VEX EDR

Purpose

The VEX Linear Actuator converts rotational motion into linear motion. This is accomplished using a lead screw and lead nut. The Tube Insert part moves up and down, creating the desired linear motion from a single VEX V5 motor.



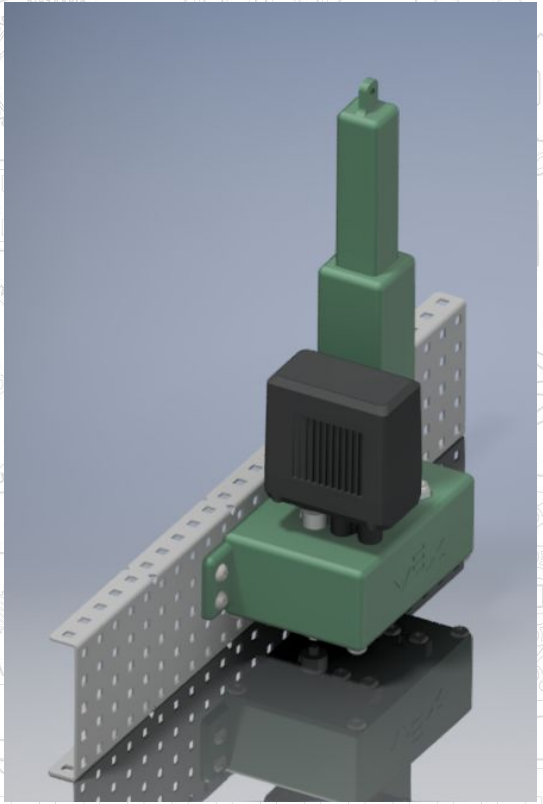
Usage of the Linear Actuator



The Linear Actuator was designed to substitute the pneumatic system, as less motors must be used if pneumatics is implemented in a VEX competition robot. By contrast, only one motor is used to create a linear motion and no motors are lost due to VEX pneumatics rules.

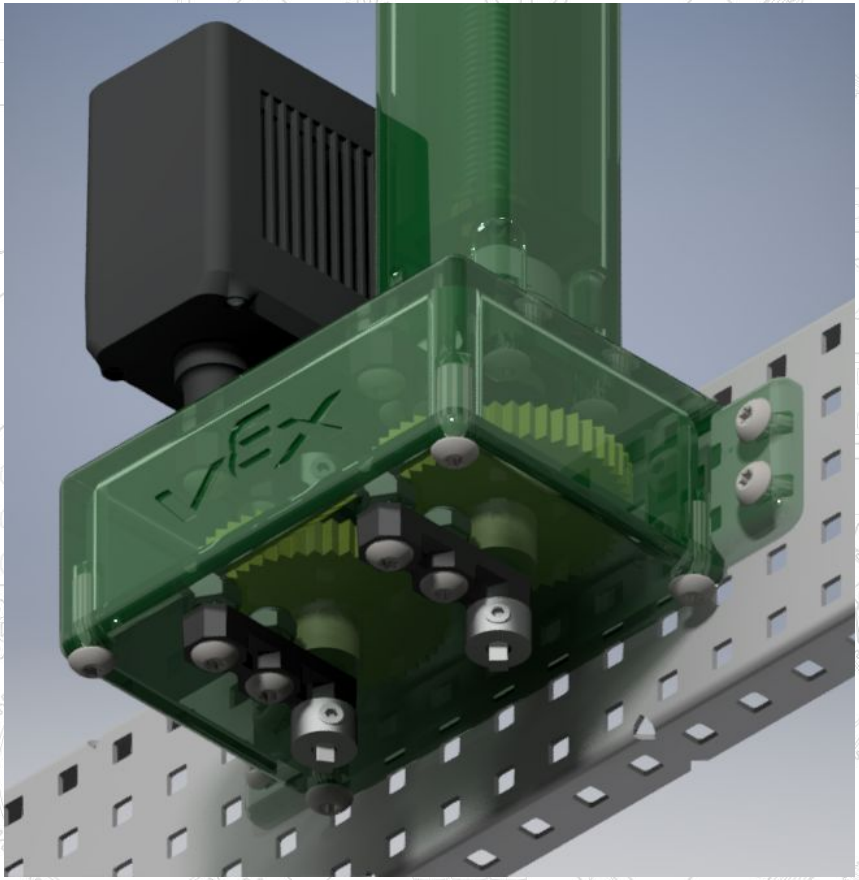
Integration into a VEX competition robot

The design of the Linear Actuator focused on compactness, which resulted in the VEX V5 motor being placed beside the linear motion tower. In addition, the base of the actuator has four mounting holes (two on each side) that line up with holes on the VEX parts and metal. The Tube Insert has one hole that can be connected to any VEX part to transfer the linear motion.

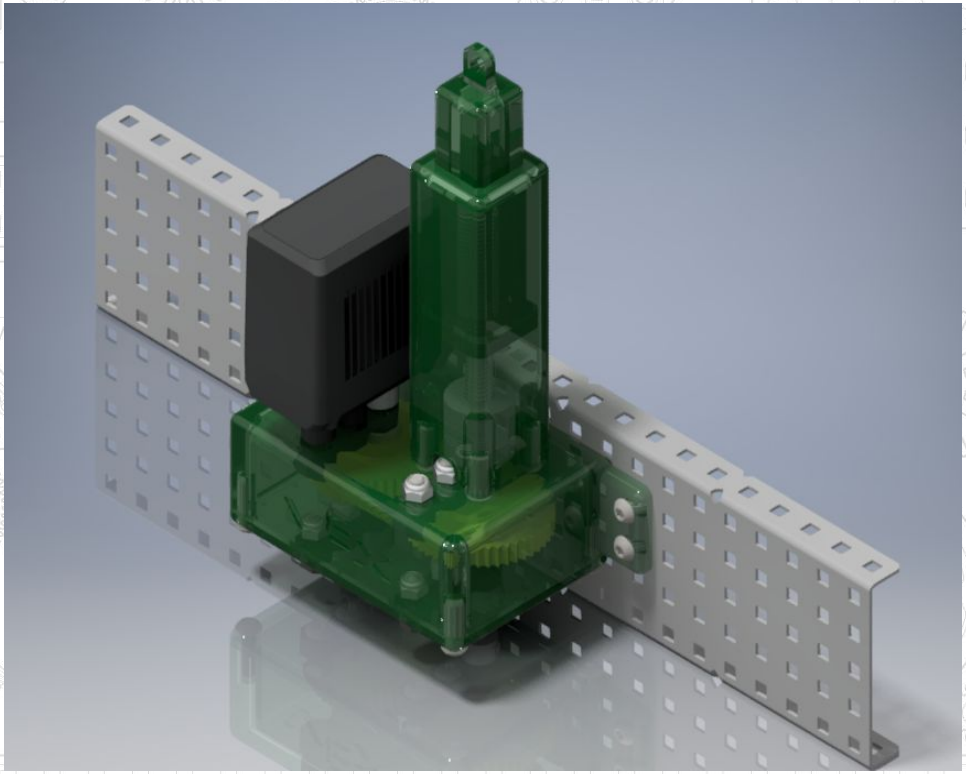


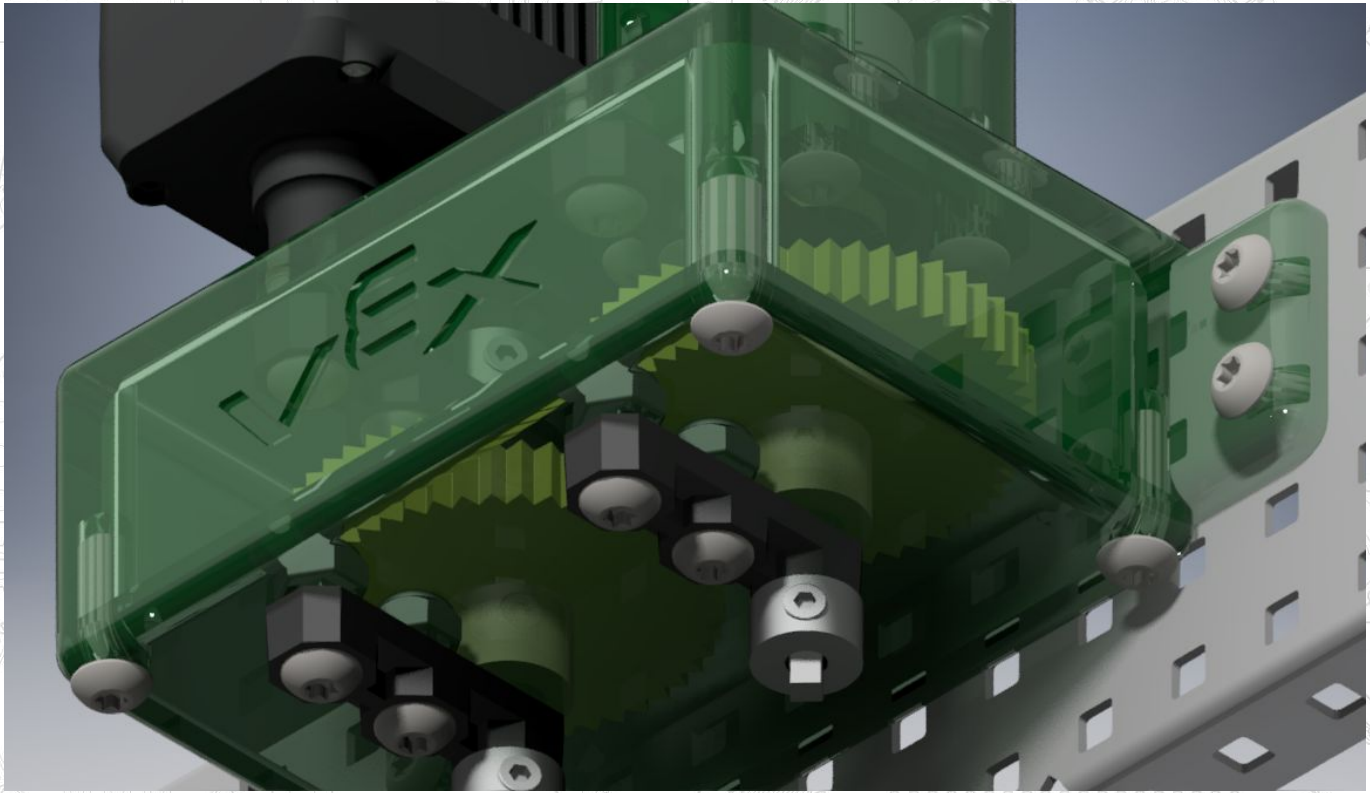
How the actuator was modeled

The Linear Actuator was CAD modeled using Autodesk Inventor Professional 2019. The design was created around a VEX V5 motor, downloaded from vexrobotics.com as a STEP and imported into Inventor. Custom parts were modeled and placed into the full assembly, remembering to assign a material to each for future physical data. Other mounting hardware was imported from VEX to use in the assembly, and everything was properly constrained to allow for correct movement and behavior. Finally, stress tests were run on the assembly to ensure the model would withstand the forces applied.

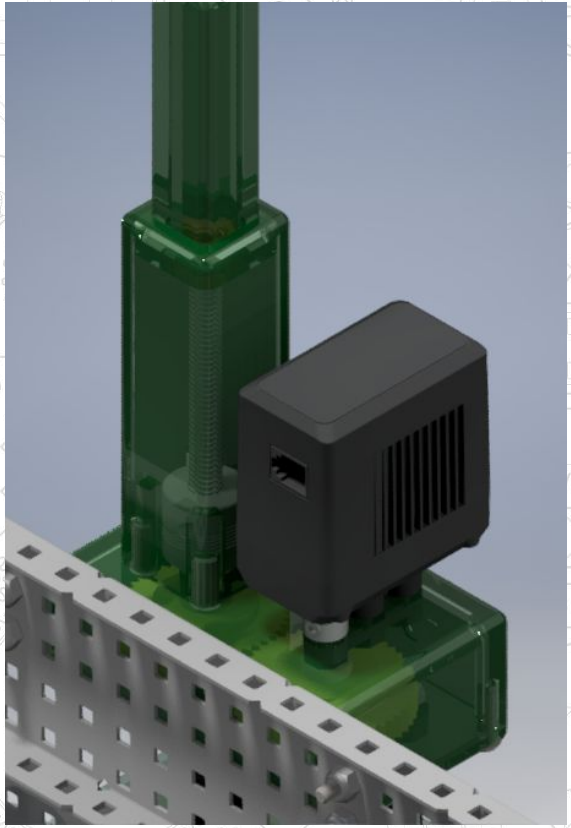


Plastic housing changed to clear green to see internal components.

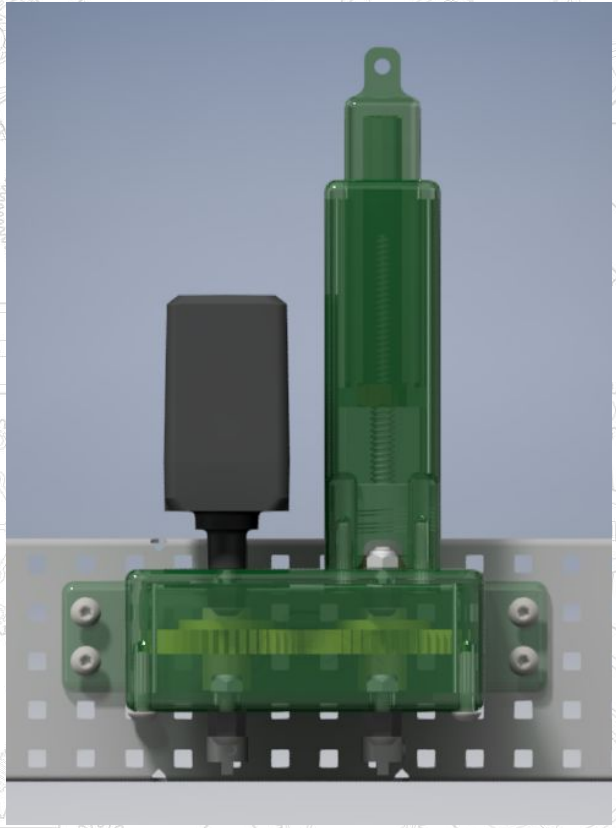




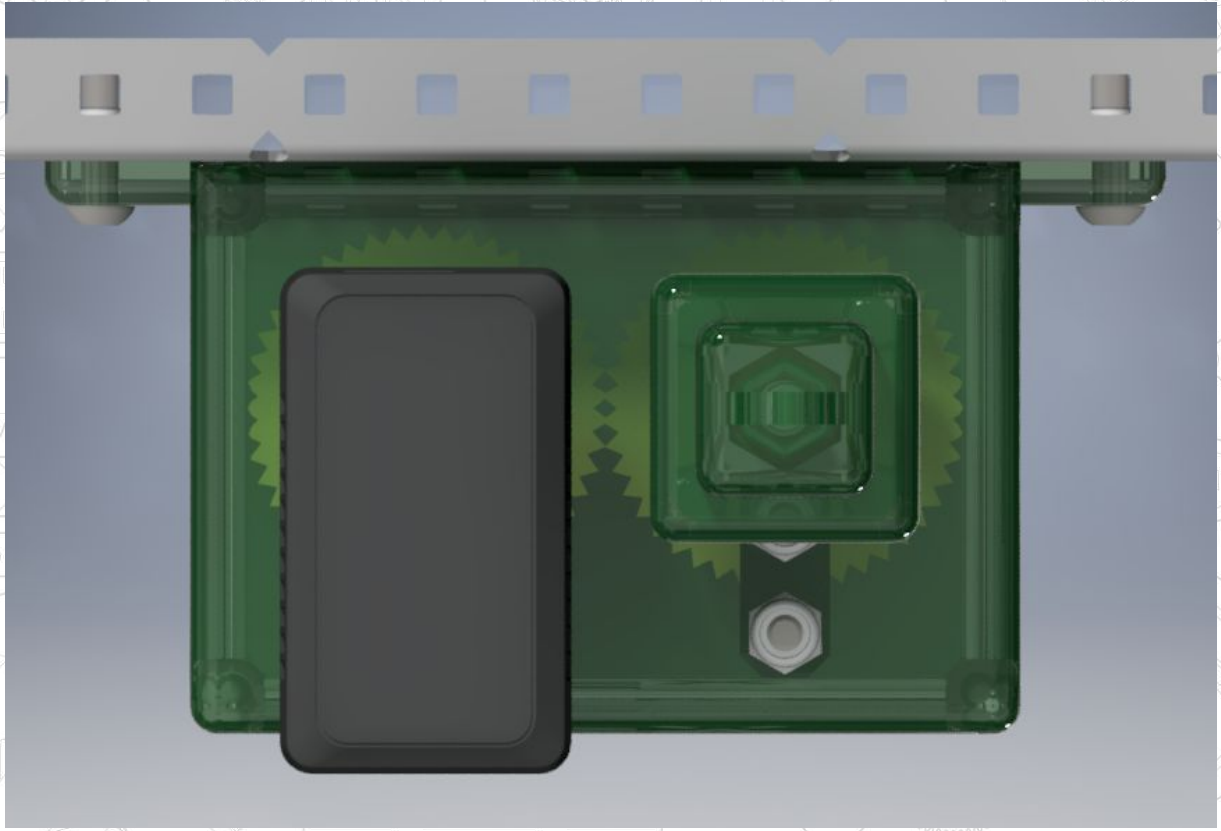
Internal view of Base housing: Two 45 tooth spur gears rotate together to move rotational force away from motor. Shaft from second gear attaches to lead screw.



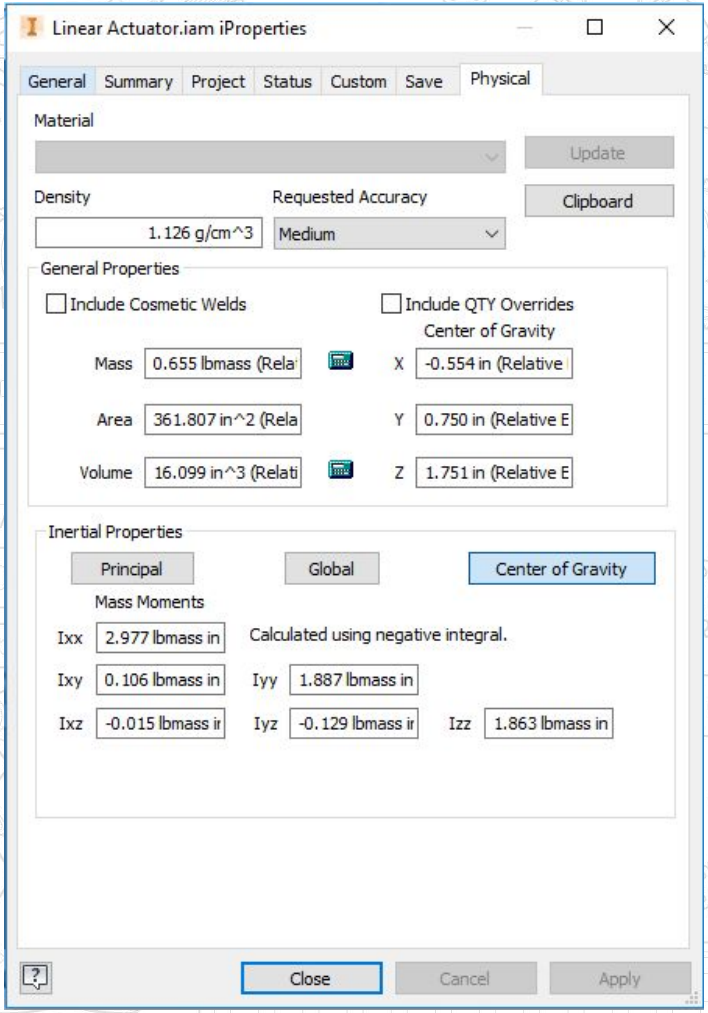
Side view of Tube assembly: The shaft from the second gear attaches to the lead screw with a coupling. The lead nut is attached to the Tube Insert and is stopped from rotating by the square shape.



Top down view: This shows the two spur gears moving the rotational motion away from the motor to be used with the lead screw and nut.

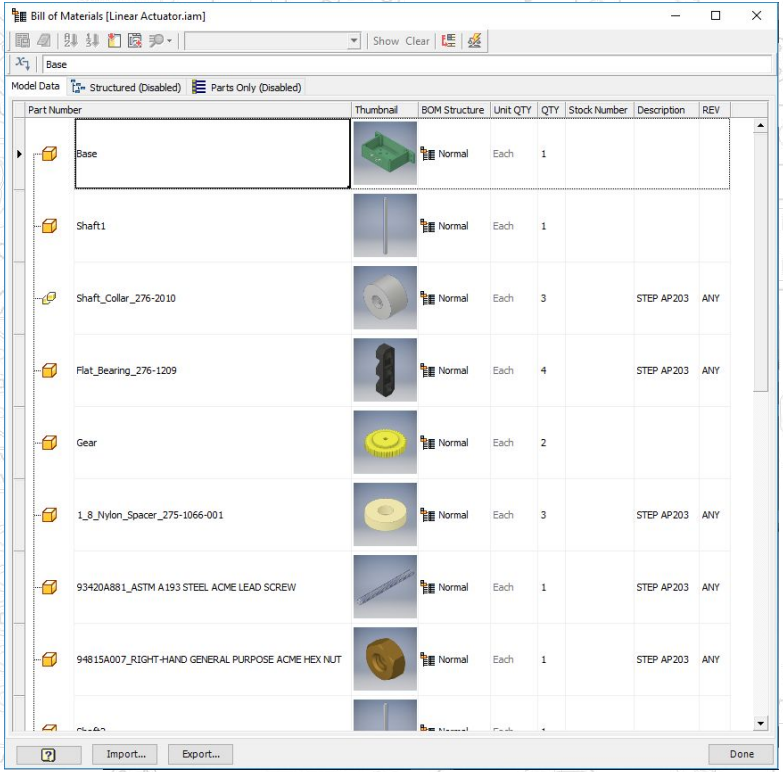


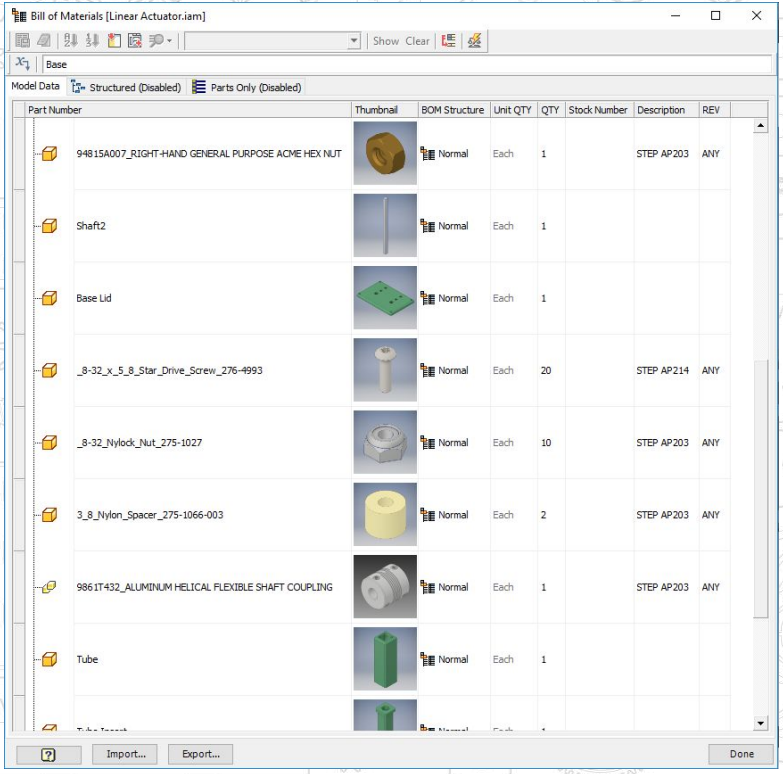
Physical data



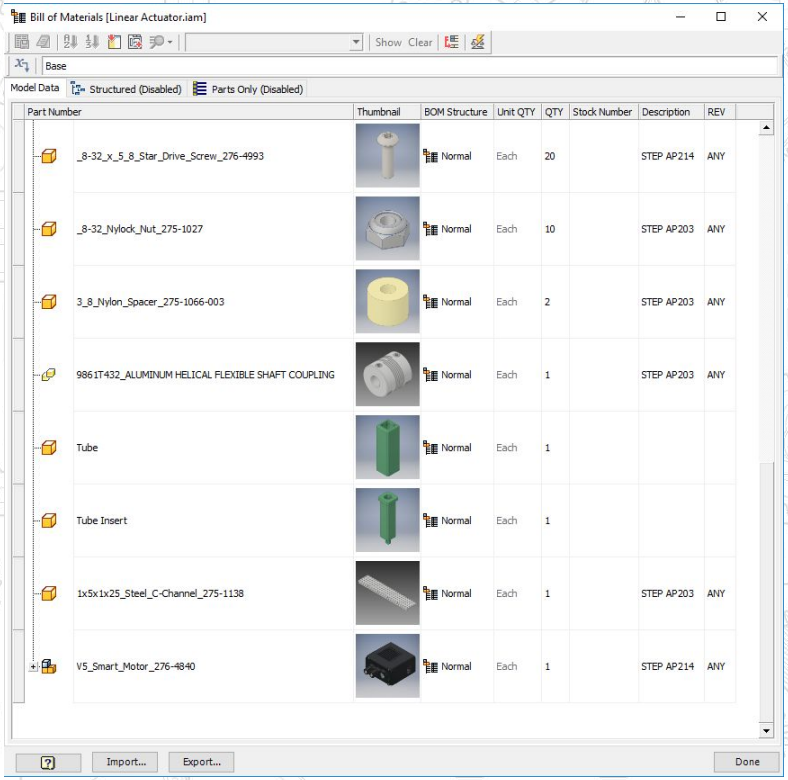
This window shows the iProperties of the Linear Actuator assembly. Mass, Area, Volume, and other technical data is shown.

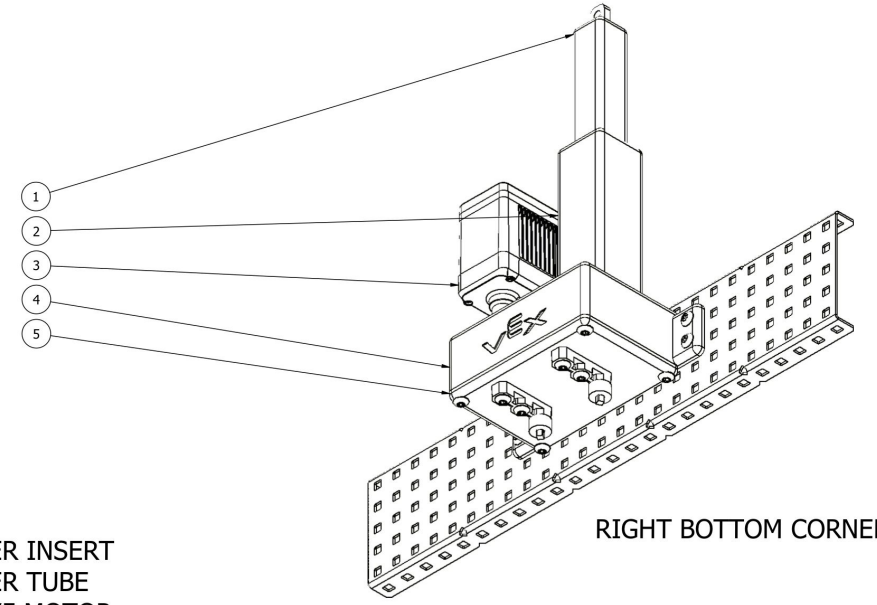
Materials list





Materials list cont.





RIGHT BOTTOM CORNER VIEW

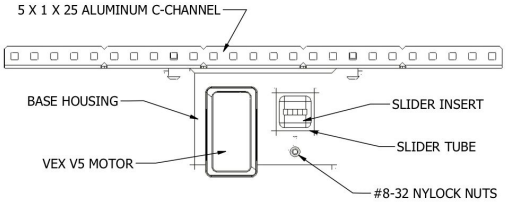
1. SLIDER INSERT
2. SLIDER TUBE
3. VEX V5 MOTOR
4. BASE HOUSING
5. BASE LID

DRAWN Jack Pinkstone	12/14/2018	VEX 242A
CHECKED Aiden Schmidt	12/17/2018	TITLE
QA PASSED		Linear Actuator
APPROVED Brandon Petcaugh	12/21/2018	

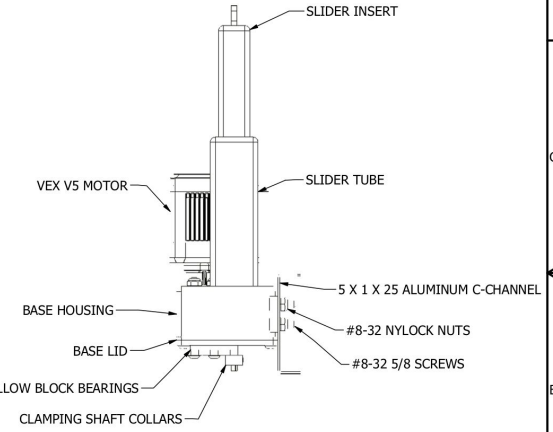
SIZE		DWG NO	REV
A3		001	V1.1

SCALE 1 / 1.5 SHEET 1 OF 7

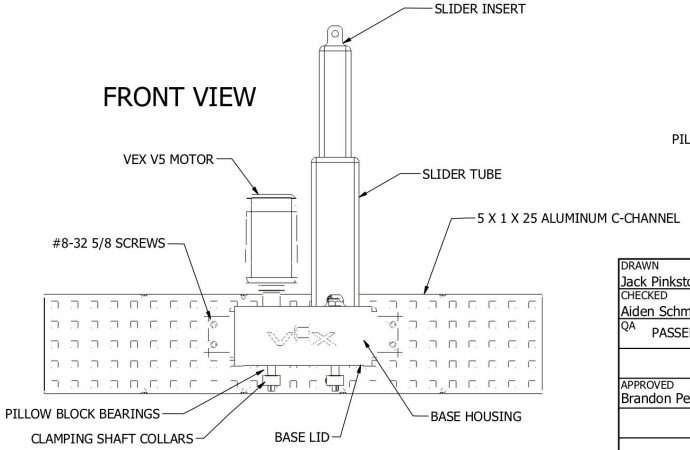
TOP VIEW



RIGHT SIDE VIEW

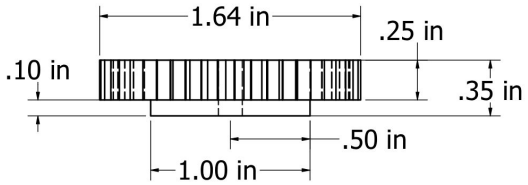


FRONT VIEW



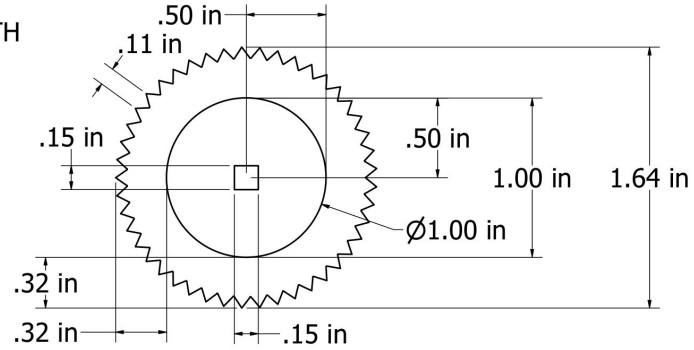
DRAWN	Jack Pinkstone	12/14/2018	VEX 242A		
CHECKED	Aiden Schmidt	12/17/2018	TITLE		
QA	PASSED		Linear Actuator		
APPROVED	Brandon Petcaugh	12/21/2018	SIZE A3	DWG NO 001	REV V1.2
			SCALE 1 / 2	SHEET 2 OF 7	

SIDE VIEW

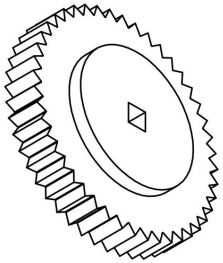


TOP VIEW

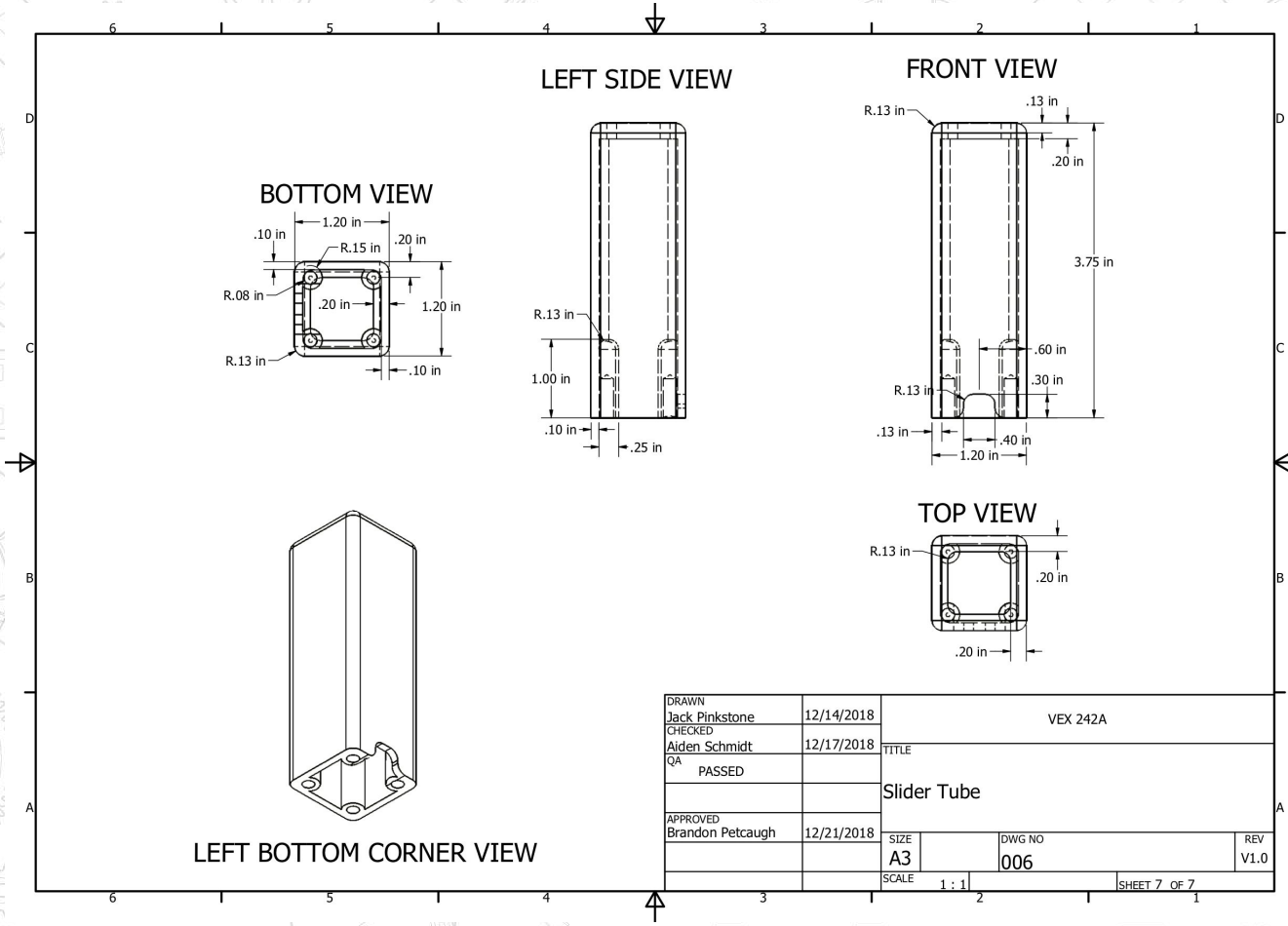
45 TEETH

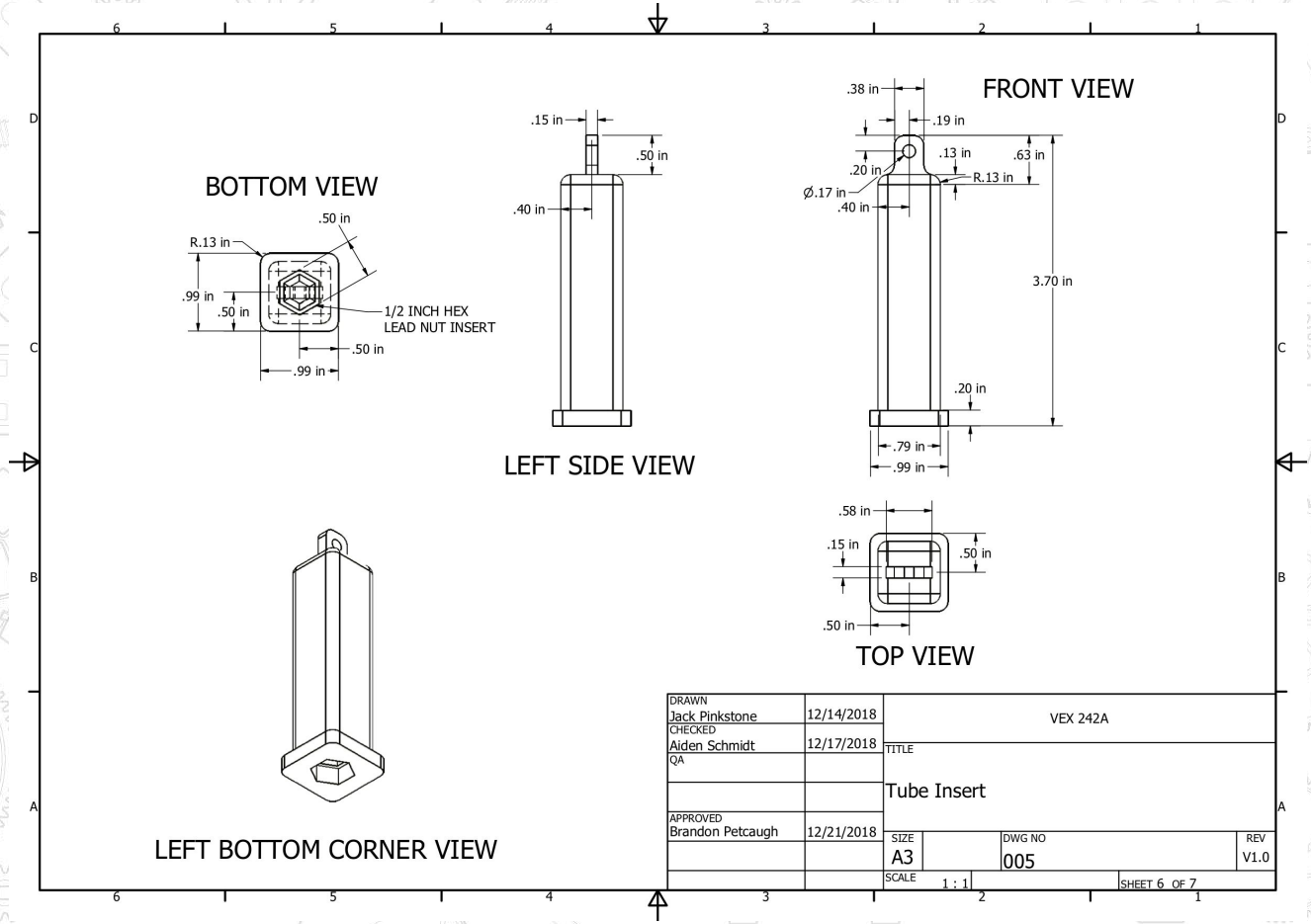


LEFT BOTTOM CORNER VIEW

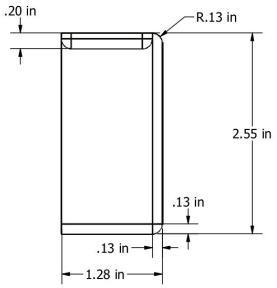


DRAWN Jack Pinkstone	12/14/2018	VEX 242A		
CHECKED Aiden Schmidt	12/17/2018	TITLE		
QA PASSED		Gear		
APPROVED Brandon Petcaugh	12/21/2018	SIZE A3	DWG NO 002	REV V1.0
		SCALE 2 : 1	SHEET 3 OF 7	

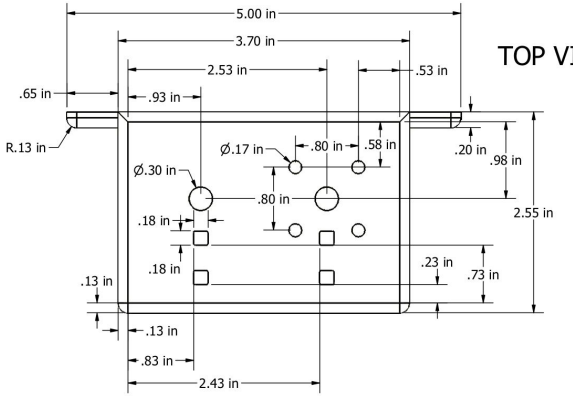

LEFT SIDE VIEW
FRONT VIEW
BOTTOM VIEW
TOP VIEW
LEFT BOTTOM CORNER VIEW
1.20 in
.10 in
R.15 in
.20 in
R.08 in
.20 in
1.20 in
R.13 in
.10 in
R.13 in
1.00 in
.10 in
.25 in
R.13 in
.13 in
.20 in
3.75 in
.60 in
.30 in
R.13 in
.13 in
.40 in
1.20 in
R.13 in
.20 in
.20 in
DRAWN
Jack Pinkstone
12/14/2018
CHECKED
Aiden Schmidt
12/17/2018
QA
PASSED
APPROVED
Brandon Petcaugh
12/21/2018
VEX 242A
TITLE
Slider Tube
SIZE
A3
DWG NO
006
REV
V1.0
SCALE
1 : 1
SHEET 7 OF 7


BOTTOM VIEW
.50 in
R.13 in
.99 in
.50 in
1/2 INCH HEX
LEAD NUT INSERT
.50 in
.99 in
.15 in
.50 in
.40 in
LEFT SIDE VIEW
FRONT VIEW
.38 in
.19 in
.13 in
.63 in
.20 in
R.13 in
Ø.17 in
.40 in
3.70 in
.20 in
.79 in
.99 in
.58 in
.15 in
.50 in
.50 in
TOP VIEW
LEFT BOTTOM CORNER VIEW
DRAWN
Jack Pinkstone
12/14/2018
CHECKED
Aiden Schmidt
12/17/2018
QA
APPROVED
Brandon Petcaugh
12/21/2018
VEX 242A
TITLE
Tube Insert
SIZE
A3
DWG NO
005
REV
V1.0
SCALE
1 : 1
SHEET 6 OF 7

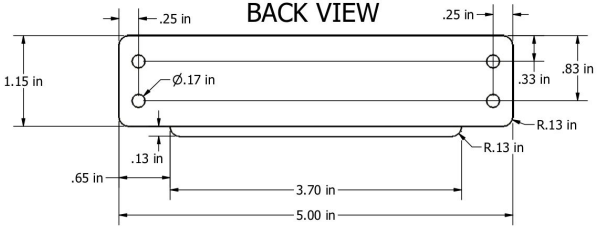
LEFT SIDE VIEW

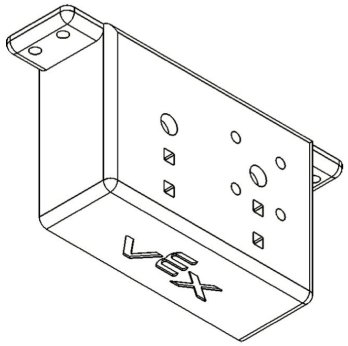


TOP VIEW



BACK VIEW

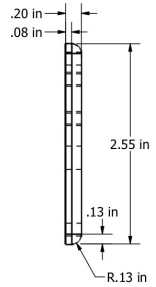




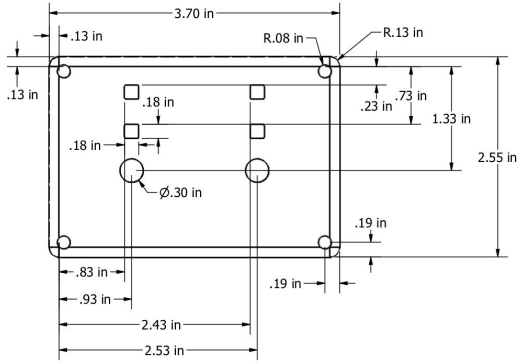
LEFT BOTTOM CORNER VIEW

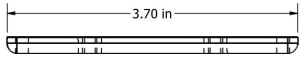
DRAWN Jack Pinkstone	12/14/2018	VEX 242A
CHECKED Aiden Schmidt	12/17/2018	TITLE
QA PASSED		Base Housing
APPROVED Brandon Petcaugh	12/21/2018	
SIZE A3	DWG NO 004	REV V1.0
SCALE 1 : 1	SHEET 5 OF 7	

LEFT SIDE VIEW

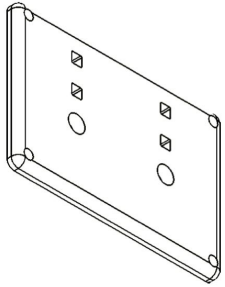


FRONT VIEW





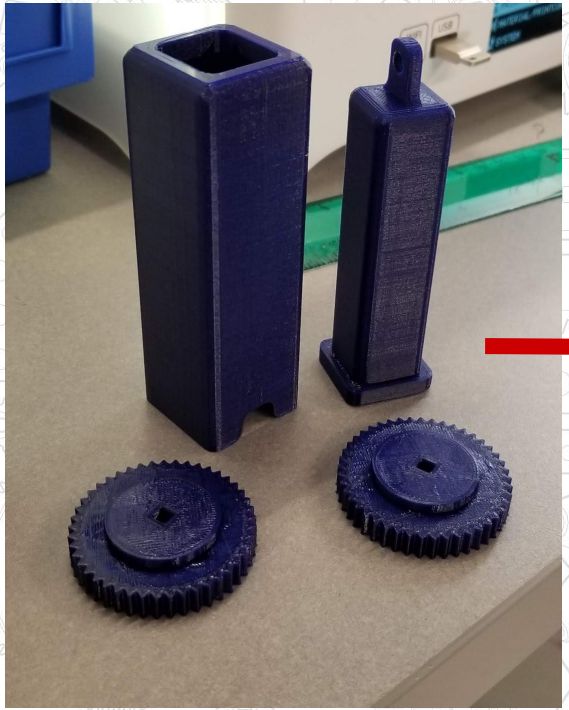
TOP VIEW

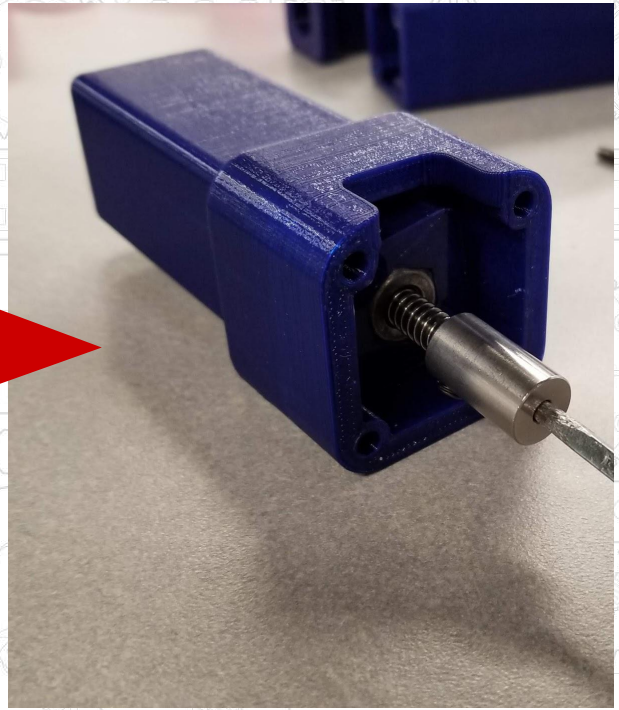


LEFT BOTTOM CORNER VIEW

DRAWN Jack Pinkstone	12/14/2018	VEX 242A	
CHECKED Aiden Schmidt	12/17/2018	TITLE	
QA PASSED		Base Lid	
APPROVED Brandon Petcaugh	12/21/2018		
		SIZE A3	DWG NO 003 / REV V1.0
		SCALE 1 : 1	SHEET 4 OF 7

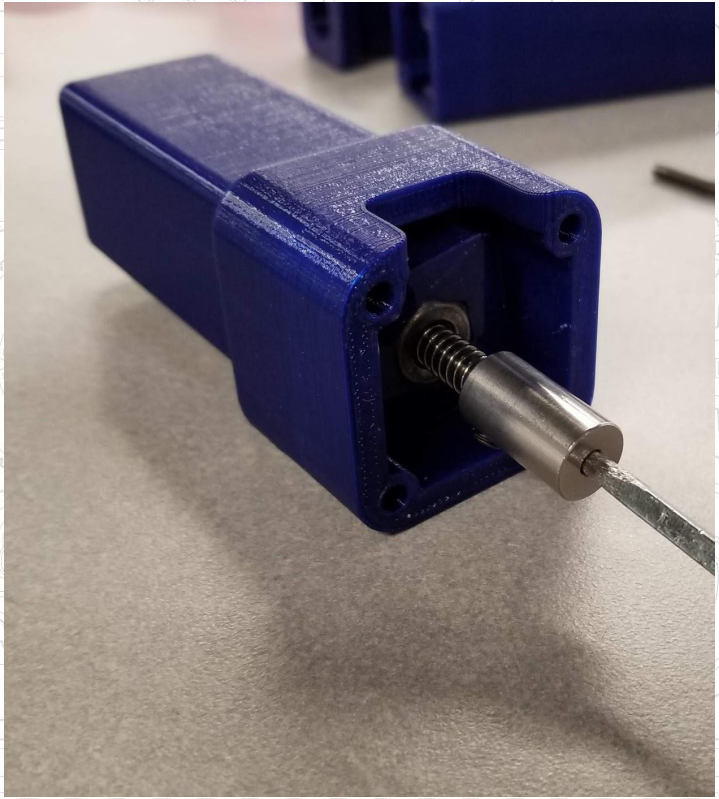
3D printing changes



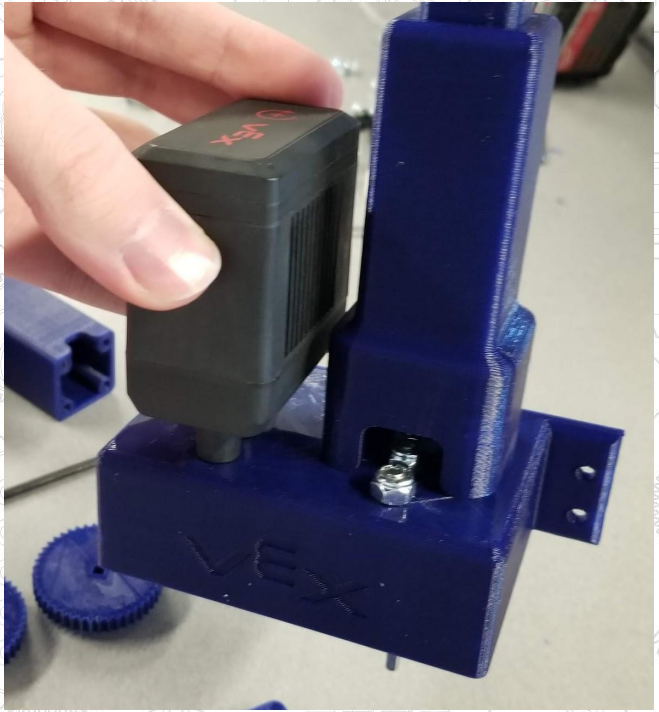


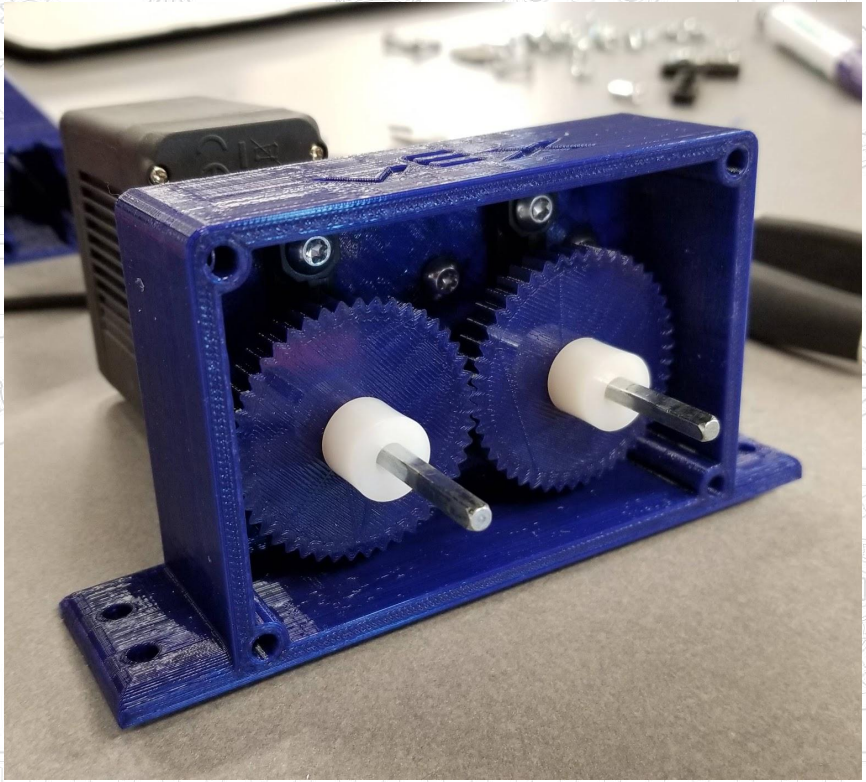
When 3D printed, the Tube Insert would not fit into the Tube because of the flat bottom. The Tube was then changed to have a wider base and the Tube Insert fit correctly.

V5 Motor attached and lead screw built

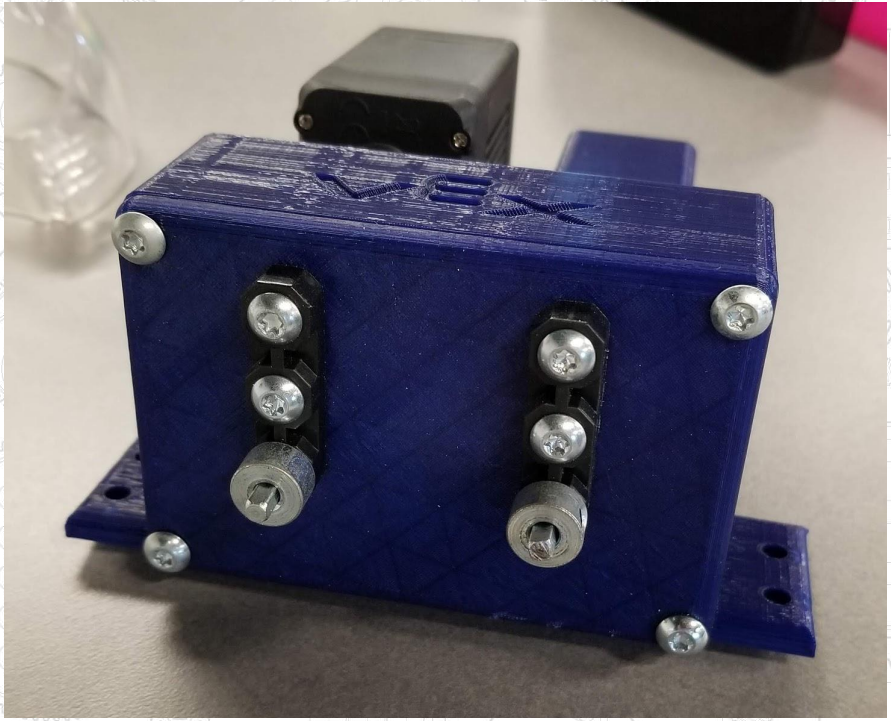


Tube attached and gears placed inside base

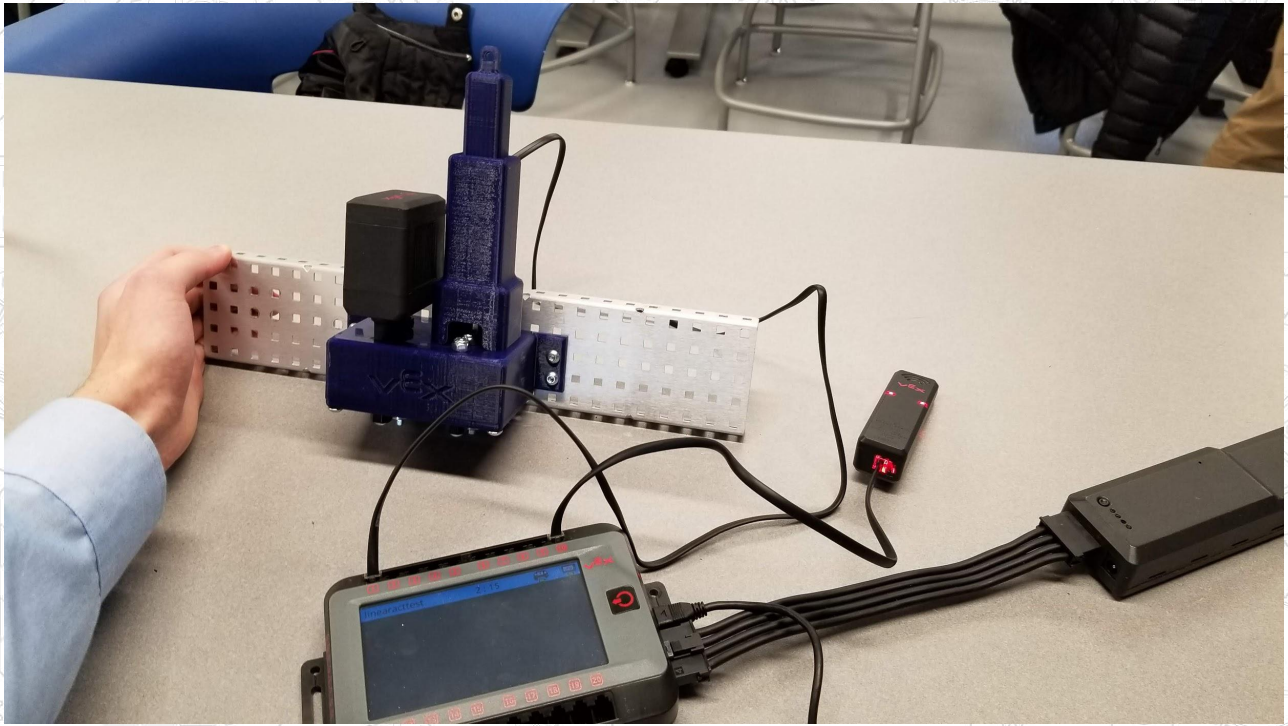




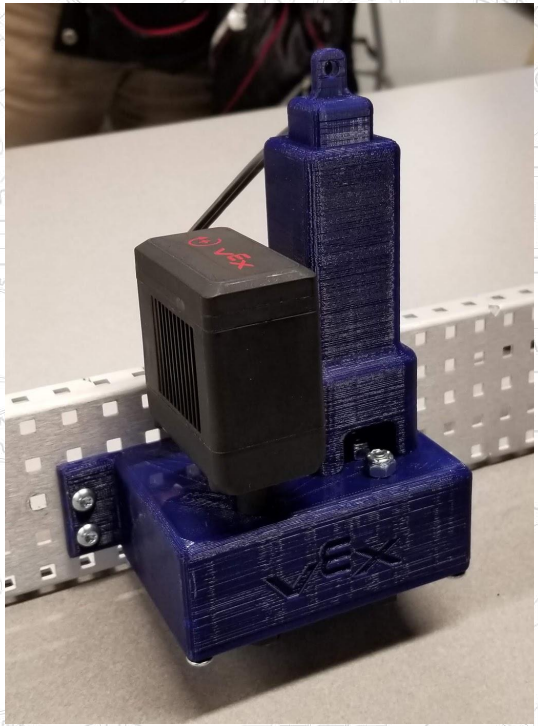
Base lid attached and final assembly

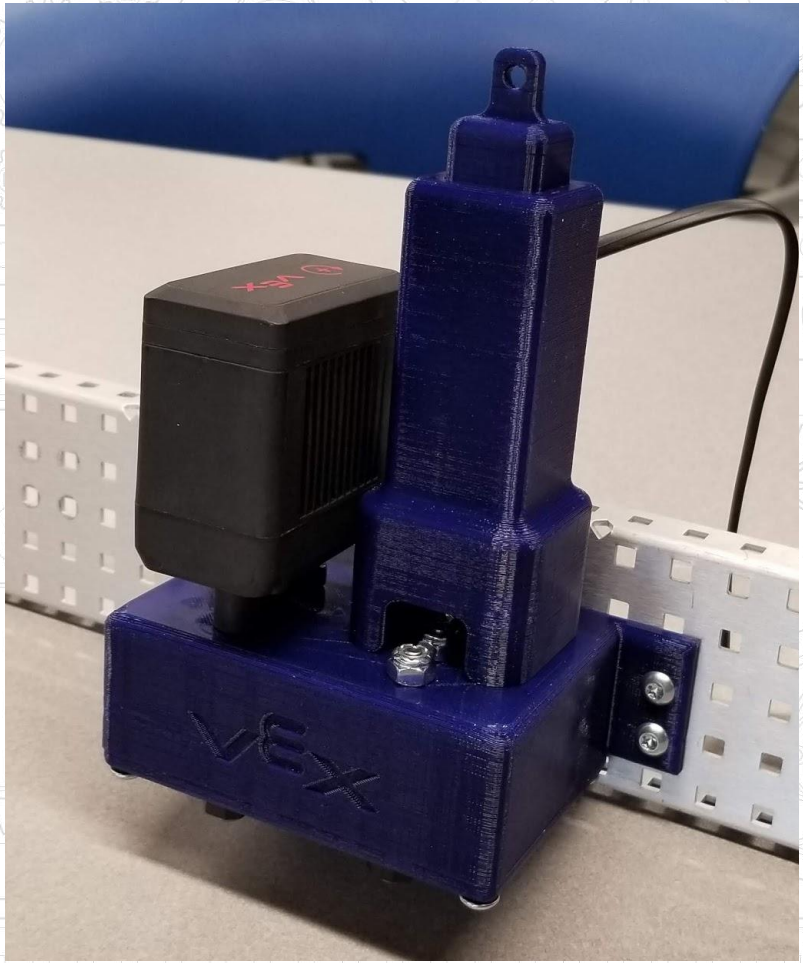


Linear actuator tested with V5 system

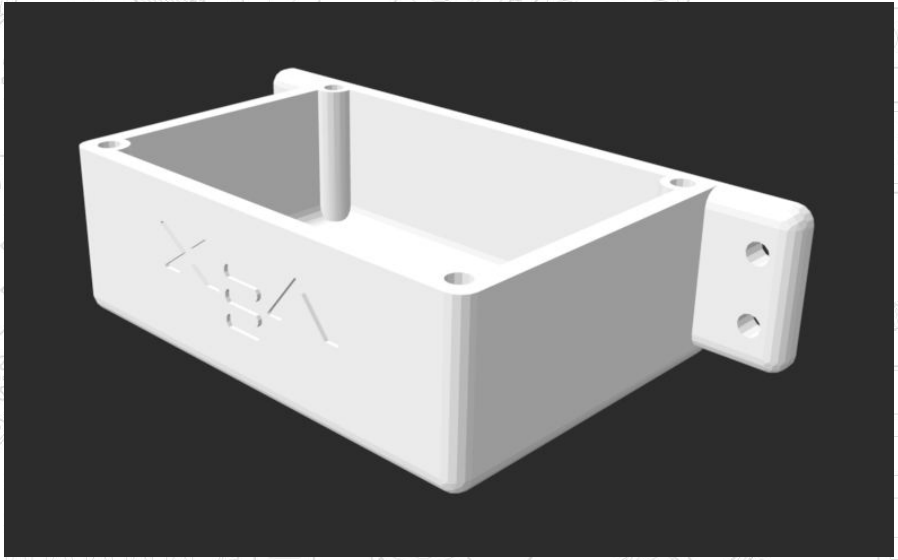


Final linear actuator

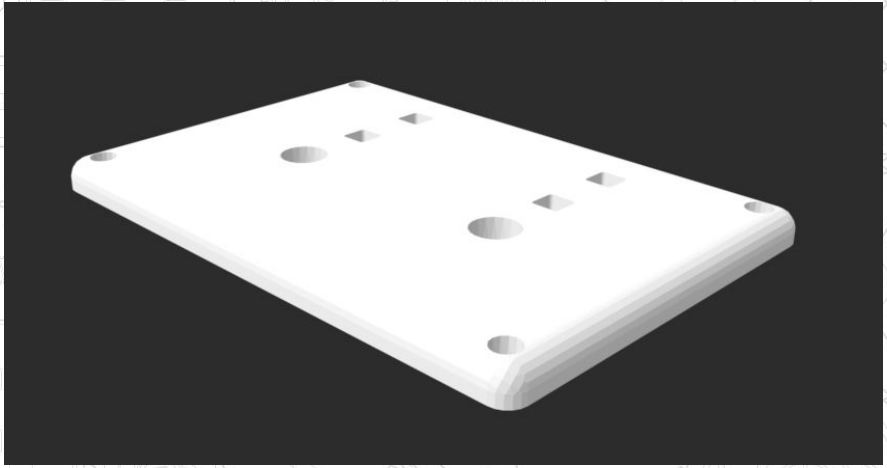




STL files

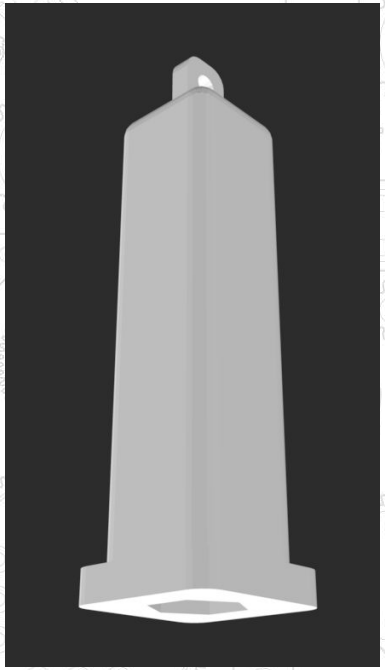


Base Housing

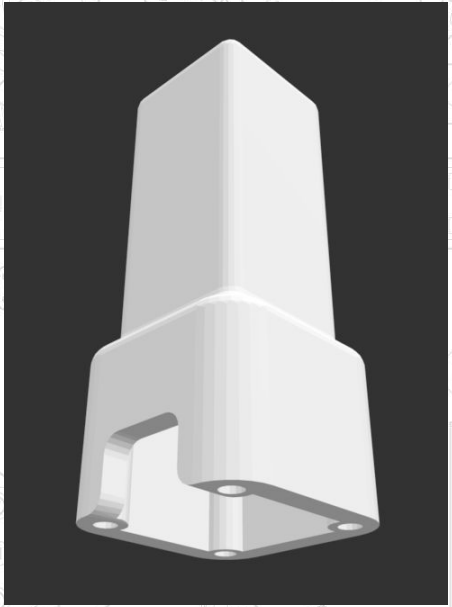


Base Lid

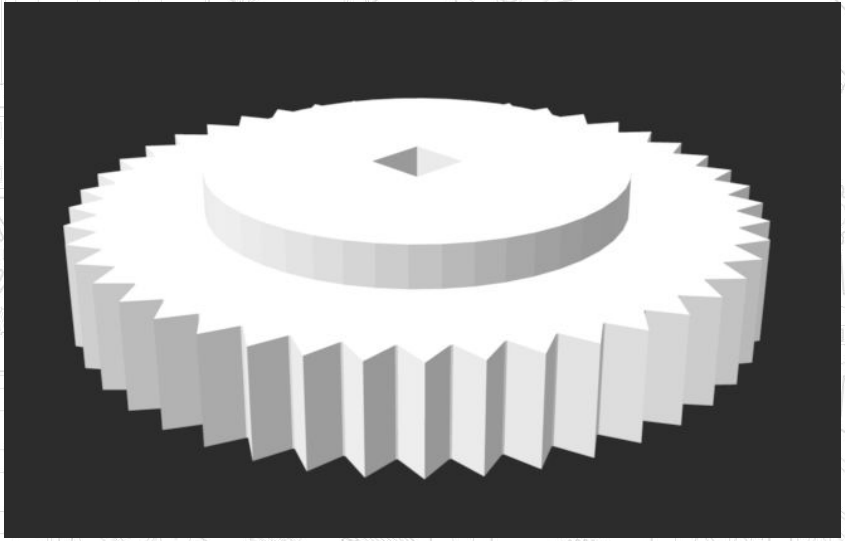
STL files cont.



Tube Insert



Slider Tube



Gear

Project takeaways

At the conclusion of this project, our team came away with two critical takeaways. First, we realized the importance of using more 3D design in the future to put our ideas into a virtual environment and try new concepts without building in the real world. We found that this engineering technique allows for a faster and more accurate way of designing and building. Second,our team learned the importance of trial and error and how mistakes can often lead to design improvements. Finally, learning Autodesk Inventor was very helpful to our team since many of us will become mechanical engineers and likely use CAD in our everyday jobs.