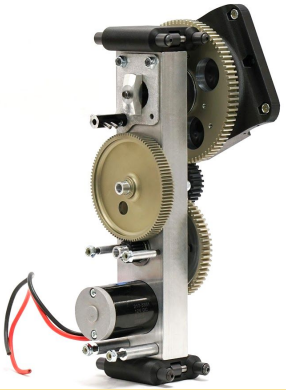
971 Manufacturing



hi

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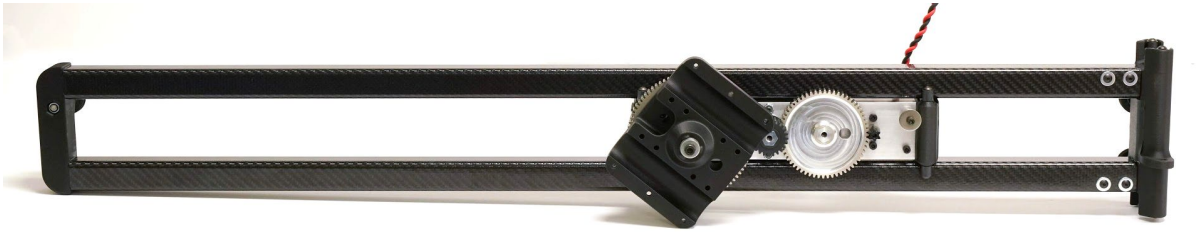
What are we doing here today?

- From Drawings to Assembly
  - process
  - workflow
- How we manufacture
  - what we do in-house



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Process :D



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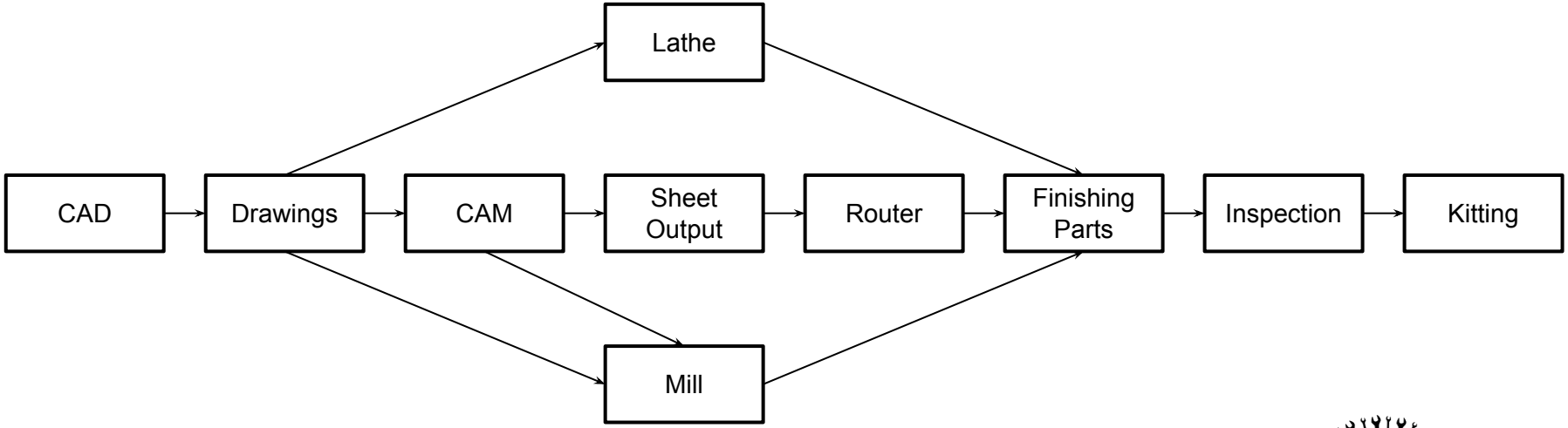
Quick Overview



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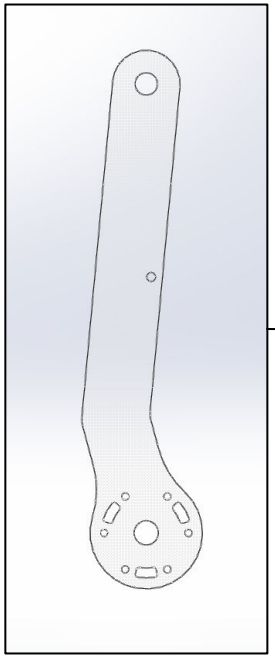
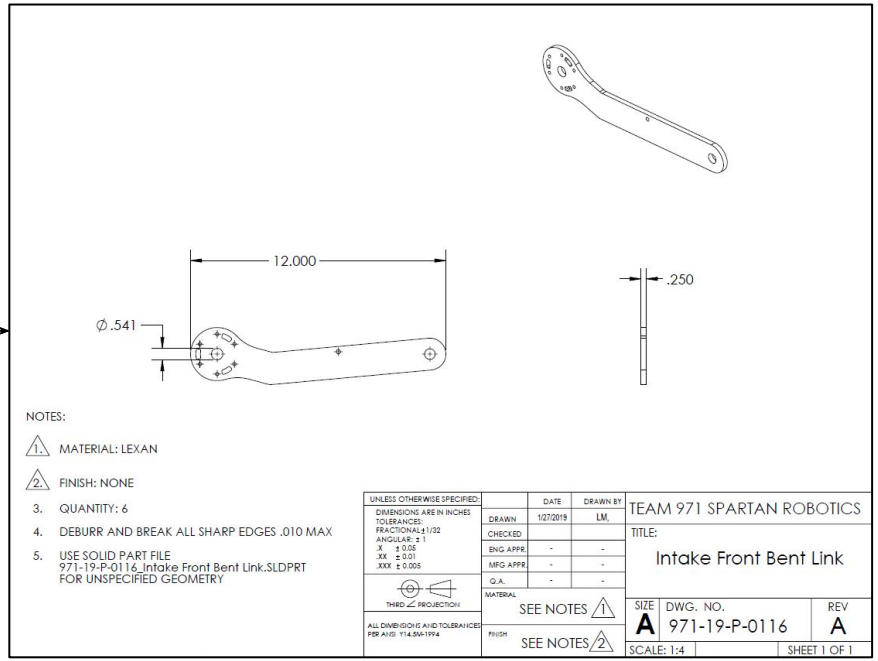
CAD ➔ Drawing





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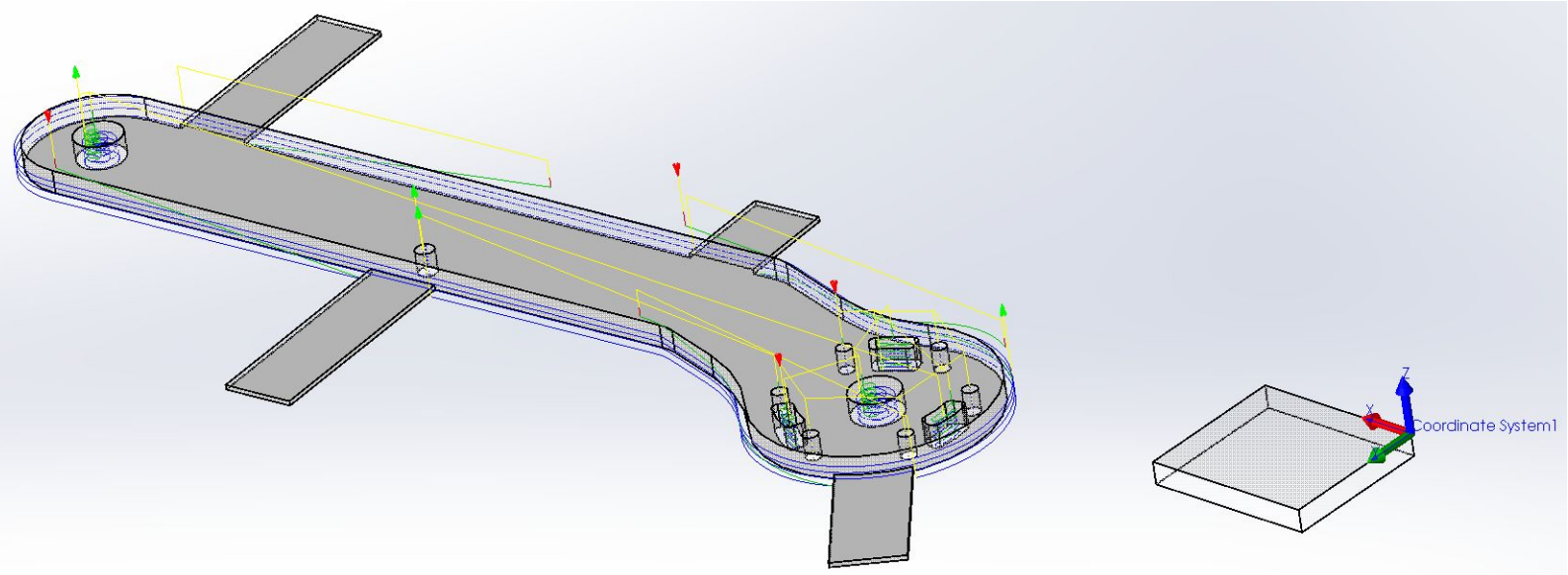
Drawing ➔ Manufacturing



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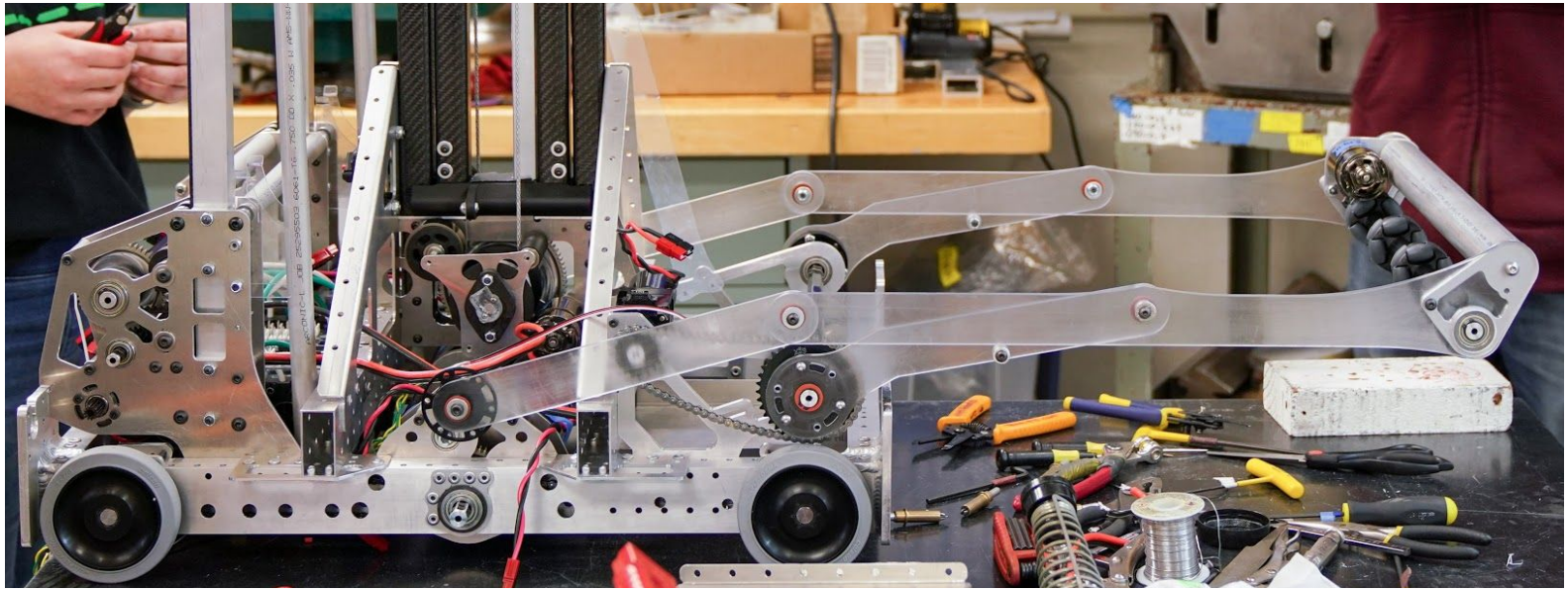
Final Product!



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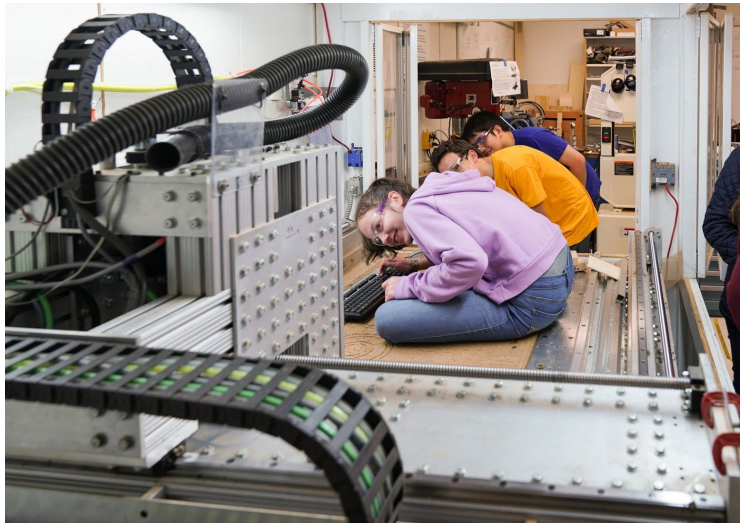
How We Manufacture



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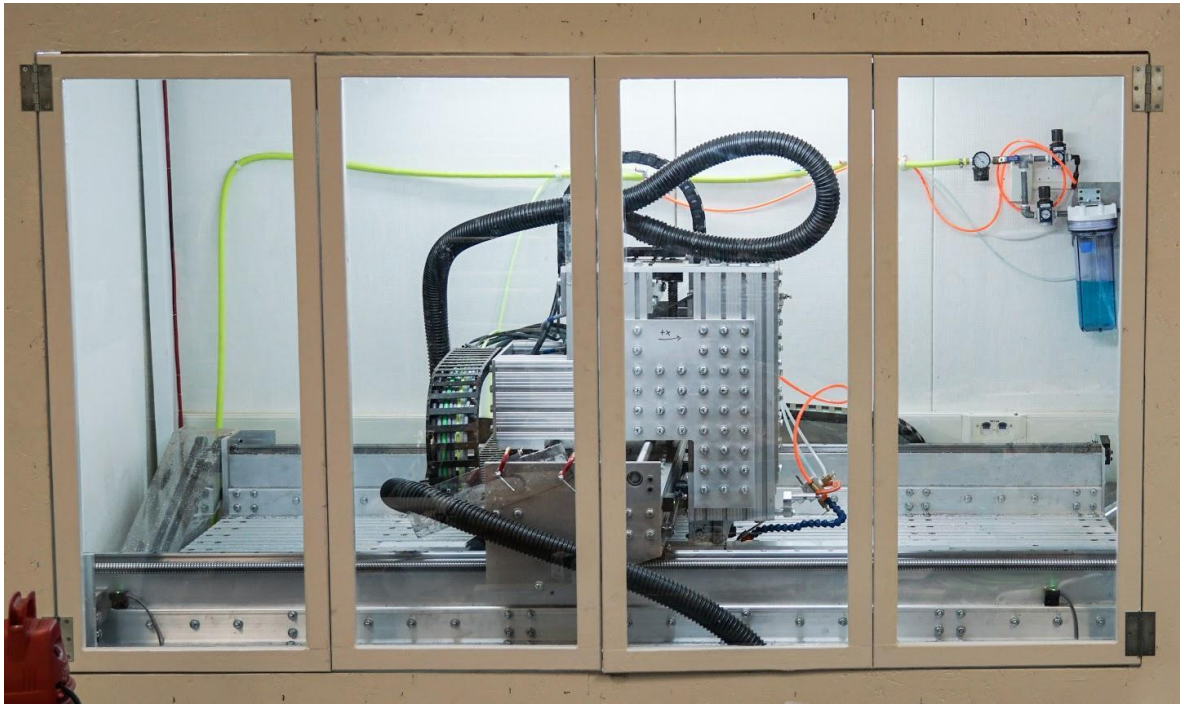
CNC Router!!!

- Super cool DIY CNC Router (don't try this at home kids)



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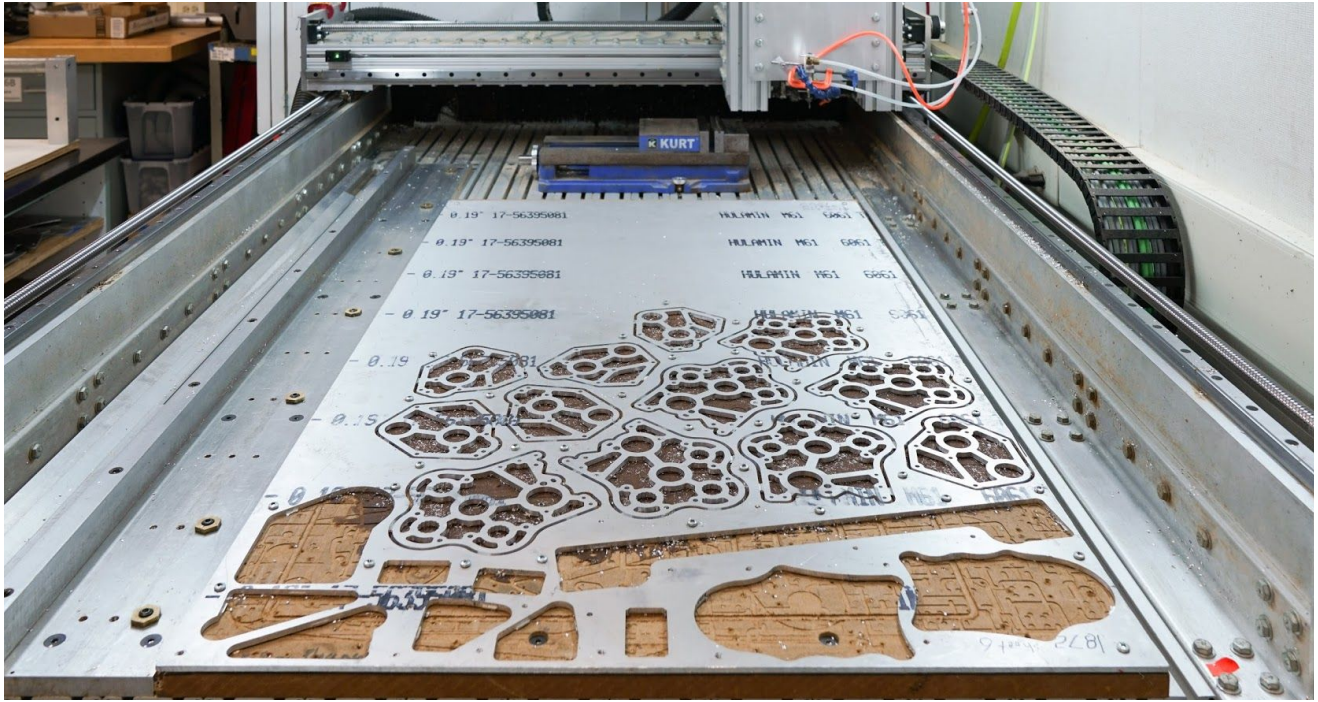
Cutting Sheets

Metal



971
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Cutting Sheets

Polycarb

971
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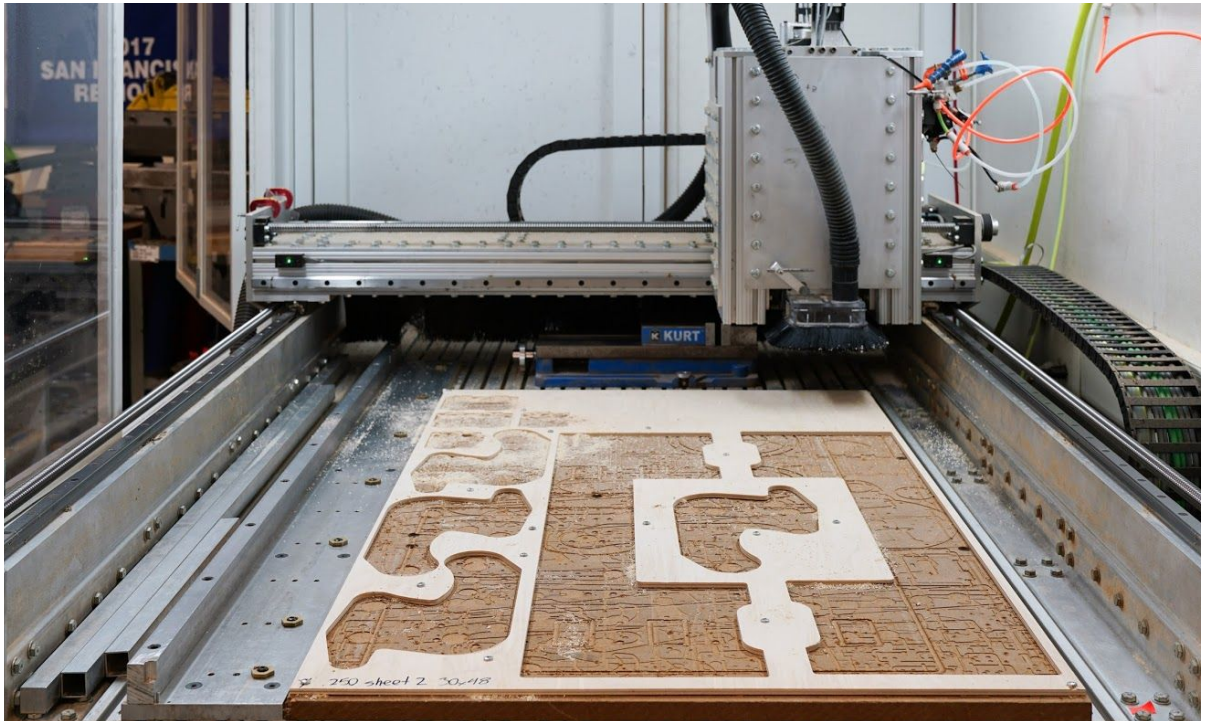
Cutting Sheets

Wood



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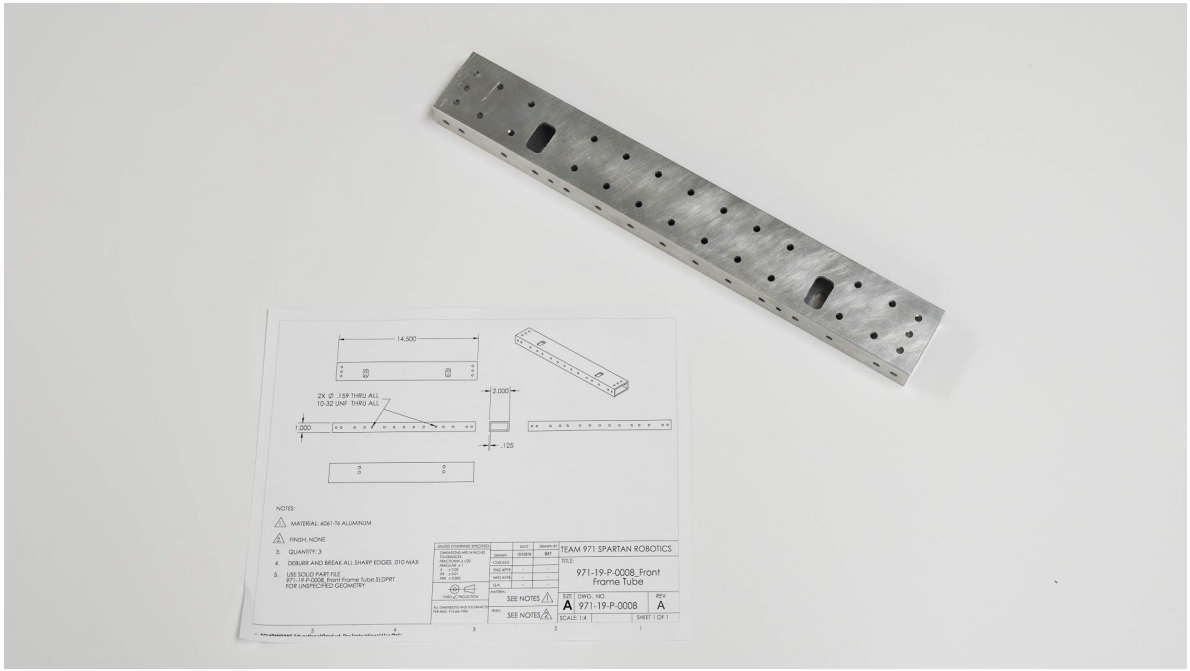
Cutting Tubestock



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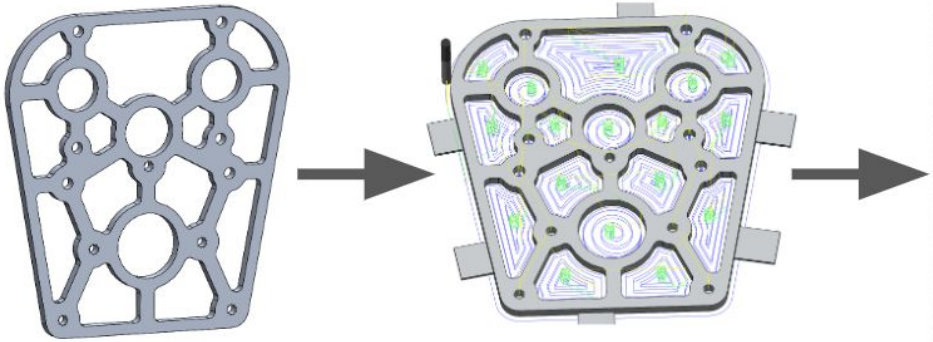
CAM



```
%
(971-16-P-0450_BALL SHIFTER CIM PLATE_1548)
(T1  D=0.1548 CR=0. - ZMIN=-0.2225 - FLAT END MILL)
G90 G94 G17 G91.1
G20
G53 G0 Z0.
(2D POCKET1)
M9
T1 M6
S13000 M3
G4 P10.
G54
M7
G0 X4.9737 Y1.9276
G43 Z0.6 H1
G0 Z0.2
G1 Z0.0504 F65.
G3 X4.9748 Y1.9274 Z0.0448 I0.0129 J0.0724 F50.
X4.9777 Y1.927 Z0.04 I0.0119 J0.0726
X4.9821 Y1.9266 Z0.0366 I0.009 J0.073
X4.9875 Y1.9265 Z0.035 I0.0066 J0.0734
X4.9858 Y2.0735 Z0.0107 I-0.0009 J0.0735
X4.9875 Y1.9265 Z-0.0136 I0.0009 J-0.0735
X4.9858 Y2.0735 Z-0.0378 I-0.0009 J0.0735
X4.9875 Y1.9265 Z-0.0621 I0.0009 J-0.0735
X5.0602 Y2. Z-0.0742 I-0.0009 J0.0735
X4.9398 I-0.0602 J0. F65.
X5.2873 I0.1337 J0.
X4.7927 I-0.2873 J0.
X5.3543 I0.2808 J0.
X4.6457 I-0.3543 J0.
X5.3543 I0.3543 J0.
X5.3465 Y2.008 I-0.008 J0.
G1 X4.9223 Y2.0192
G3 X4.9142 Y2.0126 I-0.0082 J-0.008
X5.0591 Y1.9874 Z-0.0984 I0.0724 J-0.0126 F50.
X4.9142 Y2.0126 Z-0.1227 I-0.0724 J0.0126
X4.9804 Y1.9267 Z-0.1355 I0.0724 J-0.0126
X5.0602 Y2. Z-0.1483 I0.0863 J0.0733
X4.9398 I-0.0602 J0. F65.
X5.2873 I0.1337 J0.
X4.7927 I-0.2873 J0.
X5.3543 I0.2808 J0.
X4.6457 I-0.3543 J0.
X5.3543 I0.3543 J0.
X5.3465 Y2.008 I-0.008 J0.
G1 X4.9223 Y2.0192
G3 X4.9142 Y2.0126 I-0.0082 J-0.008
X5.0591 Y1.9874 Z-0.1726 I0.0724 J-0.0126 F50.
X4.9142 Y2.0126 Z-0.1969 I-0.0724 J0.0126
X4.9804 Y1.9267 Z-0.2097 I0.0724 J-0.0126
X5.0602 Y2. Z-0.2225 I0.0863 J0.0733
X4.9398 I-0.0602 J0. F65.
X5.2873 I0.1337 J0.
```

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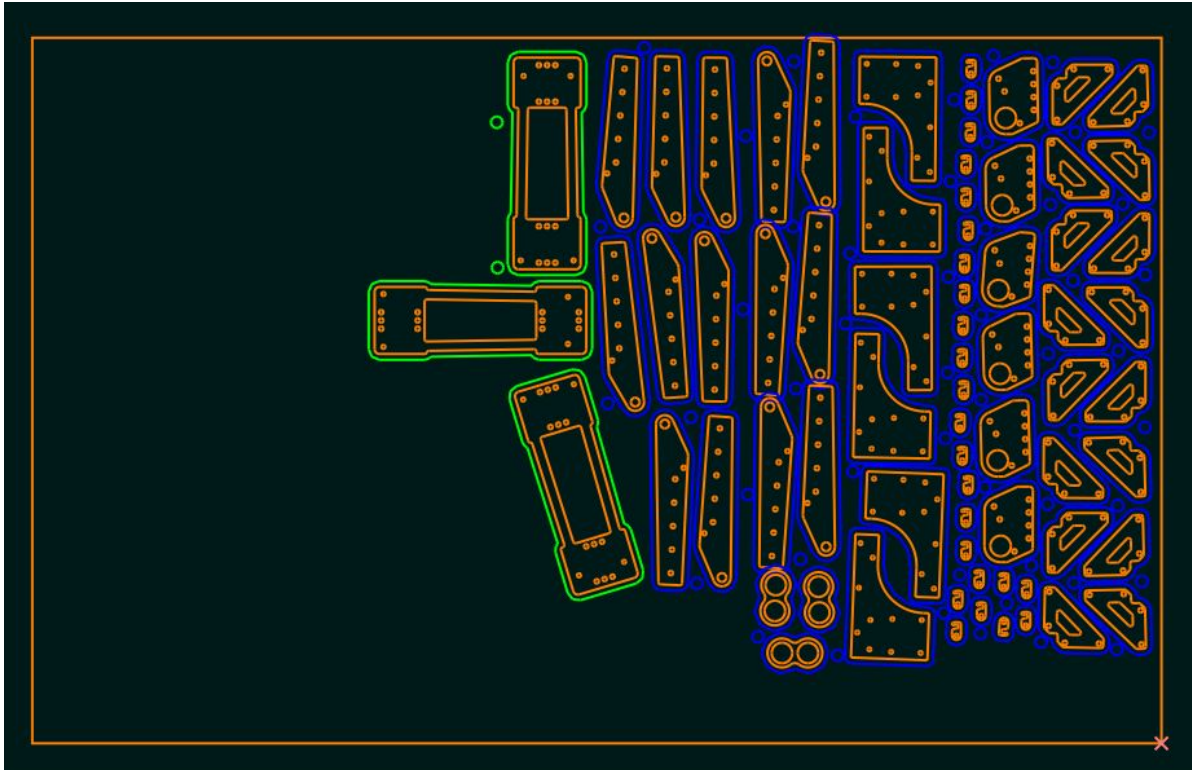
Sheet Output



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Cutting on the router

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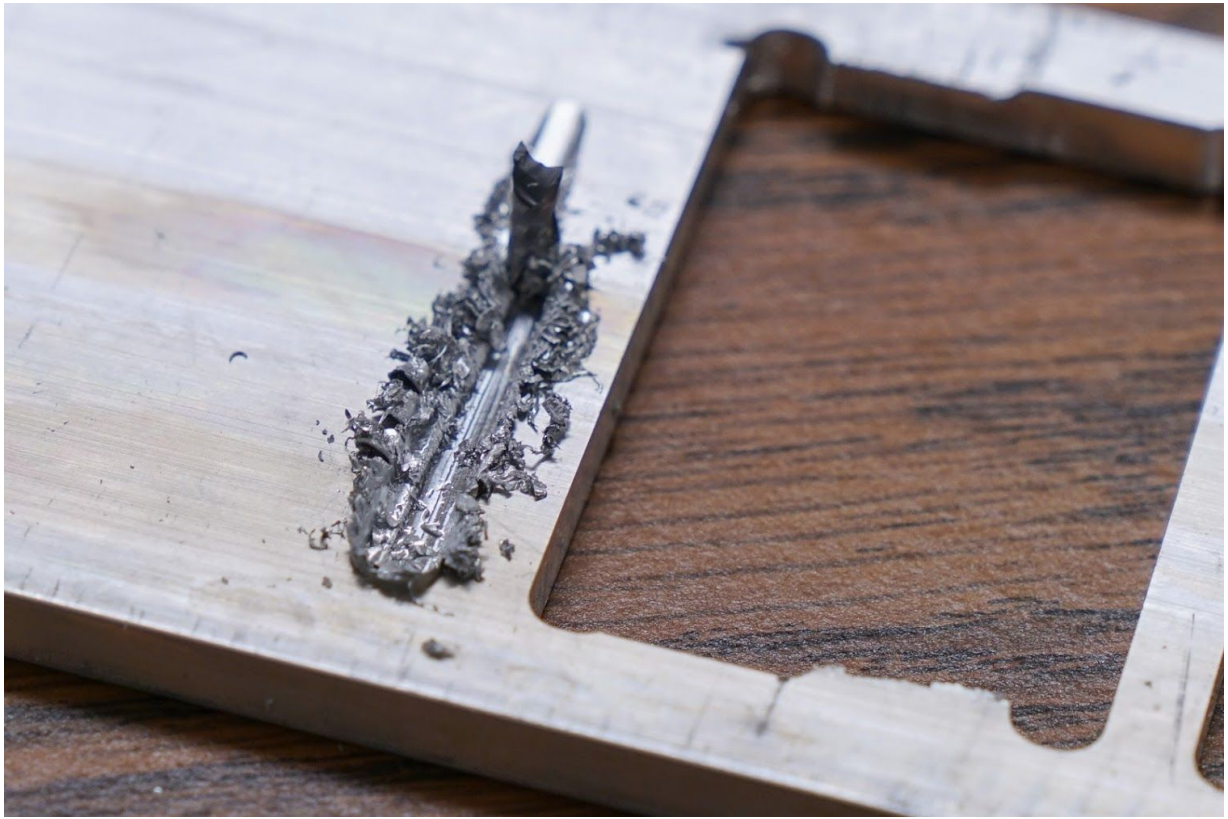
Bruh moment



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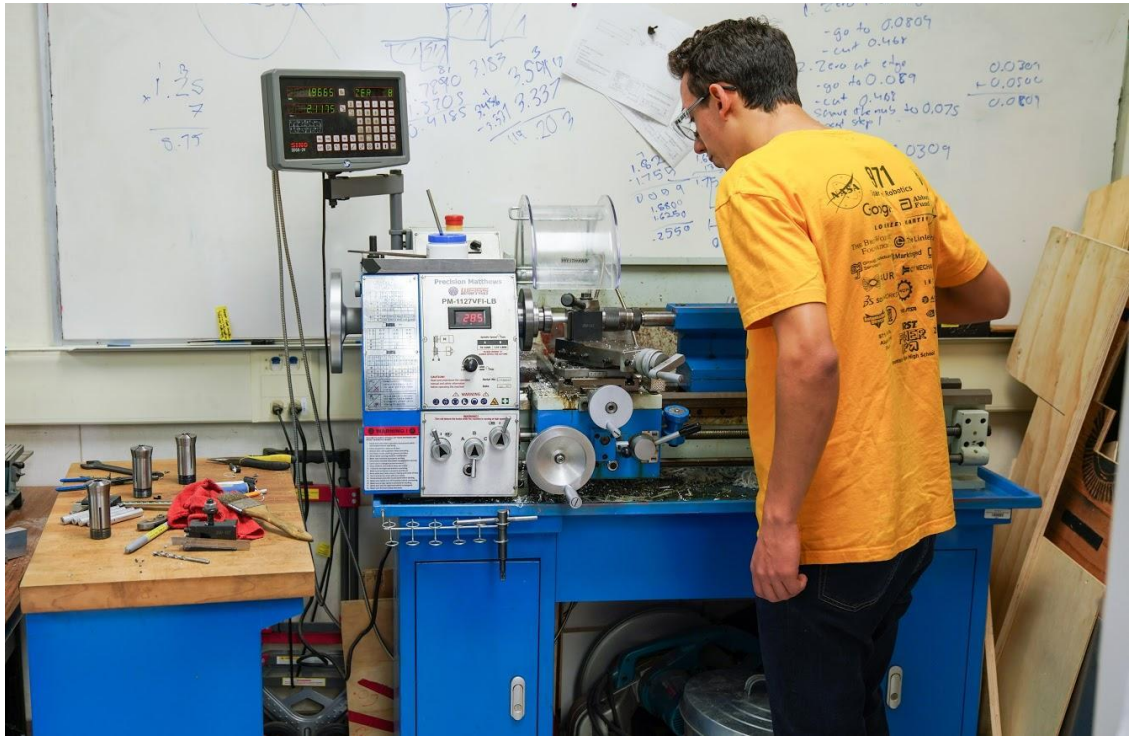
Lathe



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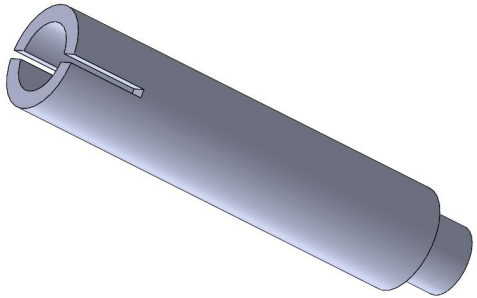
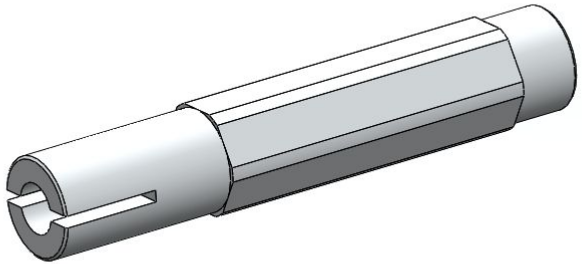
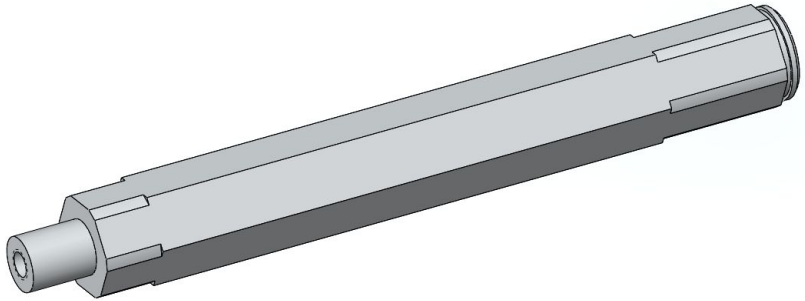
Lathe Parts







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Mill!!!

- 2.5 axis CNC

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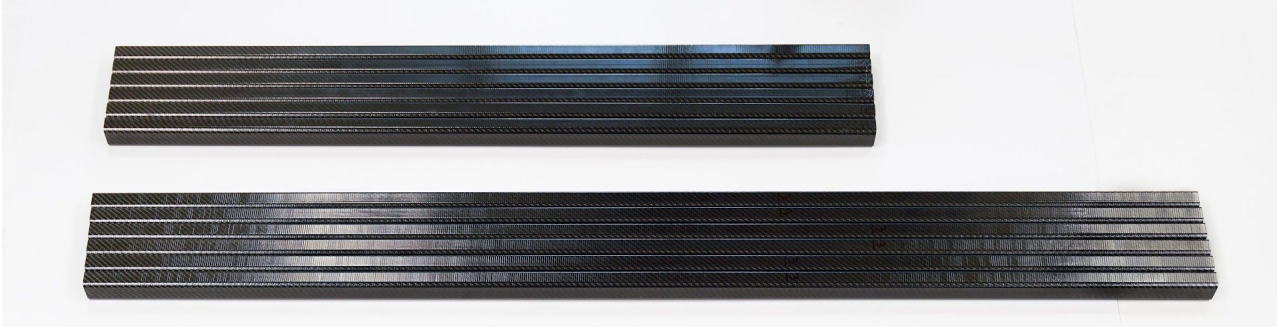
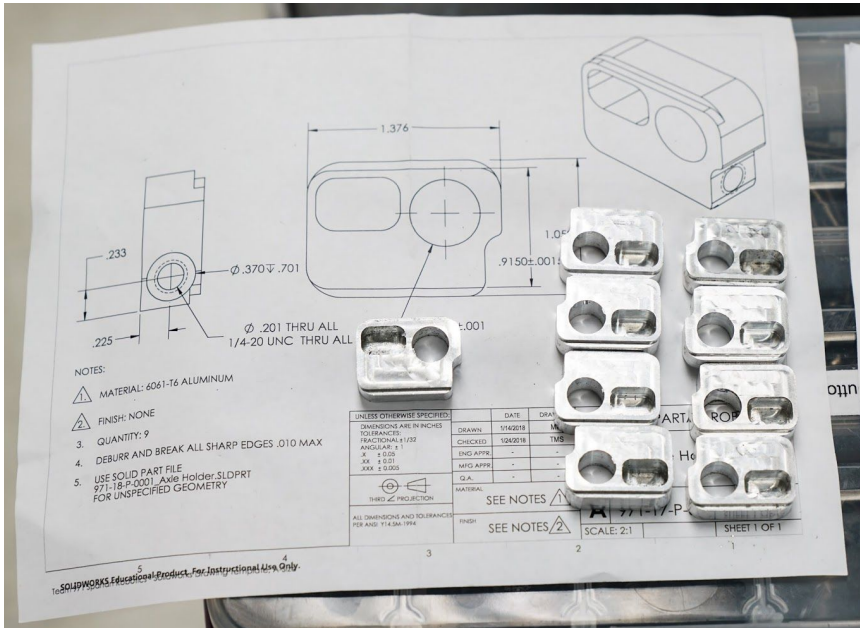
Why Mill?





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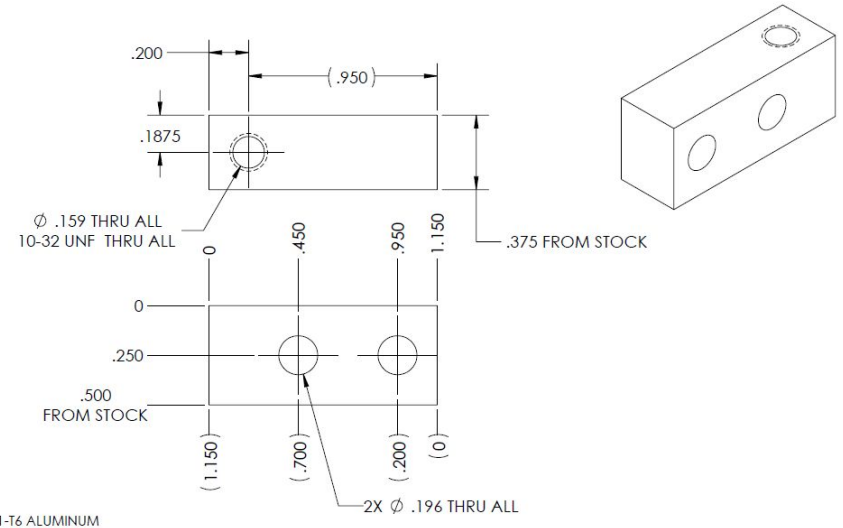
CAM vs Drawings - Mill

- Simple parts

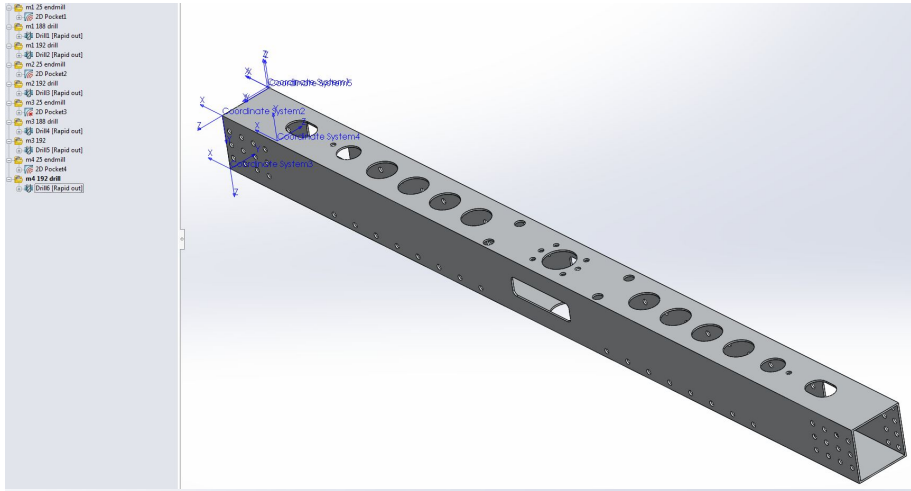


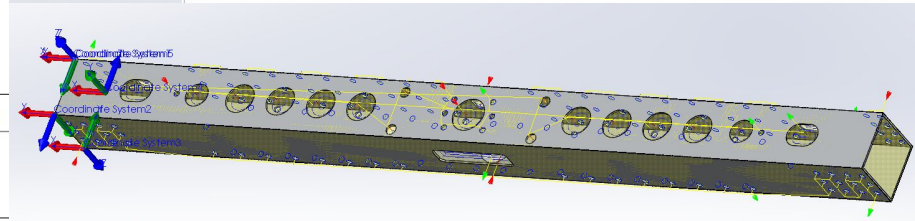
NOTES:

1. MATERIAL: 6061-T6 ALUMINUM
2. FINISH: NONE
3. QUANTITY: 3
4. DEBURR AND BREAK ALL SHARP EDGES .010 MAX
5. USE SOLID PART FILE
   971-18-P-0264_Swoopy thing 2.SLDPRT
   FOR UNSPECIFIED GEOMETRY

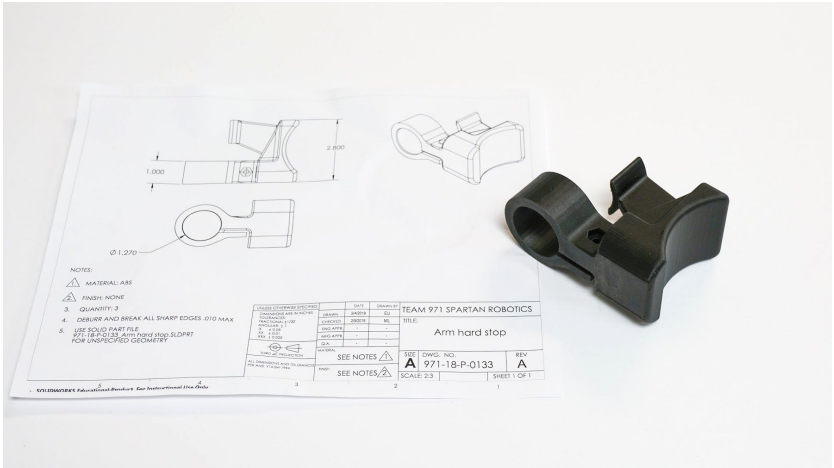
UNLESS OTHERWISE SPECIFIED:		DATE	DRAWN BY	TEAM 971 SPARTAN ROBOTICS		
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ±1/32 ANGULAR: ± 1 .X ± 0.05 .XX ± 0.01 .XXX ± 0.005	DRAWN	2/3/2018	EU	TITLE: Swoopy thing 2		
	CHECKED	2/3/2018	TMS			
	ENG APPR.	-	-			
	MFG APPR.	-	-			
THIRD ANGLE PROJECTION	Q.A.	-	-			
	MATERIAL	SEE NOTES 1		SIZE A	DWG. NO. 971-18-P-0130	REV A
ALL DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1994	FINISH	SEE NOTES 2		SCALE: 2:1	SHEET 1 OF 1	

- Complicated parts





Drawings Who?



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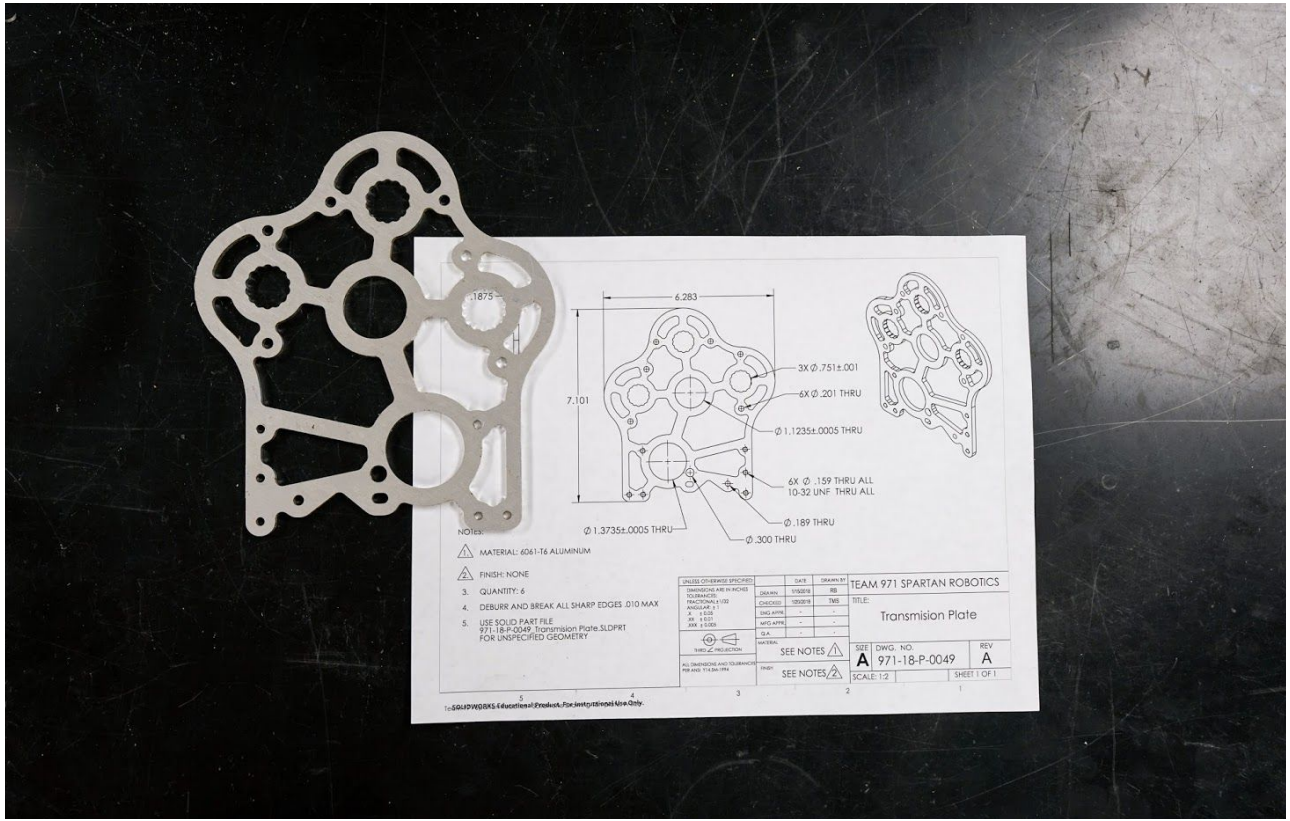
SPARTAN ROBOTICS

Part numbering!!!

	File Name		Total Qty	Drawing done by (initials)	Drawing completed (date)	Drawing Check (Travis/Annie/ Ben)	Who is doing CAM?	CAM Checked?	Sheet Ouput? (initials)	Cut?	Part Done/Inspected ? (Initials)	Stock Type	Material (For CNC parts only)	Machine	Manufacturer	Kits
971-19-P-0001	971-19-P-0001_Frame Siderail		3	BAT	1/20/2019		KK	BM	N/A	KK/KW	TS	Tube	2x1 .0626 25in	Router		1000 drivetra
~~971-19-P-0002~~	~~971-19-P-0002_Tensioner Side Plate~~	x														
971-19-P-0003	971-19-P-0003_Tensioner Standoff		12	BAT	~~1/21/18~~	TS	N/A	N/A	N/A	x	WS			Lathe		1000 drivetra
~~971-19-P-0004~~	~~971-19-P-0004_Tensioner Bearing Spacer~~	x												~~3D Printer~~		
971-19-P-0005	971-19-P-0005_Tensioner Top Spacer		12	NM	1/19/2019		CH	BM	x	x	LDD		.063 6061	Router		1000 drivetra
971-19-P-0006	971-19-P-0006_Drivetrain Chain						N/A	N/A	N/A	x						
971-19-P-0007	971-19-P-0007_Back Frame Tube		3	BAT	1/21/2019		KK	BM	N/A	x		Tube	2x1 ~15in	Router		1000 drivetra
971-19-P-0008	971-19-P-0008_Front Frame Tube		3	BAT	1/21/2019		KK	BM	N/A	x		Tube	2x1 ~15in	Router		1000 drivetra
~~971-19-P-0009~~	~~971-19-P-0009_Front Cross Tube~~	x														
~~971-19-P-0010~~	~~971-19-P-0010_Back Cross Tube~~	x														
971-19-P-0011	971-19-P-0011_Transmission Plate		6	MS	1/19/2019		KK	KW	x	x	LD	Sheet Metal	.125 6061	Router		1300 transmis
~~971-19-P-0012~~	~~971-19-P-0012_Stilts Outer Tube~~	x														
~~971-19-P-0013~~	~~971-19-P-0013_Stilts Inner Tube~~	x														
~~971-19-P-0014~~	~~971-19-P-0014_Stilt Rack Gear~~	x														
~~971-19-P-0015~~	~~971-19-P-0015_Stilt Roller Support Plate~~	x														
~~971-19-P-0016~~	~~971-19-P-0016_Stilt Plastic Roller~~	x												~~Lathe~~		
~~971-19-P-0017~~	~~971-19-P-0017_Chain Guard gusset~~	x														
971-19-P-0018	971-19-P-0018_Transmission Outside Plate		6	AF	1/19/2019		KK	KW	x	x	BL	Sheet Metal	.125 6061	Router		1300 transmis
~~971-19-P-0019~~	~~971-19-P-0019_Tubestock Gusset~~	x														
971-19-P-0020	971-19-P-0020_Bumper Corner Plate		6	LM	1/19/2019		KK 1/20/19	KW	KW	x	ET and EG	Sheet Metal	.25 6061	Router		1000 drivetra
971-19-P-0021	971-19-P-0021_1in Tread Wheel		6	CD	2/2/2019		N/A	N/A	N/A	x	on the robot					
~~971-19-P-0022~~	~~971-19-P-0022_Modified 14T Drivetrain Sprocket~~	x													~~Aren/Jay?~~	~~1000 drivetra~~
971-19-P-0023	971-19-P-0023_Center Wheel Outside Plate		6	NM	1/19/2019	BAT	KW	KW	KW	x	ET	Sheet Metal	.125 6061	Router		1000 drivetra
971-19-P-0024	971-19-P-0024_Custom 4in Colson Wheel		13	TMS	2/2/2019		N/A	N/A	N/A	x					Jay	
971-19-P-0025	971-19-P-0025_1.625x0.875 Custom Colson Wheel		6	TMS	1/27/2019		N/A	N/A	N/A	x					Jay	
~~971-19-P-0026~~	~~971-19-P-0026_Carriage Tube~~	x														
~~971-19-P-0027~~	~~971-19-P-0027_Carriage Motor Plate~~	x														
971-19-P-0028	971-19-P-0028_Foot Plate		12	BAT	1/26/2018	Travis	OB	OB	OB	x	BL					
971-19-P-0029	971-19-P-0029_Stilt Wheel Plate		8	LM	1/27/2019		KW	KW	KK	x	BL		.125 6061			
971-19-P-0030	971-19-P-0030_Stilt Tube		2	CD	2/1/2019		N/A	N/A	N/A	x				Mill		
971-19-P-0031	971-19-P-0031_Stilt Gearbox Plate		2	BAT	2/2/2019		KW	KW	OB & NM	x			.125 6061	Router		
971-19-P-0032	971-19-P-0032_Delrin Block for Stilts		12	CD	2/1/2019		N/A	N/A	N/A	x				Mill		
~~971-19-P-0033~~	~~971-19-P-0033_Wrist Dead Axle~~	x												~~Lathe~~		

Sheet Drawings



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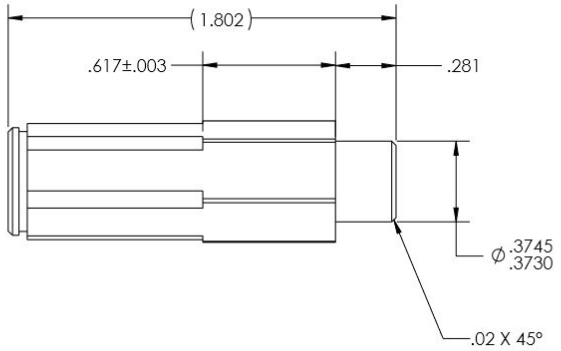
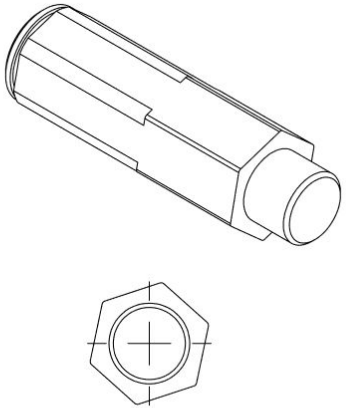
Lathe Drawings

- Double-inspection





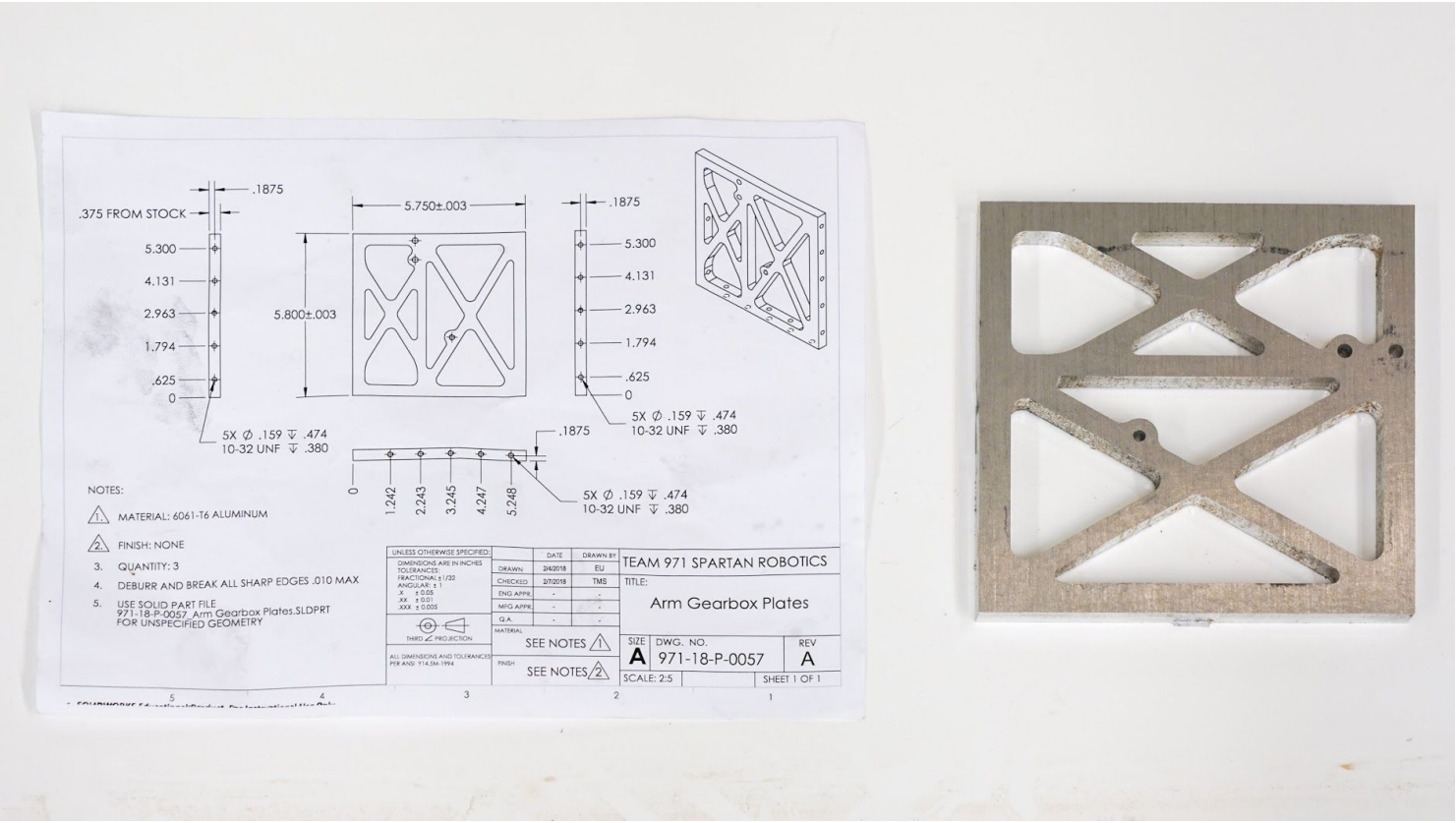
NOTES:

1. MATERIAL: 6061-T6 ALUMINUM
2. FINISH: NONE
3. QUANTITY: 6
4. DEBURR AND BREAK ALL SHARP EDGES .010 MAX
5. USE SOLID PART FILE
   971-18-P-0194_Intake Pivot Pulley Shaft.SLDPRT
   FOR UNSPECIFIED GEOMETRY

UNLESS OTHERWISE SPECIFIED:		DATE	DRAWN BY	TEAM 971 SPARTAN ROBOTICS		
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ±1/32 ANGULAR: ± 1 .X ± 0.05 .XX ± 0.01 .XXX ± 0.005	DRAWN	2/4/2018	RG	TITLE: Intake Pivot Pulley Shaft		
	CHECKED	2/11/2018	TMS			
	ENG APPR.	-	-			
	MFG APPR.	-	-			
	Q.A.	-	-			
THIRD ANGLE PROJECTION	MATERIAL	SEE NOTES 1		SIZE A	DWG. NO. 971-18-P-0194	REV A
ALL DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1994	FINISH	SEE NOTES 2		SCALE: 2:1		SHEET 1 OF 1

971 SPARTAN ROBOTICS

Mill Manufacturing Drawings



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Finishing parts

- Debur/ De-tab / File / Tap parts
- Bend

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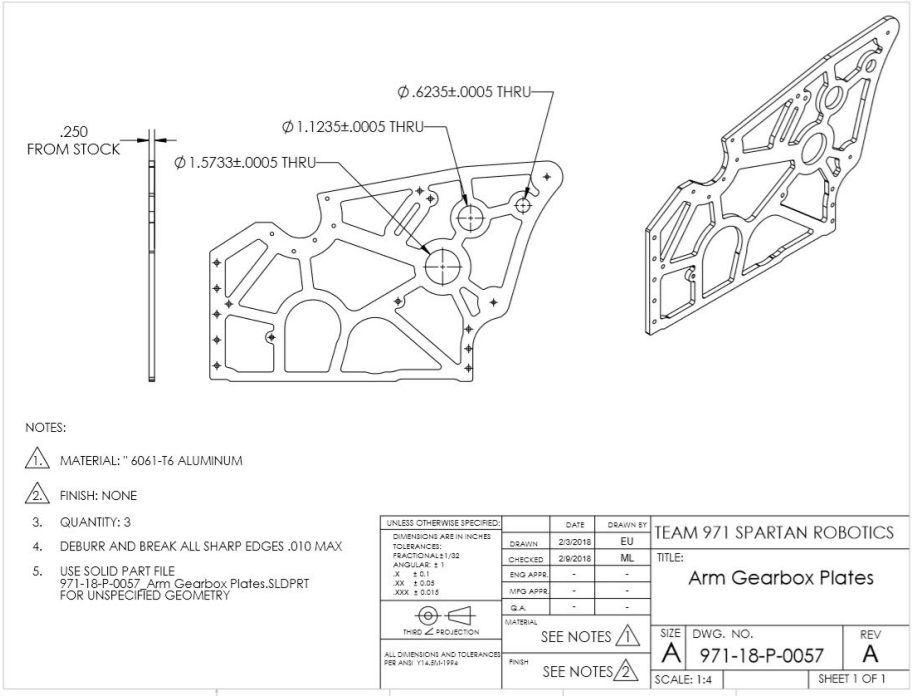
Inspection



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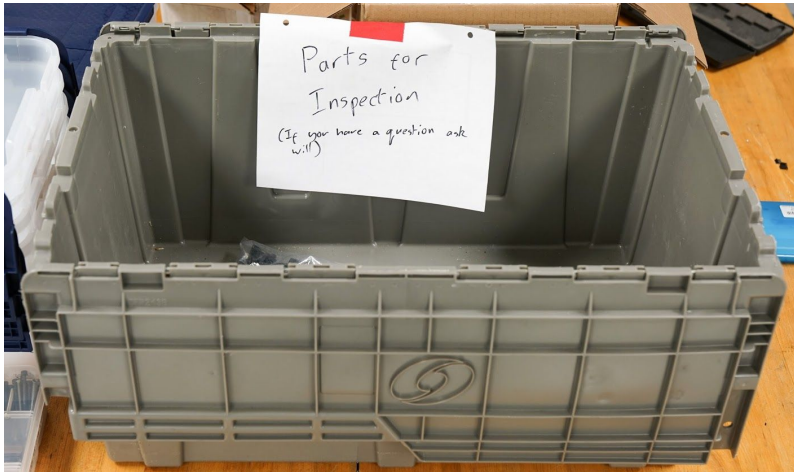
Part Managemenement

- Uninspected and Inspected bins



- Sub Assembly Kits

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But wait there’s more

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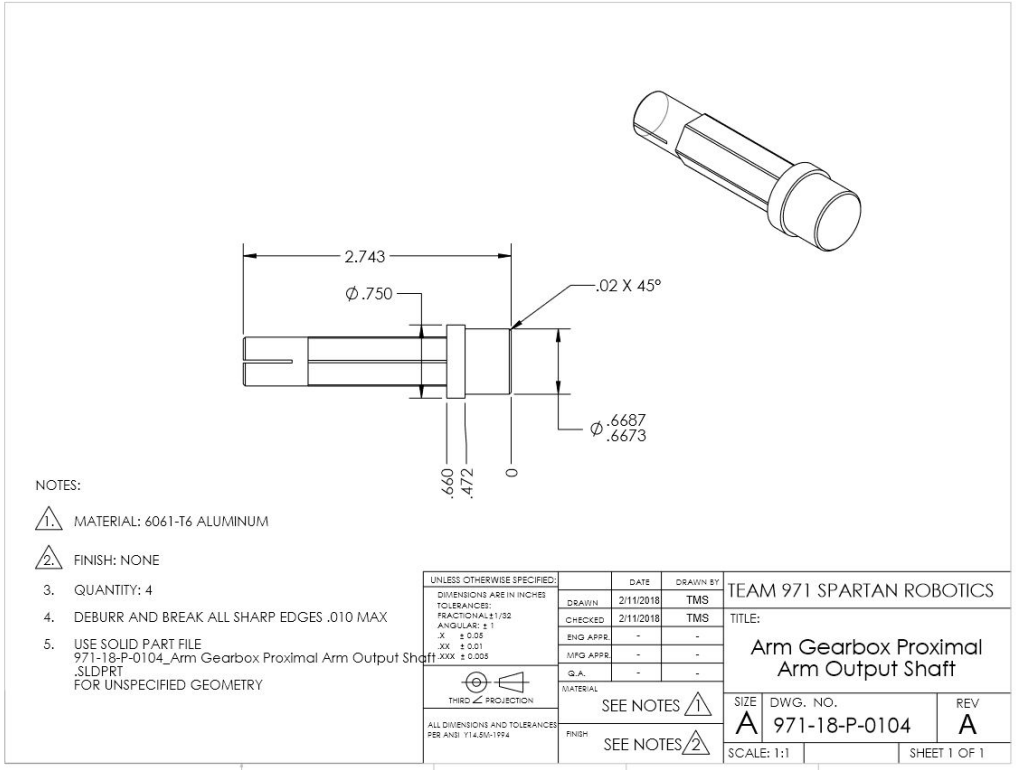
Advanced Machining

- Jay's Lathe
  - Can do more than ours
- Auris
  - HAAS CNC Mill
  - CNC Lathe



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Cool Arm Parts

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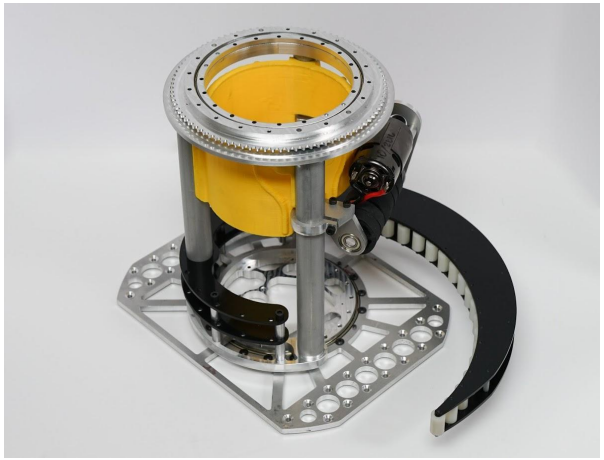
All time favorite



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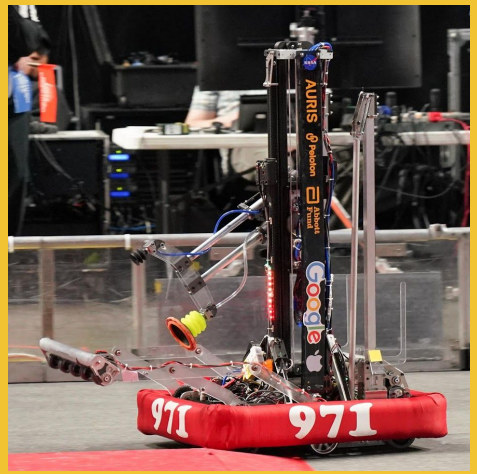
You don’t have to be 971

- Drawings
- Part numbers
- Part management
- Inspection



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Feel free to contact me: rexkseniia@gmail.com

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