To: Professor Sarah Oman and Ulises Fuentes

From: Kadeja Alhossaini, Nathan Firor, Edwin Smith, and Ethan Vieane

Date: 02/07/2020

Subject: Hardware Review memo 1

The purpose of this memo is to showcase the progress of the physical state of prototyping and manufacturing of the team's project. The project is to create a braze-welding jig for a company called SunTrac, USA. During the winter break, SunTrac provided the team with some design changes that they would like implemented on the original design. The team has worked to modify the design of the CAD package and the BOM accordingly. Visual proof will be provided below to portray the changes that have been made.

Redesign 1

The first redesign is to add a guide rail on the back of the jig to make sure the welding area is at four feet. A worm gear winch will be attached to a cable that is attached to a snatch block which lifts the carriage on the guide rail where the pivot of the jig will be attached. This allows the user to weld the jig at a height of four feet for all three sizes of manifolds. Figure 1 and 2 show the guide rail design without the face of the jig installed.

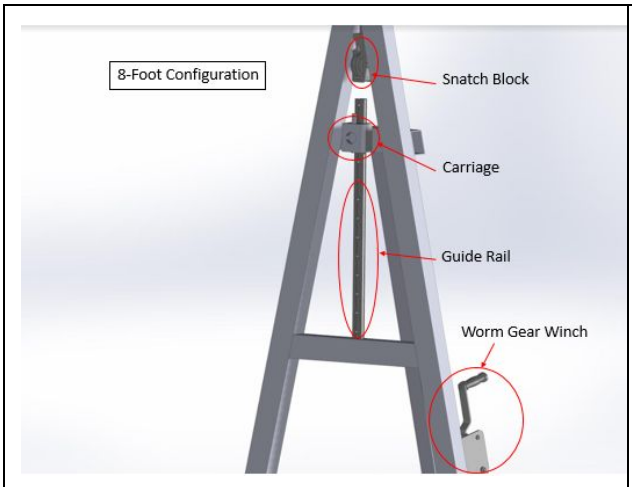

Figure 1. 8-foot pivot location

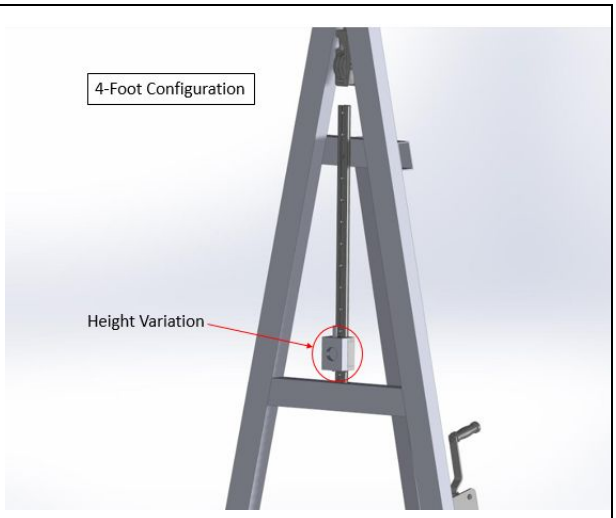

Figure 2. 4-foot pivot location

Redesign 2

The second redesign is to change the stand of the jig to an A-frame. The jig that SunTrac owns in their warehouse has an A-frame design, therefore they want the stand of the jig being used to look the same. Moreover, the locking mechanism was also changed from a foot pedal to a rope that can be pulled to release the tooth of the gear. Upon release, the rope will be attached to a spring loaded metal that will clash onto the gear which will lock the jig back into position. Figures 3 and 4 show an Isometric view of the design.

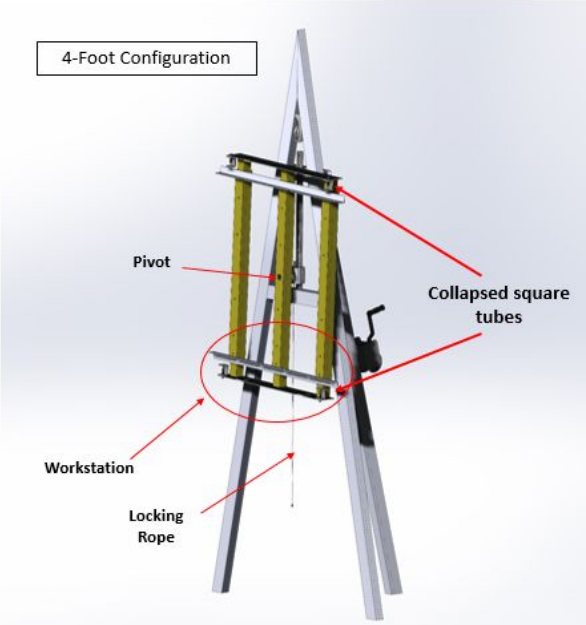

Figure 3. 4-foot configuration of the jig

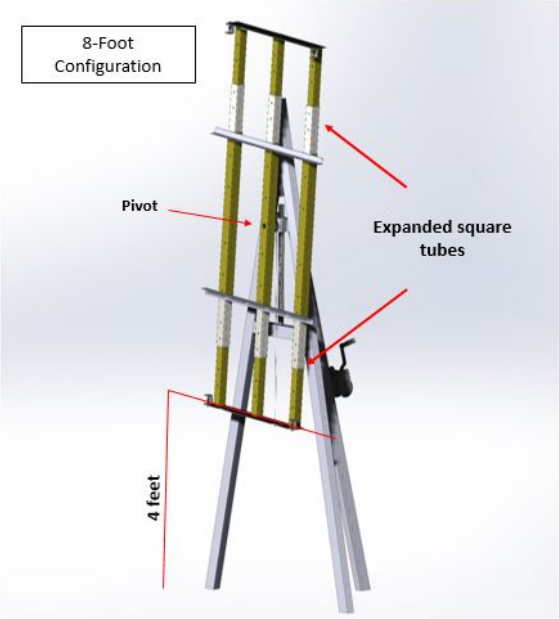

Figure 4. 8-foot configuration of the jig

Redesign 3

The final adjustment SunTrac wanted to see is on the power screws that hold the horizontal pipes of the manifold together. Tighter tolerances and interferences have been applied to ensure the pipe is flush against the power screw. Figure 5 shows the redesign of the power screw area. The figure also shows the orientation of the manifold with respect to the jig to help visualize the changes.

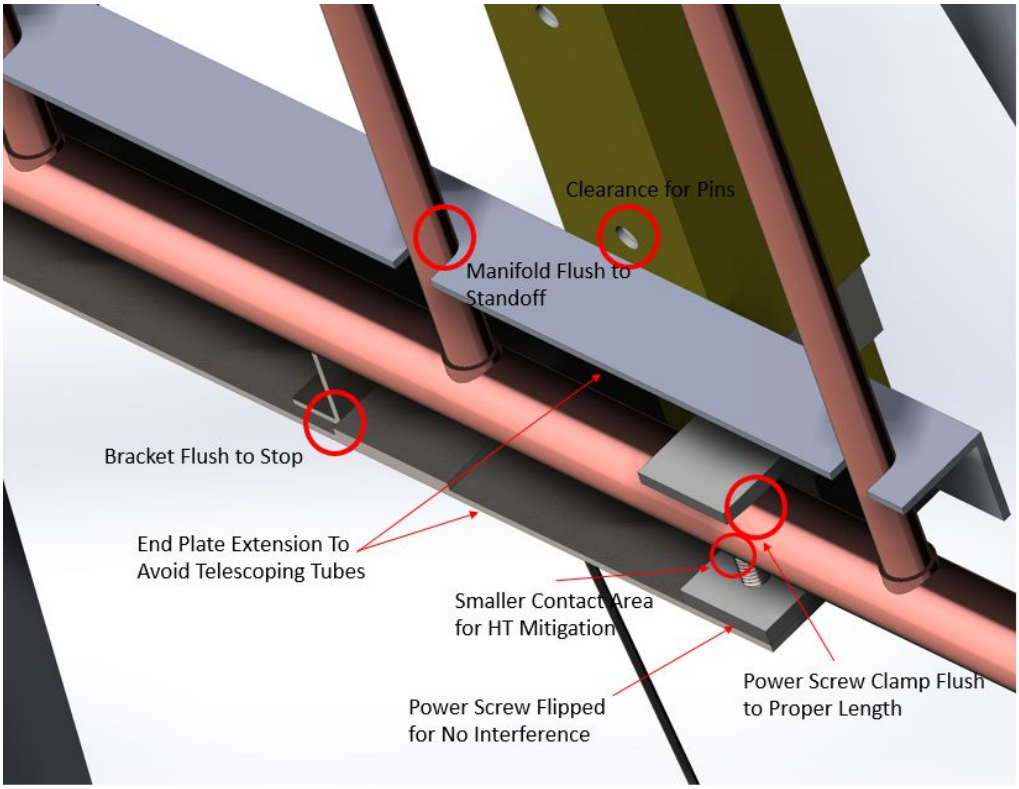

Figure 5. Manifold Orientation and power screw

Bill of Materials

Since there have been major changes on the design of the brazing jig, the bill of materials needed to be updated accordingly. New materials have been inserted and materials that are not being used anymore are erased. The updates that have been made on the bill of materials (BOM) can be seen in Table 1.

Table 1. Bill of Materials

Bill of Materials										
Team SunTrac										
Part #	**Part Name**	**Qty**	**Description**	**Functions**	**Material**	**Dimensions**	**Link to Cost estimate**	**Part ID**	**Unit Price**	**Cost ($)**
1	Steel tube	3	4 foot center	Comprises of the stationary middle skeleton structure	Carbon Steel	2.5" x 2.5" x 4'	https://www.mcmaster.com/steel-tubing	4931T146	32.16	$96.48
2	Steel tube	1	Medium Telescoping Tube	Slides in part # 1 to allow for manifold length	Carbon Steel	2.25" x 2.25" x 12'	https://www.mcmaster.com/steel-tubing	4931T145	81.43	$81.43

				variation						
3	Steel tube	1	Small Telescoping Tube	Slides in part # 2 to allow for manifold length variation	Carbon Steel	2" x 2" x 12 '	https://www.mcmaster.com/steel-tubing	4931T144	75.12	$75.12
4	Carbon Steel Strip	1	3' piece of low carbon strip	Used to provide more surface area to each tripod leg	Carbon Steel	2.0" x 1/8" x 3'	https://www.mcmaster.com/steel-strips	6511K511	16.45	$16.45
5	Steel beam	2	Tripod / A - Frame	Holds welding jig upright	Hot-Rolled Carbon Steel	2" x 3" x 2'	https://www.industrialmetalsupply.com/hot-rolled-steel-rectangle-tube/rt20030012	RT20030012	62.62	$125.24
6	Angle Iron	2	Vertical Pipe Supports	Positions the Vertical Copper Pipes/ Rotation Subassembly support	Low-Carbon Steel	1.5" x 1.5" x 6'	https://www.mcmaster.com/angle-iron	9017K484	16.95	$33.90
7	Steel Sheet	2	Top and Bottom Sheet of Metal	Base metal that all tellescoping tubes are welded	4130 Alloy Steel	36" x 6" x 1/8"	https://www.mcmaster.com/4459t188	4459T188	47.35	$94.70
8	Roller Bearing	1	For Axis of Rotation	Prevents wear to shaft	Steel Housings	1' x 1 7/16" x 2 1/2"	https://www.mcmaster.com/bushings	25015T42	8.62	$8.62
9	Steel Sheet	1	Square Sheet	All 4 Power Screw brackets	Ground Low Carbon	36" x 6" x 1/4"	https://www.mcmaster.com/squares	1388K121	54.77	$54.77
10	Steel Cylinder	1	Machinable 3 foot length	Power Screws	Low-Carbon Steel	3/8" x 3'	https://www.mcmaster.com/cylinders	8920K135	5.14	$5.14
11	Steel Cylinder 2	1	Machinable 3 foot length	Power Screw Caps	Low-Carbon Steel	1/2" x 1'	https://www.mcmaster.com/cylinders	8920K155	3.66	$3.66
12	Metal Wire	1	Stainless Steel Wire	Connects grip to gear lock pin	Multipurpose 304 Stainless Steel Wire	0.162" x 14'	https://www.mcmaster.com/metal-wire	8860K24	12.06	$12.06

13	Spring	1	Rotational Subassembly Spring	Lock the jig in place	301 Stainless Steel	2" Long, 0.938" OD, 0.778" ID	https://www.mcmaster.com/springs	9657K27	5.14	$5.14
14	Rod	1	Rotational Subassembly Rod	Locks rotation of gear	4130Alloy Steel	D = 0.75" L = 1'	https://www.mcmaster.com/6673t25	6673T25	12.04	$12.04
15	Snatch Block	1	Winch Pulley	Support Jig Face Weight	Stainless Steel	Dia 15/16"	https://www.mcmaster.com/pulleys	31625T41	140.27	$140.27
16	Winch	1	Winch	Support Jig Face Weight	Steel	(3 5/8)" x (5 1/8)"	https://www.mcmaster.com/winches	3196T56	69.51	$69.51
17	Guide Rail	1	Guide Rail	Sets path for jig movement	Anodized Aluminum	(23 x 15 x 1000)mm	https://www.mcmaster.com/guide-rails	9867K12	70	$70.00
18	Carriage	1	Guide Rail Carriage	Travels along guide rail	Aluminum	(80 x 30 x 63)mm	https://www.mcmaster.com/guide-rails	3249K3	61.42	$61.42
19	Wire Rope	1	Winch Wire Rope	Connections jig face to winch	Unfinished Steel	Dia: (3/16)" Lngth:10'	https://www.mcmaster.com/wire-rope	3440T55	14.9	$14.90
20	Block	1	Shaft / wire rod joint	Secures directly to carriage	Hot Rolled 304 Stainless Steel	(2.72x3.54 x0.5)"	https://www.mcmaster.com/blocks	6620K177	20.98	$20.98
21	Gear	1	Locking Mechanism	Allows rotation of skeleton frame	1020 Carbon Steel	OD = 4", 48 teeth	https://www.mcmaster.com/gears	5172T36	84.49	$84.49
22	Pin	24	Bent-Pull Clevis Pin	Secures position of sliding tubes	18-8 Stainless Steel	3/8" Diameter, 3" Usable Length	https://www.mcmaster.com/pins	94563A571	6.06	$145.44
23	Shaft	1	Carbon Steel Shaft	Connect jig to ball bearing and stand	1566 Carbon Steel	1-1/4" Diameter, 12" Long	https://www.mcmaster.com/precision-shafts	1346K44	28.03	$28.03
									Total Cost Estimate:	$1,259.79