

# TITANIUM FITTING SORTING

University of Idaho



# PROJECT MEMBERS

Instructor: Dr. Steven Beyerlein

Mentor: Alex Olson

## Undergraduate Students

Joshua Howard

Evan Bonar

Cody Smisek

John Hansen

Juvy Jane Tongco

(left to right)



# PROJECT OVERVIEW

## Problem Statement

Currently TDRC processes on average 2700 fittings a day that are individually placed onto cleaning racks. Manual sorting of the fittings accounts for 65% of the time required for the tankline process.

## Mission Statement

Design a sorting product that dramatically reduces the amount of manual sorting time required by the operator. Create a solution for two fittings (3/8" union and 3/8" sleeve). Identify any 3<sup>rd</sup> party commercial parts available.

# SPECS & CONSTRAINTS

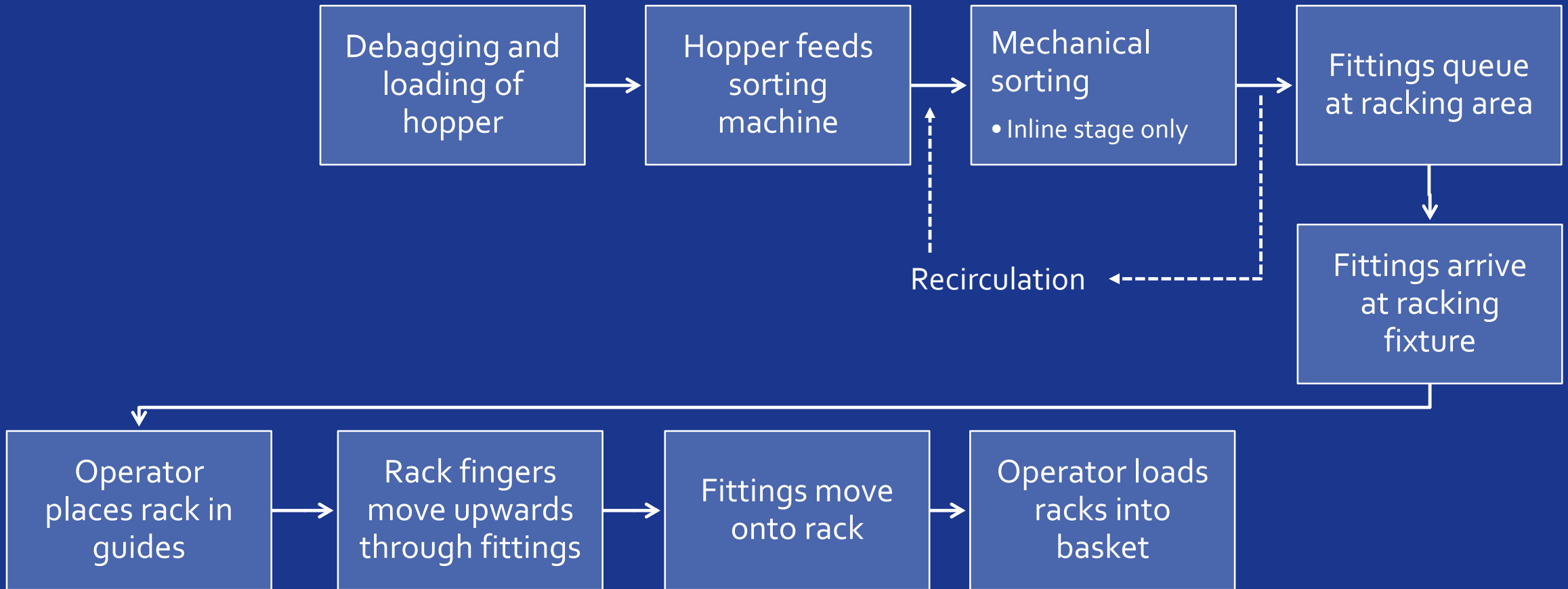
Metric	Value	Units
Footprint	6 by 6	Ft
Power	110	Volt
Air Pressure	70 to 90	PSI
Fitting Rate	2700	Fittings/Day
Fitting Defects	<1	Fittings/Day
Proper Orientation	99	% of total
Set-up Time	10-15	Minutes
Max Recirculation Rate	35	% of total

# CURRENT FITTINGS

- Working with the actual fittings after acquiring from previous site visit
- Creating a solution for both type of fittings (same size)
- 3/8" Sleeve (288,209/year)
- 3/8" Union (97,174/year)



# PROCESS FOR 3/8" UNION



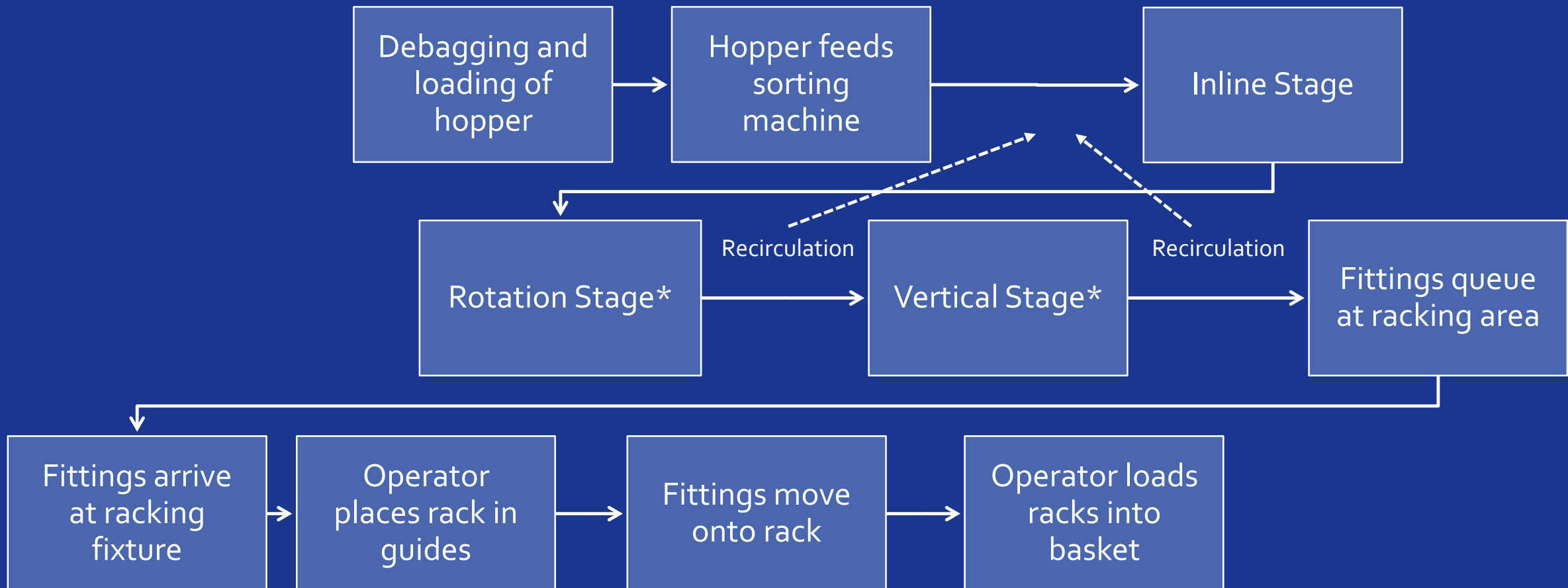


# CURRENT UNION SORT PROTOTYPE

- Single stage solution
- Fittings naturally rotate with weld cup facing down
  - Low rejection rate



# PROCESS FOR $\frac{3}{8}$ " SLEEVE



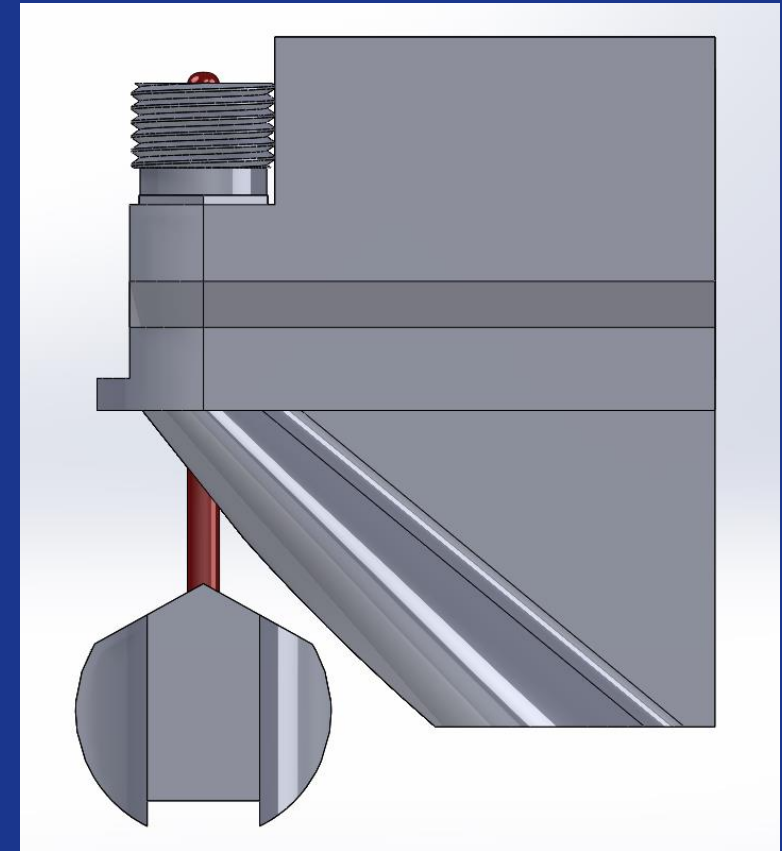
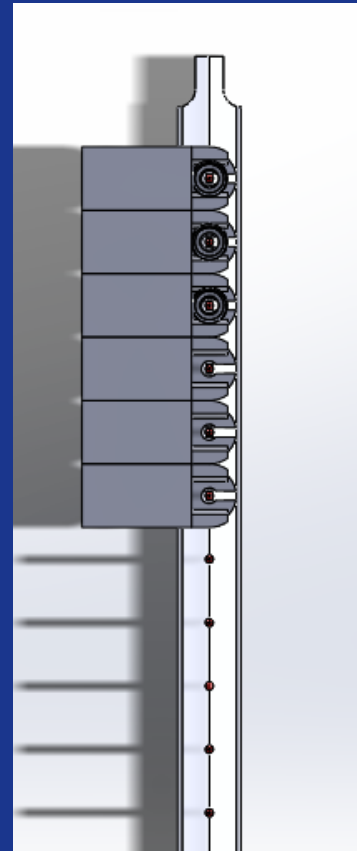
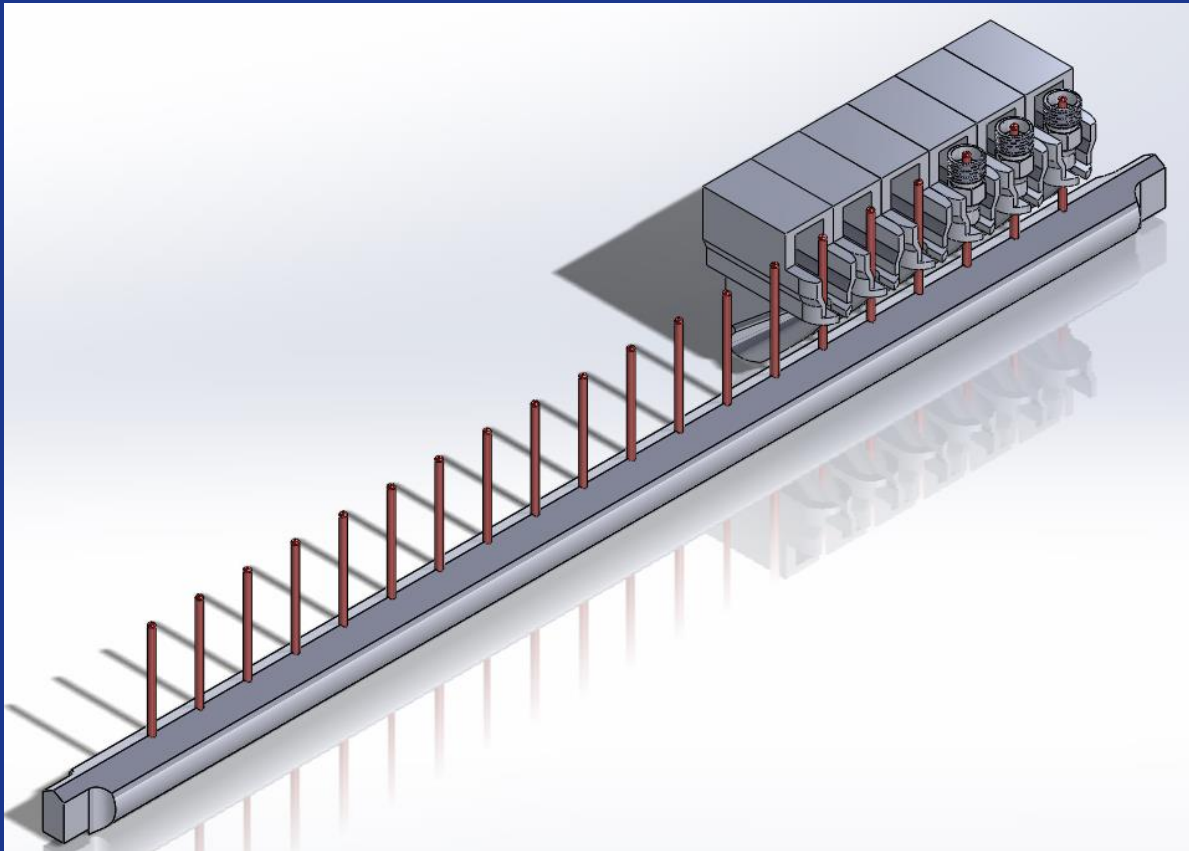


# CURRENT SLEEVE SORT PROTOTYPE

- Due to the geometry of the sleeve a multi-stage sorting operation is required
- Three stages
  - First – Inline
  - Second – Rotation
  - Third – Horizontal ejection

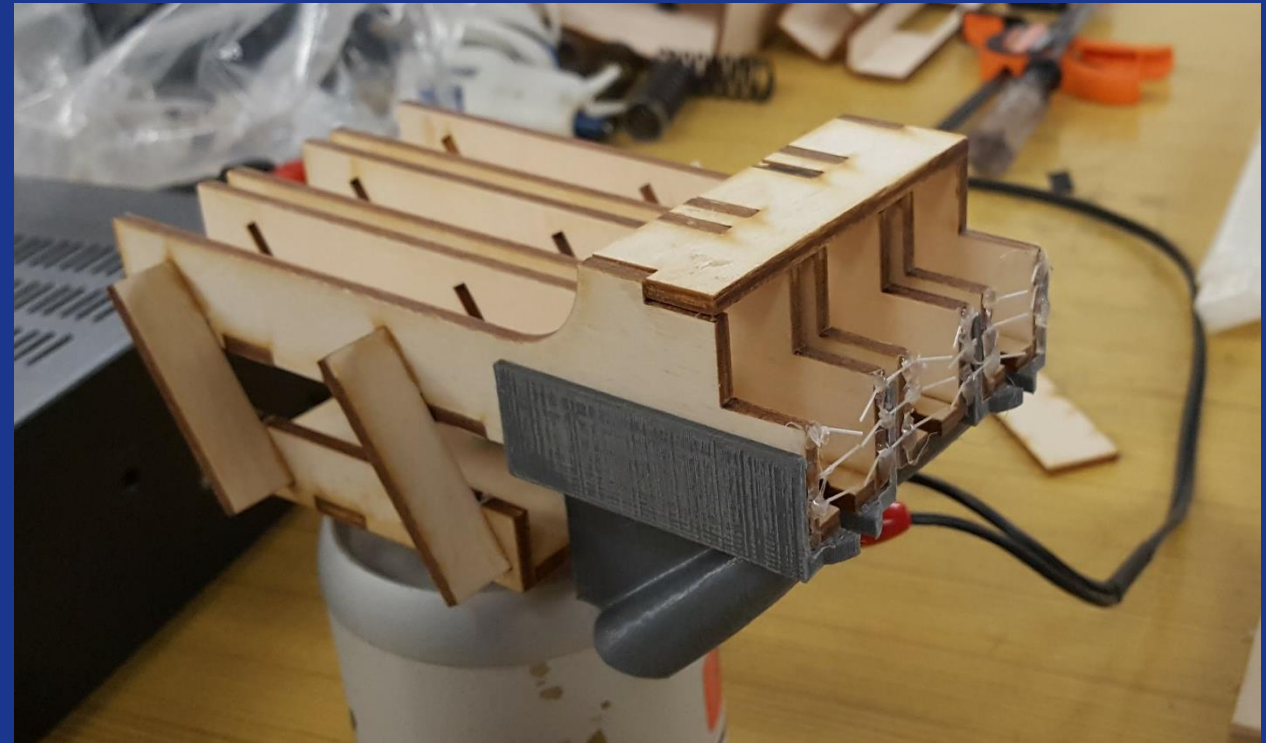


# RACKING 3D MODEL

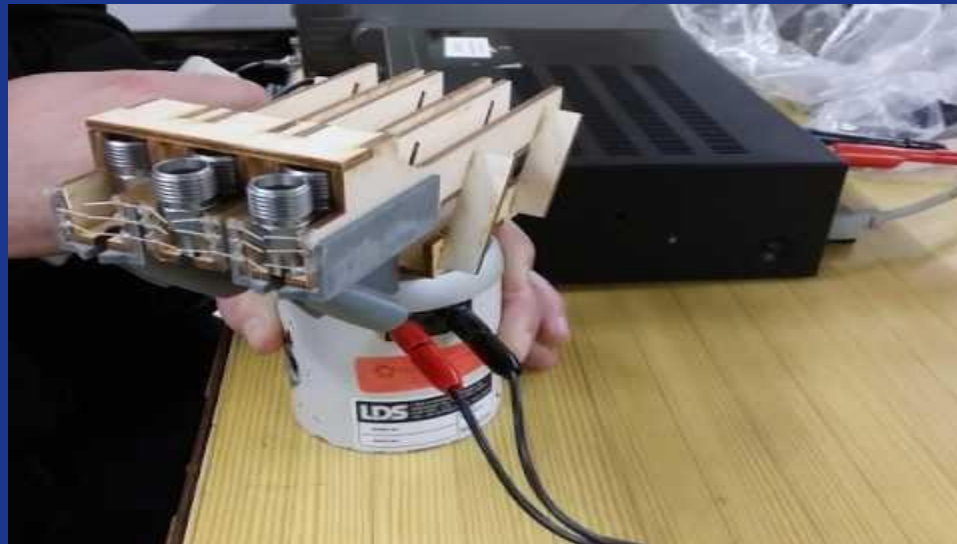


# RACKING PROTOTYPE

- Using brushes to hold fitting in place at end
  - Change in brush type needed
- Next prototype will have rails to prevent any tipping in queue
- Using 3 fixtures to prove concept

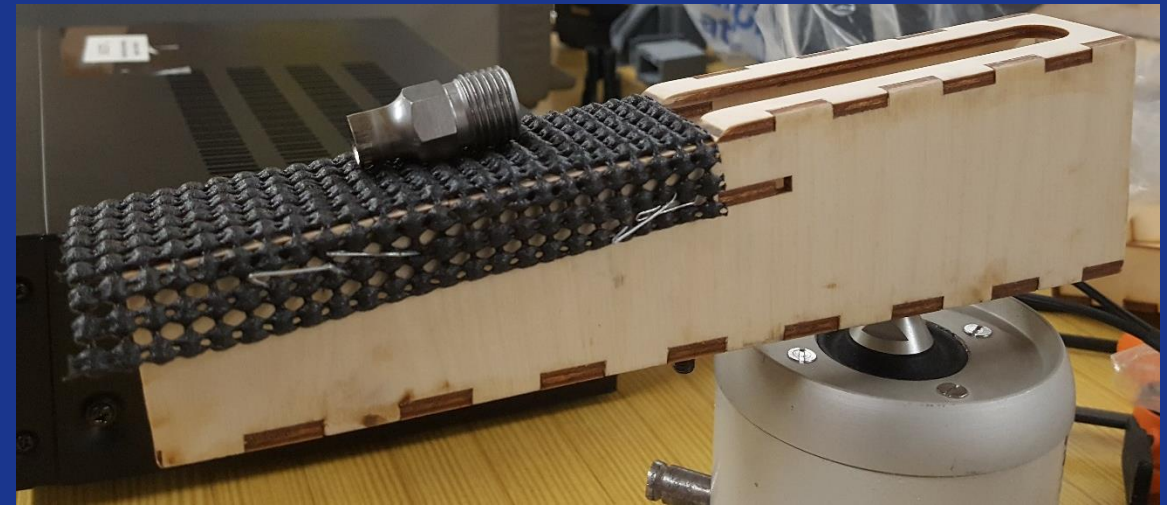


# RACKING VIDEO



# RECIRCULATION

- Currently exploring options for recirculation of rejected fittings
  - Unidirectional surfaces (using the vibratory table)
  - Conveyor belt with small paddles
  - Auger (Archimedes screw)



# DFMEA

Design Failure Mode ad Effects Analysis (DFMEA) - Titanium Fitting Sorting													
Pre-operative Verification Process Analysis									Actions			Outcome	
ID	Process Step	Failure Mode	Potential Effects of Failure	Severity	Potential Causes of Failure	Occurrence	Current Controls	R P N	Response (Eliminate Mitigate Accept)	Preventive and Corrective Actions	Severity	Occurrence	R P N
1	Feed rate from the hopper	Overfeeding of fittings	Increase the rejection rate	2	Wall opening being too wide	4	Hopper Feeder system	8	Mitigate	Make a funnel shape entrance to the rails	1	3	3
				2	Faster feed rate from hopper system	4	Hopper Feeder system	8	Mitigate	Control the feed rate	1	2	2
2	Orientation Stages	Fittings not oriented	Wrong orientation at final stage	1	Failed to orient from previous stage	3	Rail system	3	Eliminate	Add rejection stage to recirculation stage	1	0	0
3	Recirculation stage	Fittings not recirculated back to hopper	Fittings manually delivered back to hopper	1	Steep inclanation going back hopper	5	Recirculation system	8	Eliminate	Reduce inclanation angle	1	0	0
				1	Incorrect surface material	5	Recirculation system	5	Eliminate	Use Vibromat with angled fibers similar to vibratory bowl from tour (material on the way and waiting for testing)	1	0	0
				1	Vibration feeder is not effective	5	Recirculation system	5	Eliminate	Use conveyor belt system	1	0	0
4	Racking stage	Fittings knocked down from upright orientation	Fitting hole misaligned from hole guide	2	Operator pushes the fittings hard	3	Racking system	6	Mitigate	Practice new racking operation	1	1	1
				2	Smaller diameter facing down	3	Racking system	6	Eliminate	Add roof or side rails with low clearance to prevent rotation	1	0	0

Rating	Score	Guide
Severity	1 -- 5	1 - Insignificant consequence of failure
		5 - Catastrophic consequence of failure including death or permanent loss of function
Occurrence	1 -- 5	1 - Insignificant consequence of failure
		5 - Catastrophic consequence of failure including death or permanent loss of function

# MILESTONES

TASK	FINISH DATE
Complete sorting prototype	Feb 4 <sup>th</sup>
Racking system design	Feb 21 <sup>st</sup>
Recreate racking/sorting prototypes with durable material	March 10 <sup>th</sup>
Recirculation design	March 24 <sup>th</sup>
Final hopper design	March 24 <sup>th</sup>
Integration of system	April 1 <sup>st</sup>
Design report	April 21 <sup>st</sup>
Working prototype	April 21 <sup>st</sup>
Project turnover	May 5 <sup>th</sup>



# DELIVERABLES

- Working prototype at the Design Expo
  - To be delivered to Auburn Facility by end of project period
- Design Report
  - CAD Drawings
  - Time comparisons and expected efficiencies
  - Assembly/maintenance instructions
  - Troubleshooting guidelines
  - Lessons Learned
- Next generation options

# DESIGN EXPO

- Friday April 28<sup>th</sup>
- University of Idaho Bruce Pitman Center
- 709 S. Deakin Street, Moscow, ID

<http://www.uidaho.edu/engr/events/expo>

