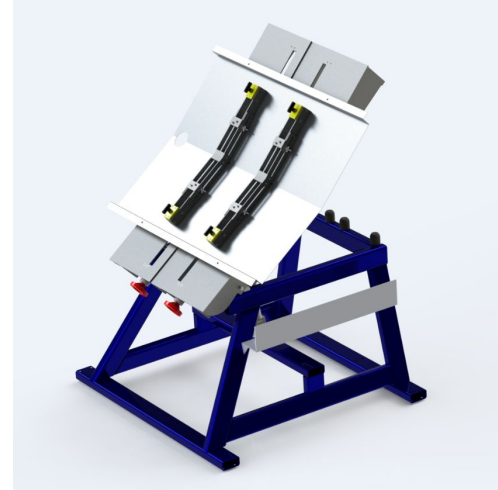
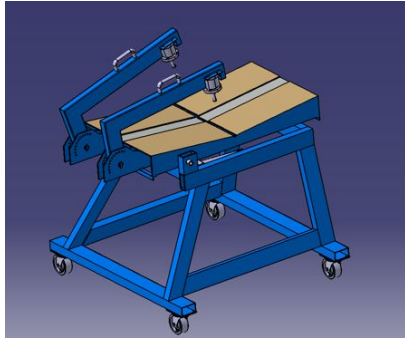


DRAIN PAN WELDING JIG

MICHAEL BOTTERBUSCH
SCOUT FERGUSON
DAKOTA MCDANIEL
TAYLOR TOSAYA



OVERVIEW

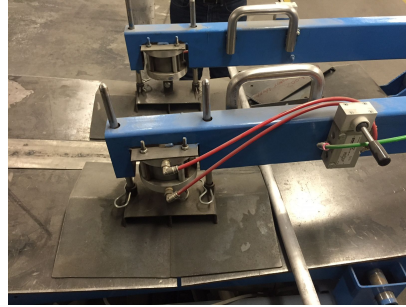


Objective:

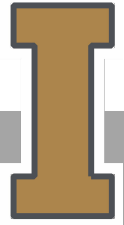
To redesign a jig that can be used on any size of drain pan and effectively align the drain pans for the welding process with repeatability and efficiency.



DESIGN PROBLEM

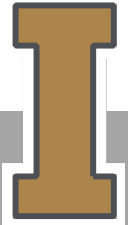


- Welders currently have to secure drain pans by hand or hand clamps
- Pans can warp easily due to an inconsistent loading force and become uneven
- Time, material, and money are wasted in the current process of making a drain pan
- An incorrectly welded drain pan cannot be used due to its poor quality of weld or alignment

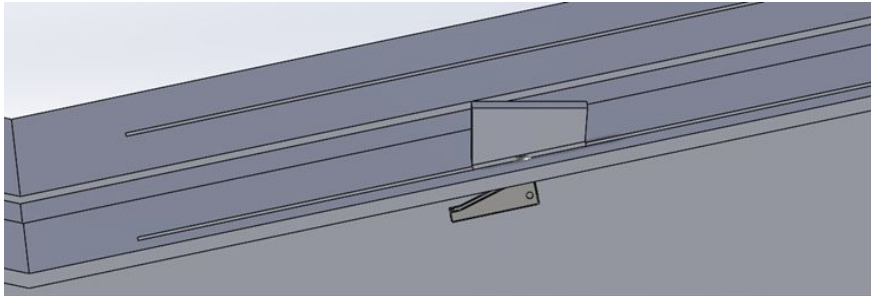


SPECIFIC FEEDBACK

- Design to eliminate warping
- Alignment from the edge flanges of the drain pan
- Avoid overhanging fixtures for the operator's ease of use
- Easily manipulatable clamping design



PRELIMINARY DESIGN



Free Floating Concept

- Cam lock friction mechanism
- Infinitely Adjustable
- Easy to manufacture

Discarded concept because:

- Difficult to access lever
- Prone to damage



Clamping

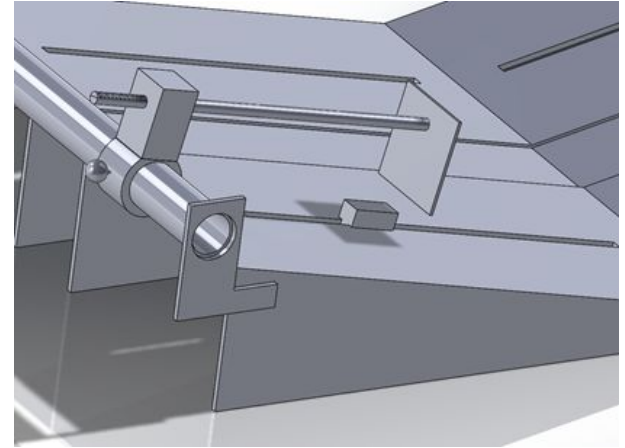
PRELIMINARY DESIGN

Spring Loaded Arm Concept

- Arm slides on track lengthwise along table
- Arm can raise and lower quickly to allow pan placement
- Arm is secured via spring system or ratchet operation
- Rotation can be locked by twisting knob on rear of pivot (set screw)

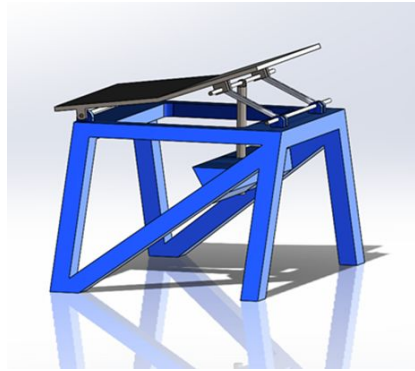
Discarded concept because:

- Didn't provide enough downforce to secure pans
- Lack of pressure on surface of pans would allow warping



Rotation

PRELIMINARY DESIGN

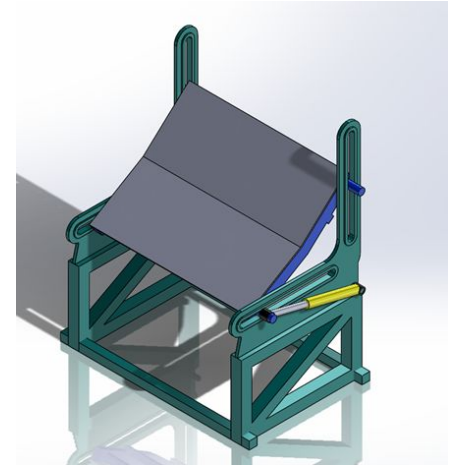
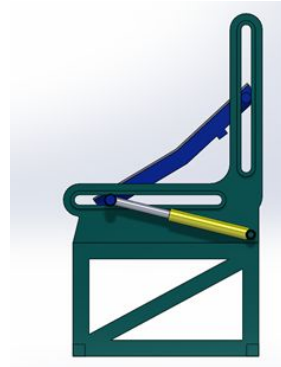
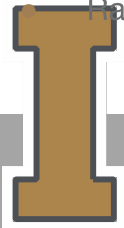


Rack and Pinion Concept

- Gas charged shocks for steady movement
- Pivot moved toward center of table to reduce moment arm

Discarded concept because:

Rack and Pinion motor may have limited speed



Virtual Pivot Concept

- Can allow welding from many angles
- Frame can implement a locking feature for safety
- Multiple structures could be put in series

Discarded concept because:

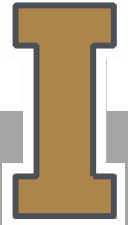
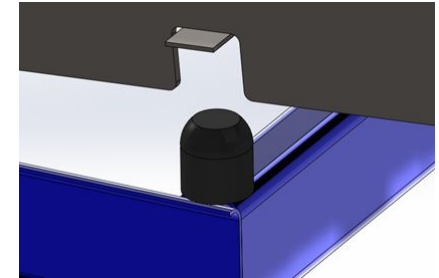
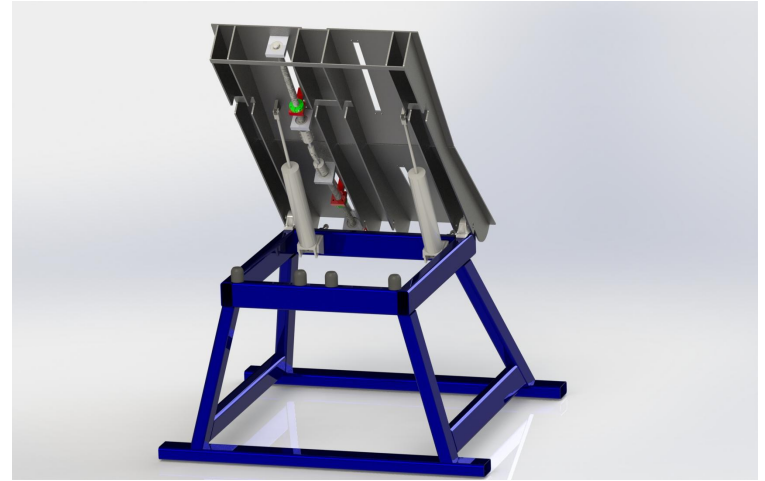
- Sides of pan may contact supports
- The pan realistically only needs to be vertical or horizontal

Rotation

DESIGN CHOICE

Rotation Design

- Decided to implement original pneumatic system
- Pre-existing damper remains attached to bottom of tabletop
- Pillow block bearings added to eliminate friction in the shaft
- Added four rubber bump stops to soften impact when lowering

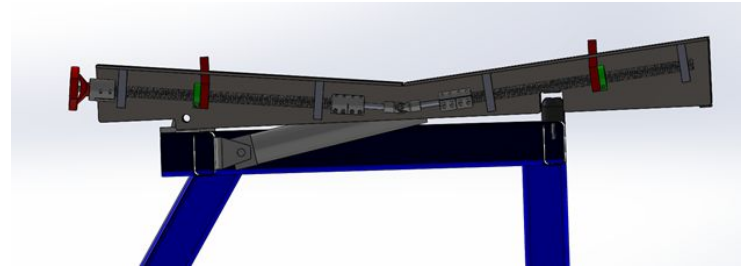
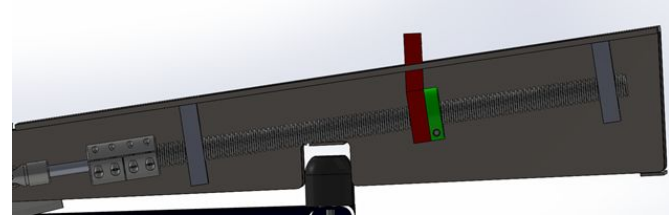


Alignment

DESIGN CHOICE

Lead Screw Design

- Lead screws rest in bearings attached under tabletop
- LH and RH collars fastened to alignment blocks
- Universal joint allows for symmetrical movement
- Screw thread is offset from exposed table, no welding slag issues
- Infinitely adjustable for various drain pan widths

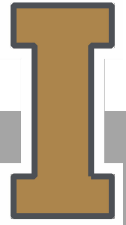
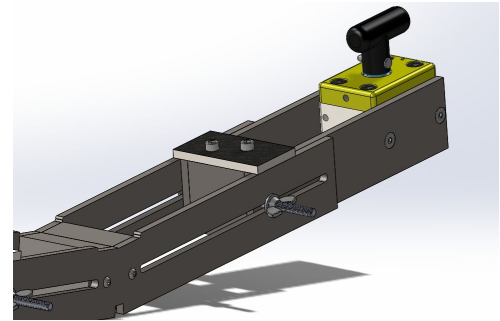
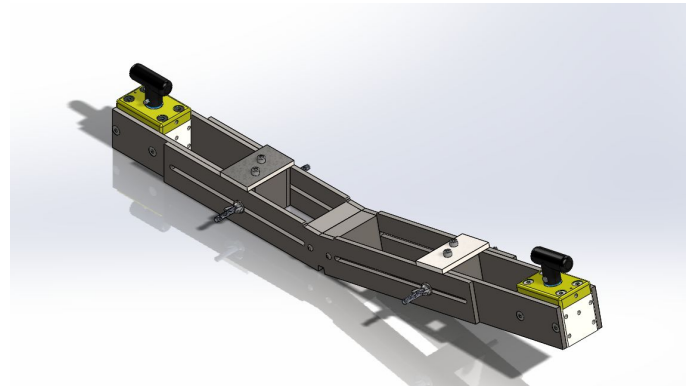


Clamping

DESIGN CHOICE

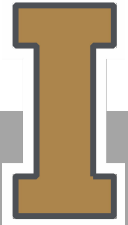
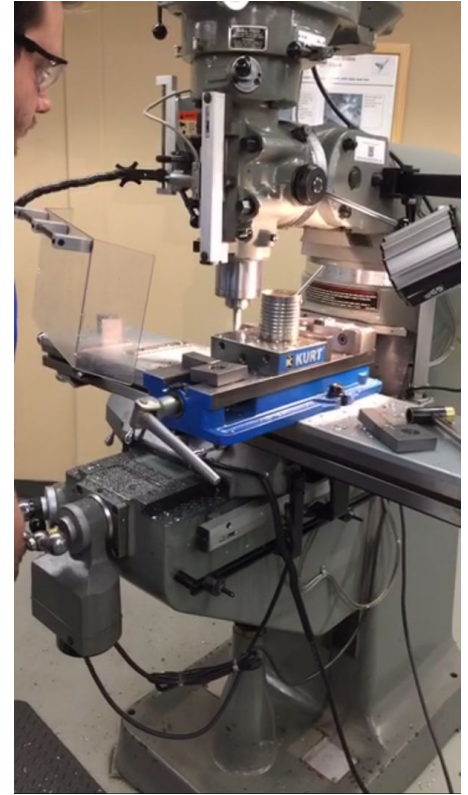
Magnetic Welding Clamp Design:

- Low profile
- Two 600 lb. welding magnets
- Frame provides force distribution
- Adjustable to accomodate all widths of drain pans



MANUFACTURING PROCESS

- *Colmac Coil*: Laser-cut pieces
- *Facilities machine shop*: Small machined blocks along with the welding of the tabletop
- *Our design group*: Extra machining on laser-cut pieces, small pieces of hardware and modifications to existing parts



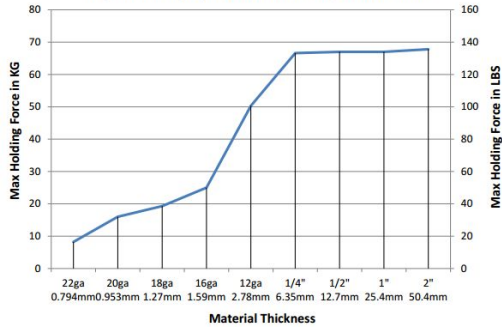
BUDGET

BUDGET NUMBER:		FEK269-FY17		ALLOCATION 05:		3,750.80	
EXPENDITURE:		05 OTHER EXPENSE		BALANCE 05:		-143.02	
TOTAL BUDGET BALANCE:		731.20		42,837.00			
		Total to date 05 Other Expense:		3,893.82			
DATE	E-Code	Doc Code	Doc Ref	VENDOR	EXP/RESERV	MO	DESCRIPTION
112916		I1895717	CV	Scout Ferguson	118.71	06	Rubbermaid Pelouze digital hanging scale
111016		J1129632		CT fr FE8013	376.58	05	
012617		Z0816645	CC	Amazon	21.99	08	green PLA filament
				City North American	93.94		shipping
							ball bearing, connecting rod, socket head, washers, screws, hex drive screws, hand wheel, collar, coupling, shaft adapter, u-joint, rotary shaft, threaded rod
032217		Z0818532	CC	McMaster-Carr	1,280.74		
032117		Z0818532	CC	CyberWeld	138.60		mag switch mag square
040717		Z0819553	CC	CyberWeld	415.80		3 qty magswitch
				UI Facilities	1,360.00		welding of table top/ other operations
		Z0819553	CC	Suspension parts	30.73		rubber bump stops
		Z0819553	CC	McMaster-Carr	56.73		rotary shaft

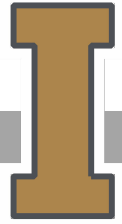
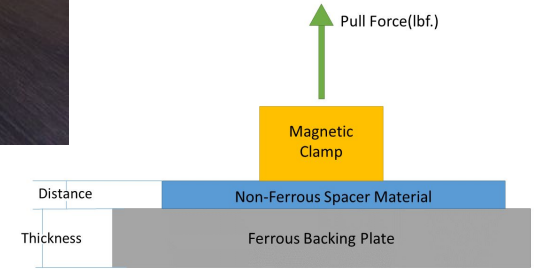
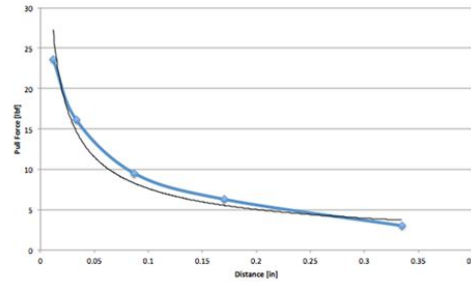


TESTING

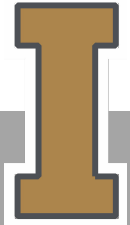
Magswitch MagSquare 165 Breakaway vs. Thickness



MagSquare 165

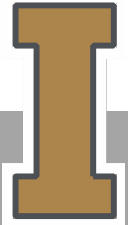


PHYSICAL DEMONSTRATION



FUTURE WORK

- Tertiary piston to aid initial rotation
- Damper to reduce upward impact force
- Upgrade to MagSquare 1000 to increase clamping force
- Side shelf for clamp storage



QUESTIONS

