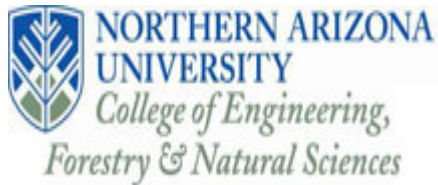


Orbital Test Stand

Midpoint Review

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James Ellis, and Nicholas Garcia

March 11, 2015



Presentation Overview

- Introduction
- Manufacturing Progress
 - Plate Assembly
- Design Updates
- Conclusion

Introduction

- Orbital pleased with progress
- Main focus has been plate fabrication and assembly

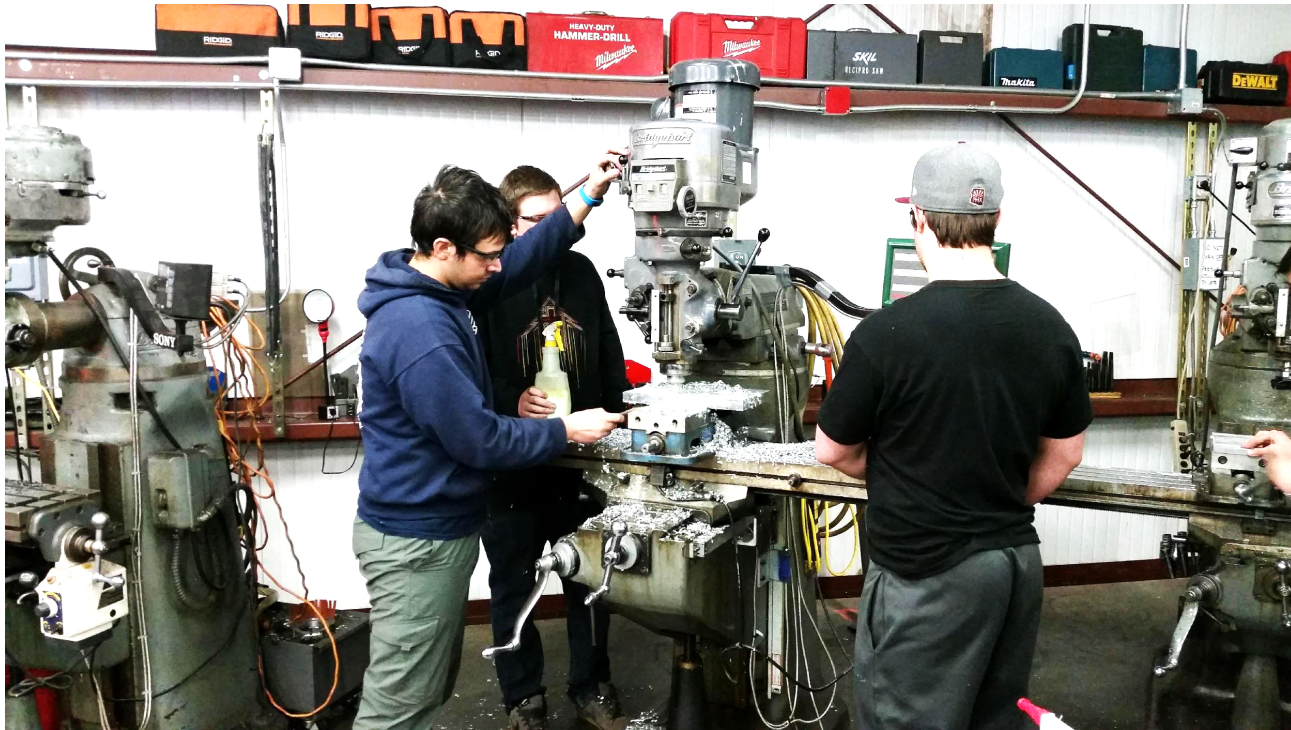


Figure: Machining slots for test stand adapter plate

Manufacturing Progress

- Plate fabrication for final plate assembly
 - Test Stand Adapter Plate (x2)
 - Slotted Vertical Plate (x2)
 - Horizontal Plate (x2)
 - Triangular Supports (x4)
- Holes and slots machined
- Orbital ordering motors and gearboxes
 - Timeline: Requested all parts be shipped by March 20, 2015

Assembly Progress

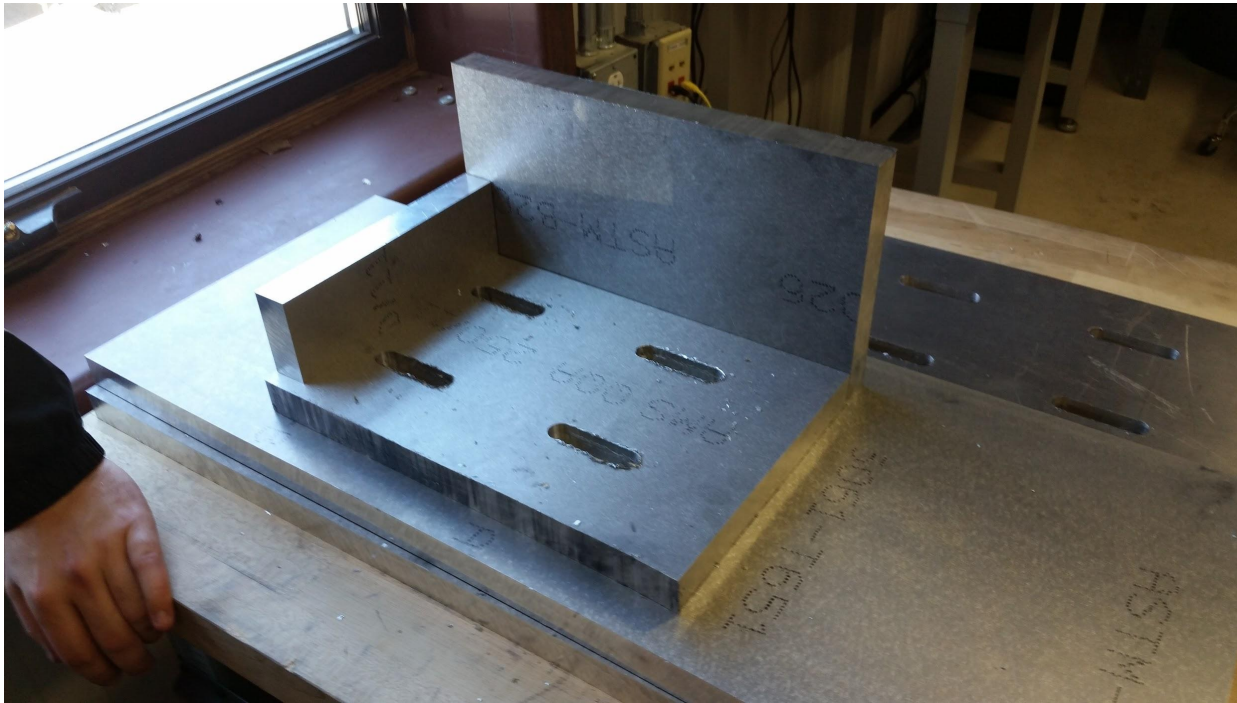
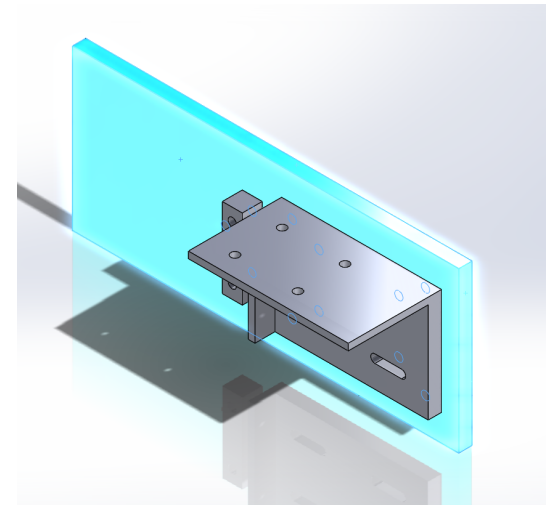


Figure: Assembly showing TSAP, SVP, and HP

Test Stand Adapter Plate (x2)

- **Purpose:** Adapter to limit modifications to existing test stand
- **Material:** 6061 Aluminum
- **Dimensions:** 12 x 30 x 1 in.
- **Bolt Pattern:** Based on pre-existing holes in test stand



Slotted Vertical Plate (x2)

- **Purpose:** Attachment to Test Stand Adapter Plate (TSAP)
- **Material:** 6061 Aluminum
- **Dimensions:** 8 x 13 x 1 in
- **Mass:** 10.2 lbs
- **No. of Threaded Inserts** (each plate):
 - 6 along top face for connection with horizontal plate
 - 3 each on right and left faces for triangular support
- **Threaded Insert Type:** $\frac{3}{8}$ -16 Swage Blind Insert
- **Insert Material:** Steel
- **Slotted:** For adjustment on TSAP

Slotted Vertical Plate (x2)

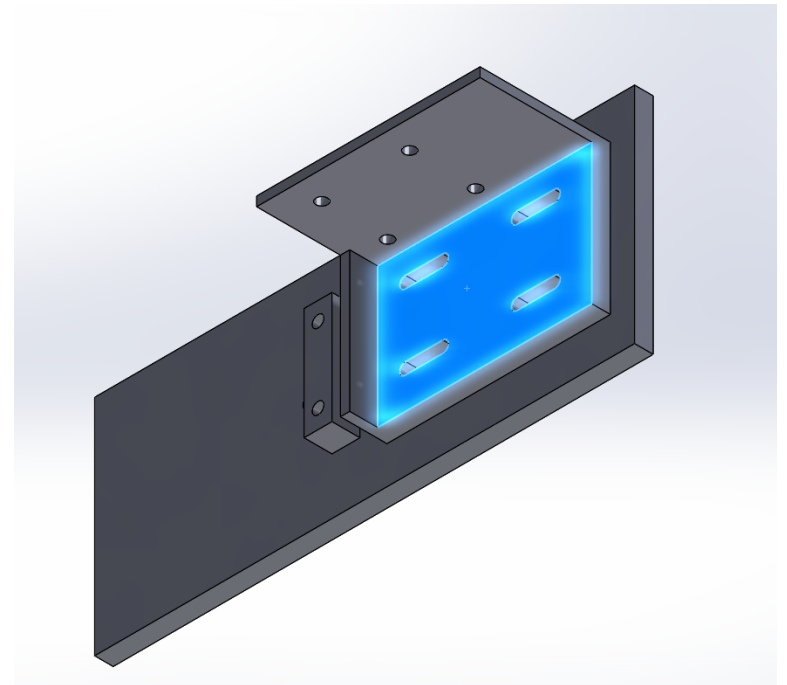
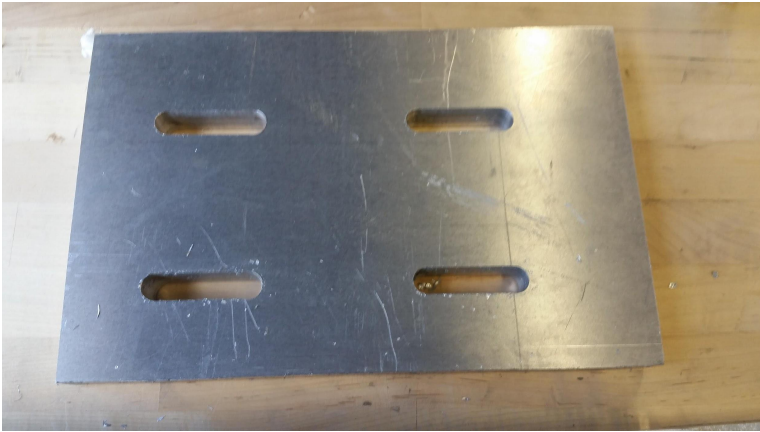


Figure: Slotted Vertical Plate

Horizontal Plate (x2)

- **Purpose:** Motor and Gearbox Attachment Point
- **Material:** 6061 Aluminum
- **Dimensions:** 7 x 13 x 1 in
- **Mass:** 9 lbs
- **No. of Threaded Inserts** (each plate):
 - 3 each on right and left faces for triangular support
- **Threaded Insert Type:** $\frac{3}{8}$ -16 Swage Blind Insert
- **Insert Material:** Steel
- **Through Holes:** 6 along top face for attachment to slotted vertical plate

Triangular Supports (x4)

- **Purpose:** Provide additional support to horizontal plate; increase FOS for entire assembly
- **Material:** 6061 Aluminum
- **Through Holes:** 6 total for each plate
 - 3 spanning vertical direction for attachment to vertical plate
 - 3 spanning horizontal direction for attachment to horizontal plate

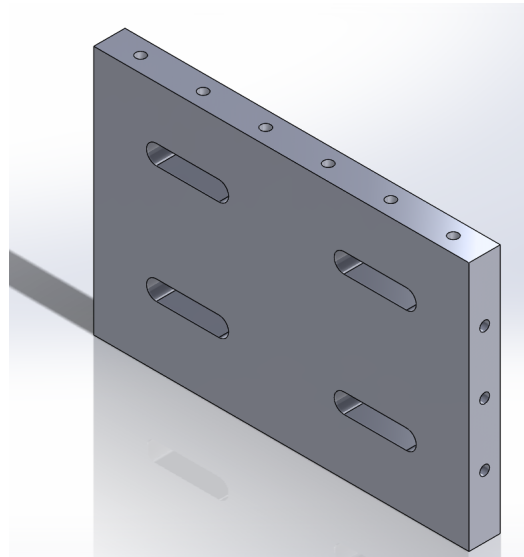
Design Updates

- Use of threaded inserts for attachments
- Chain tensioner



Threaded Inserts

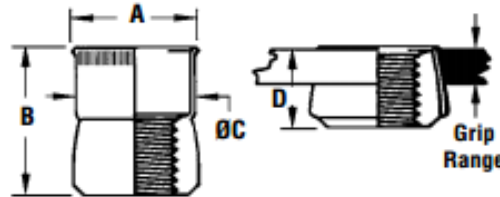
- **Purpose:** Add strength to holes; prevent cross threading
- **Insert Material:** Steel
- **Type:** $\frac{3}{8}$ -16 360° Swage Blind Insert
- **Screw Type:** $\frac{3}{8}$ -16 x 2 in Grade 5 Hex Head Cap Screw



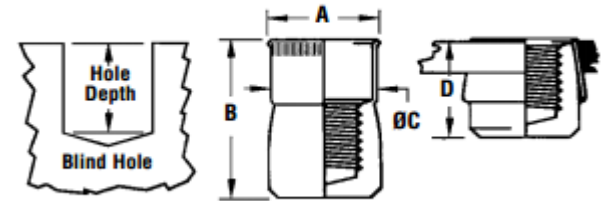
Threaded Inserts



OPEN END



CLOSED END

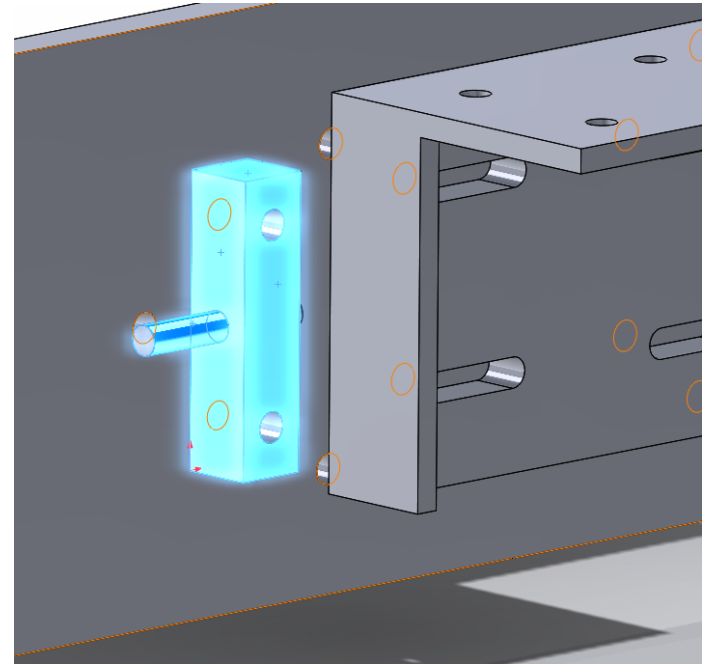


Thread Size	Type			Thread Code	Installation Hole Size				Open							Closed				Blind Hole Depth Min.
	Steel	Stain-less	Alum-inum		Grip Range				A ±.005	B ±.015	ØC Max.	D Ref.	Weight lbs./1000			A ±.005	B ±.015	ØC Max.	D Ref.	
					.030 - .090	.091 - .124	.125 - .186	.187 - OVER					AETS	AETC	AETA					
#4-40	AETS	AETC	AETA	440	.188	.194	.194	.196	.211	.370	.1875	.205	0.99	0.99	0.33	.211	.660	.1875	.495	.400
#6-32	AETS	AETC	AETA	632	.219	.221	.228	.228	.240	.370	.2185	.205	1.48	1.48	0.49	.240	.675	.2185	.505	.400
#8-32	AETS	AETC	AETA	832	.250	.257	.266	.266	.269	.370	.2495	.205	1.98	1.98	0.65	.269	.675	.2495	.505	.400
#10-24	AETS	AETC	AETA	1024	.281	.290	.290	.297	.306	.370	.2805	.205	2.22	2.22	0.74	.306	.685	.2805	.520	.400
#10-32	AETS	AETC	AETA	1032	.281	.290	.290	.297	.306	.370	.2805	.205	2.23	2.23	0.74	.306	.685	.2805	.520	.400
1/4-20	AETS	AETC	AETA	420	.375	.375	.386	.391	.400	.515	.3745	.275	5.94	5.94	1.98	.400	1.005	.3745	.760	.540
5/16-18	AETS	AETC	AETA	518	.500	.500	.516	.516	.528	.615	.4995	.325	12.74	12.74	4.26	.528	1.065	.4995	.770	.640
3/8-16	AETS	AETC	AETA	616	.563	.563	.578	.578	.588	.745	.5615	.390	17.82	17.82	5.94	.588	1.450	.5615	1.095	.770
1/2-13	AETS	AETC	AETA	813	.750	.766	.781	.790	.800	.935	.7485	.485	19.50	19.50	6.27	.800	NA	.7485	NA	.960

Images Source: Penn Engineering, "Blind Threaded Inserts Catalog"

Chain Tensioner

- Used in tandem with tire inflation to ensure contact
- Simple yet effective design



Conclusion

- **Focus:** Complete plate assembly
 - Reason: Waiting for parts from Orbital
- **To do:** Finish machining through holes and installing threaded inserts (40 total)
- **Timeline:** Have plates assembled by March 23, 2015