

Synthetic Aperture Radar Imager

Team 18 Spring 2016: Presentation II

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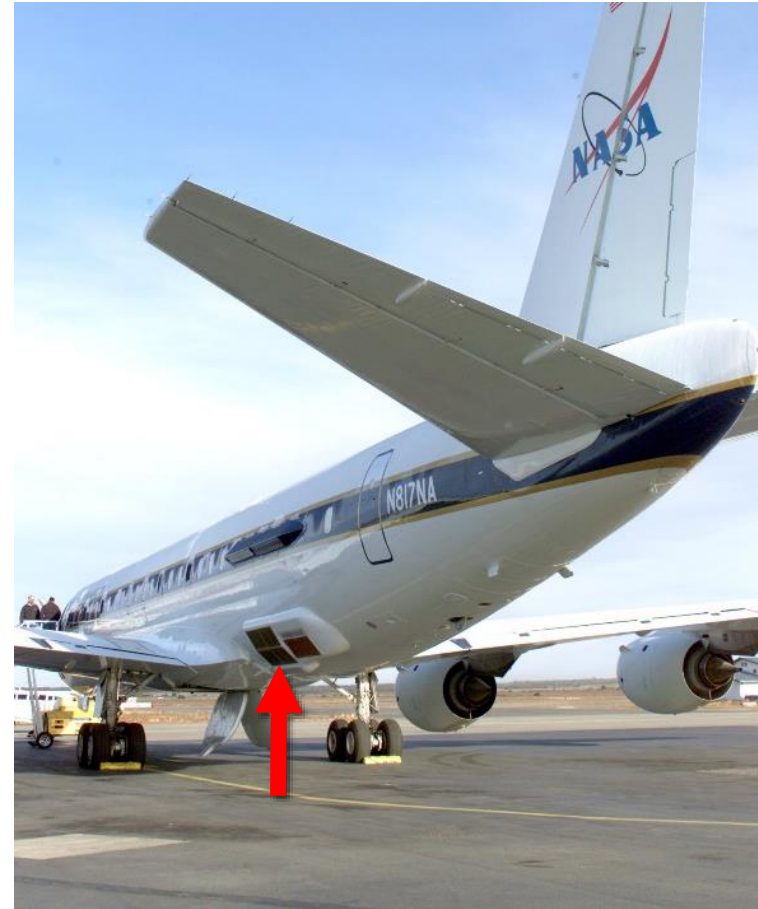
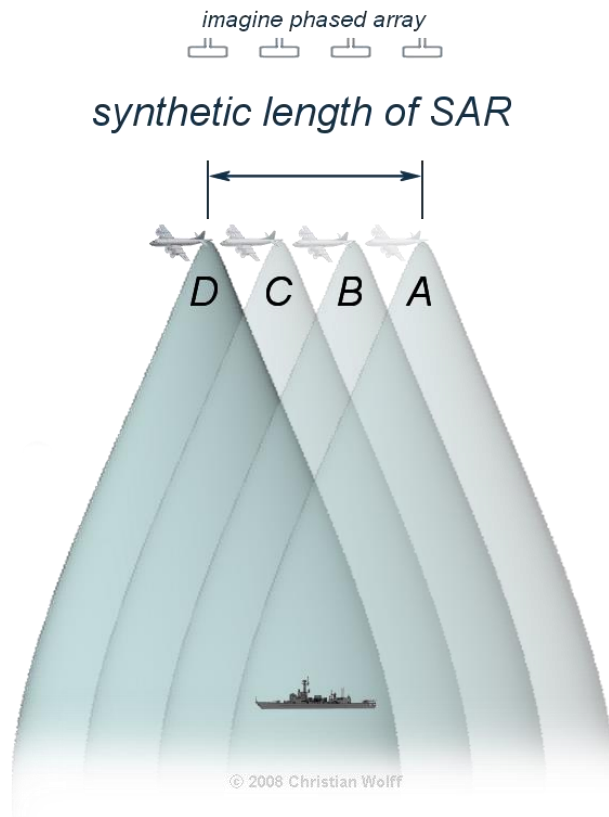
INSTRUCTOR: DR. NIKHIL GUPTA

DATE: 2/16/2016

Outline

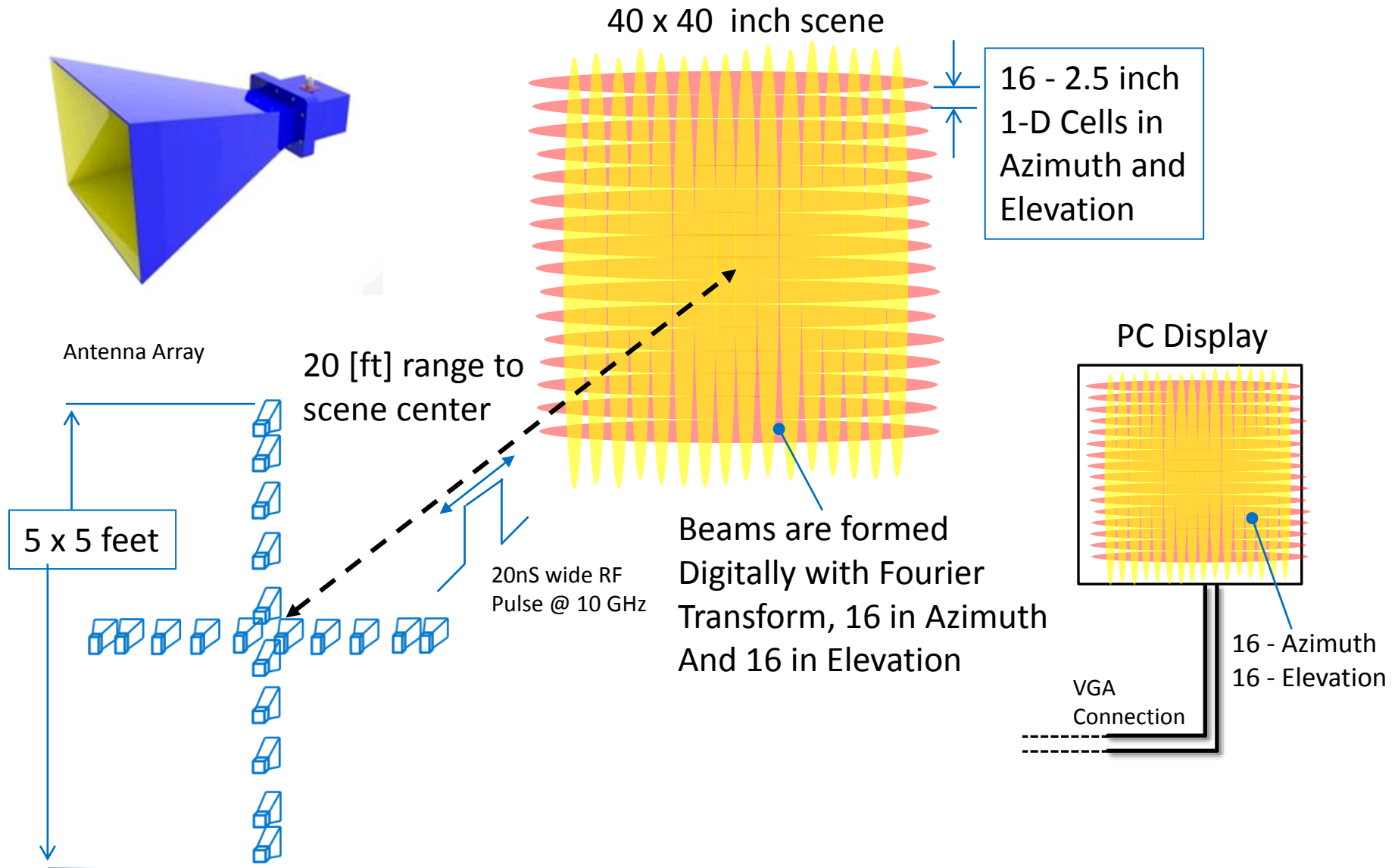
- Review of Project Scope
- Design Updates
- Procurement
- Schedule and Future Plans

Working SAR



[1]

Imaging Radar Operational Concept



[4]

Project Goals

Create a Synthetic Aperture Radar:

- Project Features:
 - Weapons detection for homeland security
 - Stationary
 - Low resolution
 - Concealable
 - Low Cost
 - Relatively mobile

NORTHROP GRUMMAN

The logo for Northrop Grumman, featuring the company name in a bold, italicized, blue sans-serif font. Below the text is a thick, blue, curved underline that starts under the 'N' and ends under the 'M', arching upwards in the middle.

Project Organization

- ME Team
 - Structure
 - Horn holders
- EE Team
 - Hardware Box
 - Signal processing

Second Generation Improvements

- Mobility
 - Attach wheels
- Weight
 - < 80 lbs
- Horn Adjustment
 - Aligned within 1ft circle at 20ft away
- Stability
 - Movement causes artificial phase shift
 - Max movement: 1/72 inch
- Cost
 - Minimize



1st Generation Project – Class of 2015

Prioritizing Engineering Characteristics

Customer Requirements	Customer Importance	Engineering Characteristics								
		Structural Thickness	Material Used	Locking Mechanism	Axis Adjustability	Mounting Mechanism	Base size	Height Above Ground	Number of Crossbeams	Weight
Increased Stability	5	9	3	6		3	9	6	6	
Lower Weight	5	3	9				6	3	6	9
Good Images	5			6	9	9		3		
Better Horn Mounting	5			9	9	9				
Cost	4	3	6	3		3	3		3	
Hardware Box	2	3	6							3
Portability	2		6				9	6		9
Score		18	30	24	18	24	27	18	15	21
Relative Weight		78	108	117	90	117	105	72	72	69
Rank		6	3	1	5	1	4	7	7	9

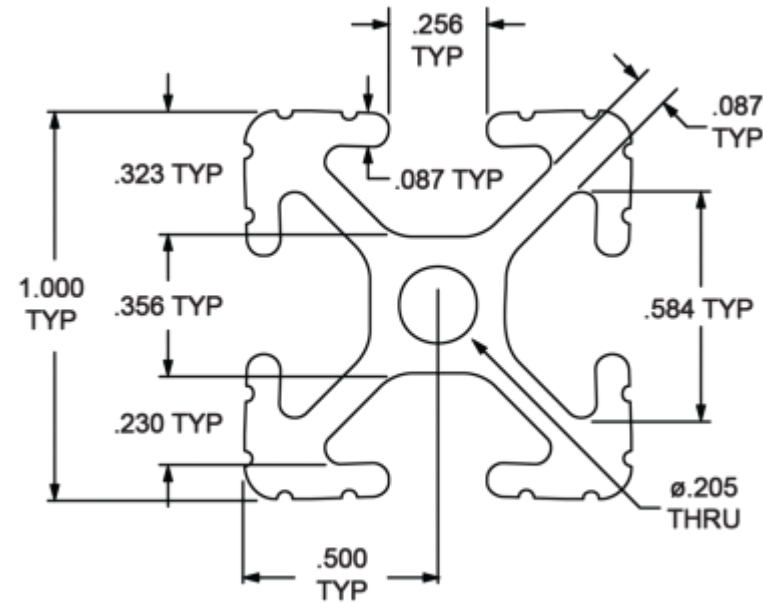
Most Important EC's:

1. **Mounting Mechanism**
1. **Locking Mechanism**
3. Material Used
4. Base Size
5. Axis Adjustability
6. Structural Thickness
7. Height Above Ground
7. Number of Crossbars
9. Weight

Key:	
■	#1 Important EC
■	#2 Important EC
■	#3 Important EC

Structure: Design

- 80/20 Design
 - Light Weight
 - Cheap
 - Modular
 - Light Machining Required
- Support Mechanisms
 - Bottom Frame
 - Outer Frame
 - Brackets
 - Leveling Castors



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Structure: Assembly

- 80/20 Material easily machined as expected
- Weight: ~ 60 lb.
- Cost: ~ \$800
- Additional Modifications:
 - Add Support Braces



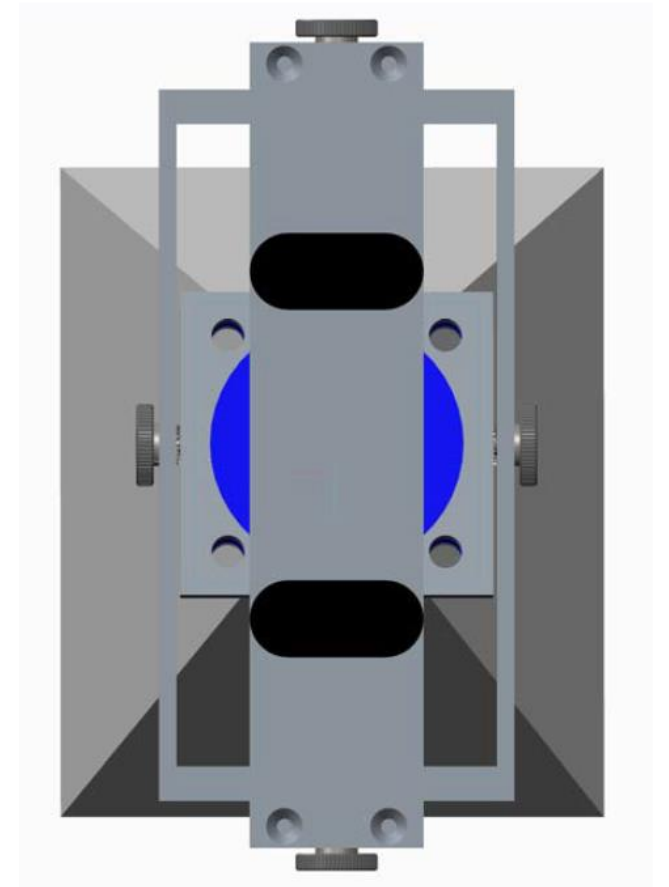
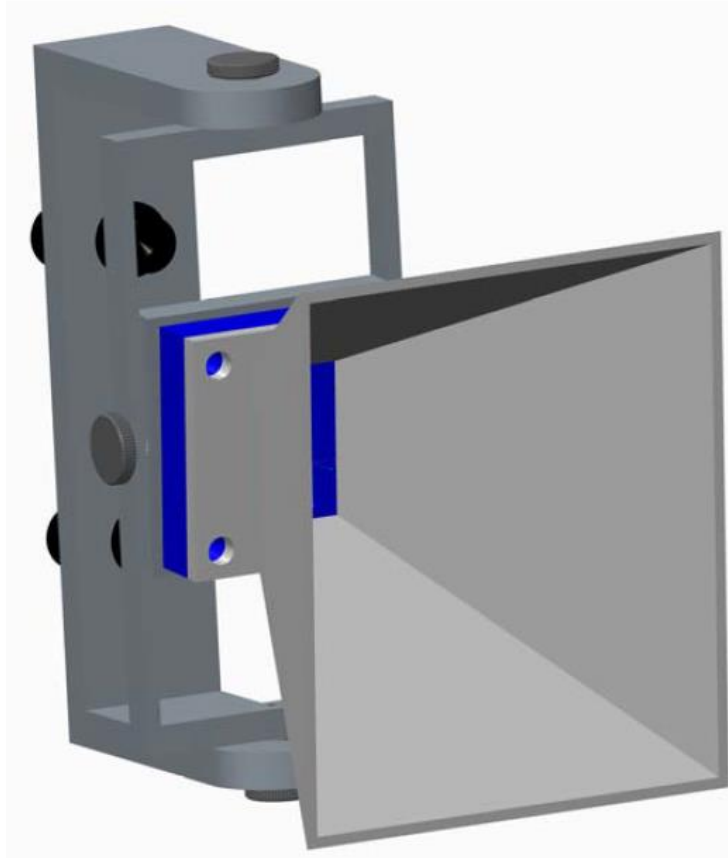
Horn Holder Design and Assembly

Design

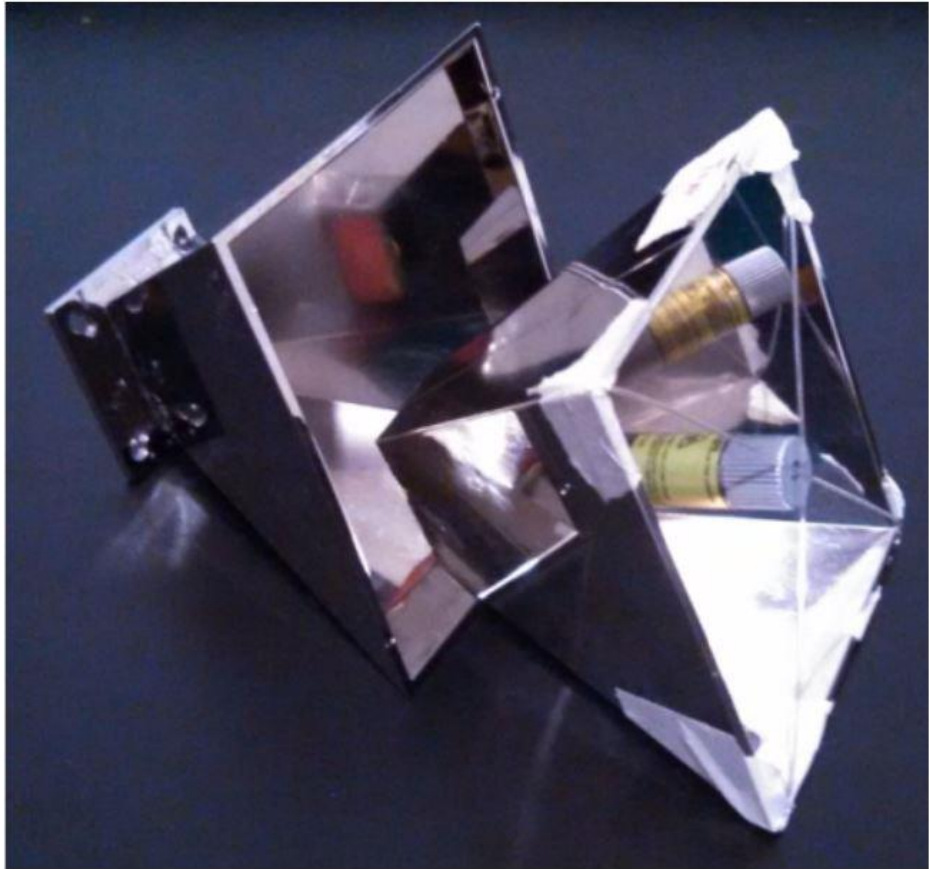
- Compatible With 80/20 Design
 - 80/20 Connection
- Independent Axis Locking and Adjustability
- Compact

Assembly

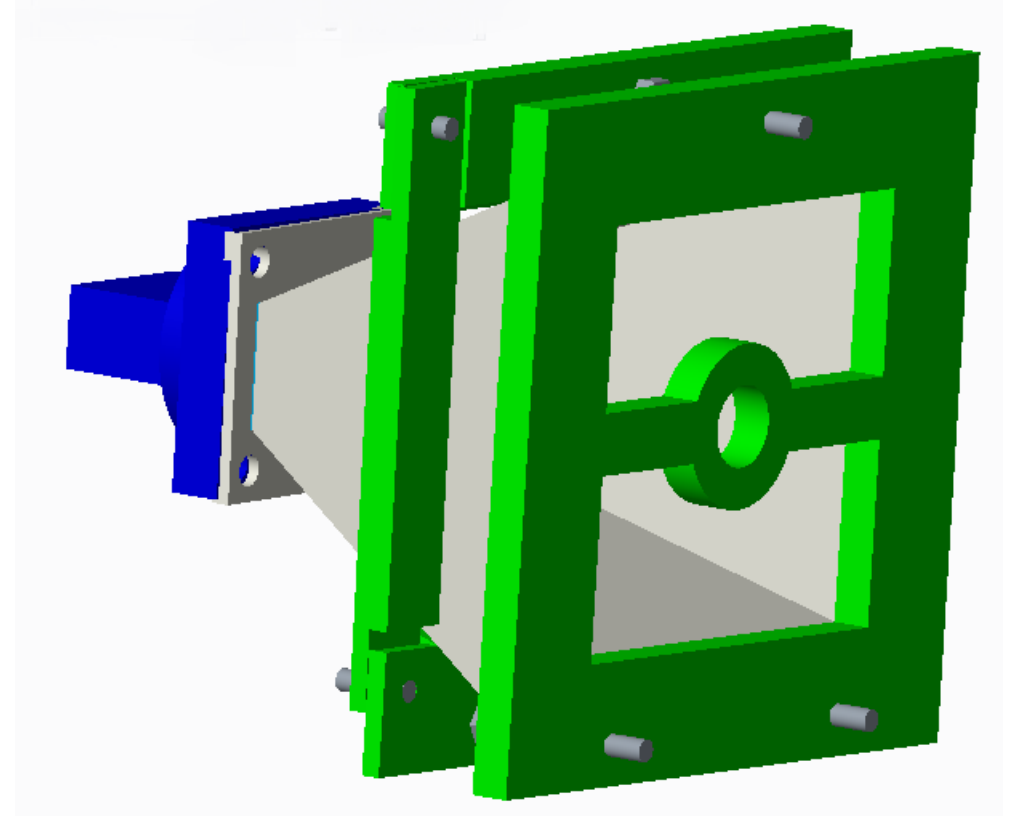
- Twenty full assemblies include:
 - Fabrication
 - COE Machine Shop
 - Water Jet
 - Hole Threading



Addition of Laser Alignment



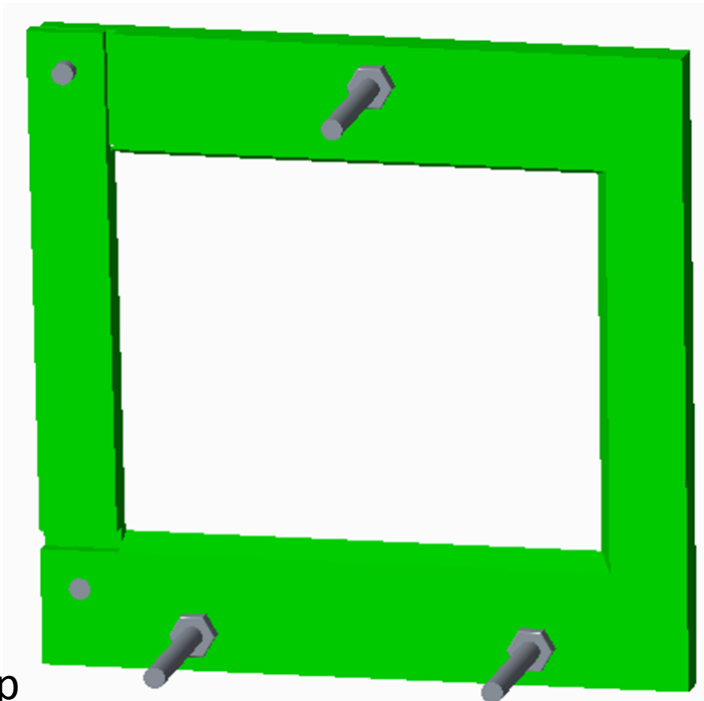
Generation 1



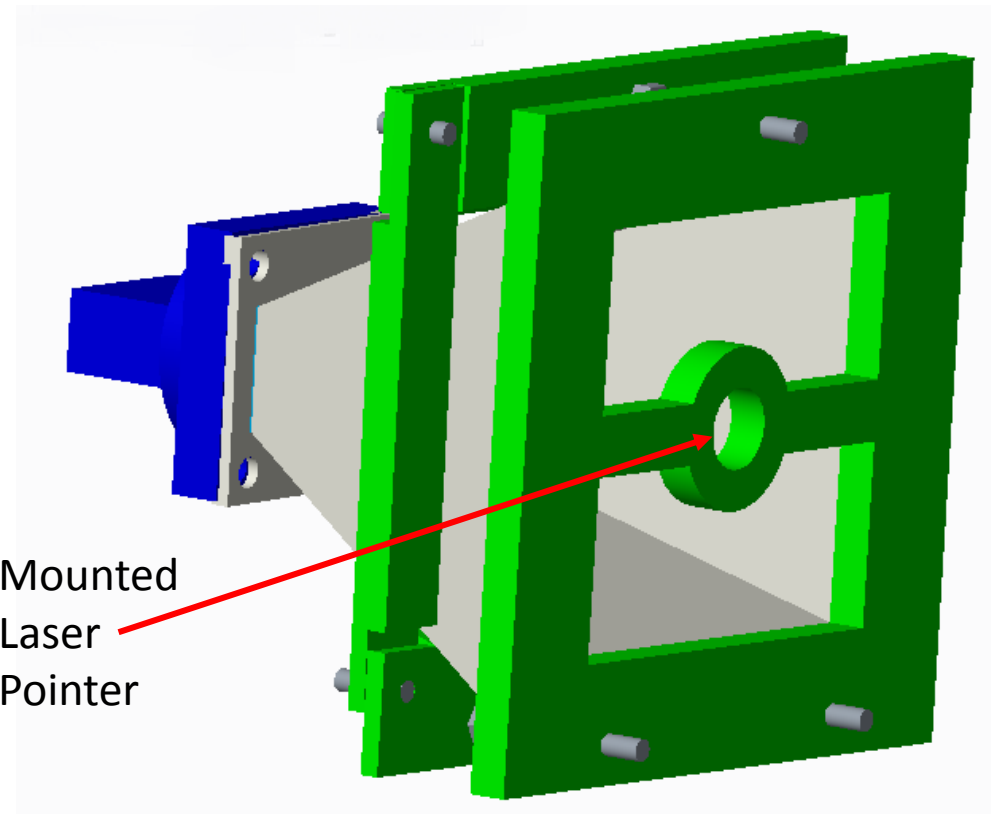
Generation 2
Prototype

Laser Alignment Prototype

- Assembly:
 - U-Clamp
 - Bolt in 3 Places
 - Latch in a Corner



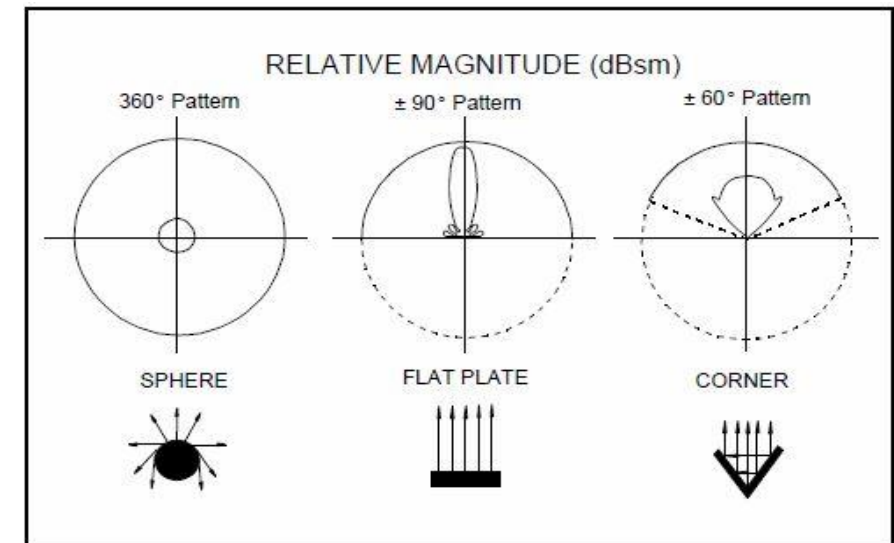
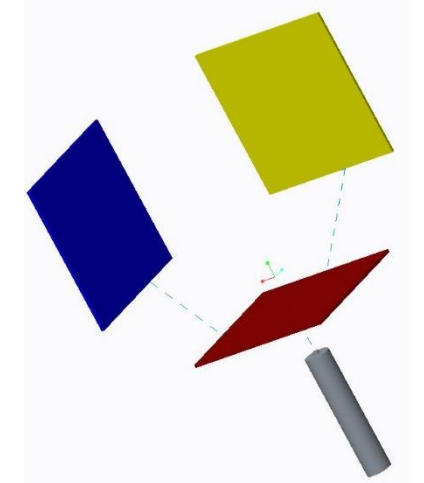
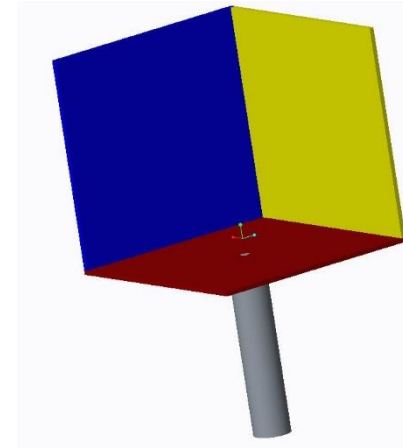
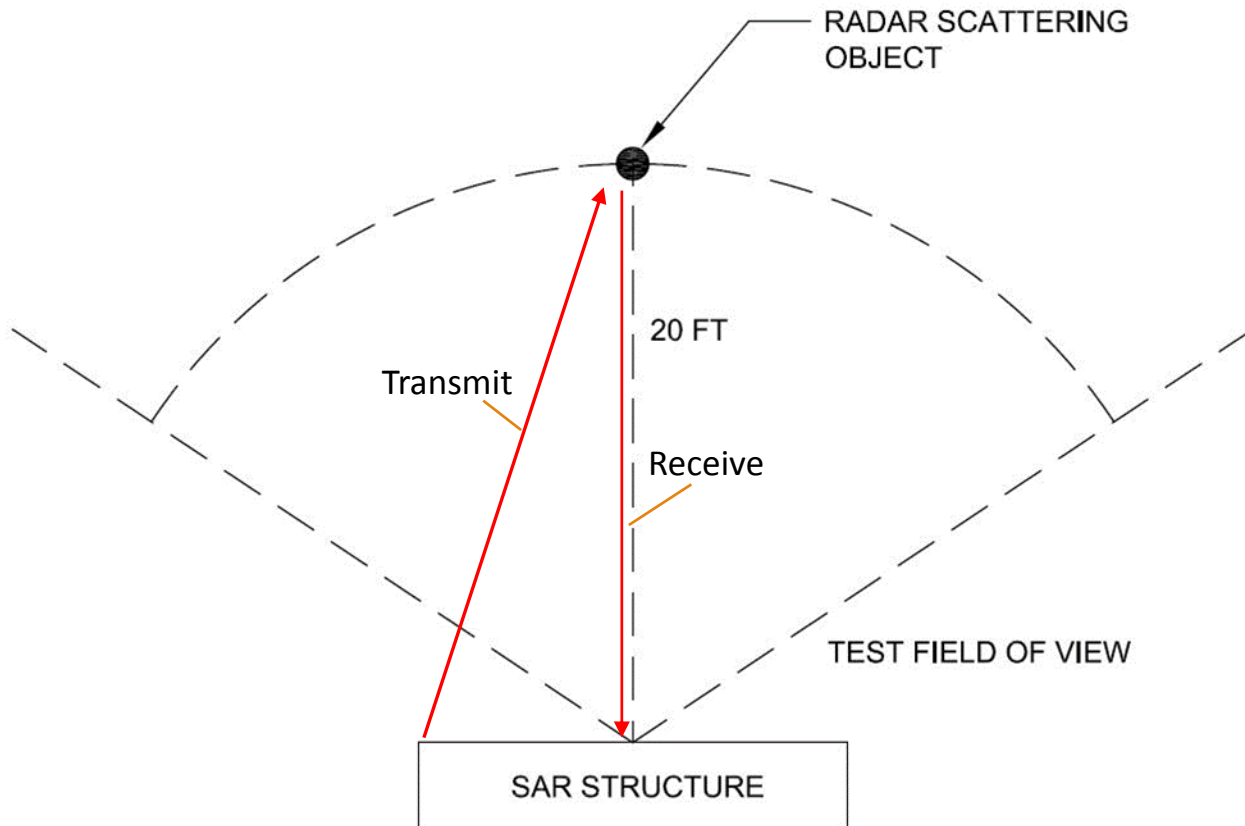
U-Clamp



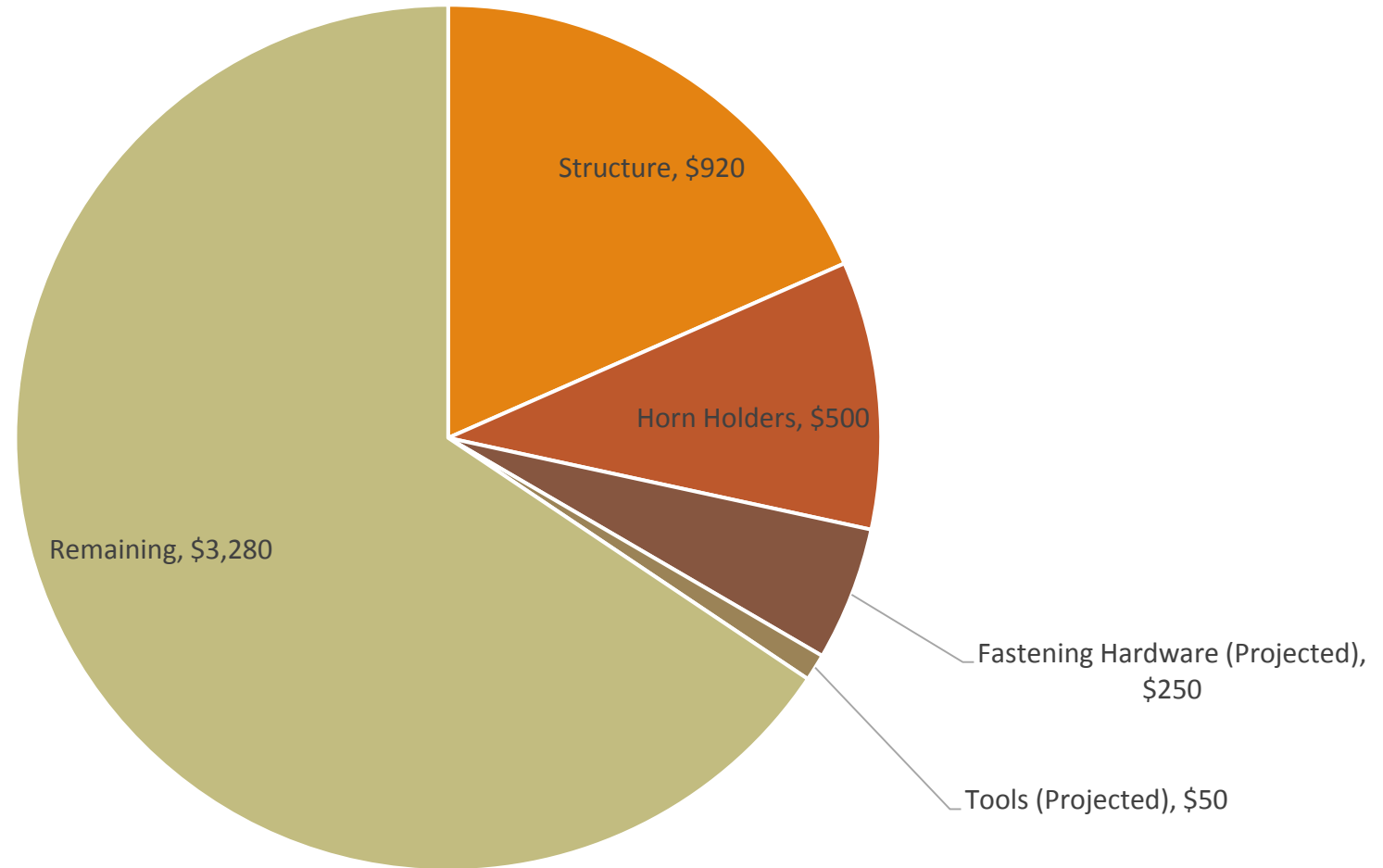
Mounted
Laser
Pointer

Radar Reflectors

- Purpose is to create backscatter
 - Reflects transmitted RF back to receiving horns

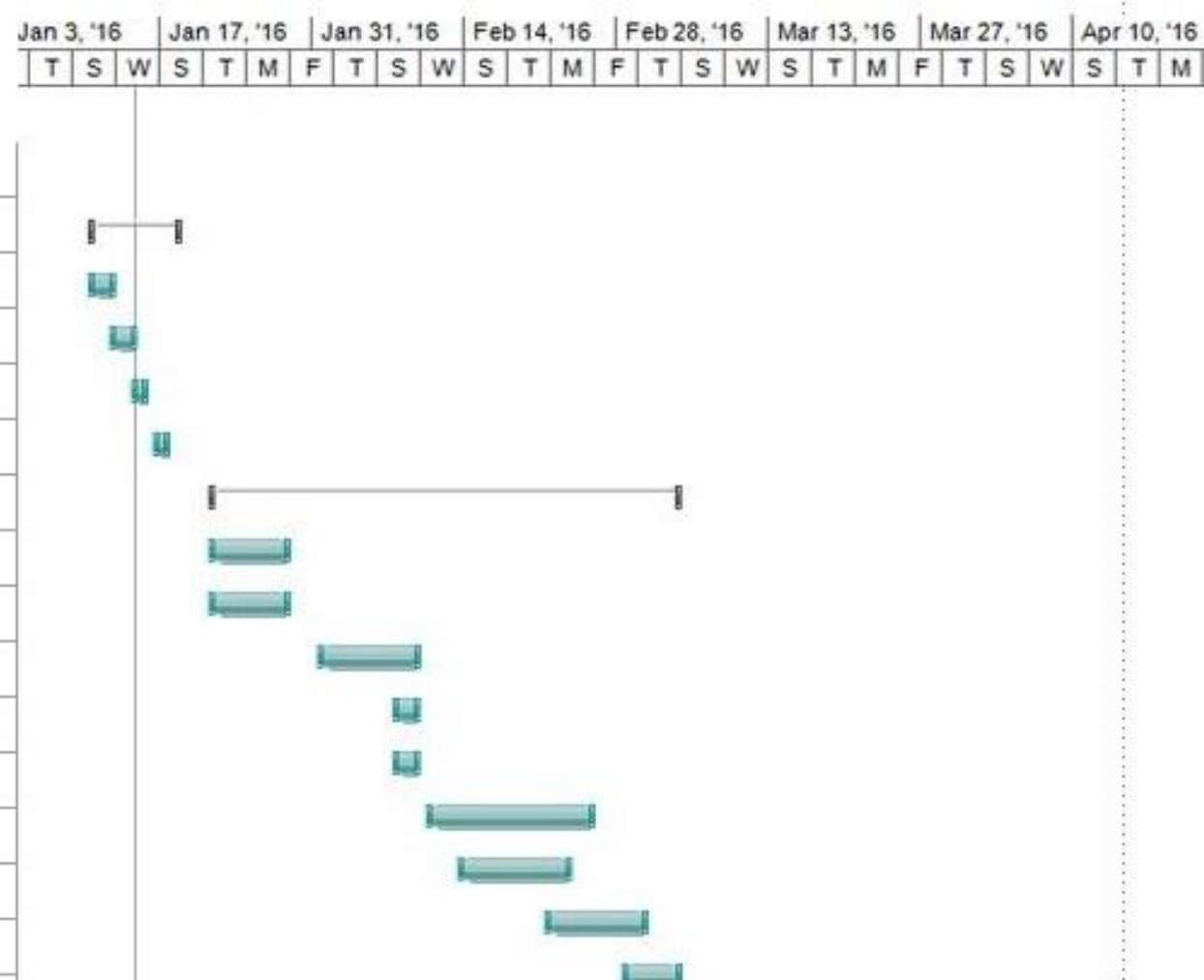


Budget



Schedule

Procurement	6 days	Mon 1/11/16	Mon 1/18/16
Prepare Drawings for Manufacturing	2 days	Mon 1/11/16	Tue 1/12/16
Bill of Materials	2 days	Wed 1/13/16	Thu 1/14/16
Submit for Quotation	1 day	Fri 1/15/16	Fri 1/15/16
Submit Purchase Order	1 day	Sun 1/17/16	Sun 1/17/16
Fabrication	31 days	Fri 1/22/16	Fri 3/4/16
Prepare Schematics	5 days	Fri 1/22/16	Thu 1/28/16
Prepare Drawings for machining	5 days	Fri 1/22/16	Thu 1/28/16
Fabricate 2 horn holders for testing	7 days	Mon 2/1/16	Tue 2/9/16
Submit remaining HH for fabrication	2 days	Mon 2/8/16	Tue 2/9/16
Submit 8020 Parts to COE Shop	2 days	Mon 2/8/16	Tue 2/9/16
Begin Assembly of Structure	11 days	Thu 2/11/16	Thu 2/25/16
Attach Horn Holders to Structure	8 days	Sun 2/14/16	Tue 2/23/16
Complete Assembly, Propose Plans for Im	7 days	Mon 2/22/16	Tue 3/1/16
Implement any improvements	5 days	Mon 2/29/16	Fri 3/4/16



Summary

- Review of Project Scope
- Design Updates
- Procurement

Future Plans

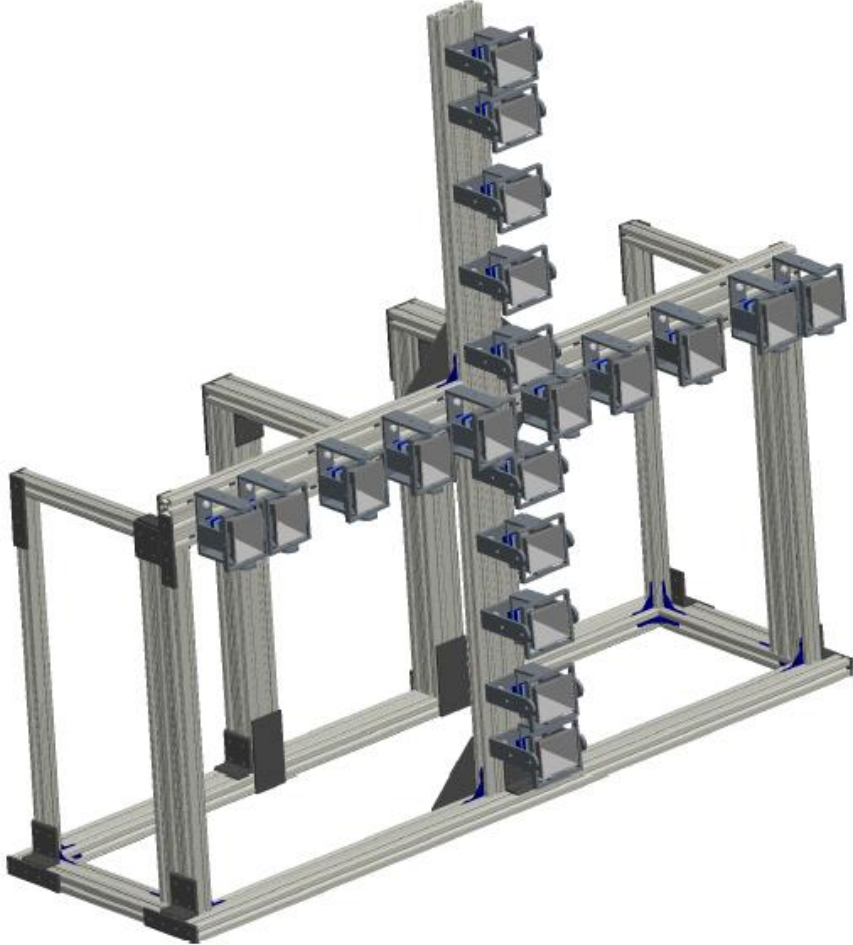
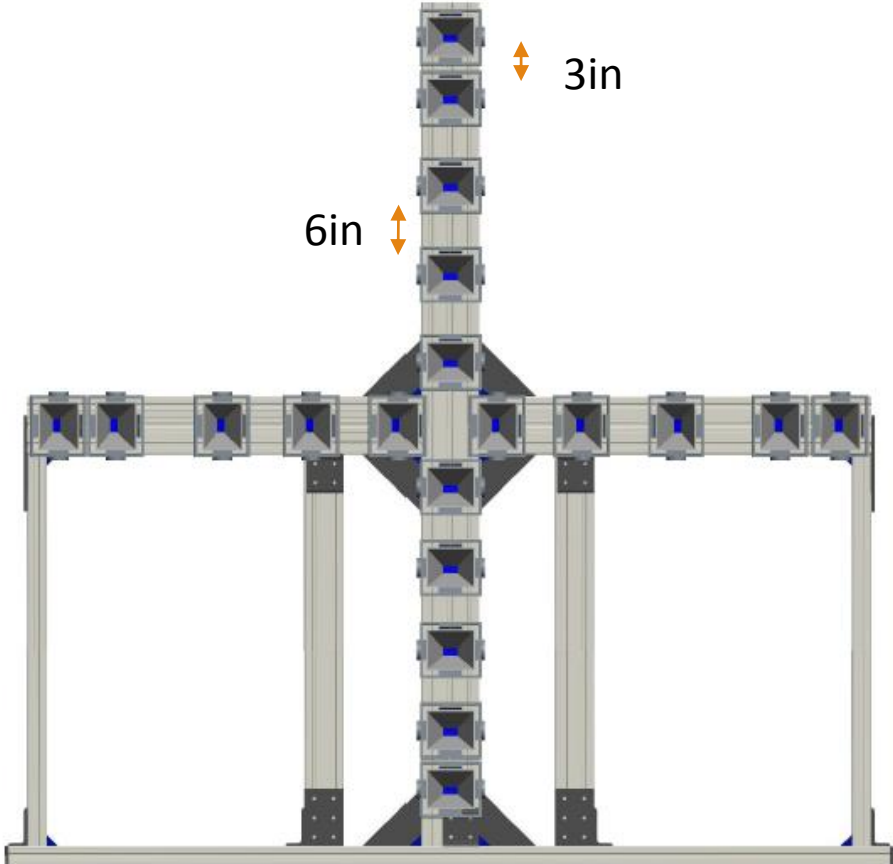
- Create operational instructions
- Fabrication of Horn Holders, Laser Mount, Radar Reflector
- Laser and Radar Reflector Testing
- Testing & Modification of Full Structure and Horns

References

1. NASA AirSAR, <https://upload.wikimedia.org/wikipedia/commons/a/a6/AirSAR-instrument-on-aircraft.jpg>
2. Radar Tutorial, http://www.radartutorial.eu/20.airborne/pic/sar_principle.print.png
3. Cammuse, Matthew. "SAR Final Presentation."
http://eng.fsu.edu/me/senior_design/2015/team27/Webpage/presentations/Team%20E%20311_Milestone%20%237%20Presentation_%20Final%20Report.pptx. Web 10/18/2015.
4. E11 Milestone – Final Report, http://eng.fsu.edu/me/senior_design/2015/team27/
5. http://www.northropgrumman.com/Photos/pgM_BA-10002_067.jpg

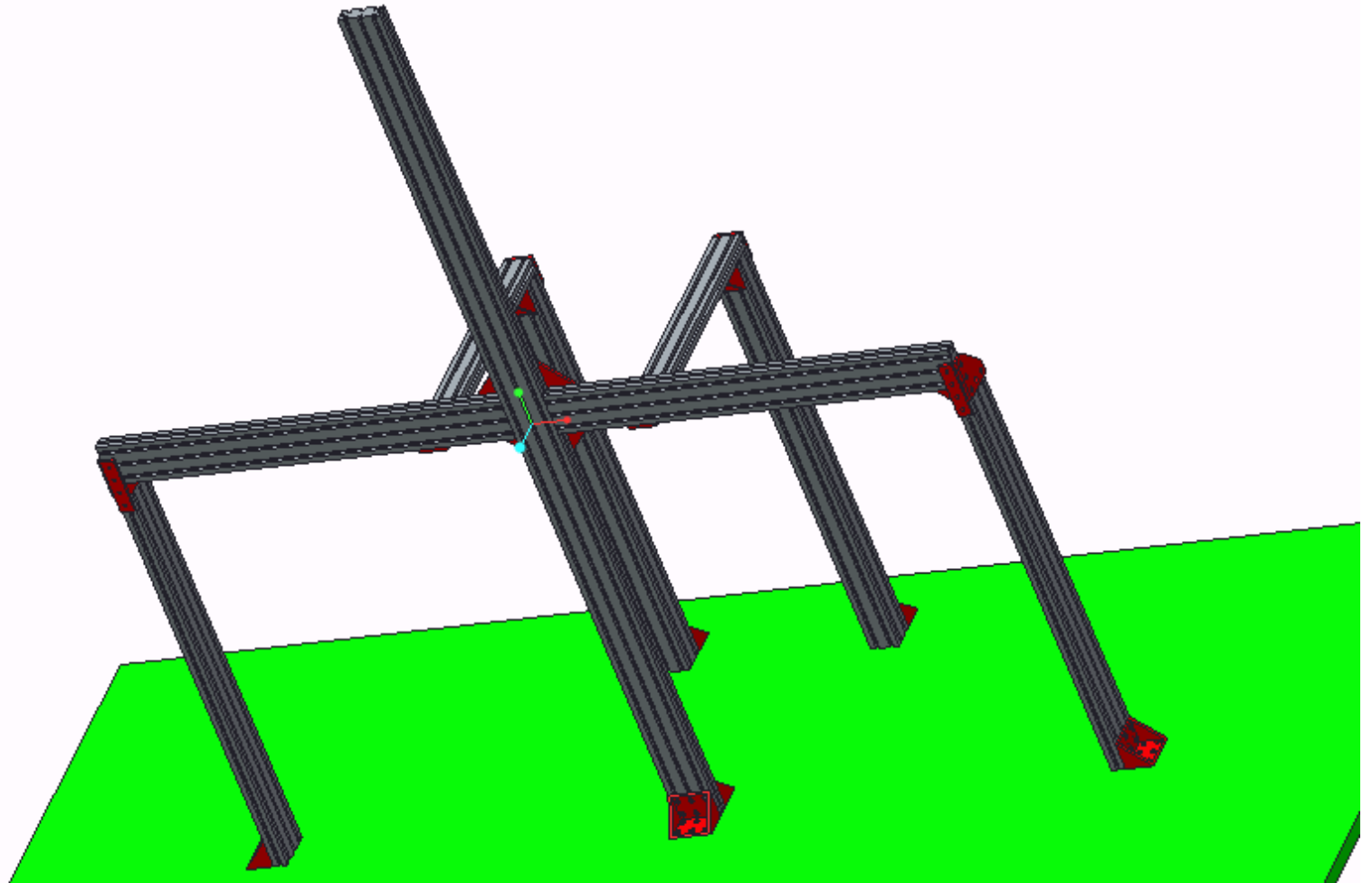
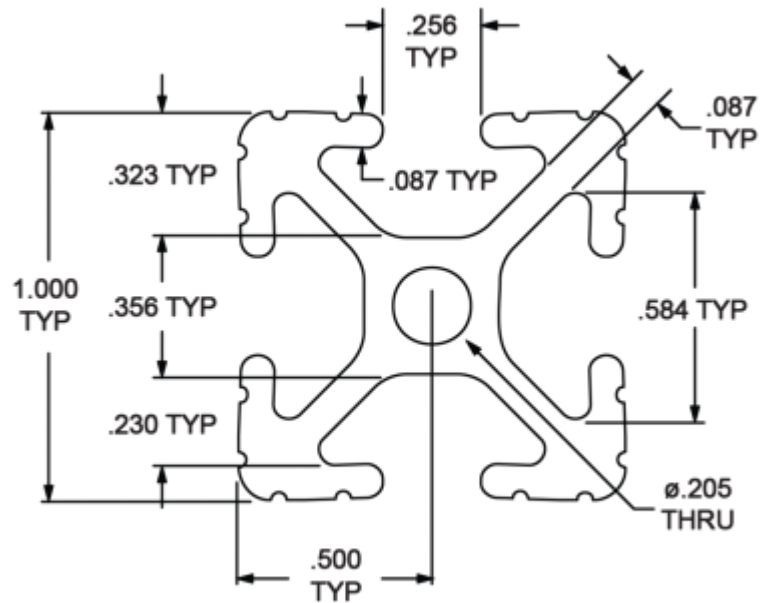
Questions?

Structure Version 3
Horn Holder Version 2
Full Assembly



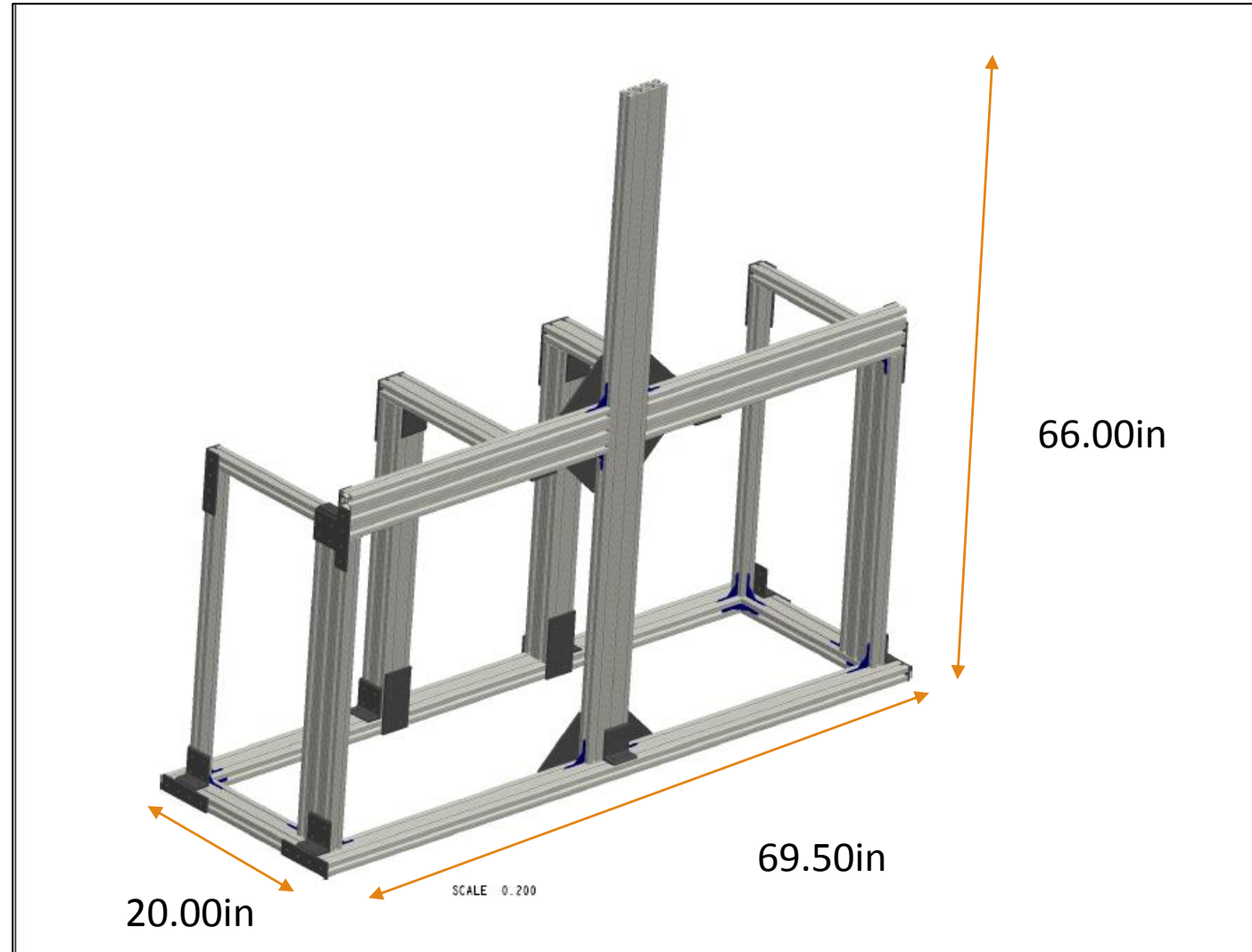
Structure: Version 1

- 80/20 Design
- Lightweight
- Cheap
- Modular
- Light machining required



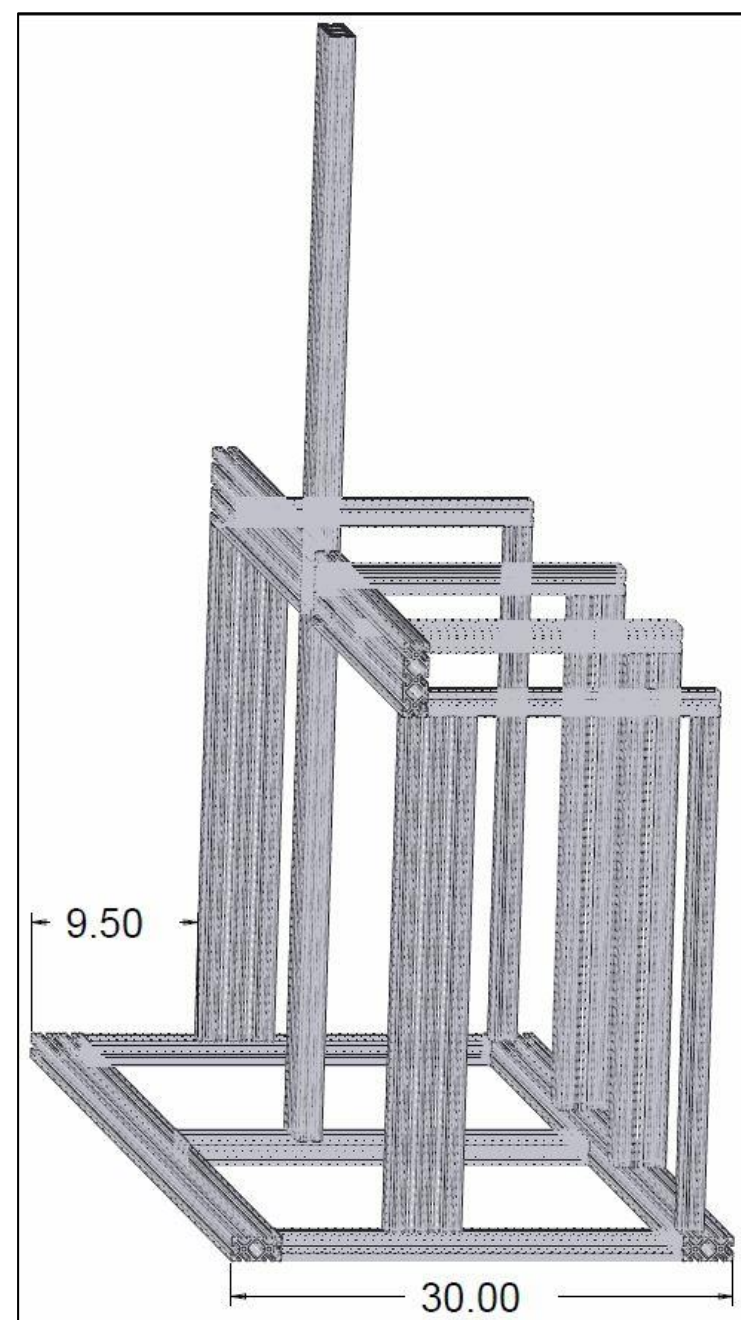
Structure: Version 3

- Increased cross section width from 1.00" to 1.50"
- Added:
 - Bottom frame
 - Outer Braces
 - Brackets
- Possible leveling castors



Structure: Version 4

- Increased stability
 - Extended horizontal bar on bottom



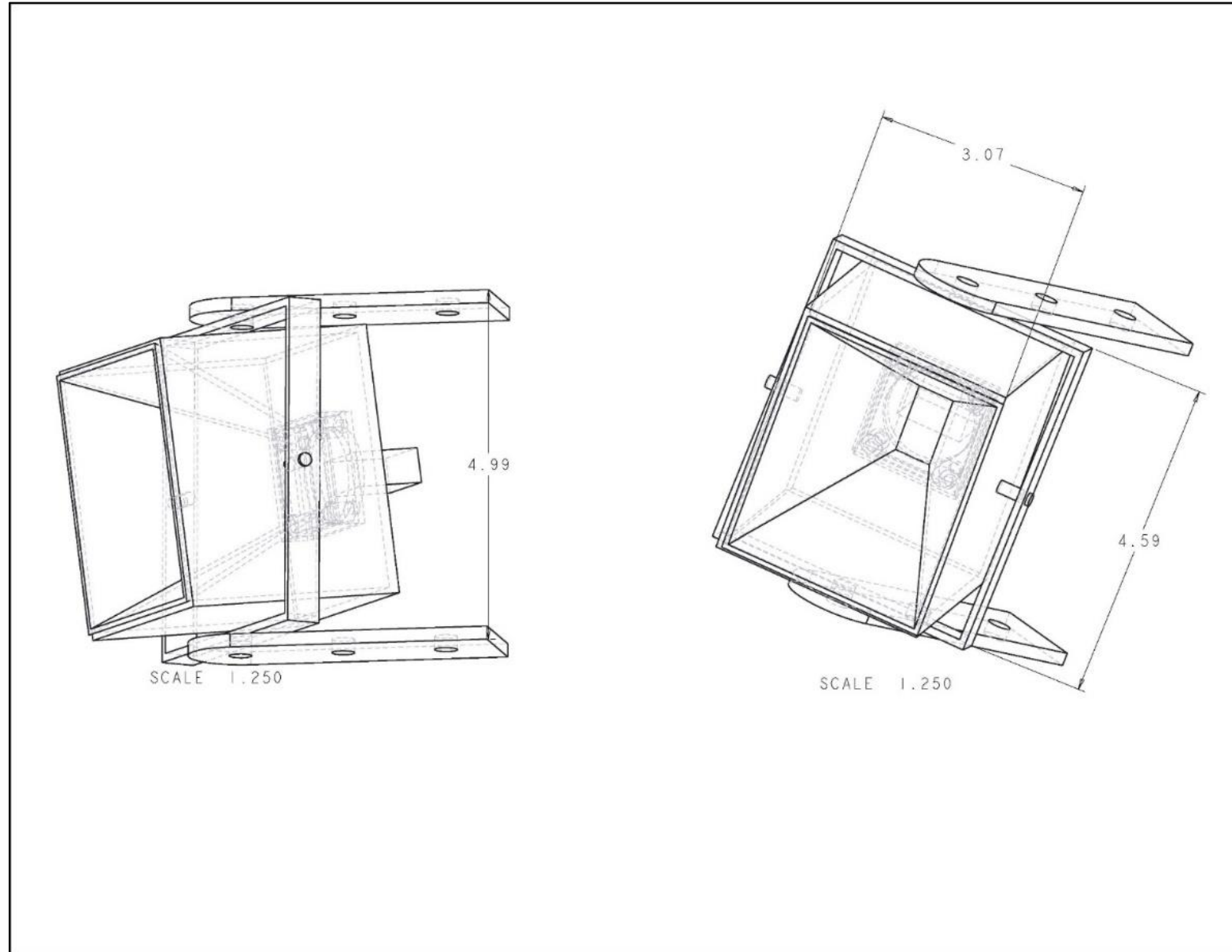
Structure: Version 5

- Reduced weight
 - Change from 1.50" cross section width bar to 1.00"
- Fixed possible radar interference
 - Removed horizontal bar, kept protruding struts on bottom
- Increased stability
 - Added braces at some joints



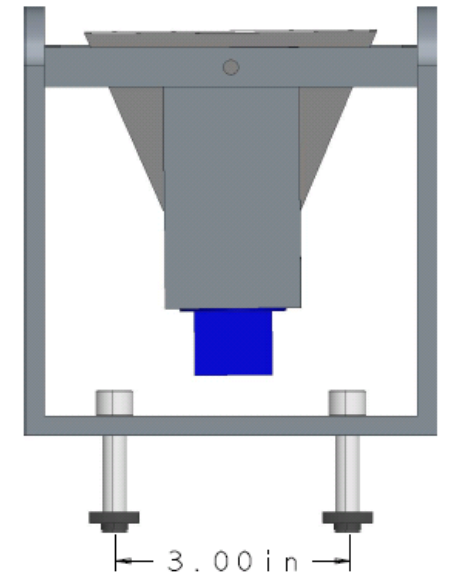
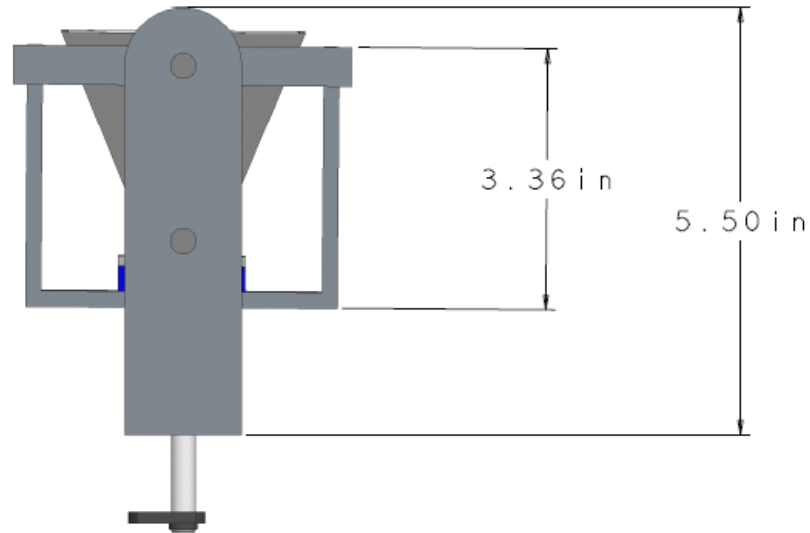
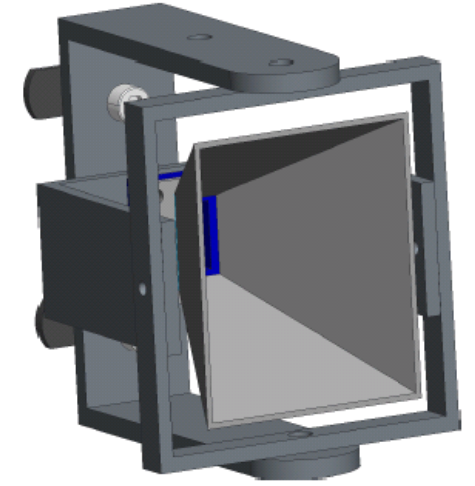
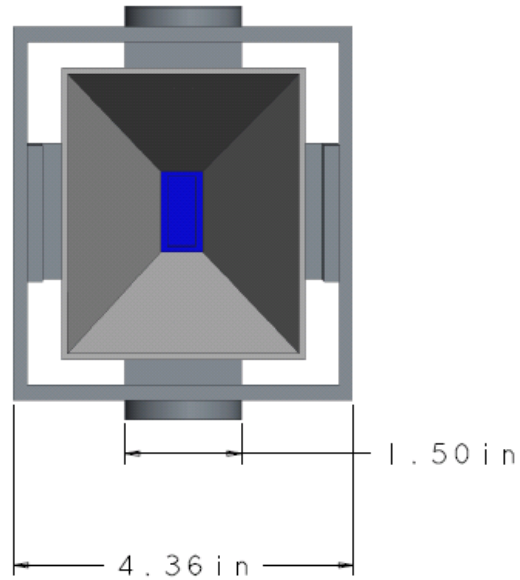
Horn Holder: Version 1

- Compatible with 80/20
- Independent locking and adjustability
- Compact



Horn Holder: Version 2

- Removed box shell
- Refined rotation locking
- Added 80/20 connection



Horn Holder: Version 3

- Clearance
 - Moved horn forward in assembly
- Standardization
 - Small changes in dimensions

Full Schedule (including deliverables)

Procurement	6 days	Mon 1/11/16	Mon 1/18/16
Prepare Drawings for Manufacturing	2 days	Mon 1/11/16	Tue 1/12/16
Bill of Materials	2 days	Wed 1/13/16	Thu 1/14/16
Submit for Quotation	1 day	Fri 1/15/16	Fri 1/15/16
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Complete Assembly, Propose Plans for Im	7 days	Mon 2/22/16	Tue 3/1/16
Implement any improvements	5 days	Mon 2/29/16	Fri 3/4/16
Deliverables	67 days	Thu 1/14/16	Fri 4/15/16
Restated Project Definition and Scope/Pla	5 days	Mon 1/11/16	Fri 1/15/16
Presentation I	3 days	Fri 1/15/16	Tue 1/19/16
Team Evaluation Report I	4 days	Tue 1/19/16	Fri 1/22/16
Web Page Update	11 days	Fri 1/22/16	Fri 2/5/16
Midterm Presentation I	10 days	Fri 2/5/16	Thu 2/18/16
Team Evaluation Report II	2 days	Wed 2/17/16	Thu 2/18/16
Midterm Presentation II	20 days	Fri 2/19/16	Thu 3/17/16
Team Evaluation Report III	3 days	Wed 3/16/16	Fri 3/18/16
Operational Manual, Design Report	11 days	Fri 3/18/16	Fri 4/1/16
Walk Through Presentation	5 days	Fri 4/1/16	Thu 4/7/16
Final Report	6 days	Fri 4/1/16	Fri 4/8/16
Final Web Page	6 days	Fri 4/1/16	Fri 4/8/16
Final Presentation	5 days	Fri 4/8/16	Thu 4/14/16
Team Evaluation Report IV	6 days	Fri 4/8/16	Fri 4/15/16

