

Model Rocket Launch Pad

Sean Murray

GC-120 Section 001

4/20/2017



Rational

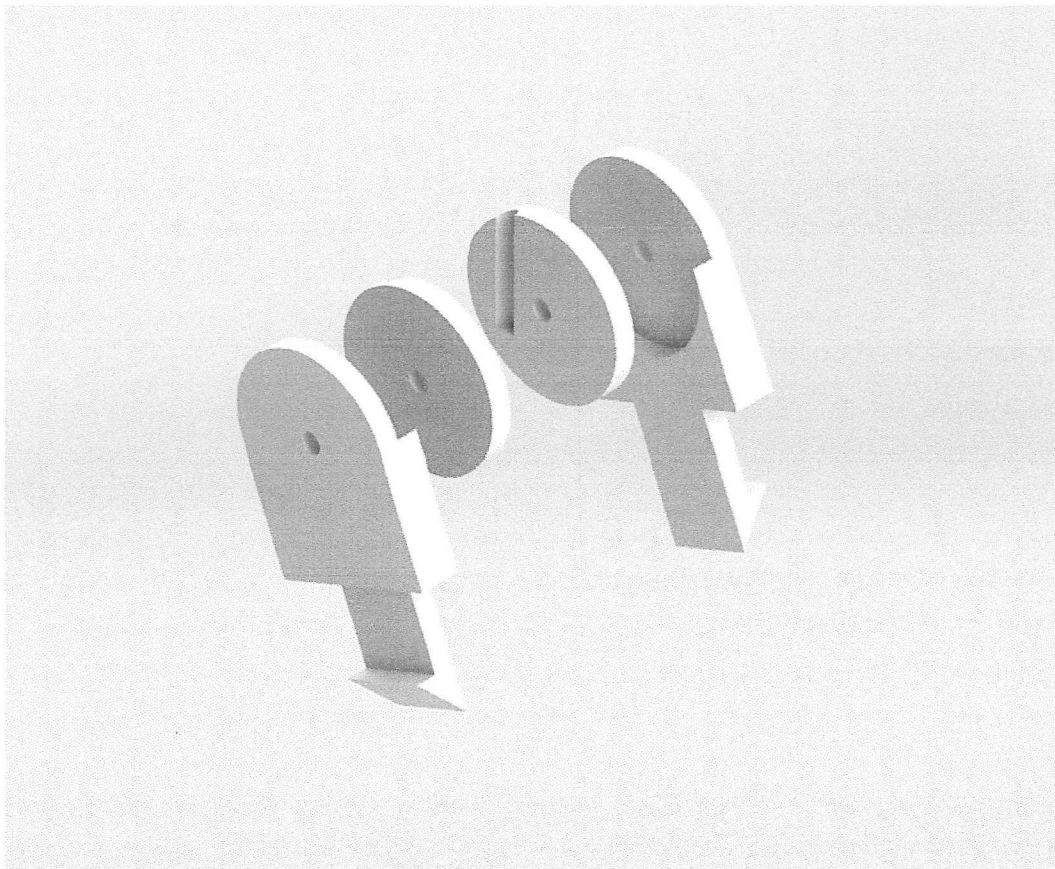
An essential part of model rocketry is the pad from which the model rocket is launched. A company called Estes Rockets is the major provider of model rocket kits, motors, and launch pads. Estes basic launch pad simply holds the launch rod vertically, but the inability to adjust the angle of the launch rod is a major flaw. Adding the capability to adjust the launch angle would be a major improvement for the design of the launch pad, allowing users to successfully launch their model rockets in a larger range of conditions.

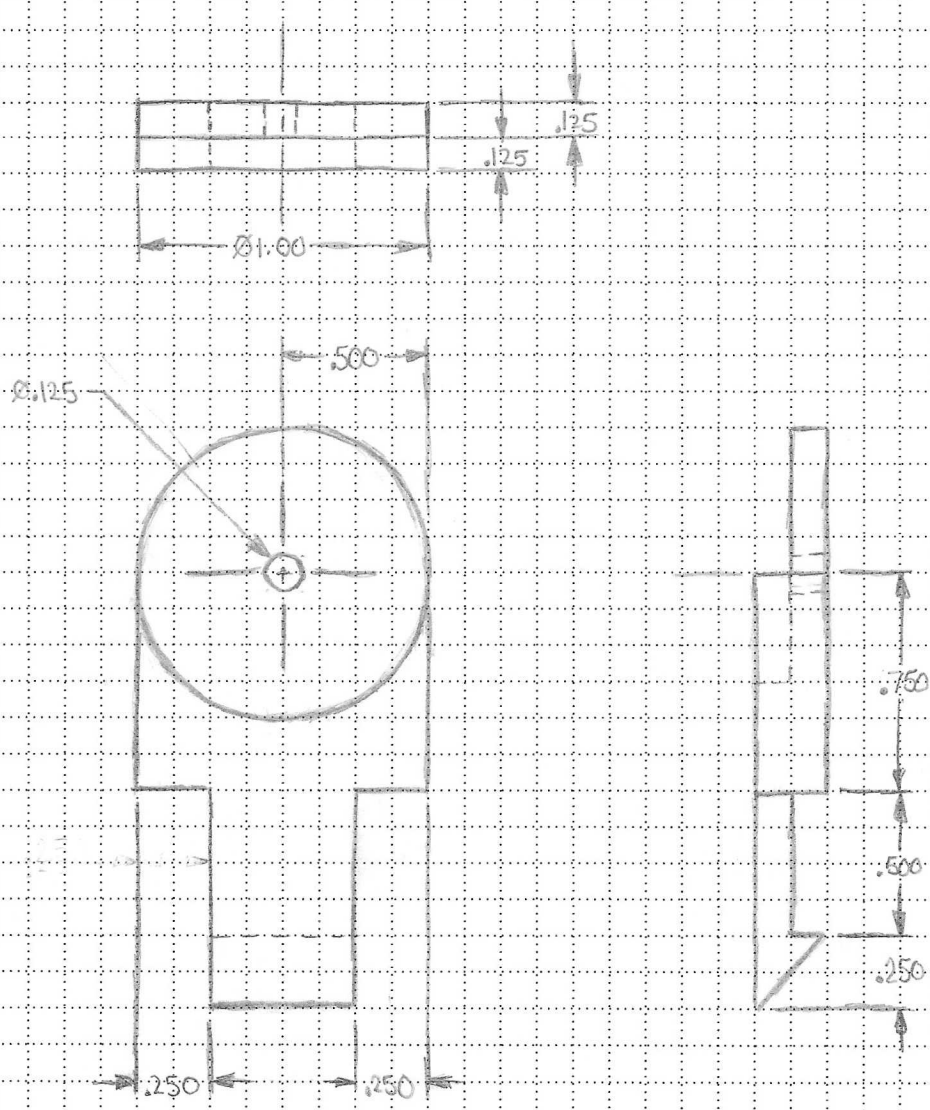
No one likes walking a mile round trip to recover a small model rocket. Only being able to launch model rockets vertically places large restrictions on the wind conditions and field sizes required to have a successful launch. When a rocket is launched, a parachute is normally deployed shortly after apogee by the ejection charge. Having a parachute slows the rate of descent of the rocket, allowing the rocket to be recovered unharmed. The problem is that when there is wind, the parachute will also cause the rocket to drift significant distances away from the launch site. This means the user needs either a very large field or minimal wind to launch their model rockets. When one chooses to ignore these restrictions, and launch their rockets despite a small field and high wind, rockets are often lost in the trees. Losing a rocket that you have spent countless hours building, sanding and painting is heartbreaking. This could dissuade people, especially children, from wanting to continue building and launching rockets.

By including a new part on the launch pad that allows the angle of the launch rod to be adjusted, users will be able to easily minimize the drifting caused by the wind. The launch rod can be angled into the wind, causing the horizontal distance traveled during the launch by the rocket to counteract the distance the rocket will drift after apogee. This will effectively allow the

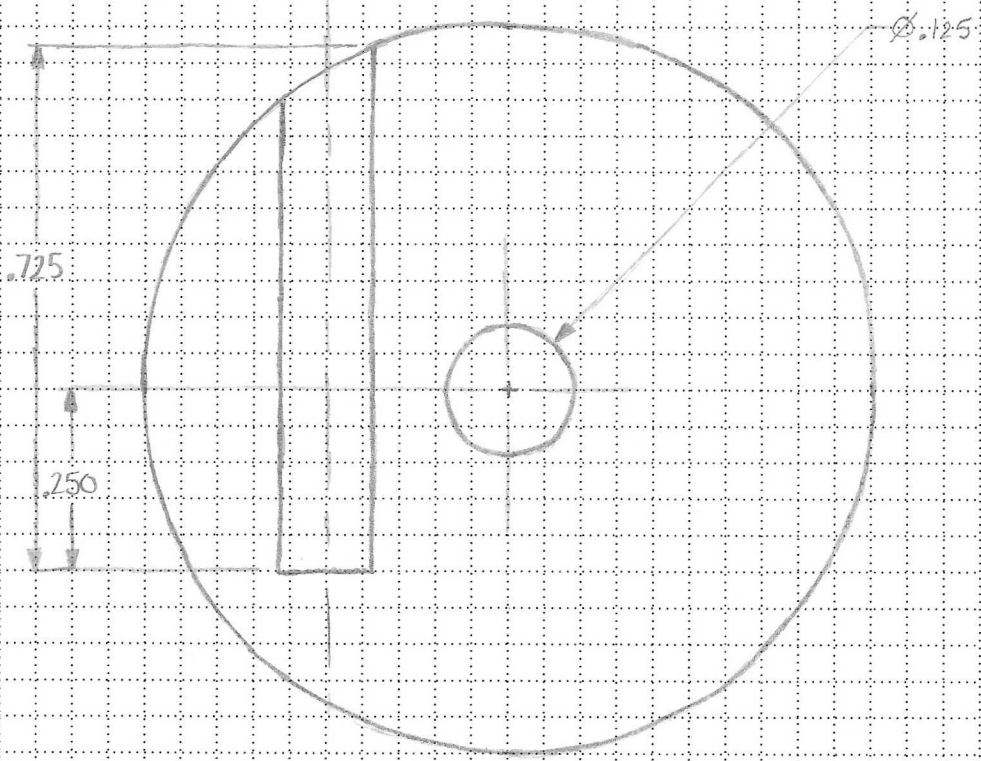
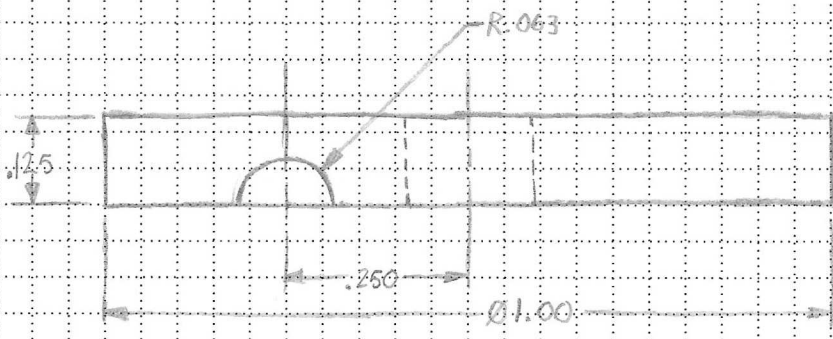
rocket to land and be recovered significantly closer to the launch site than would otherwise be possible with a fixed vertical launch rod. Through the addition of this part, the restrictions placed on model rocket launch can be significantly reduced. Users will be able to launch their rockets in smaller fields or with higher wind speeds. Most importantly, it means that fewer model rockets will be lost in the woods and consequently, user's satisfaction and enjoyment of model rocketry will be improved.

New Part: addition of the inner cylinders allows for adjustment of the launch rod



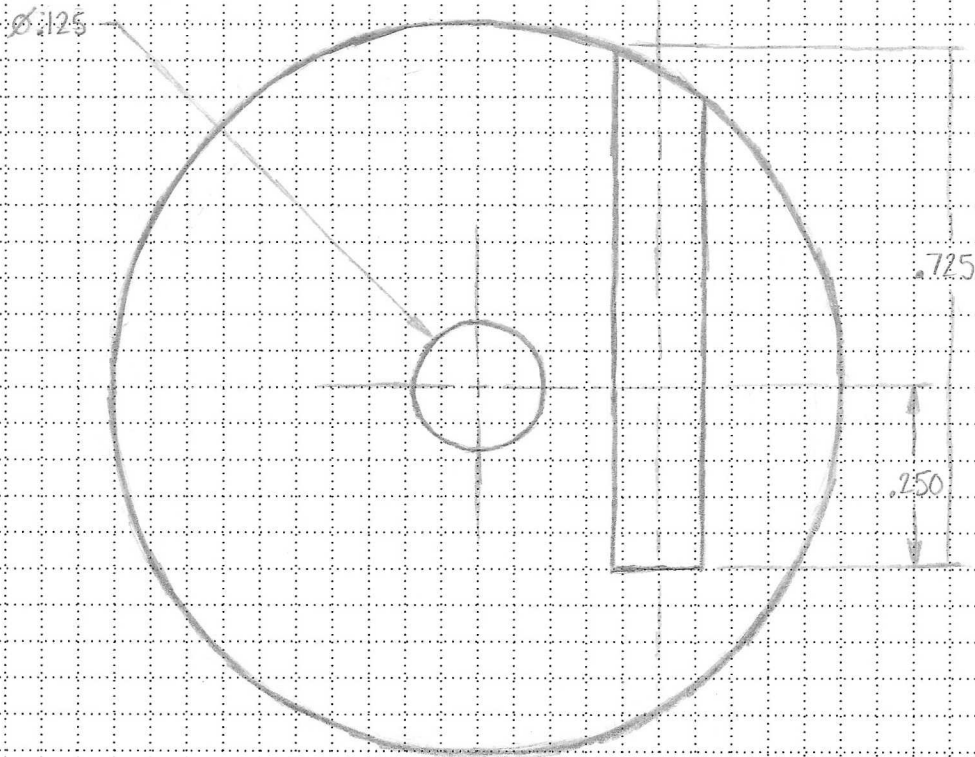
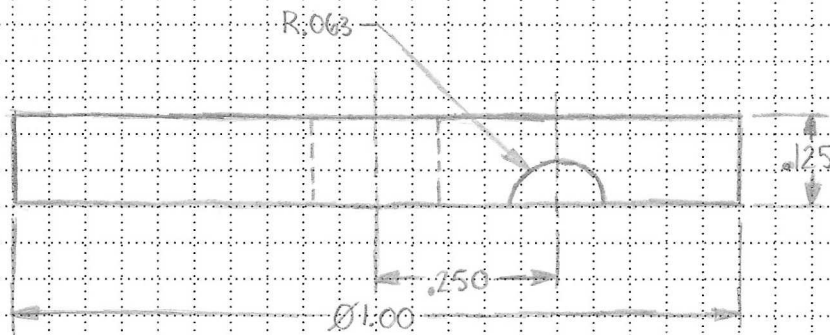


| | | |
|-----------------------|-----------------------------|--------------------------|
| DRAWN BY: SEAN MURRAY | TITLE: OUTER ANGLE ADJUSTER | GRID SQR. REV 2008 |
| COURSE: GC-120 | SECTION: 001 | |



| | |
|-----------------------|-------------------------------|
| DRAWN BY: SEAN MURRAY | TITLE: RIGHT INNER ANGLE ADJ. |
| COURSE: GC-120 | SECTION: 001 |
| SCALE: 4:1 | DATE: 4/20/17 |

GRID
SQR.
REV 2008

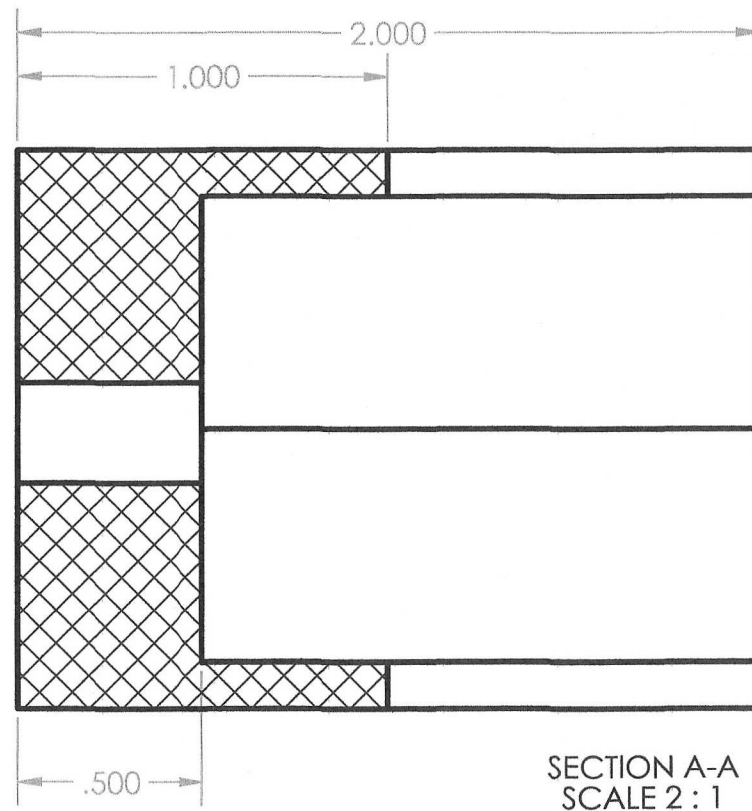
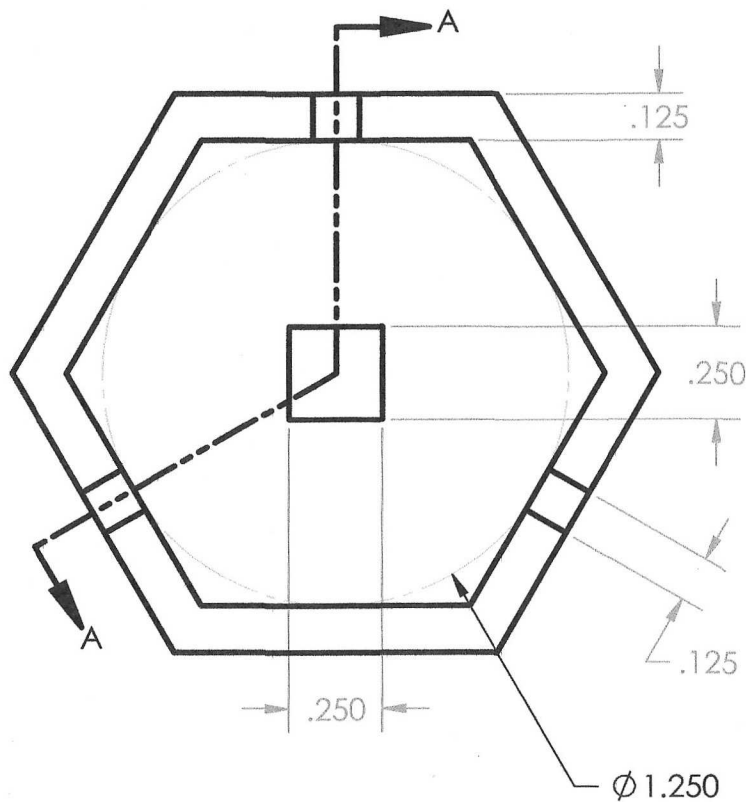


| | |
|-----------------------|------------------------------|
| DRAWN BY: SEAN MURRAY | TITLE: LEFT INNER ANGLE ADJ. |
| COURSE: GC 120 | SECTION: 001 |
| SCALE: 4:1 | DATE: 4/18/17 |

GRID
SQR.
REV 2008

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FILE: Connector

D
C
B
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D
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DECIMALS .XXX+ .XXX
ANGLES +1

DRAWN

SEAN MURRAY

DATE

4/11/17

TITLE

CONNECTOR

MATERIAL

ABS PLASTIC

SCALE

2:1

SIZE

A

PRT. NO.

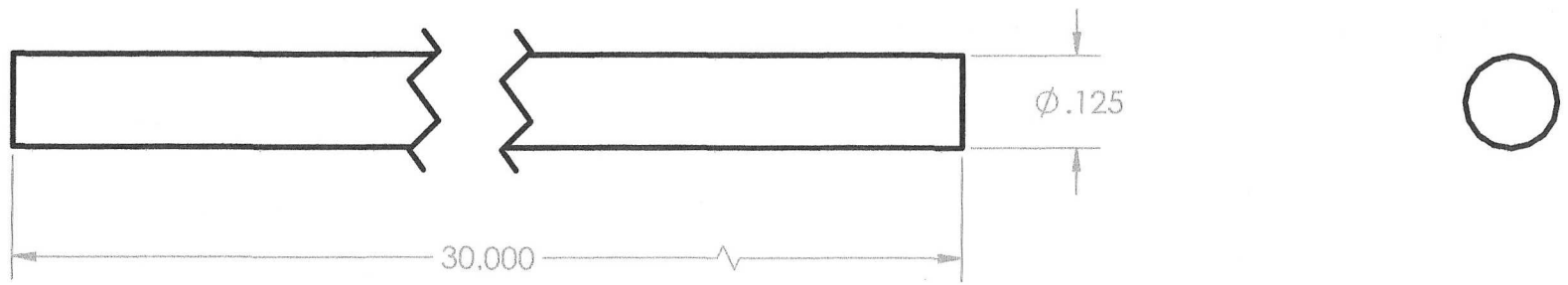
SHEET 1 OF 12

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1

1 2 3 4 5 6 7 8

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 FILE: Launch Rod



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 .XXX+.XXX

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DATE

4/20/2017

TITLE

LAUNCH ROD

MATERIAL

1010 STEEL

SCALE

4:1

SIZE

A

PRT. NO.

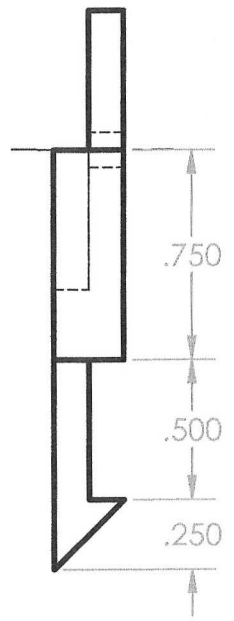
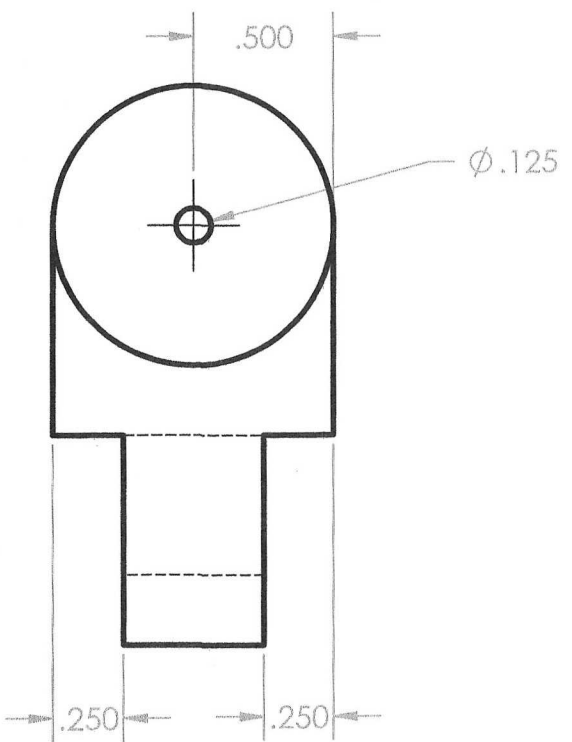
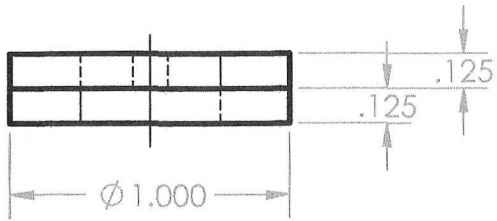
SHEET 2 OF 12

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FILE: Outer Angle Adjuster



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ANGLES + 1

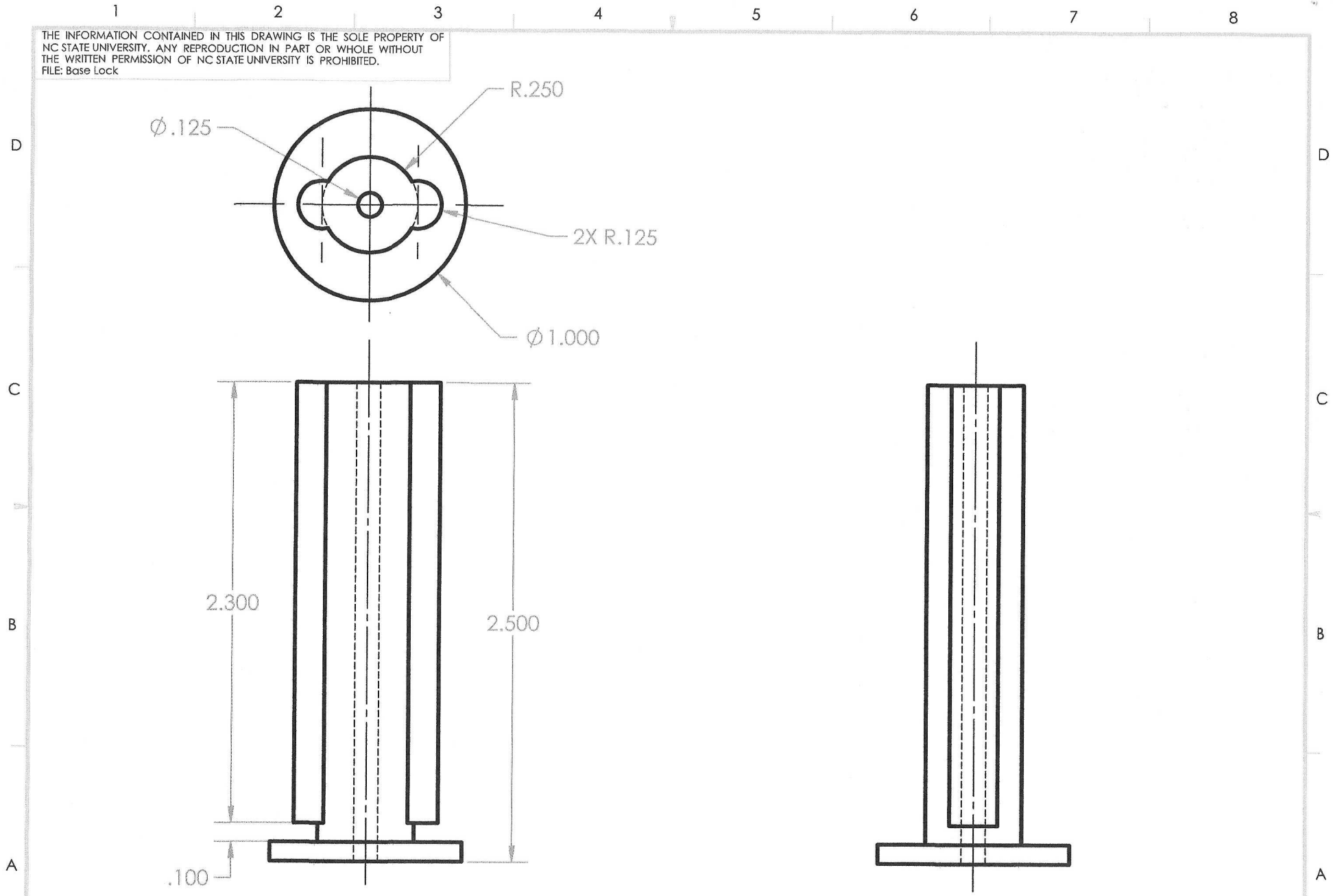
DRAWN
SEAN MURRAY
MATERIAL
ABS PLASTIC

DATE
4/18/17
SCALE
3:2

TITLE
OUTER ANGLE ADJUSTER
SIZE
A
PRT. NO.
SHEET 3 OF 12

1

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FILE: Base Lock



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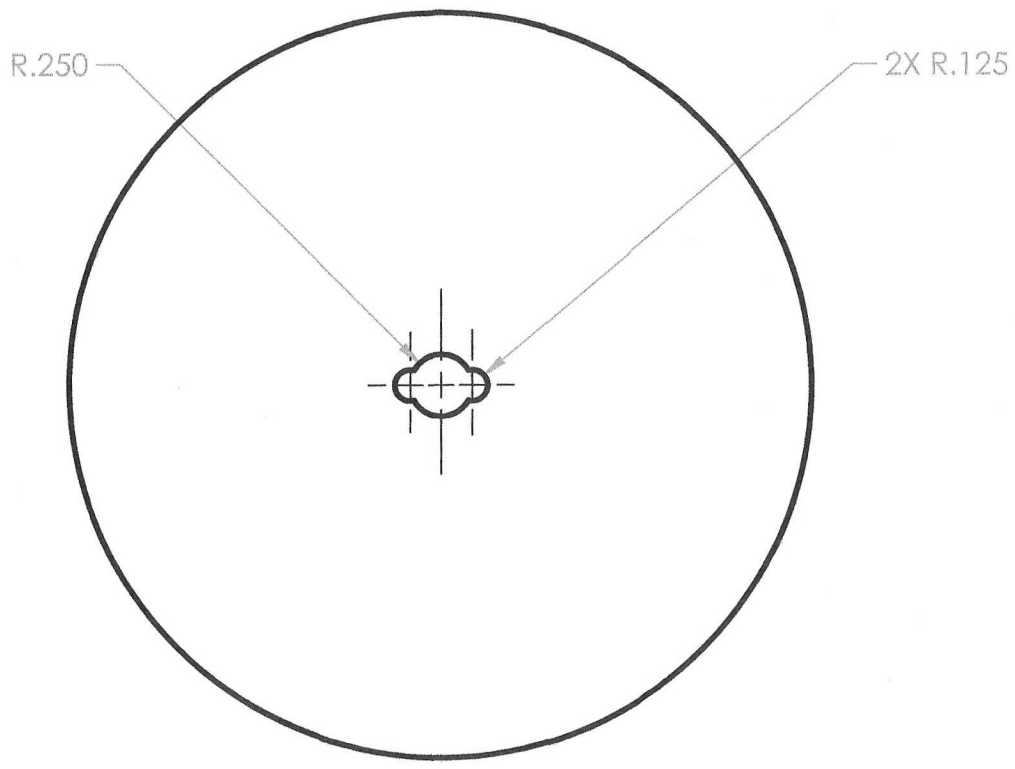
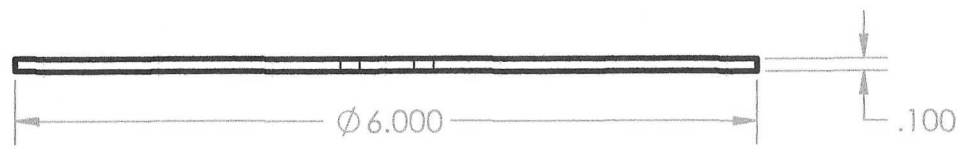
DRAWN
SEAN MURRAY
MATERIAL
ABS PLASTIC

DATE
4/18/17
SCALE
3:2

TITLE
BASE LOCK
SIZE
A
PRT. NO.
SHEET 4 OF 12

1

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 FILE: Launch Pad Base



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 DECIMALS .XXX+ .XXX
 ANGLES + 1

DRAWN

SEAN MURRAY

MATERIAL

STAINLESS STEEL

DATE

4/20/2017

SCALE

2:3

TITLE

LAUNCH PAD BASE

SIZE

A

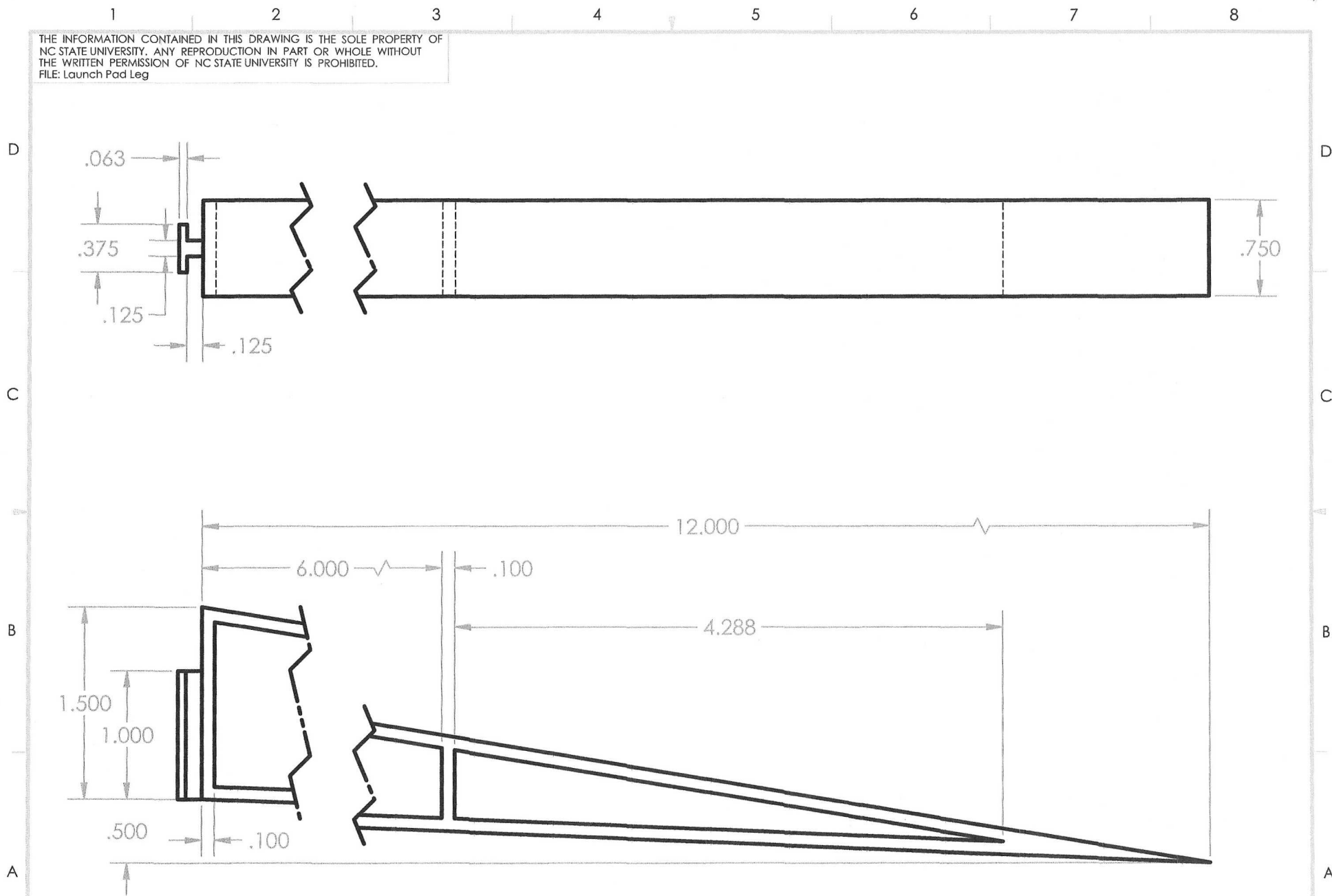
PRT. NO.

SHEET 5 OF 12

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1

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FILE: Launch Pad Leg



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+ .XX+ .XX + 1
.XXX+.XXX

DRAWN

SEAN MURRAY

DATE

4/18/17

TITLE

LAUNCH PAD LEG

MATERIAL

ABS PLASTIC

SCALE

1:1

SIZE

A

PRT. NO.

SHEET 6 OF 12

#

1

1

2

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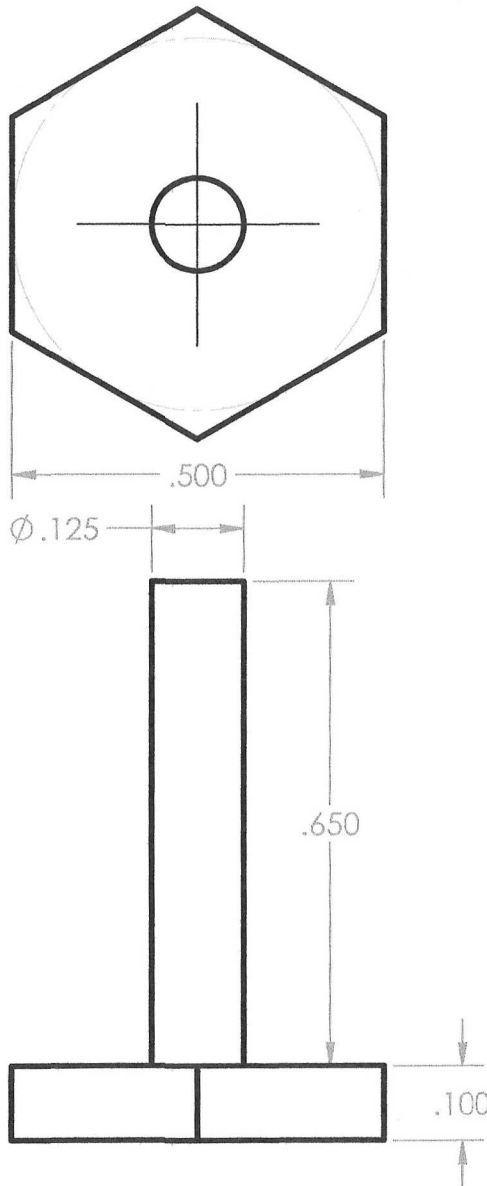
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7

8

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FILE: Bolt



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DECIMALS .XXX+ .XXX
ANGLES + 1

DRAWN

SEAN MURRAY

MATERIAL

CARBON STEEL

DATE

4/20/2017

SCALE

4:1

TITLE

BOLT

SIZE

A

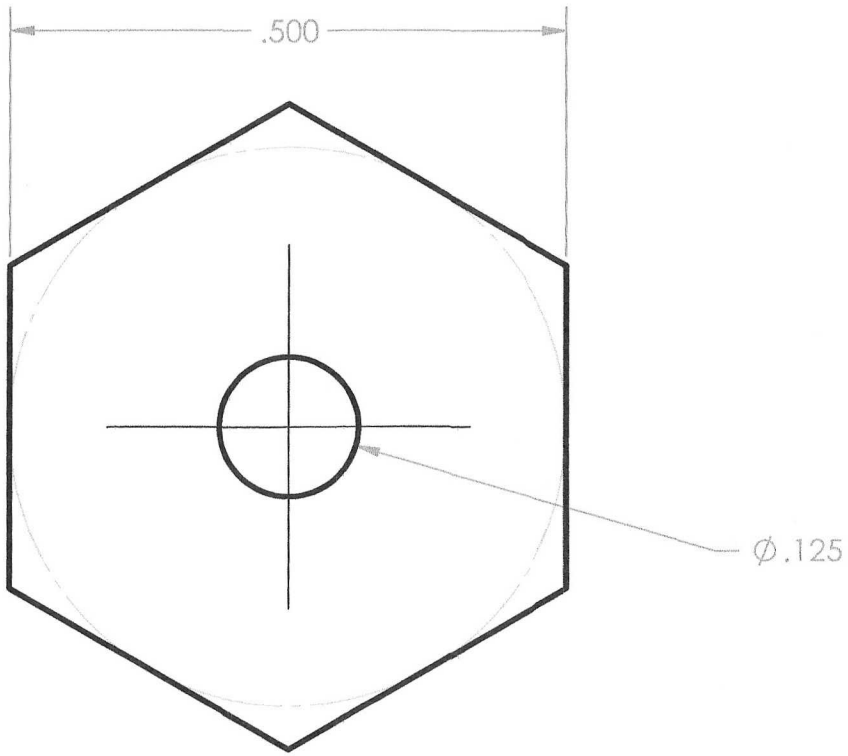
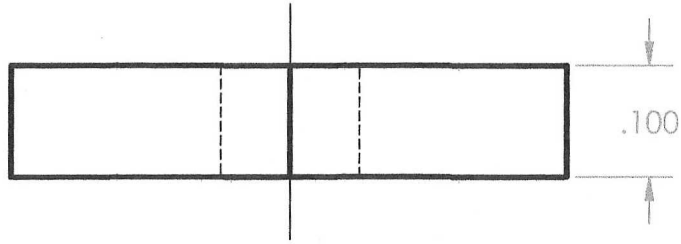
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SHEET 7 OF 12

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1

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FILE: Nut



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FRACTIONS .XX+ .XX + 1
DECIMALS .XXX+ .XXX
ANGLES + 1

DRAWN

SEAN MURRAY

MATERIAL

CARBON STEEL

DATE

4/20/2017

SCALE

6:1

TITLE

NUT

SIZE

A

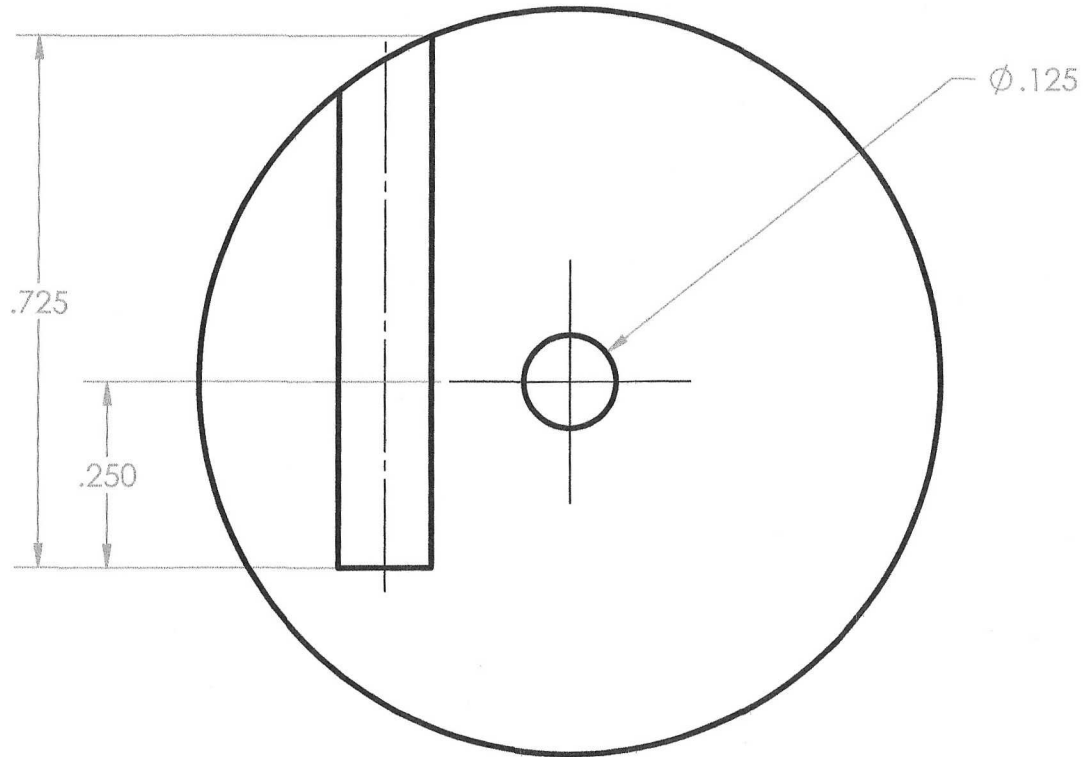
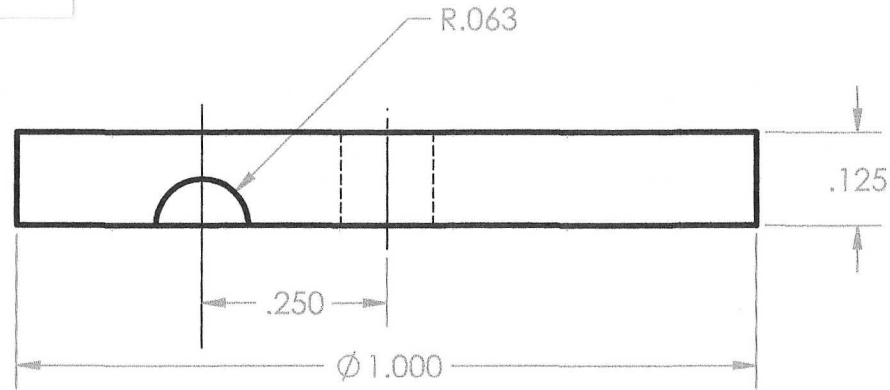
PRT. NO.

SHEET 8 OF 12

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1

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FRACTIONS DECIMALS ANGLES
+ .XX+ .XX + 1
.XXX+.XXX

DRAWN

SEAN MURRAY

DATE

4/20/2017

TITLE

RIGHT INNER ANGLE ADJ.

MATERIAL

ABS PLASTIC

SCALE

4:1

SIZE

A

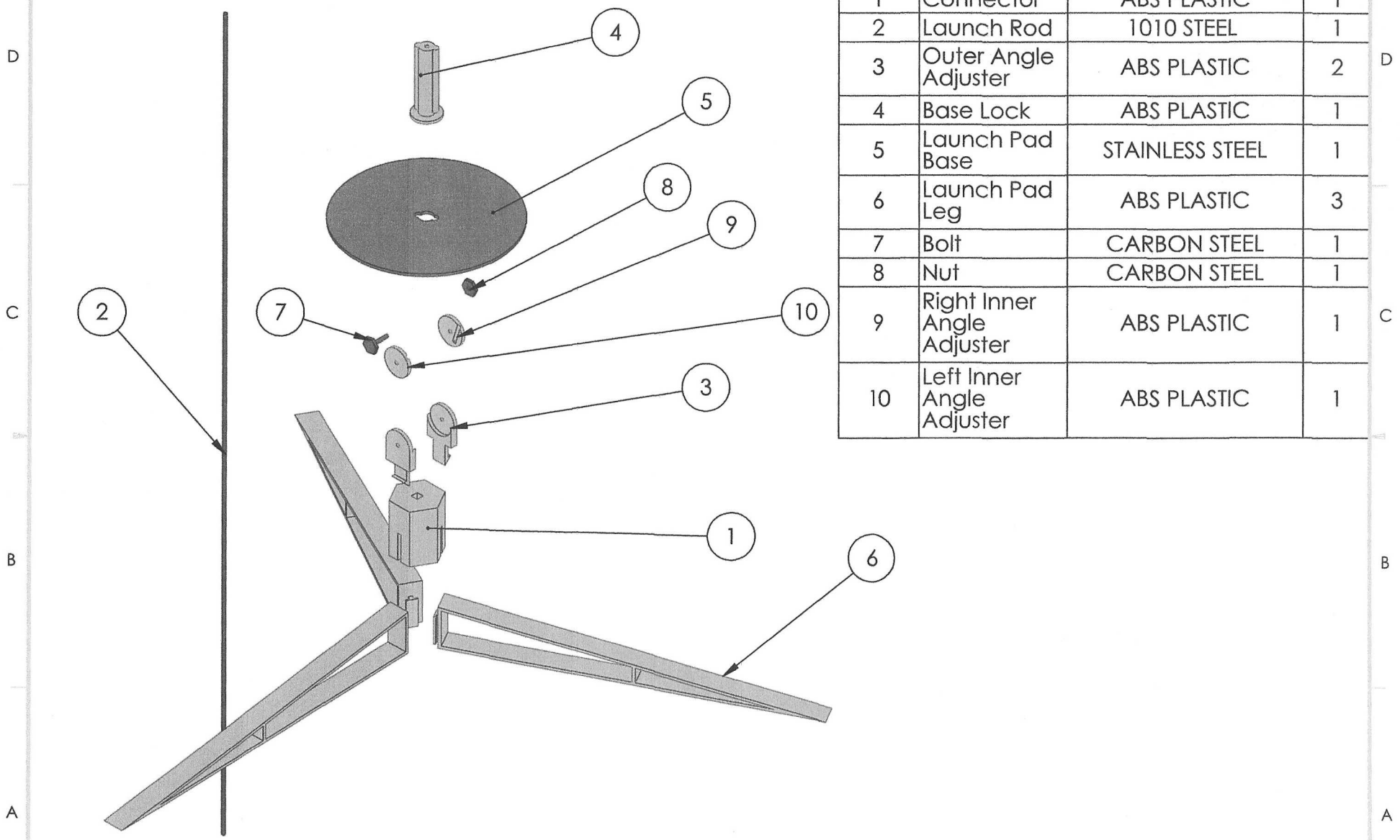
PRT. NO.

SHEET 9 OF 12

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1

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FILE: Launch Pad Assembly



| ITEM NO. | PART | MATERIAL | QTY. |
|----------|----------------------------|-----------------|------|
| 1 | Connector | ABS PLASTIC | 1 |
| 2 | Launch Rod | 1010 STEEL | 1 |
| 3 | Outer Angle Adjuster | ABS PLASTIC | 2 |
| 4 | Base Lock | ABS PLASTIC | 1 |
| 5 | Launch Pad Base | STAINLESS STEEL | 1 |
| 6 | Launch Pad Leg | ABS PLASTIC | 3 |
| 7 | Bolt | CARBON STEEL | 1 |
| 8 | Nut | CARBON STEEL | 1 |
| 9 | Right Inner Angle Adjuster | ABS PLASTIC | 1 |
| 10 | Left Inner Angle Adjuster | ABS PLASTIC | 1 |

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+ .XX+ .XX + 1
.XXX+.XXX

DRAWN

SEAN MURRAY

MATERIAL

VARIED

DATE

4/20/2017

SCALE

1:4

TITLE

LAUNCH PAD EXPLODED VIEW

SIZE

A

PRT. NO.

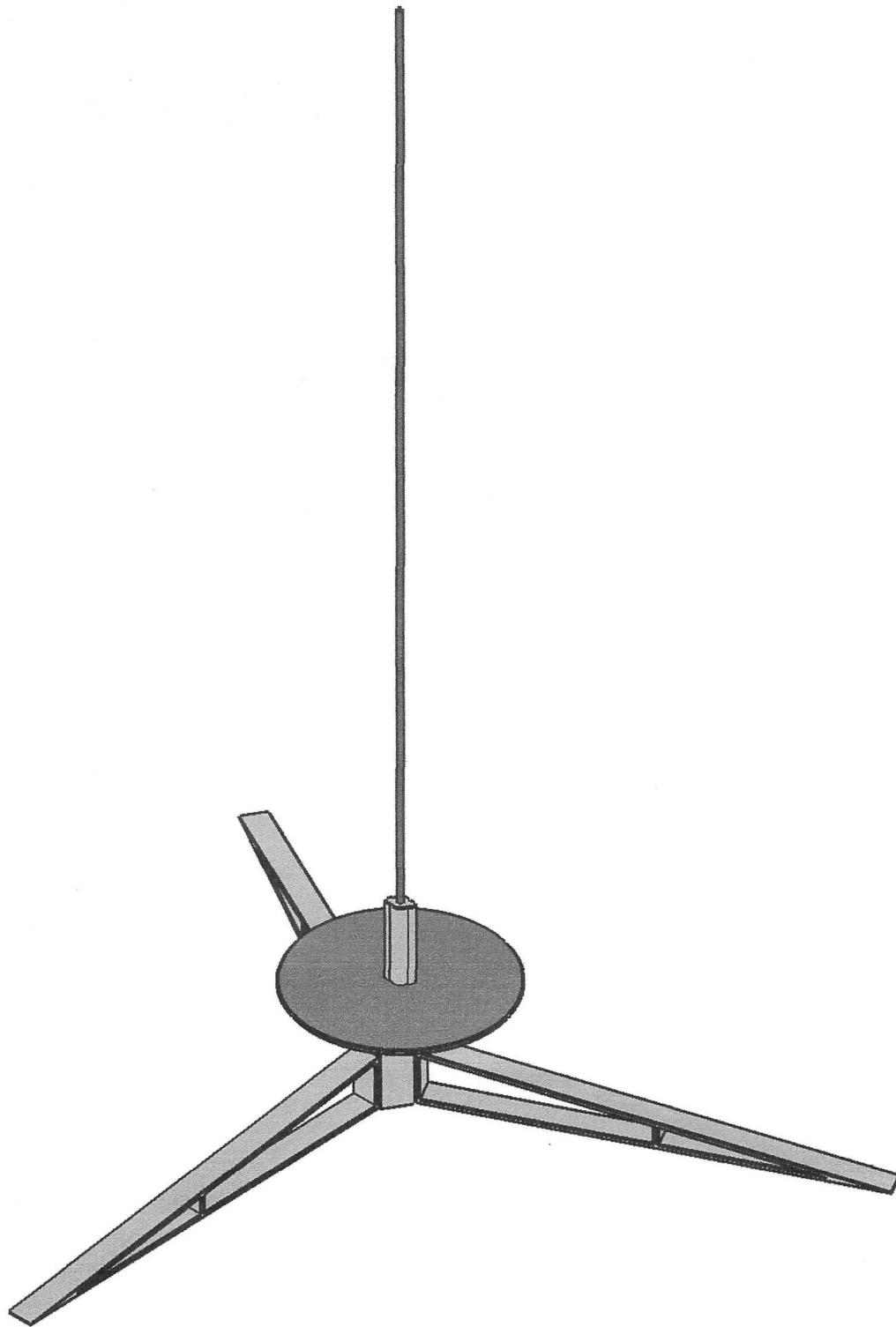
SHEET 11 OF 12

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1 2 3 4

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 FILE: Launch Pad Assembly



| | | | | | | | | |
|---|----------|-------------|-------|-----------|-------|----------------|---|---------------------|
| NC STATE UNIVERSITY P.O. BOX 7801 Raleigh, North Carolina | DRAWN | SEAN MURRAY | DATE | 4/23/2017 | TITLE | | | LAUNCH PAD ASSEMBLY |
| | MATERIAL | VARIED | SCALE | 1:4 | SIZE | PRT. NO. | # | |
| | | | | | A | SHEET 12 OF 12 | 1 | |

**TERM PROJECT
EVALUATION SHEET**



Student Name: SEAN MURRAY

I. Technical Sketch of the modified/new part

20 points 20

- ✓ Accuracy of depicted orthographic views ---4 3 2 1 0
- ✓ Annotations ---6 5 4 3 2 1 0
- ✓ Line type ---4 3 2 1 0
- ✓ Quality ---4 3 2 1 0
- ✓ Title block ---2 1.5 1 .5 0

Comments: Excellent

II. 3D Solid Models of all parts

20 points 20

- ✓ Model orientation and procedure ---8 7 6 5 4 3 2 1 0
- ✓ Accuracy and constraints ---8 7 6 5 4 3 2 1 0
- ✓ Material assignment ---2 1.5 1 .5 0
- ✓ Naming convention ---2 1.5 1 .5 0

Comments: _____

III. CAD Drawings of 5 parts including new part

20 points 17

- ✓ Accuracy of depicted views + specialty view ---4 3 2 1 0
- ✓ Annotations ---6 5 4 3 2 1 0
- ✓ Line type ---4 3 2 1 0 *center marks / lines*
- ✓ Quality ---4 3 2 1 0
- ✓ Title block ---2 1.5 1 .5 0

Comments: _____

IV. Assembly & CAD Assembly Drawing(s)

20 points 20

- ✓ Correct mates/relations between parts ---6 5 4 3 2 1 0
- ✓ Appropriate orientation of assembly ---4 3 2 1 0
- ✓ Proper collapsed and exploded drawing representation ---4 3 2 1 0
- ✓ Bill of materials with identification ---4 3 2 1 0
- ✓ Title block ---2 1.5 1 .5 0

Comments: _____

V. Project Portfolio

20 points 20

Hardcopy Deliverables

1. Title Page with rendered assembly (rendered assembly, title, name, section, semester, and date) ---4 3 2 1 0
2. Rationale (typed) behind modified design with visual representation ---10 8 6 4 2 0
 - Isometric representation of modified versus original part (screenshots)

or

 - Isometric representation of newly designed part (screenshot)
3. Technical Sketch of the modified/new part ---1 0
4. CAD Drawings of 5 parts including new part ---1 0
5. CAD Assembly Drawing(s) with Bill of Materials ---1 0
6. Evaluation Sheet ---1 0

Digital Deliverable

7. Compressed Folder - Upload to Moodle submission link (All digital project and Solidworks files) ---2 1 0

Comments: _____

TOTAL: 97