IRON MAN MK3

Design Package

Shristhi Pant - Radhika Mishra

12/17/2025

Table of Contents

Configuration Management

Design parts are measured in inches, and files are stored in a shared Google Drive folder organized by final versions in the naming convention:

> EXAMPLE: MK3_V2_SP_URLEG_COLOR
> MK3_VERSION_INITIALS_(Upper/Lower)(PART)_COLOR
> Iron Patriot Configurations: An addition of “COLORS” in files.
> Version 2, indicating the final part.

The drawing file format used is A3 (ANSI) Landscape.

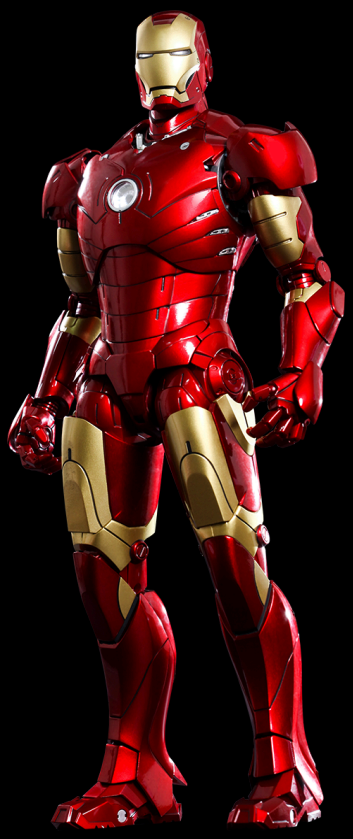
The material used is Ti-6Al-4V Solution Treatment and Aged (SS) to mimic the titanium-gold alloy from the original MK3 armour.

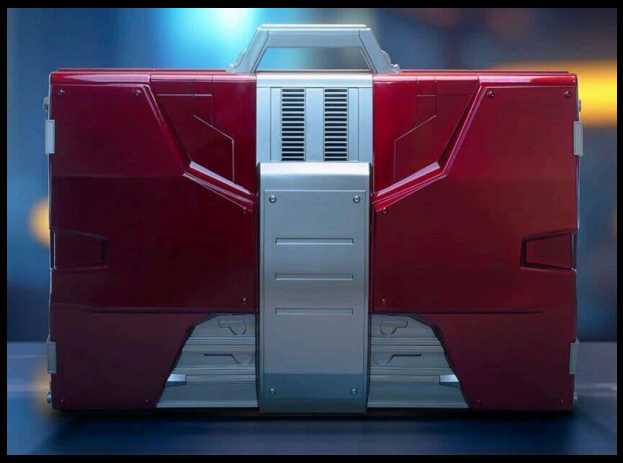
Link to the Final Google Drive of all parts, assembly, drawings, renders, animation, analysis, e assembly drawing, and presentation. Each section of the Design Package also contains its corresponding Google Drive link.

DESIGN OVERVIEW

Design Overview

We are making the Iron Man MK3 Armour that can compress into a suitcase, inspired by MK5. Design elements utilized from class include: Lofting, Mirroring, Assembly, Spline, Fillets, Revolve,and more. We are also configuring the MK3 to the Iron Patriot design.





RENDERED IMAGES

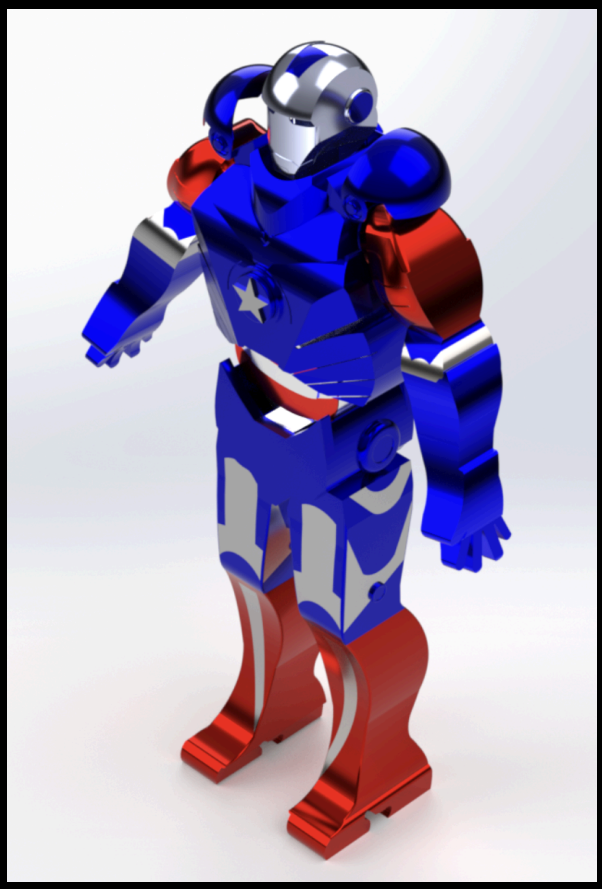
Rendered MK3 Iron Man:

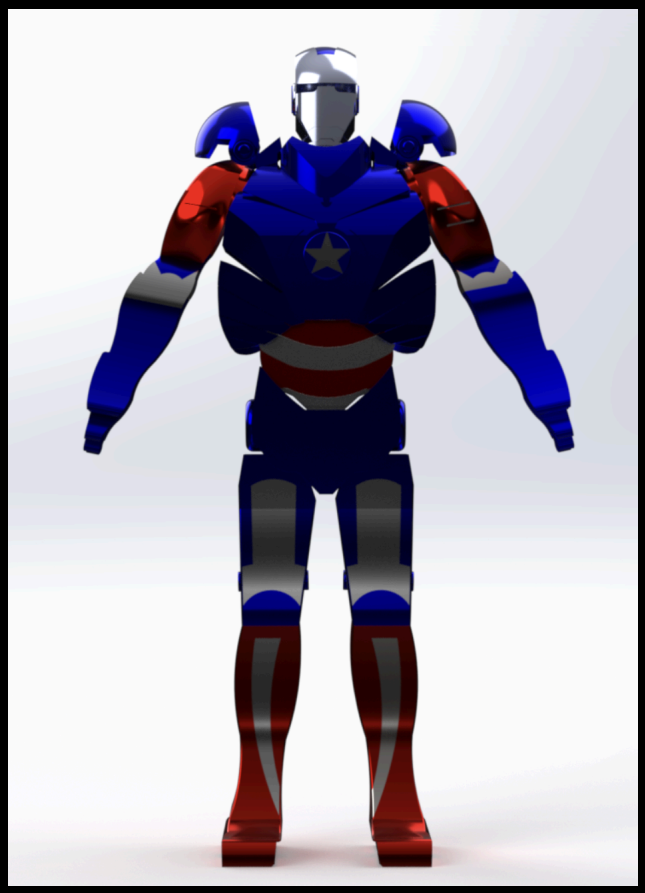
Render link to Google Drive
Assembly Link & Parts Link

The overall Ironman MK3 ended up being 73 inches and 41.19 lb. It has two configurations: Suitcase and Iron Patriot.

Rendered Suitcase Configuration:

Rendered Iron Patriot Configuration:





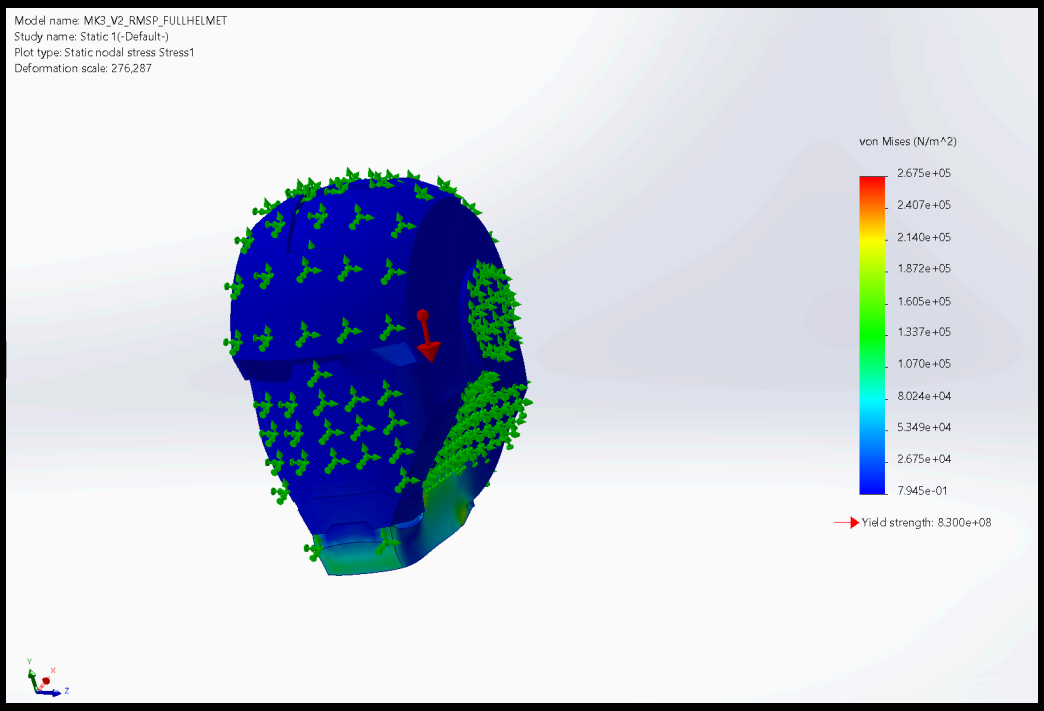
ANALYSIS

Static Structural Analysis: Link to all Analysis

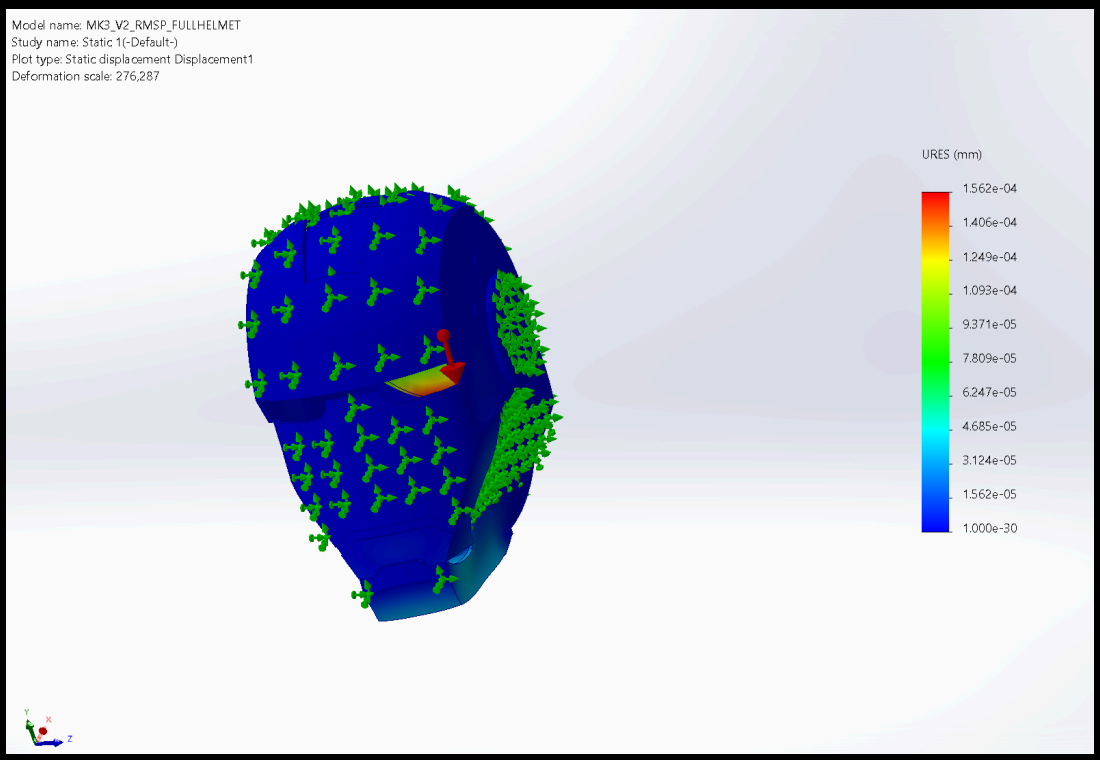
- What does the analysis mean? Why is it important?

We did a Static Structural Analysis of the MK3 Head due to the entire assembly being complex, with large shells so the computational generation failed in the process. A larger, more powerful software or hardware is needed to complete the static analysis.

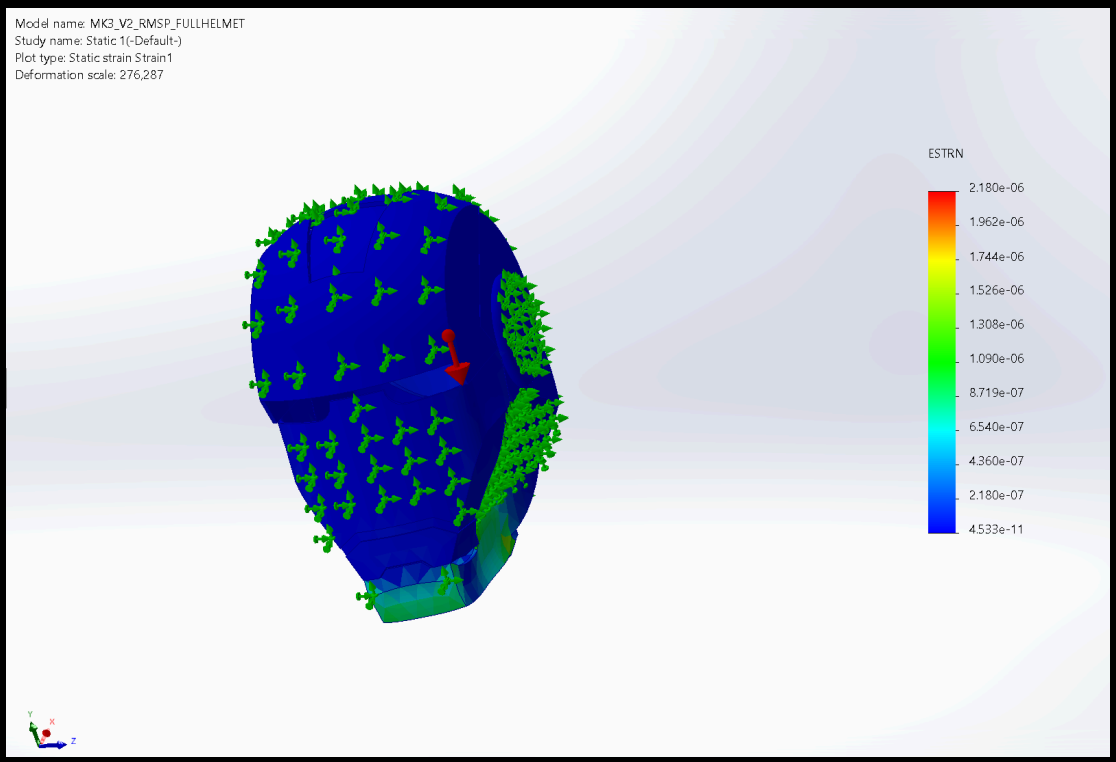
Static Stress:



Displacement:



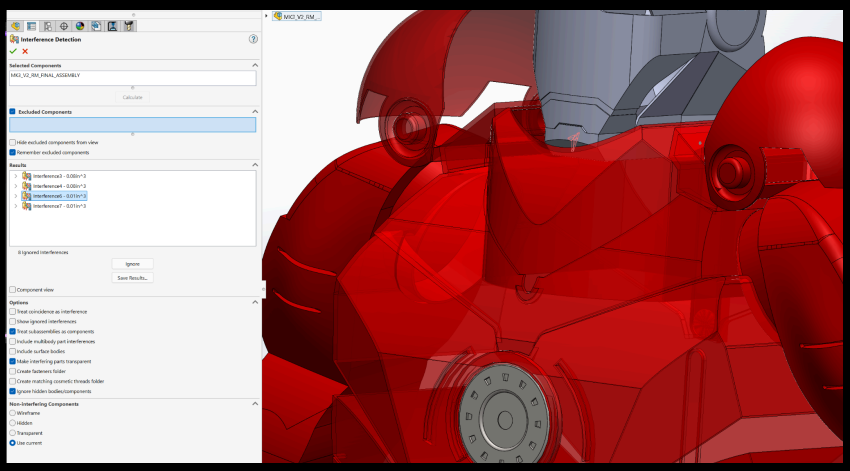
Static Strain:



Interference Checks:

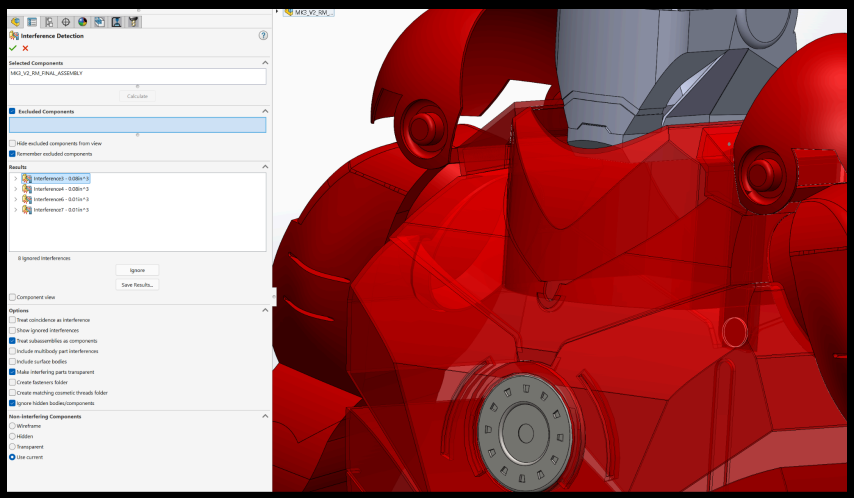
Shoulder interference of assembly:

There is slight interference in the shoulders of the MK3. When converting to the suitcase configuration, the shoulders go inside the torso; therefore, interference is expected in the design.



Dynamic interference of the moving slot part:

There is slight interference in the dynamic slot movement of the head and suitcase handle. This is due to using the same slot for movement and consistency.

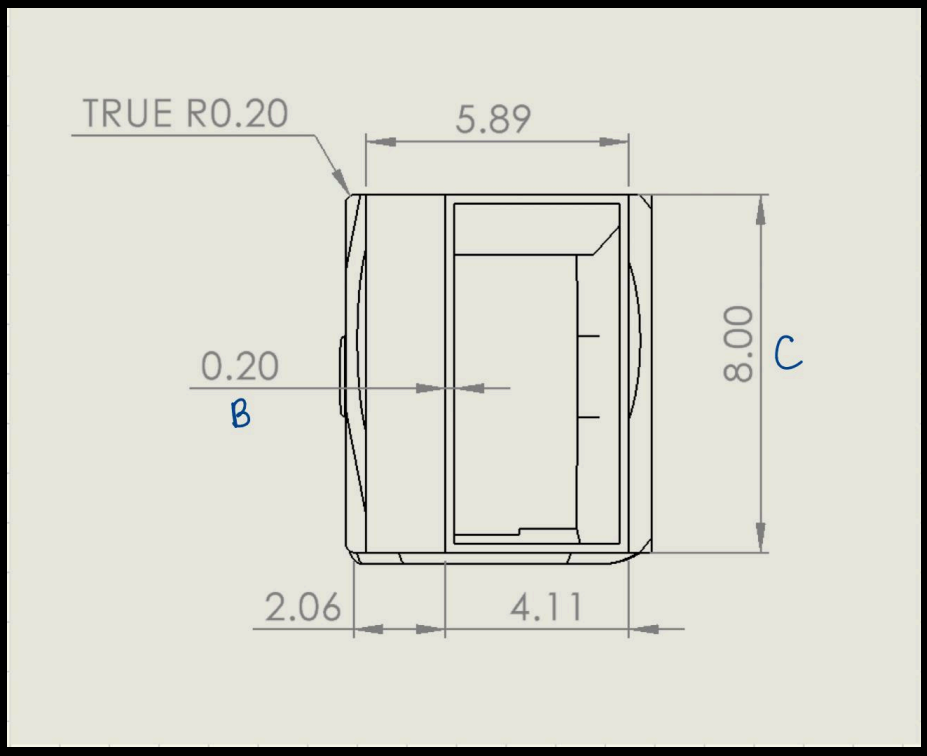


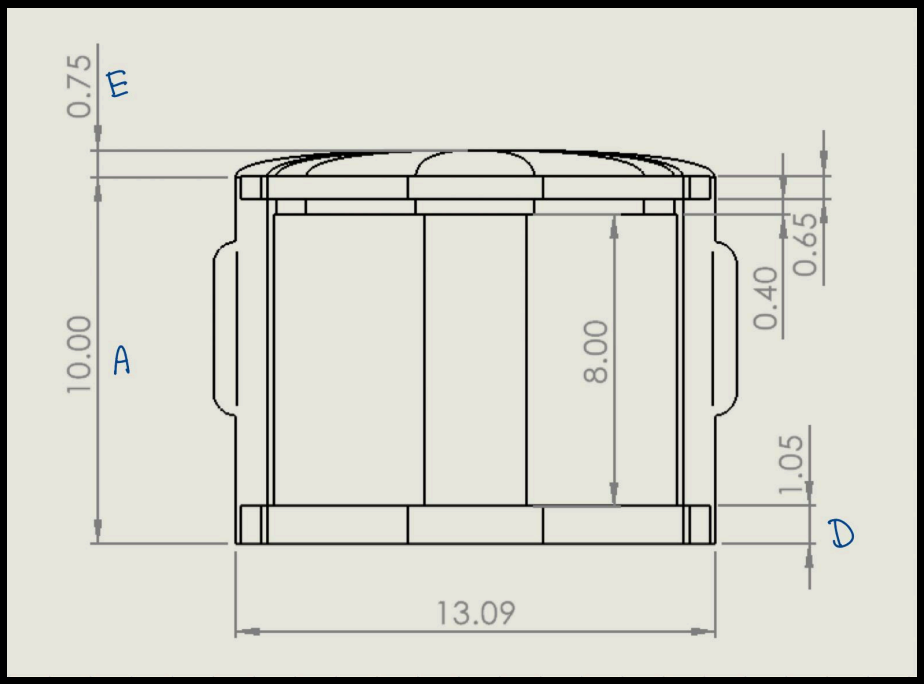
Tolerance Analysis:

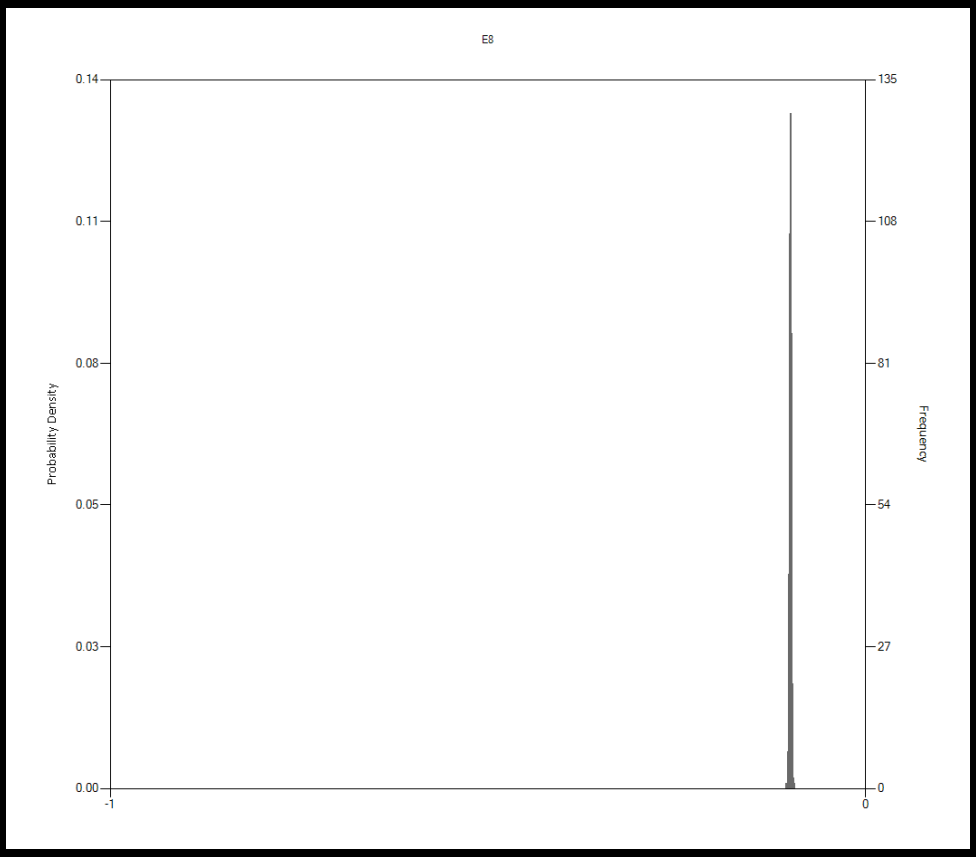
	Dim	Tolerance	STD	SIM	
A	10	0.0015	0.0005	10.00049	whole thickness
B	-0.2	0.0015	0.0005	-0.19945	leg thickness
C	-8	0.0015	0.0005	-8.00026	leg opening
D	-1.05	0.0015	0.0005	-1.04988	thickness of hip
E	-0.75	0.0015	0.0005	-0.74959	butt thickness
				-0.09954	

```
=@RtaRESULT(E3+E5+2*E6)
```

We ended up using the above equation because the leg thickness was within the 8 inches of the leg width, and the behind thickness was not included in the 10 inches. This can be seen within the drawings below.


TRUE R0.20
5.89
8.00
C
0.20
B
2.06
4.11


0.75
E
10.00
A
8.00
0.40
0.65
1.05
D
13.09



Stats | Percentile Table | Options

Basic Statistics	
Mean	-0.100000606948921
Standard Deviation	0.00124442732267095
Variance	0.000002
Coefficient of Variance	-0.012444
Skewness	-0.001885
Kurtosis	0.434938
Mode	NaN
Standard Error	0.000039
Maximum	-0.0950006927118272
Minimum	-0.105326284627315
Range	0.0103255919154877
Advanced Statistics	
Mean Semi-variance	0.000001
Mean Semi-deviation	0.000876679876616748
Expected Loss	-0.100001
Expected Loss Ratio	1.000000
Expected Gain	0.000000
Expected Gain Ratio	0.000000
Expected Value Margin	-1.000000

The critical dimension in this design is the radial clearance between the Iron Man leg component and the inner walls of the hip. This dimension is critical because it affects the assembly feasibility, the range of motion, the prevention of interference, and the structural integrity of the joint during motion. The most sensitive feature in this part is the inner hip wall to the outer leg surface, because it is controlled by multiple stacked dimensions, such as the hip wall thickness, the leg thickness, and the alignment. All features are to be manufactured with a tight +/- 0.0015 tolerance, which we got from the solution treated titanium, (the poor man's vibranium).

Our target condition was to have a nominal gap of 0.000 inches, as our design intent was to have a zero-gap contact condition without interference. The calculated clearance was 0.009954 inches with a maximum of 0.095 inches and a minimum of 0.105 inches. Although the CAD model visually shows the leg contacting the hip wall without obvious interference, the tolerance stack analysis reveals a nonzero clearance, indicating sensitivity to dimensional variation.

The best-case condition would be when the leg outer size is at a minimum material condition and the hip inner dimension is at a maximum material condition, ensuring smooth unrestricted motion. The worst case would be the opposite, where the leg is too thick and the hip is too thin, increasing friction, binding during motion, and creating local stress. The total tolerance of that portion is +/- 0.0030inches, where the best case is 0.09954 + 0.0030 = 0.10254 inches, which is around the minimum we got, and the worst case is 0,09954 - 0.0030 = 0.09654 inches, which is around the maximum we got.

A +/- 15% change in tolerance, would mean the tolerance is 0.0015 x 1.15 = 0.001725 inches, making the new stack tolerance 0.001725 + 0.001725 = +/- 0.00354 inches. The best case would be 0.09954 + 0.00345 = 0.10299 inches and the worst would be 0.09954 - 0.00345 = 0.09609 inches. Although the CAD model shows no visible interference, the tolerance stack analysis reveals a clearance range of around 0.096-0.103 inches. This means the joint is highly sensitive to variation during manufacturing and a small increase in the tolerance would significantly affect the functionality of the design.

SALES DRAWING

IRON MAN SUITCASE

Classic Suit that becomes a suitcase!

ON THE GO!

WILL NOT GET PAST TSA

SO AWESOME

JUST LIKE THE IRON MAN 2 SUIT UP SCENE!

IRON PATRIOT SUITCASE AVAILABLE UPON REQUEST

Reach out to Shristhi Pant and Radhika Mishra for info.

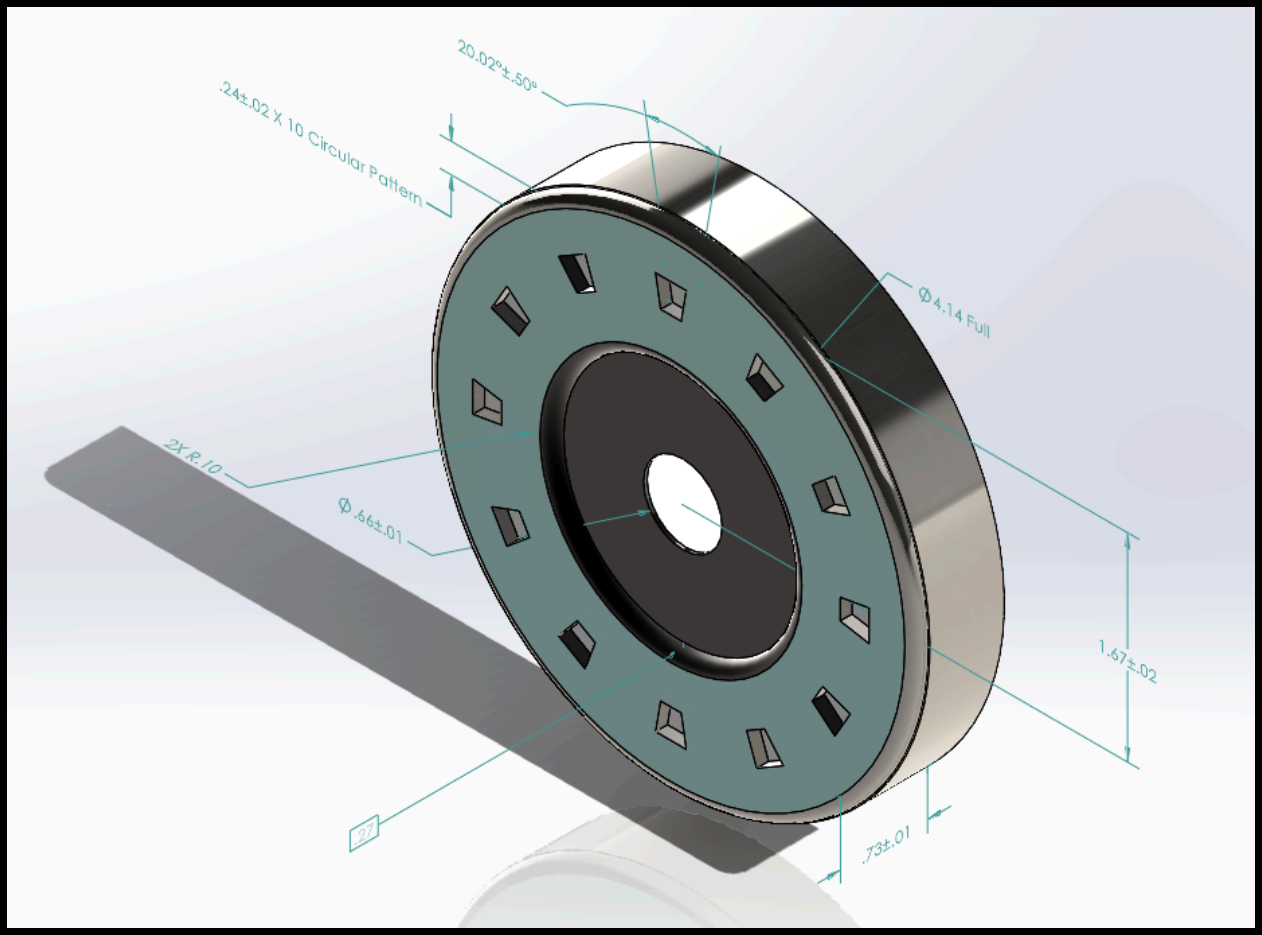
ENGINEERING DRAWINGS

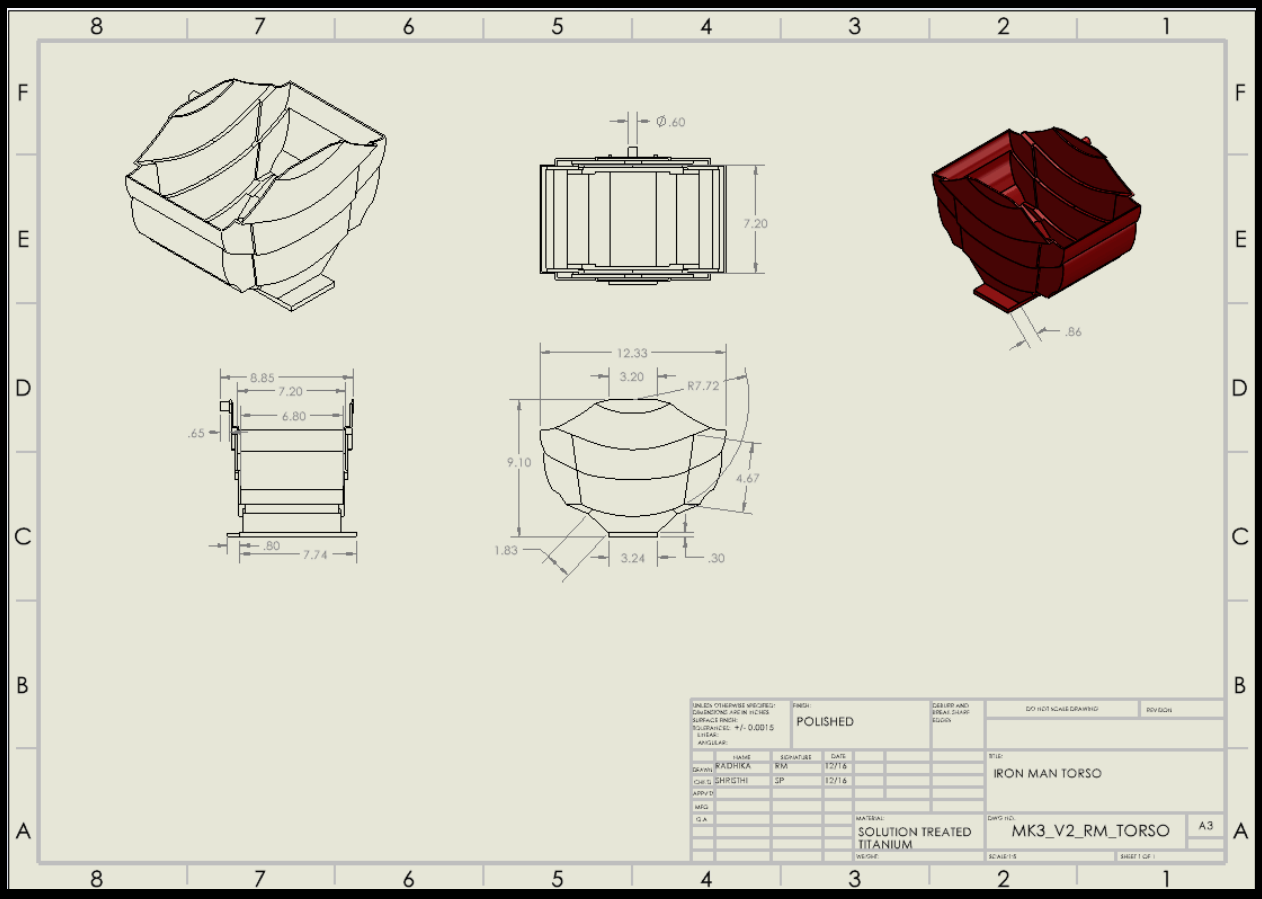
Engineering Drawings

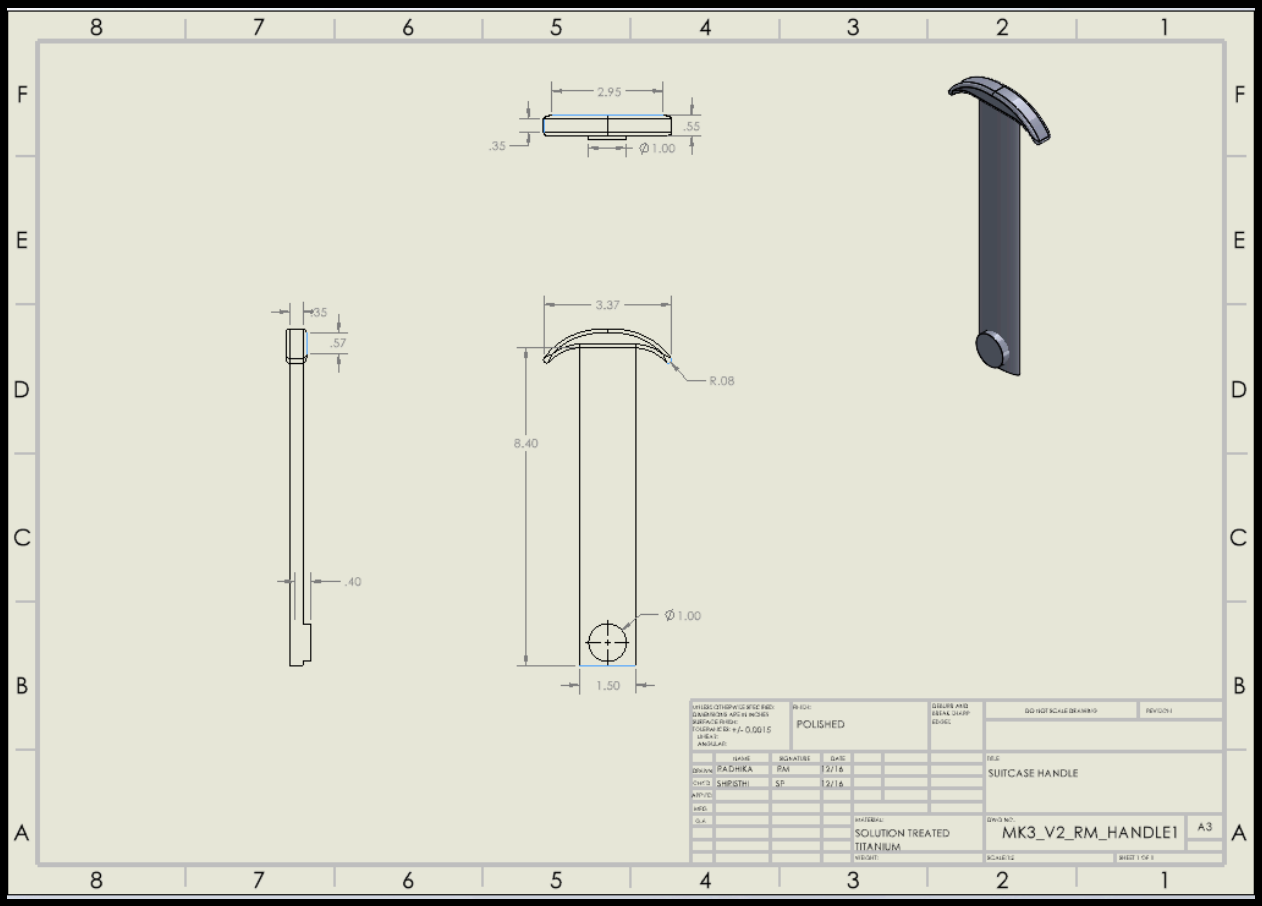
**All PDFs attached, including one MBD*

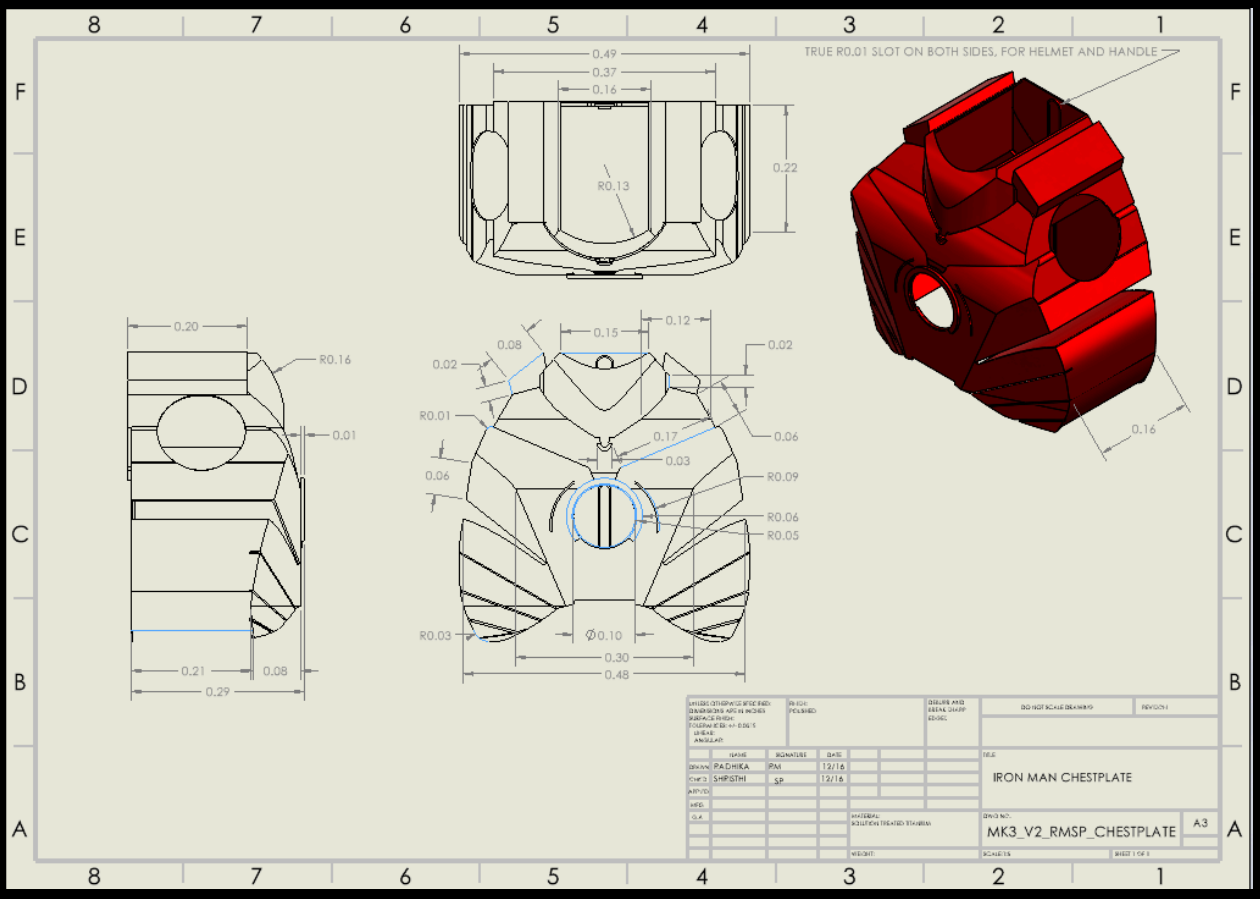
GOOGLE DRIVE LINK TO [V2 DRAWINGS & MBD](#).

MBD of MK3 Reactor:

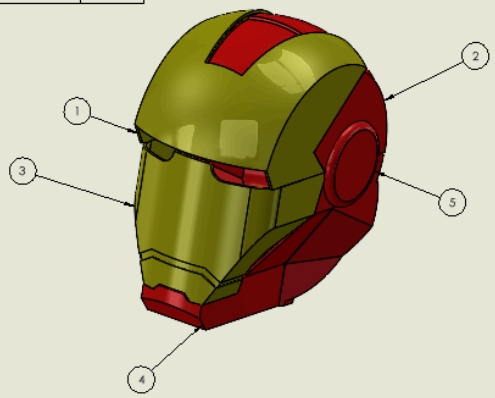



Ø.60
7.20
.86
8.85
7.20
6.80
.65
.80
7.74
12.33
3.20
R7.72
9.10
4.67
1.83
3.24
.30
POLISHED
RADHIKA
RM
12/16
SHRESTHI
SP
12/16
IRON MAN TORSO
SOLUTION TREATED TITANIUM
MK3_V2_RM_TORSO
A3


2.95
.55
.35
Ø1.00
.35
.57
.40
3.37
R.08
8.40
Ø1.00
1.50
POLISHED
SUITCASE HANDLE
MK3_V2_RM_HANDLE1
A3
SOLUTION TREATED
TITANIUM


TRUE R0.01 SLOT ON BOTH SIDES, FOR HELMET AND HANDLE
0.49
0.37
0.16
0.22
R0.13
0.20
R0.16
0.01
0.21
0.08
0.29
0.08
0.02
0.15
0.12
0.02
R0.01
0.17
0.06
0.03
0.06
R0.09
R0.06
R0.05
R0.03
Ø0.10
0.30
0.48
0.16
IRON MAN CHESTPLATE
MK3_V2_RMSP_CHESTPLATE
A3

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	MK3_V2_RM_HELMETP 1	FRONT HEAD PIECE/VISOR	1
2	MK3_V2_RM_HELMETP 2	BACK TOP HEAD PIECE	1
3	MK3_V2_RM_HELMETP 3	FRONT FACE PIECE WITH EYE SOCKETS	1
4	MK3_V2_RM_HELMETP 4	CHIN AND JAW PIECE	1
5	MK3_V2_RM_HELMETP 5	BACK OF HEAD WITH EAR COVERS	1

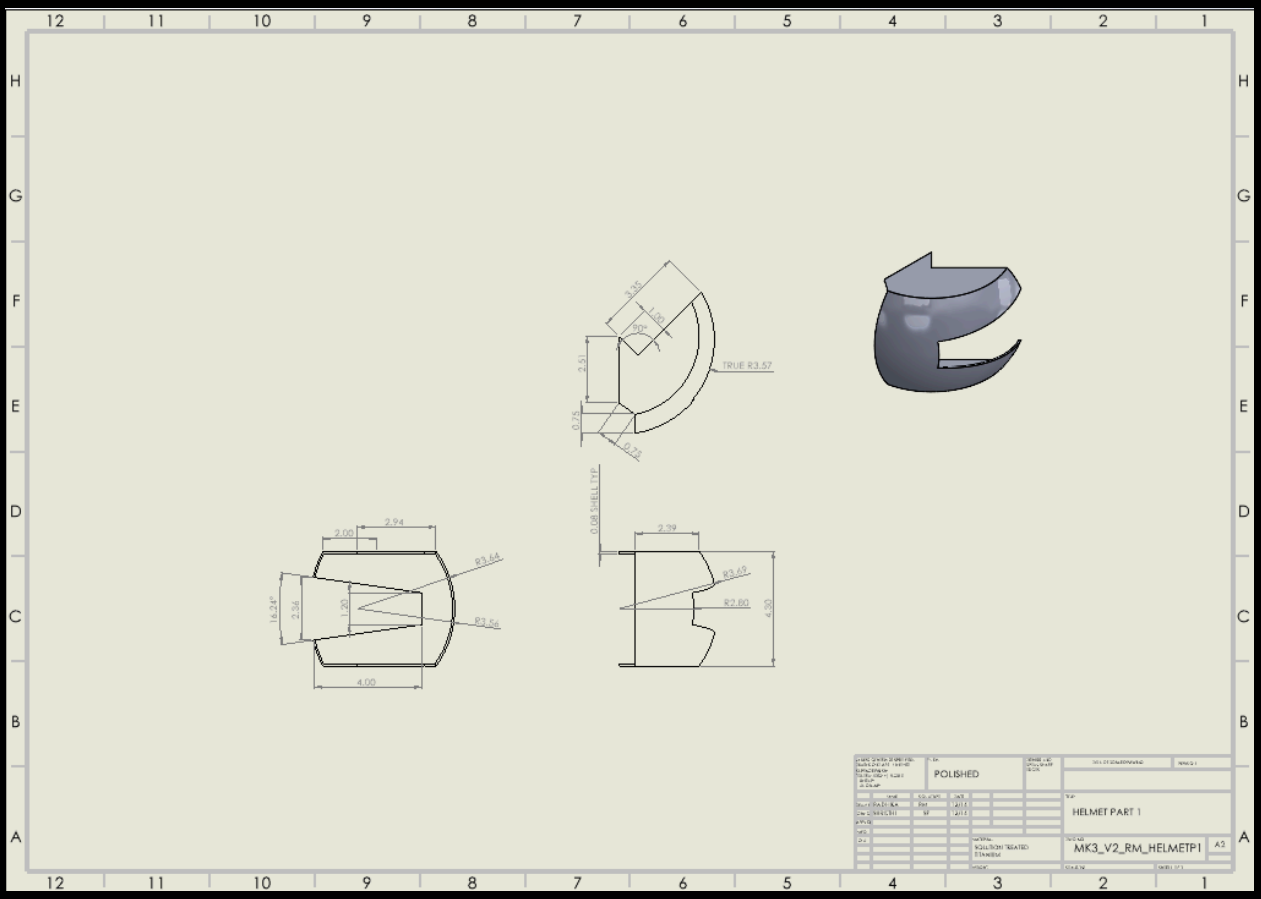


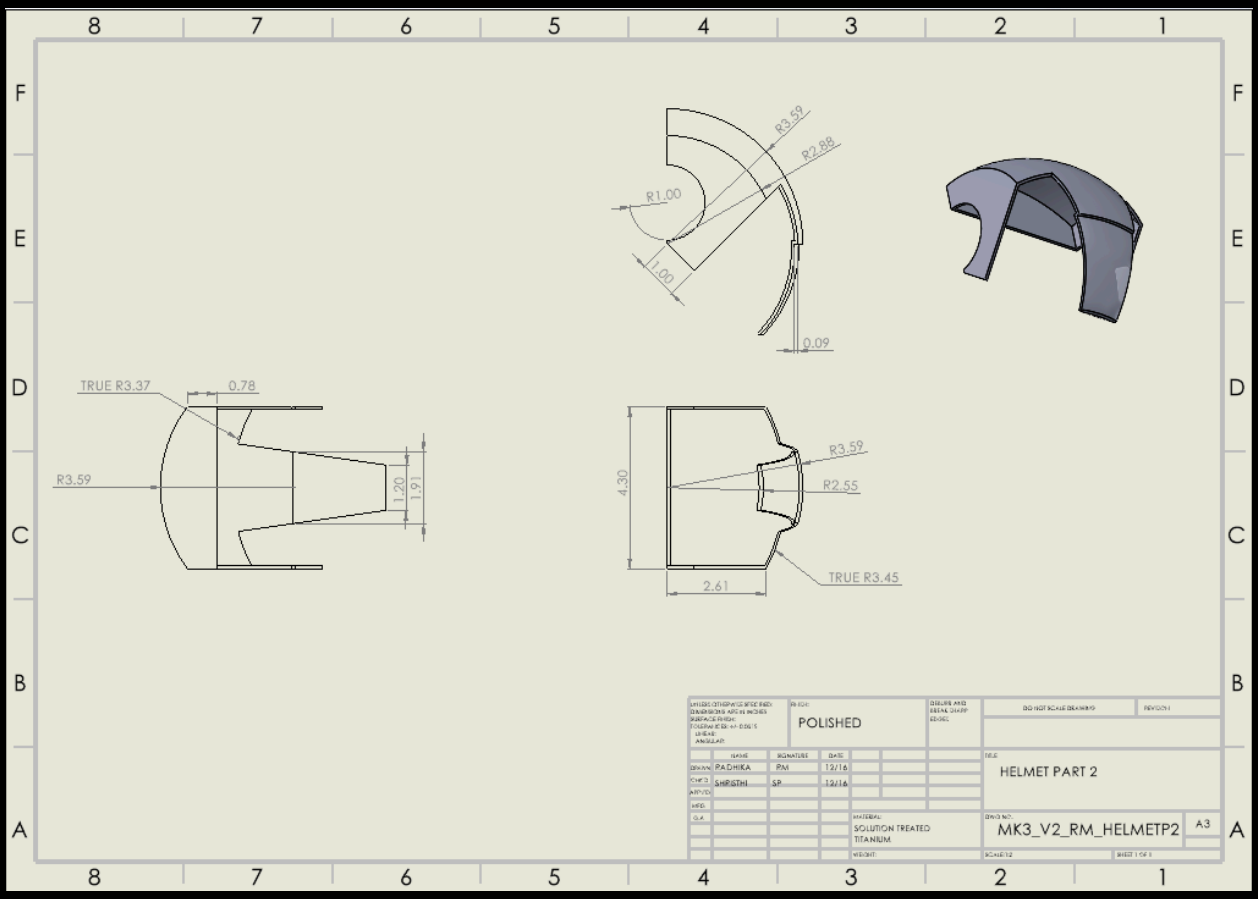
HELMET ASSEMBLY

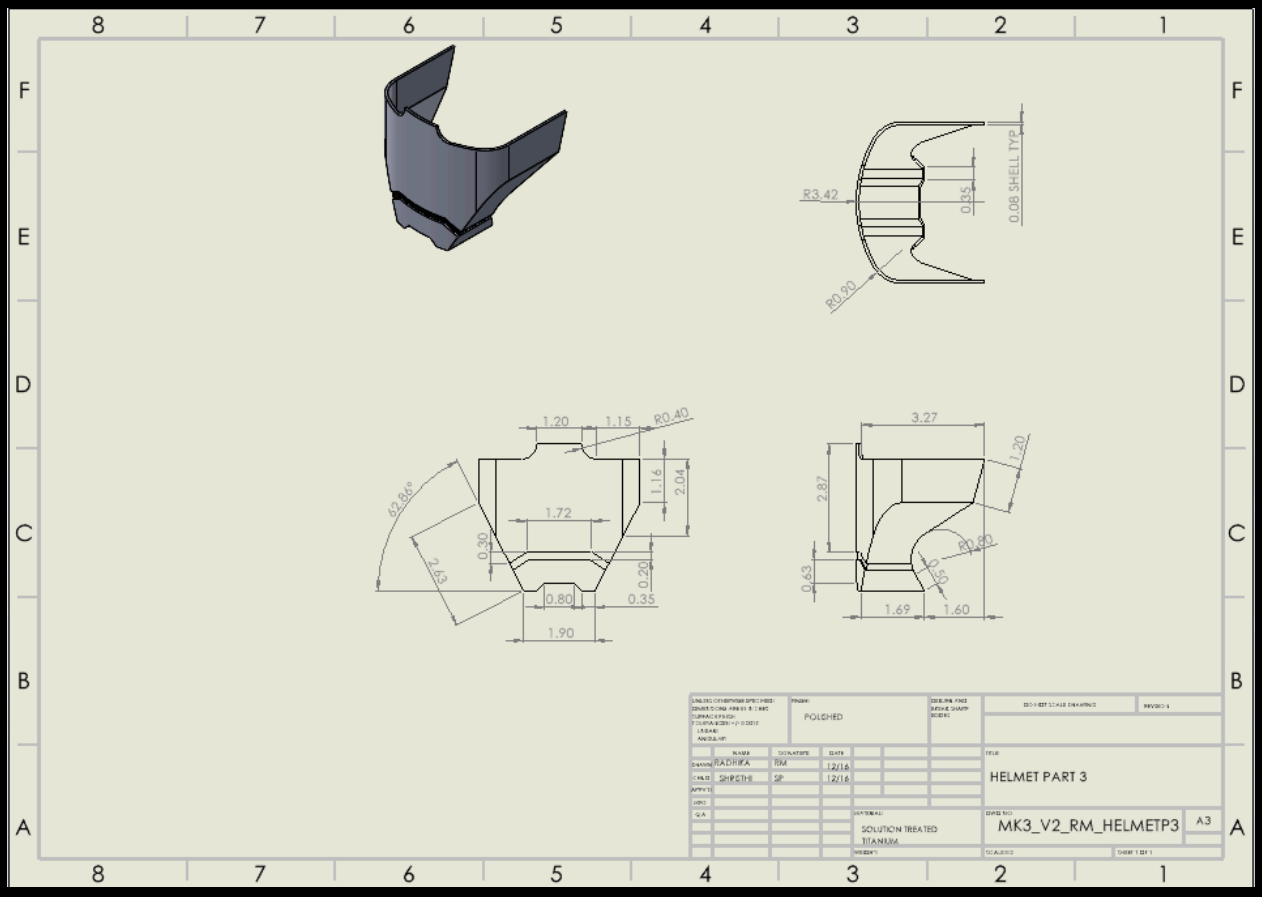
MATERIAL: SOLUTION TREATED TITANIUM

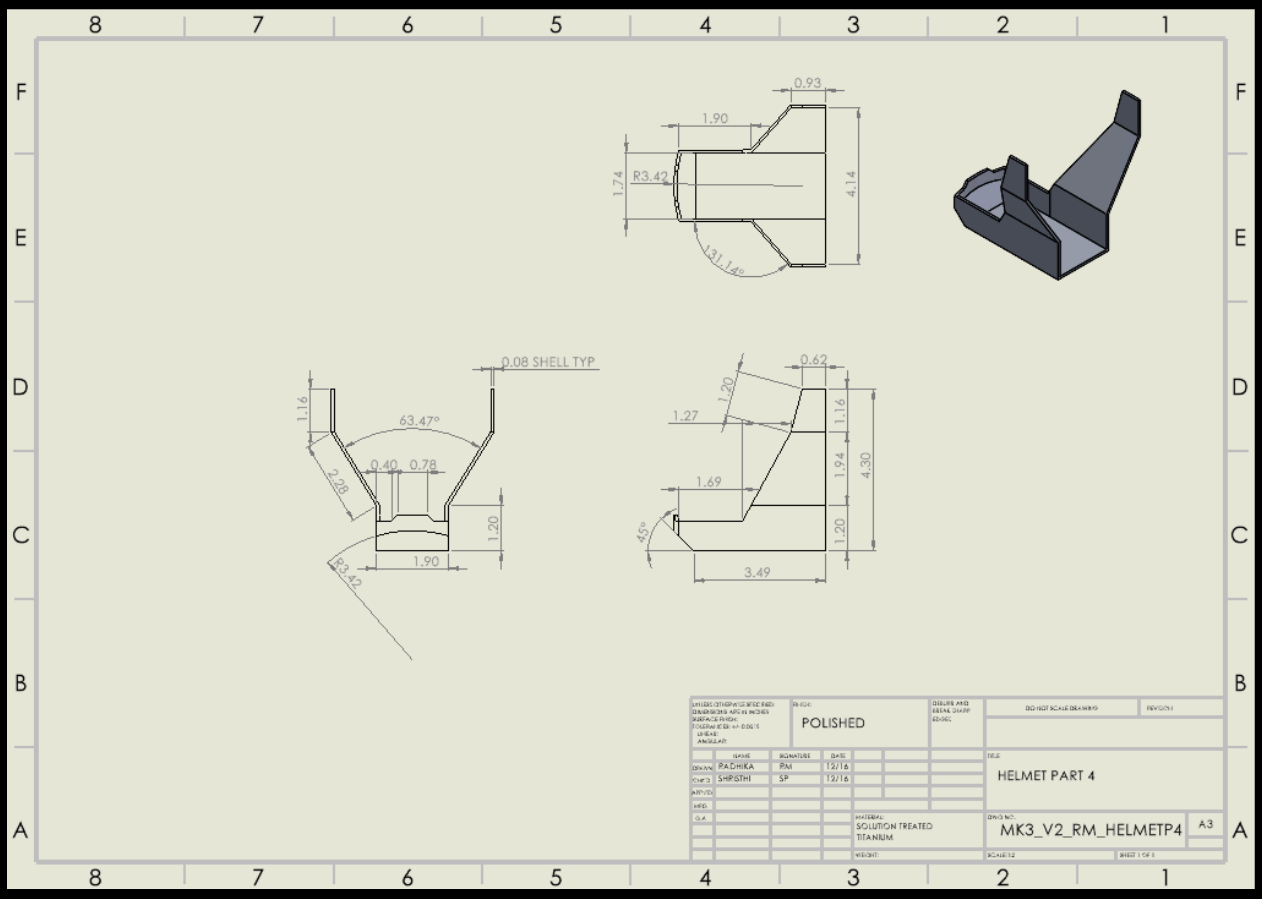
DWG NO. MK3_V2_RM_HELMETASSEMBLY

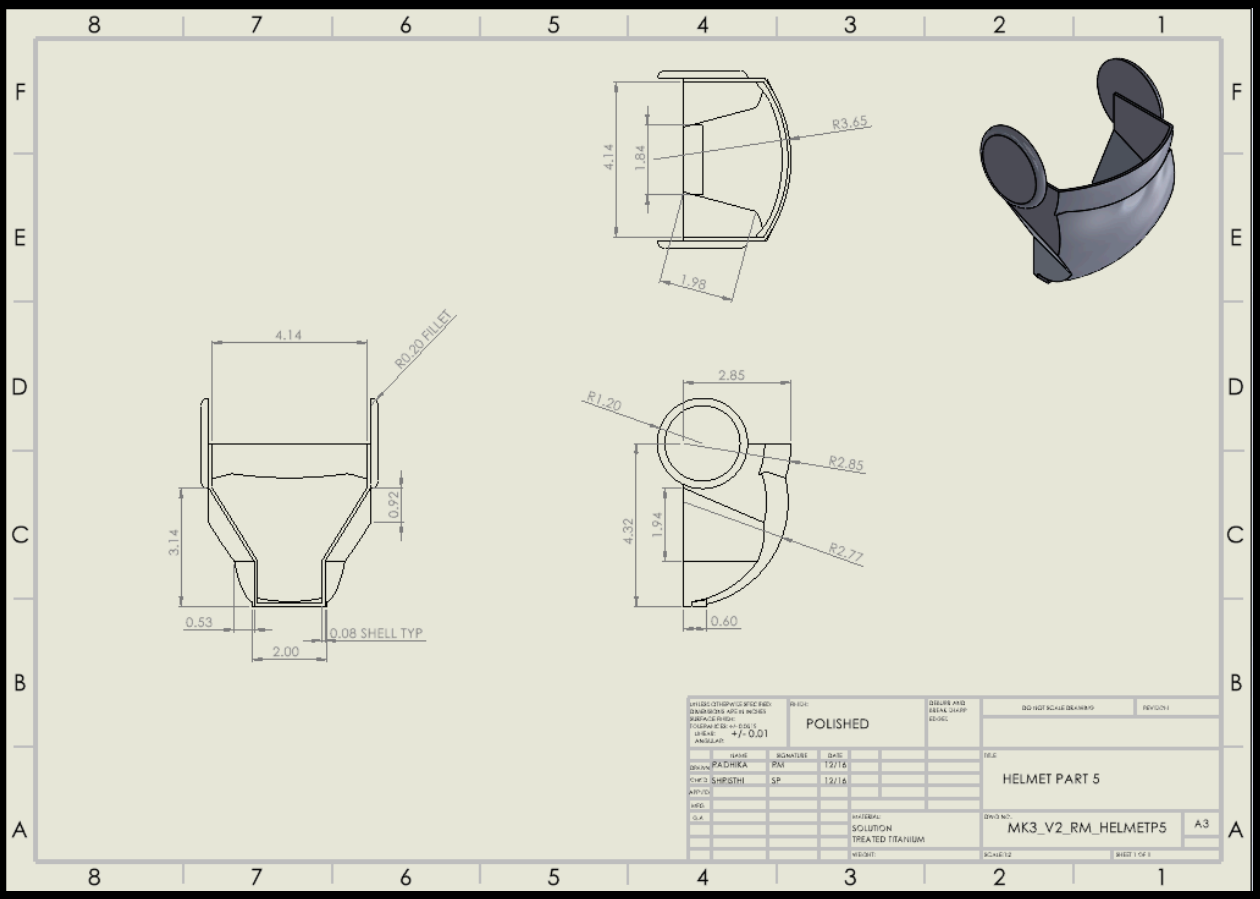
A3

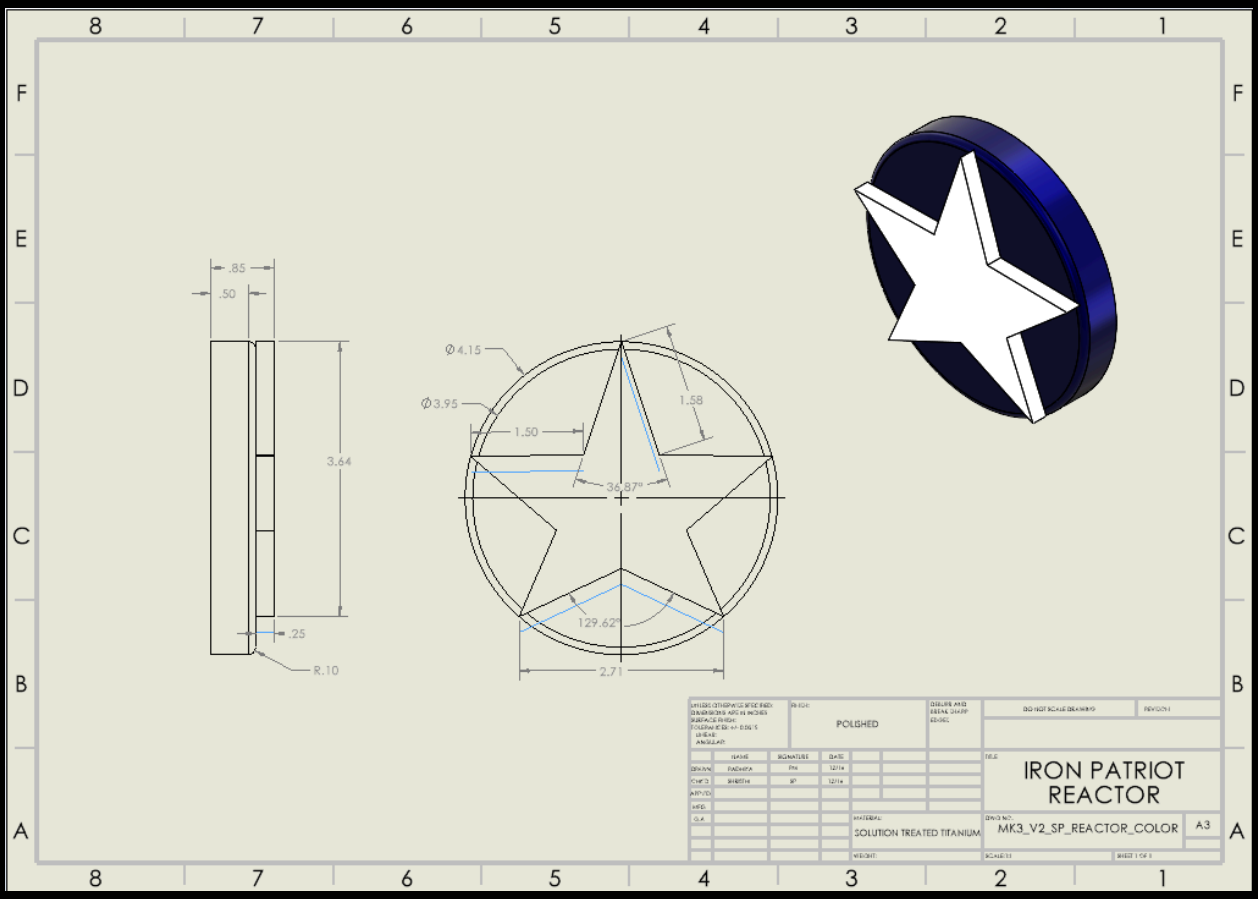

POLISHED
HELMET PART 1
MK3_V2_RM_HELMETP1
A2

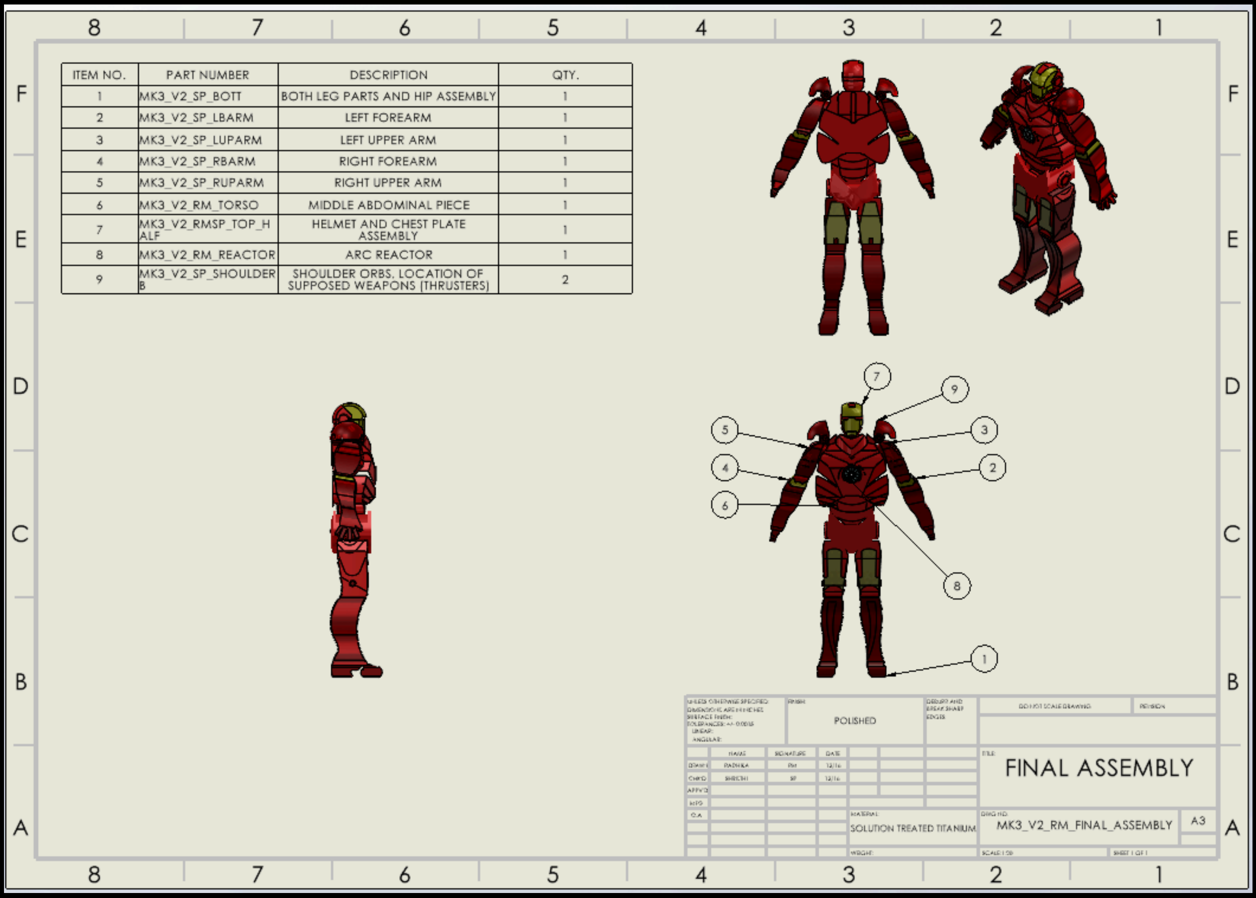

R3.59
R2.88
R1.00
1.00
0.09
TRUE R3.37
0.78
R3.59
1.20
1.91
4.30
R3.59
R2.55
2.61
TRUE R3.45
POLISHED
HELMET PART 2
MK3_V2_RM_HELMETP2
A3
SOLUTION TREATED TITANIUM

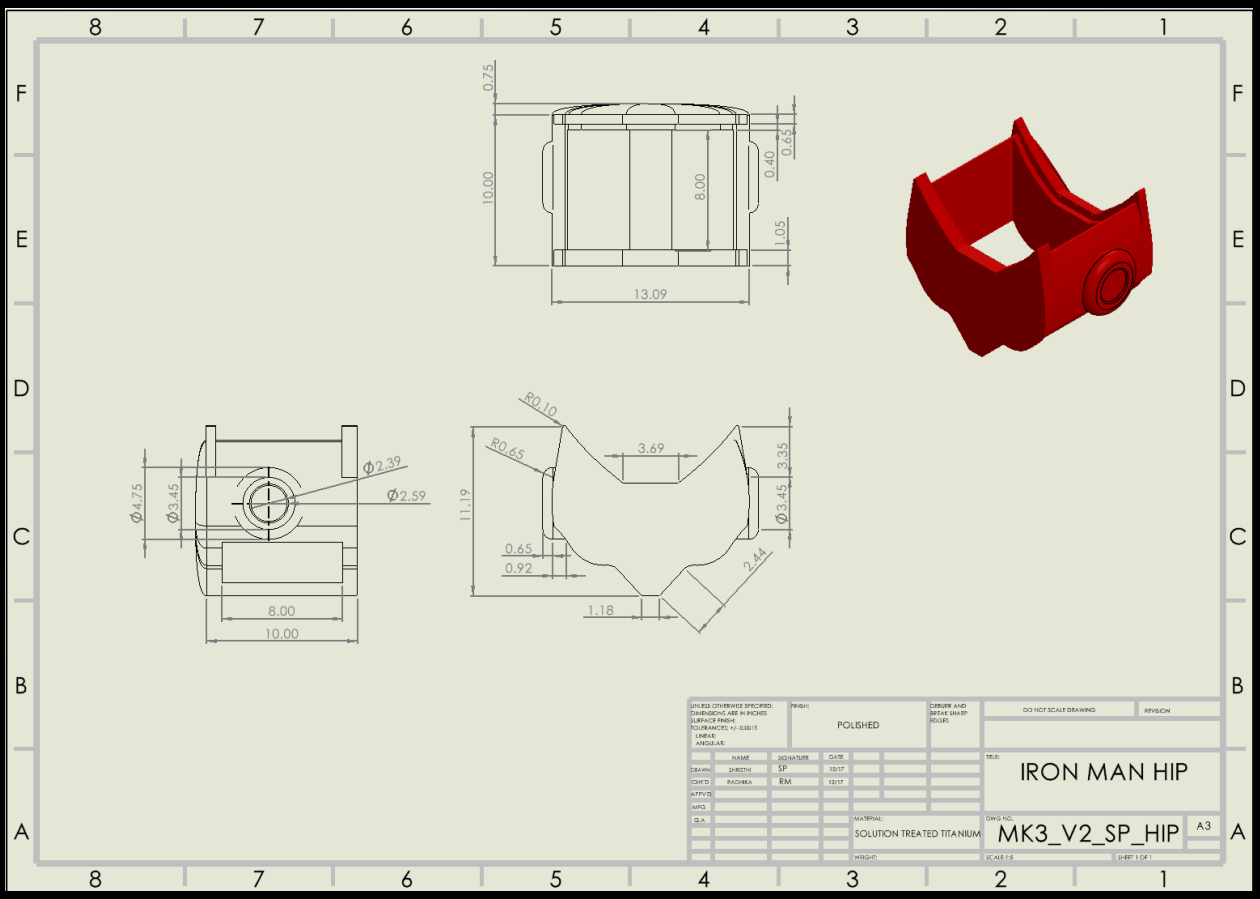

R3.42
0.35
0.08 SHELL TYP
R0.90
1.20
1.15
R0.40
1.16
2.04
1.72
62.86°
0.30
2.63
0.20
0.80
0.35
1.90
3.27
1.20
2.87
R1.80
0.63
1.69
1.60
POLISHED
RADRIFA
RM
12/16
SHPETHI
SP
12/16
HELMET PART 3
SOLUTION TREATED
TITANIUM
MK3_V2_RM_HELMETP3
A3

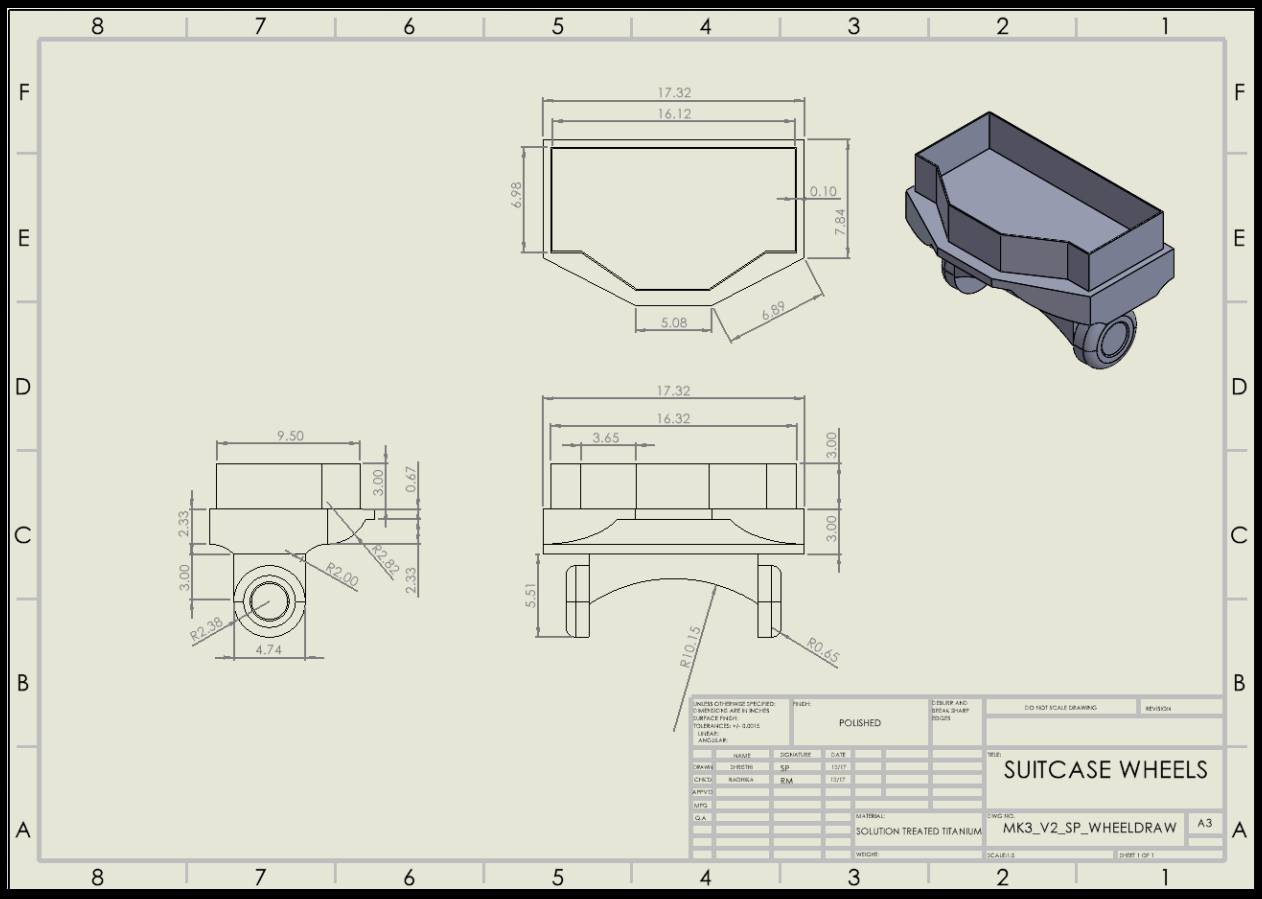

0.93
1.90
R3.42
1.74
4.14
131.14°
0.08 SHELL TYP
1.16
63.47°
0.40
0.78
2.28
1.20
1.90
R3.42
0.62
1.20
1.27
1.16
1.94
4.30
1.69
45°
1.20
3.49
POLISHED
DRAWN
PADHIKA
PM
12/16
CHK'D
SHRISTHI
SP
12/16
HELMET PART 4
SOLUTION TREATED
TITANIUM
MK3_V2_RM_HELMETP4
A3

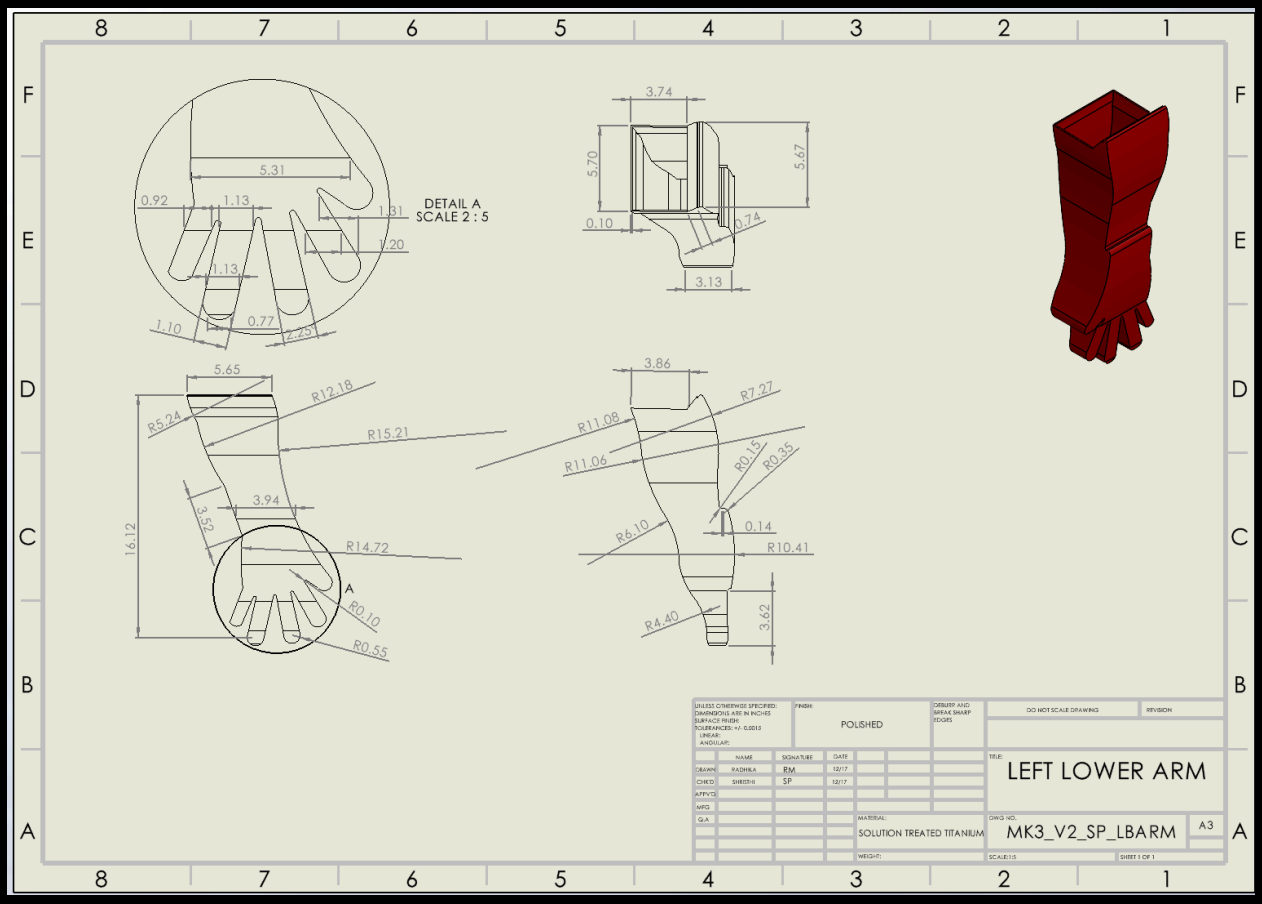

R3.65
4.14
1.84
1.98
4.14
R0.20 FILLET
0.92
3.14
0.53
0.08 SHELL TYP
2.00
2.85
R1.20
R2.85
4.32
1.94
R2.77
0.60
POLISHED
+/- 0.01
PADHIKA
PM
12/16
SHIPSTHI
SP
12/16
HELMET PART 5
SOLUTION TREATED TITANIUM
MK3_V2_RM_HELMETP5
A3

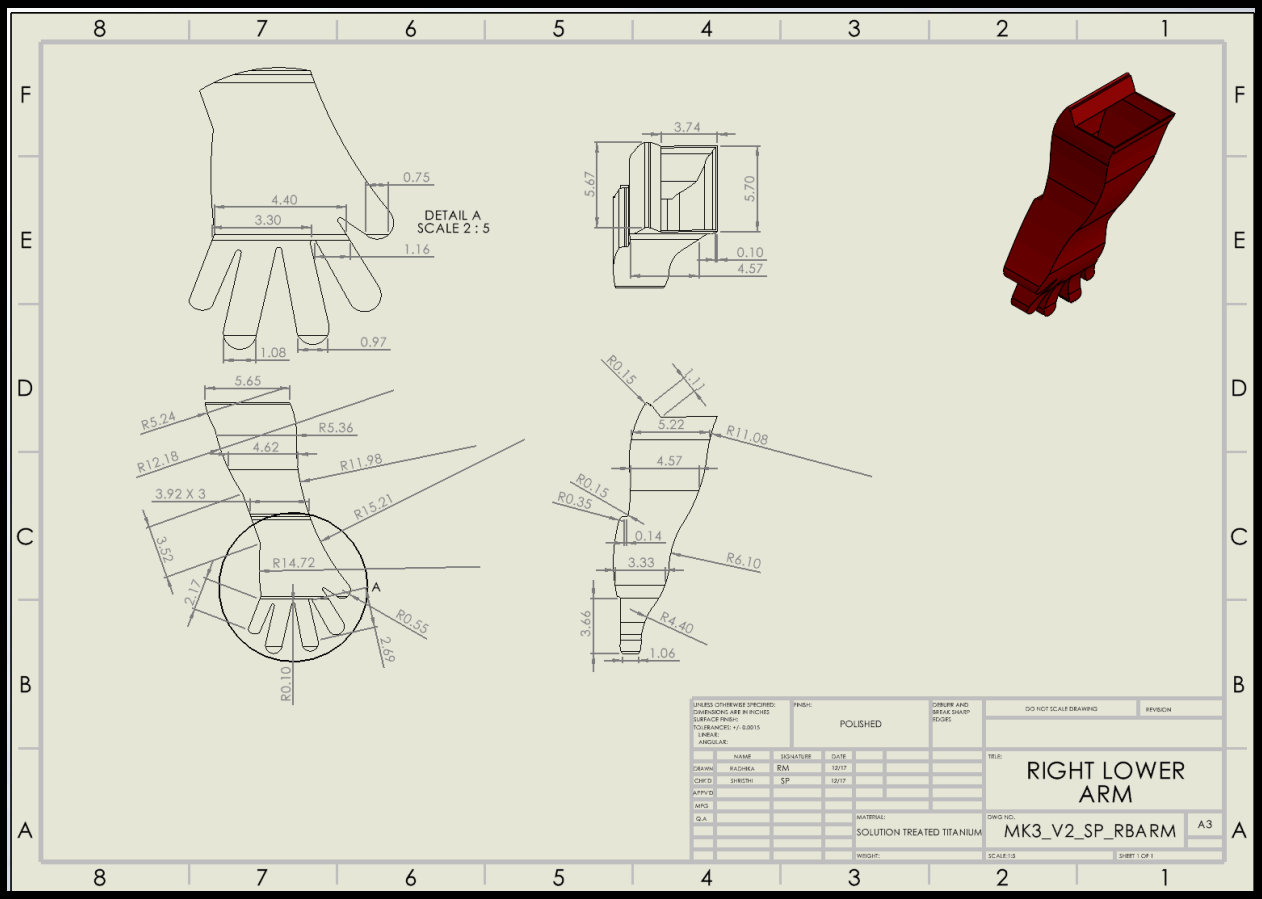

.85
.50
3.64
.25
R.10
Ø4.15
Ø3.95
1.50
1.58
36.87°
129.62°
2.71
POLISHED
SOLUTION TREATED TITANIUM
IRON PATRIOT REACTOR
MK3_V2_SP_REACTOR_COLOR
A3

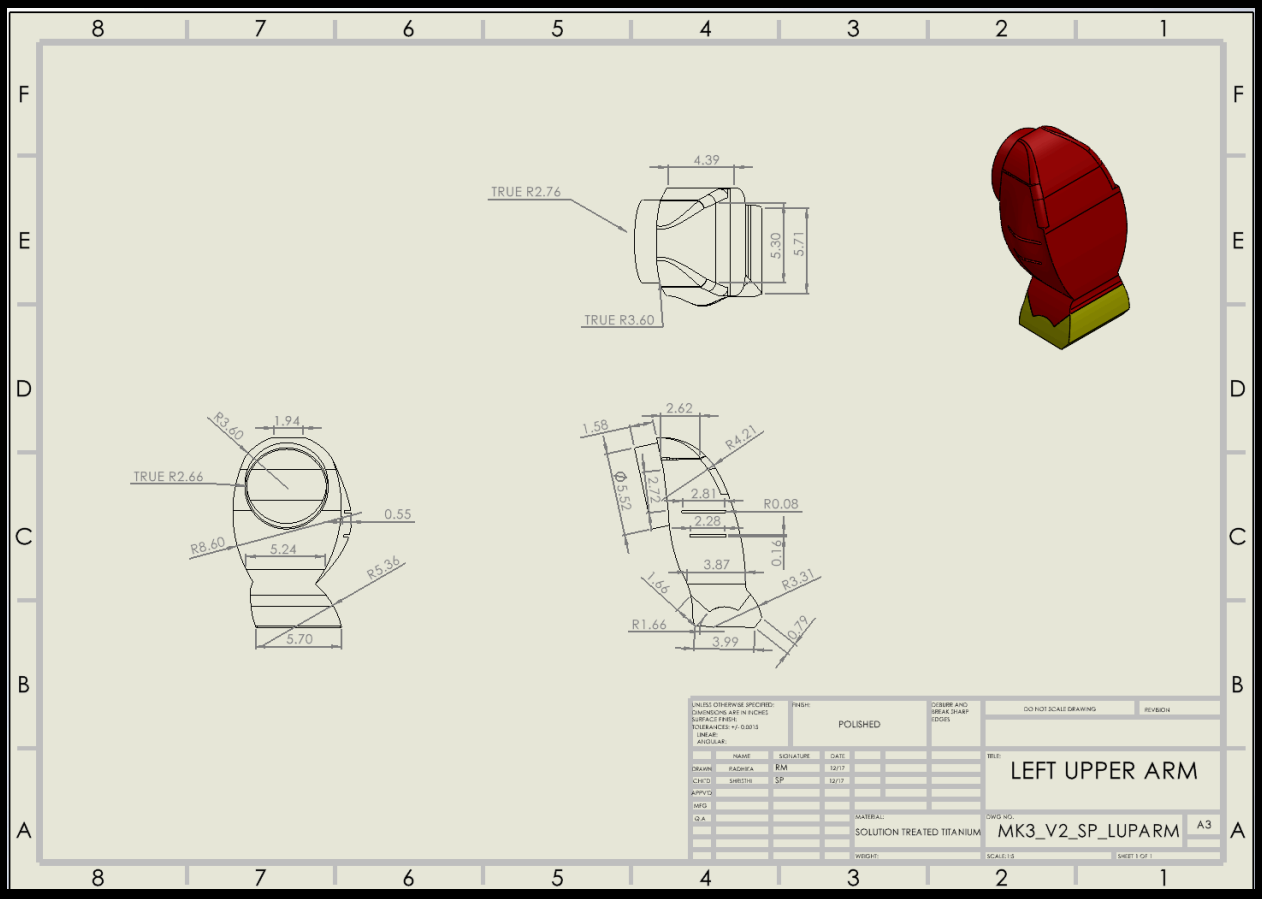

ITEM NO. | PART NUMBER | DESCRIPTION | QTY.
1 | MK3_V2_SP_BOTT | BOTH LEG PARTS AND HIP ASSEMBLY | 1
2 | MK3_V2_SP_LBARM | LEFT FOREARM | 1
3 | MK3_V2_SP_LUPARM | LEFT UPPER ARM | 1
4 | MK3_V2_SP_RBARM | RIGHT FOREARM | 1
5 | MK3_V2_SP_RUPARM | RIGHT UPPER ARM | 1
6 | MK3_V2_RM_TORSO | MIDDLE ABDOMINAL PIECE | 1
7 | MK3_V2_RMSP_TOP_HALF | HELMET AND CHEST PLATE ASSEMBLY | 1
8 | MK3_V2_RM_REACTOR | ARC REACTOR | 1
9 | MK3_V2_SP_SHOULDERB | SHOULDER ORBS, LOCATION OF SUPPOSED WEAPONS (THRUSTERS) | 2
POLISHED
FINAL ASSEMBLY
SOLUTION TREATED TITANIUM
MK3_V2_RM_FINAL_ASSEMBLY
A3

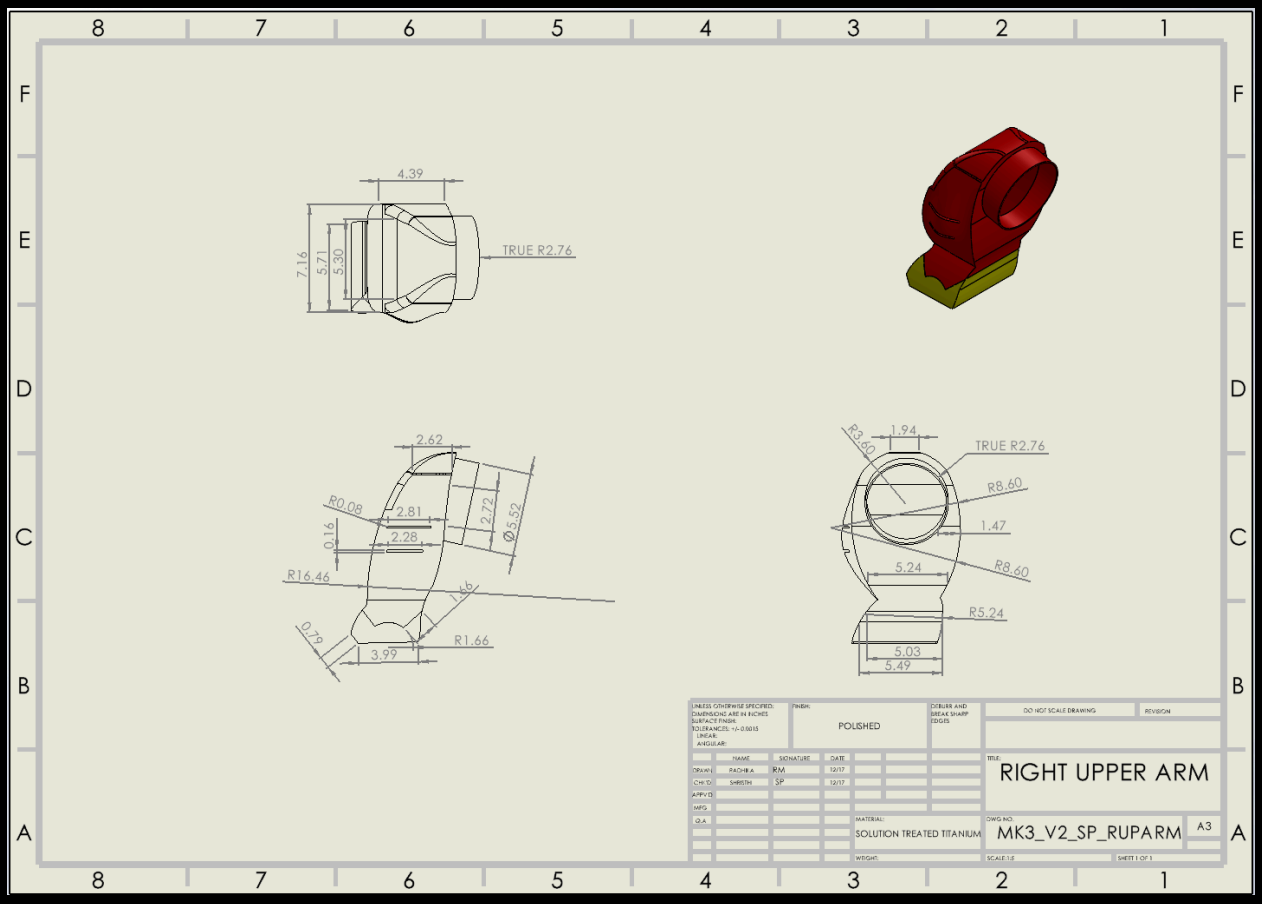

0.75
10.00
8.00
0.65
0.40
1.05
13.09
R0.10
R0.65
3.69
3.35
Ø3.45
11.19
0.65
0.92
2.44
1.18
Ø2.39
Ø2.59
Ø4.75
Ø3.45
8.00
10.00
POLISHED
IRON MAN HIP
SOLUTION TREATED TITANIUM
MK3_V2_SP_HIP
A3

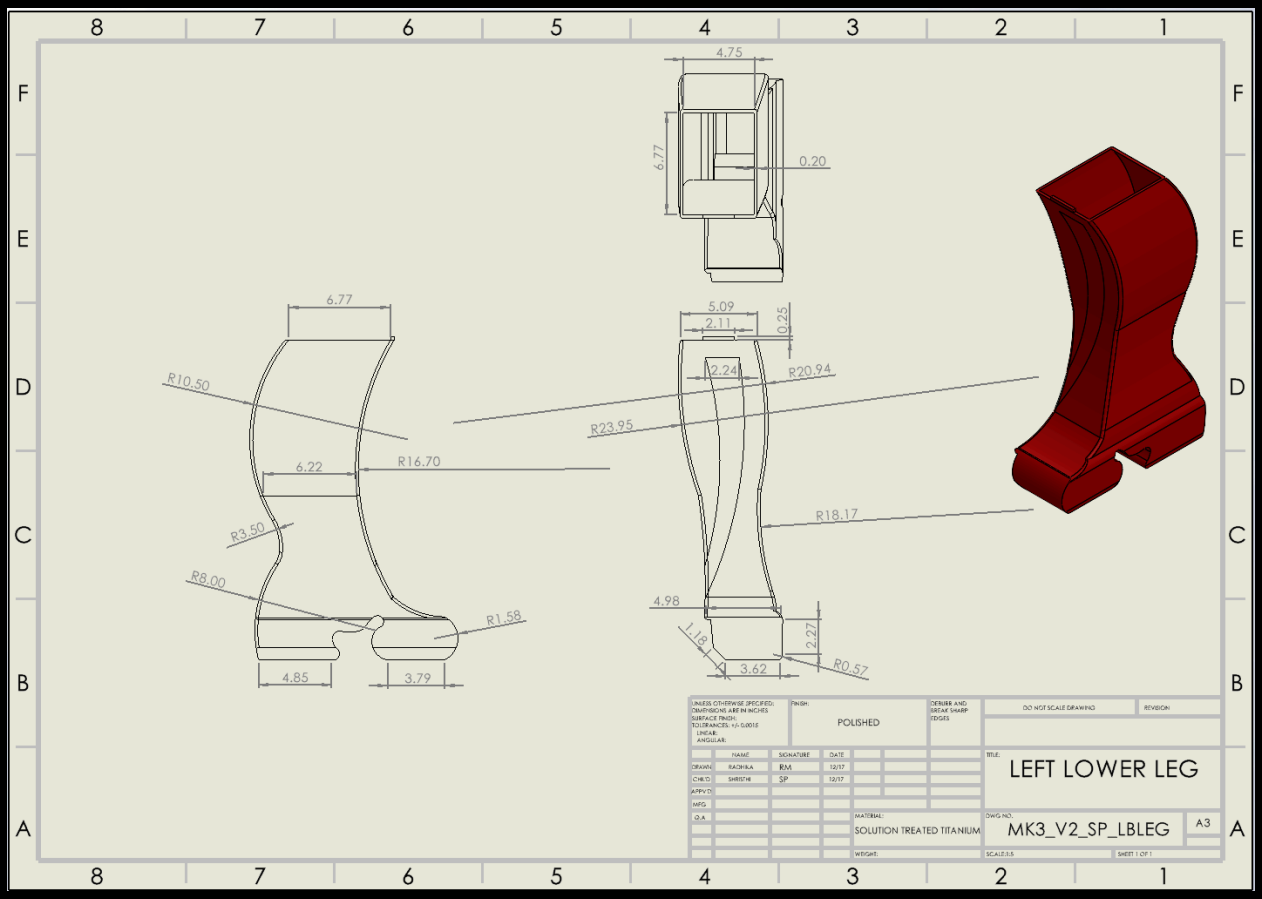

17.32
16.12
6.98
0.10
7.84
5.08
6.89
17.32
16.32
3.65
3.00
3.00
5.51
R10.15
R0.65
9.50
3.00
0.67
2.33
3.00
R2.82
R2.00
2.33
R2.38
4.74
POLISHED
DO NOT SCALE DRAWING
REVISION
SUITCASE WHEELS
SOLUTION TREATED TITANIUM
MK3_V2_SP_WHEELDRAW
A3

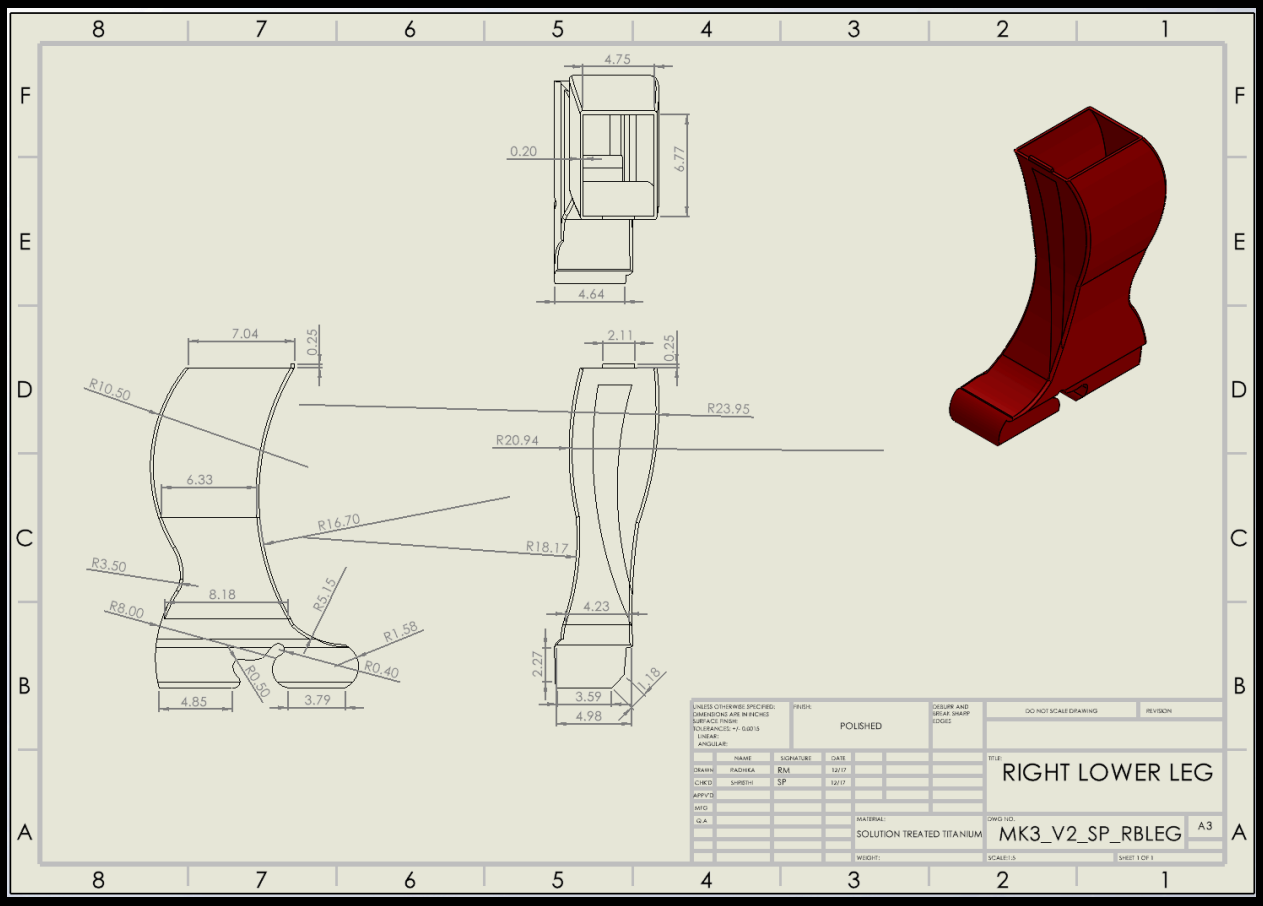

DETAIL A
SCALE 2 : 5
5.31
0.92
1.13
1.31
1.20
1.13
1.10
0.77
2.25
3.74
5.70
5.67
0.10
0.74
3.13
5.65
R12.18
R5.24
R15.21
3.94
3.52
16.12
R14.72
A
R0.10
R0.55
3.86
R7.27
R11.08
R11.06
R0.15
R0.35
R6.10
0.14
R10.41
R4.40
3.62
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE FINISH:
TOLERANCES: +/- 0.005
LINEAR:
ANGULAR:
FINISH:
POLISHED
DEBURR AND BREAK SHARP EDGES
DO NOT SCALE DRAWING
REVISION
NAME
SIGNATURE
DATE
DRAWN
RADHIKA
RM
12/17
CHK'D
SHREESHI
SP
12/17
APPV'D
MFG
Q.A.
MATERIAL:
SOLUTION TREATED TITANIUM
WEIGHT:
TITLE:
LEFT LOWER ARM
DWG NO.
MK3_V2_SP_LBARM
A3
SCALE:1:5
SHEET 1 OF 1

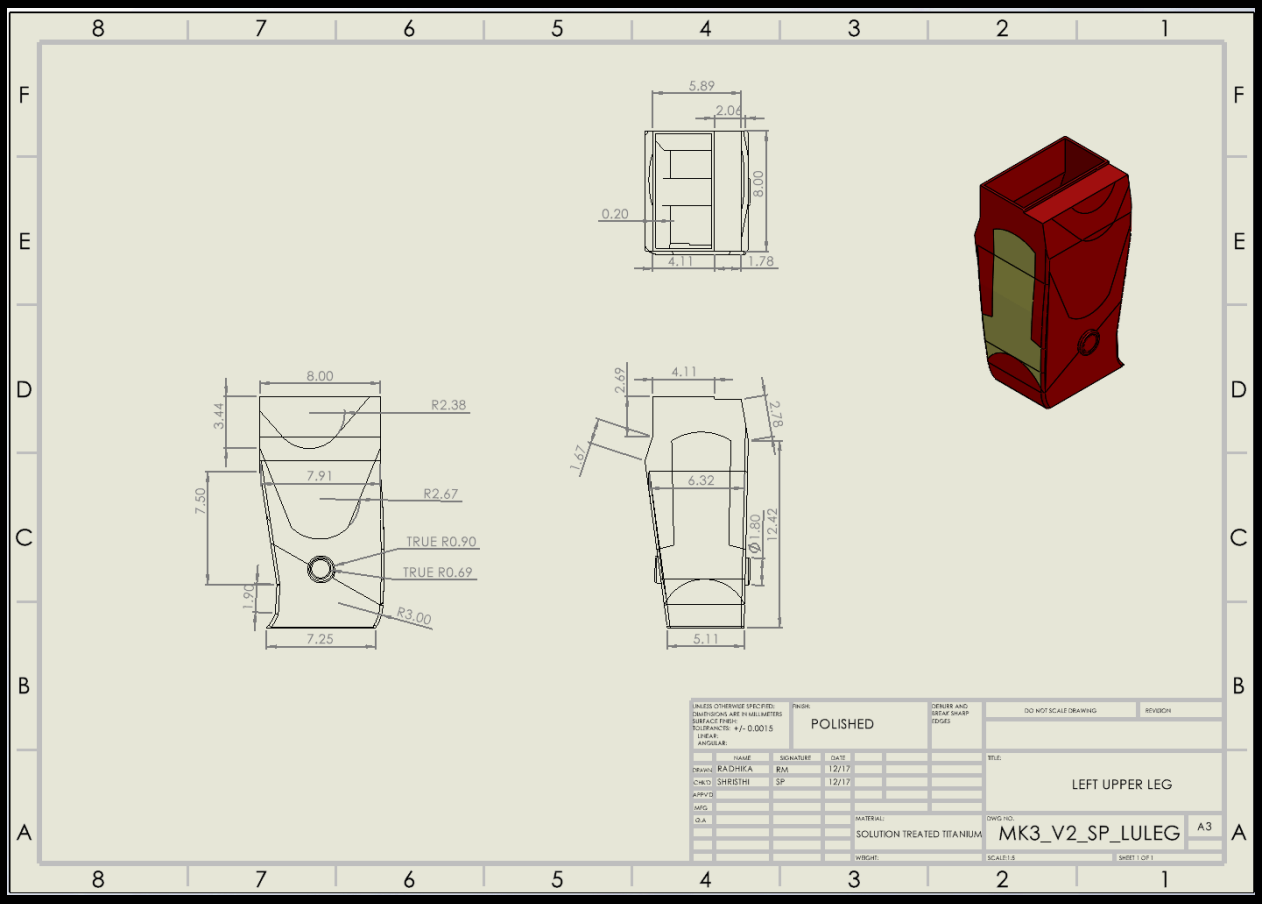

DETAIL A
SCALE 2 : 5
0.75
4.40
3.30
1.16
1.08
0.97
3.74
5.67
5.70
0.10
4.57
5.65
R5.24
R5.36
4.62
R12.18
R11.98
3.92 X 3
R15.21
3.52
R14.72
A
2.17
R0.55
2.69
R0.10
R0.15
.11
5.22
R11.08
4.57
R0.15
R0.35
0.14
3.33
R6.10
3.66
R4.40
1.06
POLISHED
DO NOT SCALE DRAWING
RIGHT LOWER ARM
SOLUTION TREATED TITANIUM
MK3_V2_SP_RBARM
A3

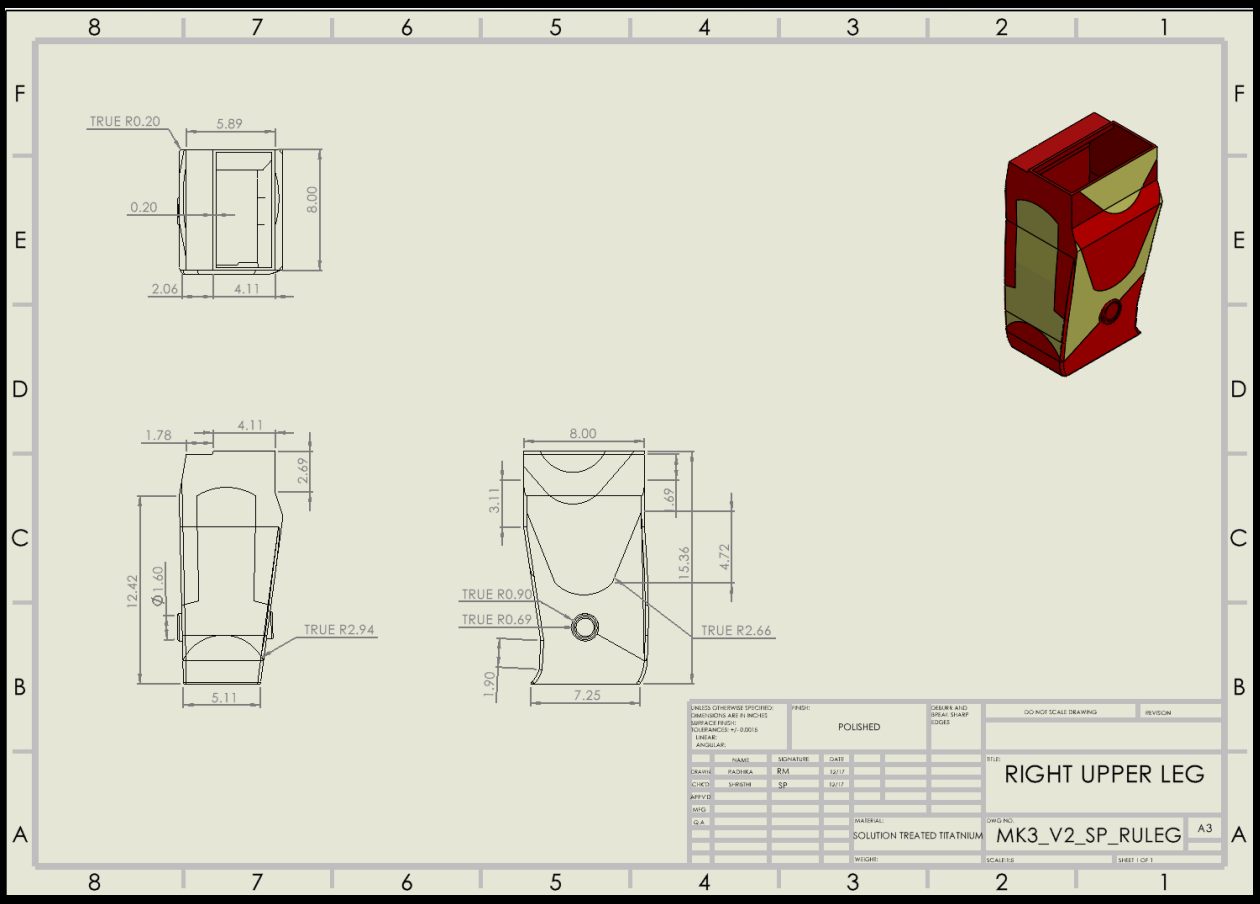

4.39
TRUE R2.76
5.30
5.71
TRUE R3.60
R3.60
1.94
TRUE R2.66
0.55
R8.60
5.24
R5.36
5.70
2.62
1.58
R4.21
Ø5.52
2.72
2.81
R0.08
2.28
0.16
3.87
1.66
R3.31
R1.66
0.79
3.99
POLISHED
DO NOT SCALE DRAWING
REVISION
LEFT UPPER ARM
SOLUTION TREATED TITANIUM
MK3_V2_SP_LUPARM
A3

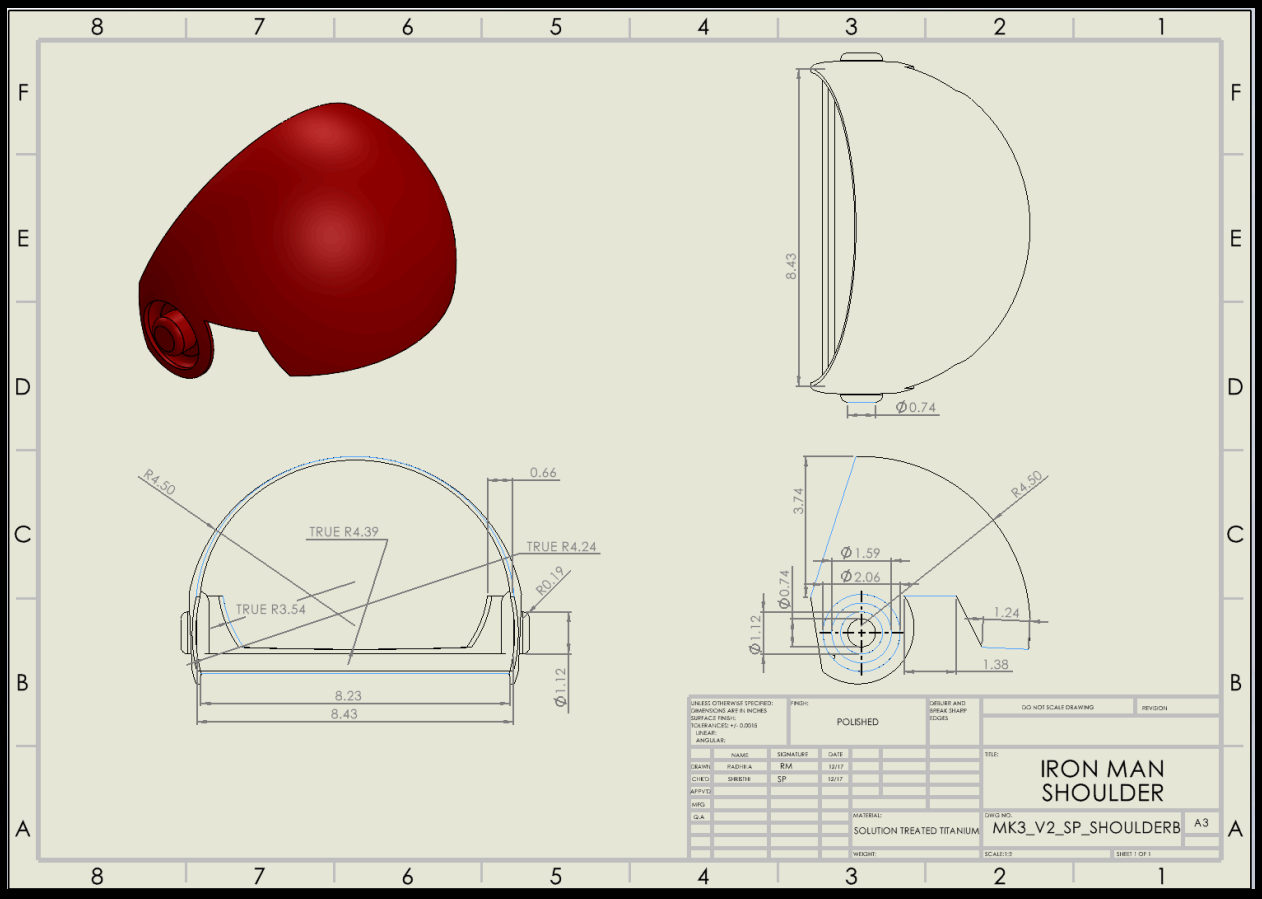

4.39
7.16
5.71
5.30
TRUE R2.76
2.62
R0.08
2.81
2.72
Ø5.52
0.16
2.28
R16.46
1.79
0.79
3.99
R1.66
R3.60
1.94
TRUE R2.76
R8.60
1.47
5.24
R8.60
R5.24
5.03
5.49
POLISHED
DO NOT SCALE DRAWING
RIGHT UPPER ARM
SOLUTION TREATED TITANIUM
MK3_V2_SP_RUPARM
A3


4.75
6.77
0.20
6.77
5.09
2.11
0.25
2.24
R20.94
R23.95
R10.50
6.22
R16.70
R3.50
R8.00
R1.58
4.85
3.79
R18.17
4.98
1.18
2.27
3.62
R0.57
POLISHED
DO NOT SCALE DRAWING
REVISION
LEFT LOWER LEG
SOLUTION TREATED TITANIUM
MK3_V2_SP_LBLEG
A3


4.75
0.20
6.77
4.64
7.04
0.25
2.11
0.25
R10.50
R23.95
R20.94
6.33
R16.70
R18.17
R3.50
8.18
R5.15
R8.00
R1.58
R0.40
R0.50
4.85
3.79
4.23
2.27
1.18
3.59
4.98
POLISHED
RIGHT LOWER LEG
SOLUTION TREATED TITANIUM
MK3_V2_SP_RBLEG
A3


5.89
2.06
8.00
0.20
4.11
1.78
8.00
R2.38
3.44
7.91
R2.67
7.50
TRUE R0.90
TRUE R0.69
1.90
R3.00
7.25
4.11
2.69
2.78
1.67
6.32
Ø1.80
12.42
5.11
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
SURFACE FINISH:
TOLERANCES: +/- 0.0015
LINEAR:
ANGULAR:
FINISH:
POLISHED
DEBURR AND BREAK SHARP EDGES
DO NOT SCALE DRAWING
REVISION
NAME
SIGNATURE
DATE
DRAWN RADHIKA RM 12/17
CHK'D SHRISTHI SP 12/17
APPV'D
MFG
Q.A
MATERIAL:
SOLUTION TREATED TITANIUM
WEIGHT:
TITLE:
LEFT UPPER LEG
DWG NO.
MK3_V2_SP_LULEG
A3
SCALE:1:5
SHEET 1 OF 1


TRUE R0.20
5.89
0.20
8.00
2.06
4.11
1.78
4.11
2.69
12.42
Ø1.60
TRUE R2.94
5.11
8.00
3.11
1.69
15.36
4.72
TRUE R0.90
TRUE R0.69
TRUE R2.66
1.90
7.25
POLISHED
DO NOT SCALE DRAWING
REVISION
RIGHT UPPER LEG
SOLUTION TREATED TITATNIUM
MK3_V2_SP_RULEG
A3


8.43
Ø0.74
R4.50
TRUE R4.39
TRUE R4.24
TRUE R3.54
0.66
R0.19
8.23
8.43
Ø1.12
3.74
Ø1.59
Ø2.06
Ø0.74
Ø1.12
R4.50
1.24
1.38
POLISHED
IRON MAN
SHOULDER
SOLUTION TREATED TITANIUM
MK3_V2_SP_SHOULDERB
A3