

Team 23-16
MIME 498
Final CAD Package
March 18, 2024

CAD Requirements

1. Overall Assembly View and Drawing

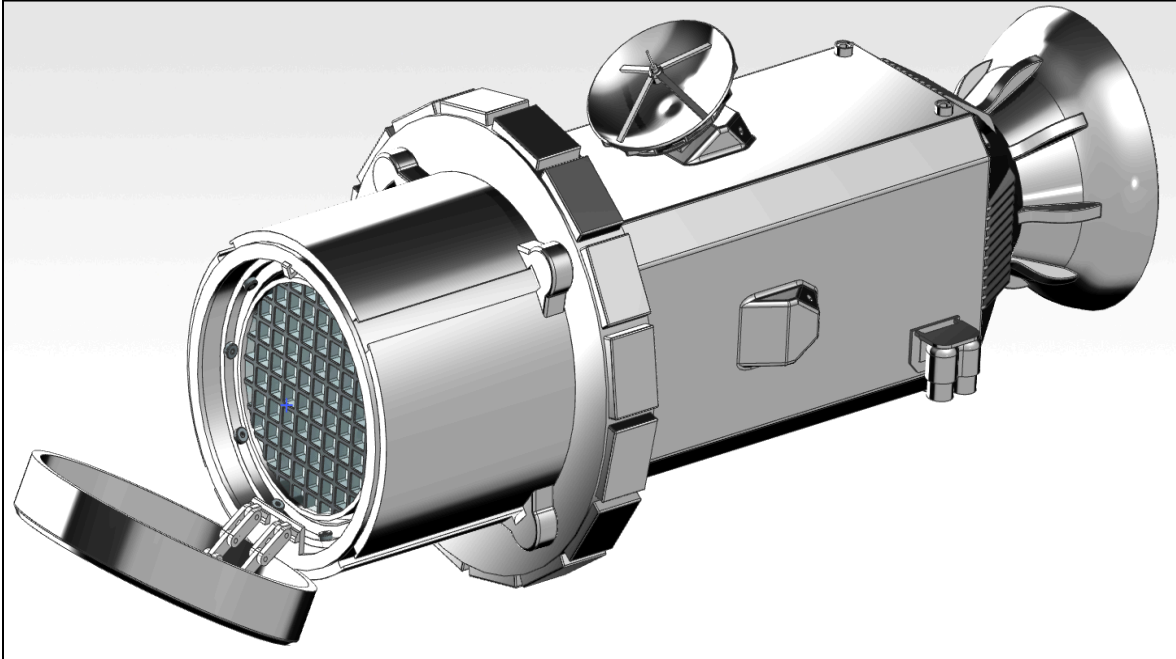


Figure 1. Rendered Drone Assembly Model.

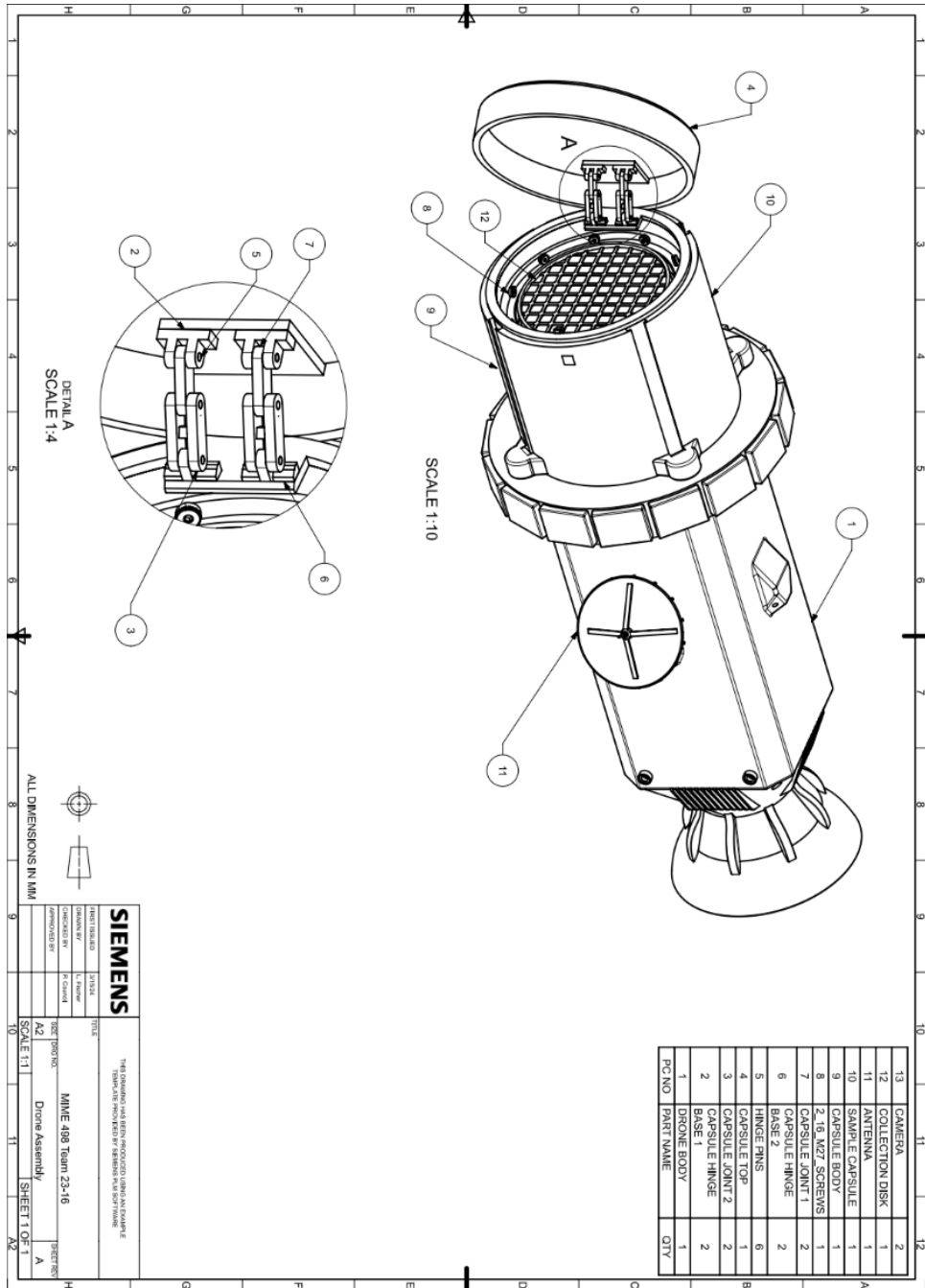


Figure 2. Drone Assembly Drawing with Labeled Parts.

2. Part Drawings

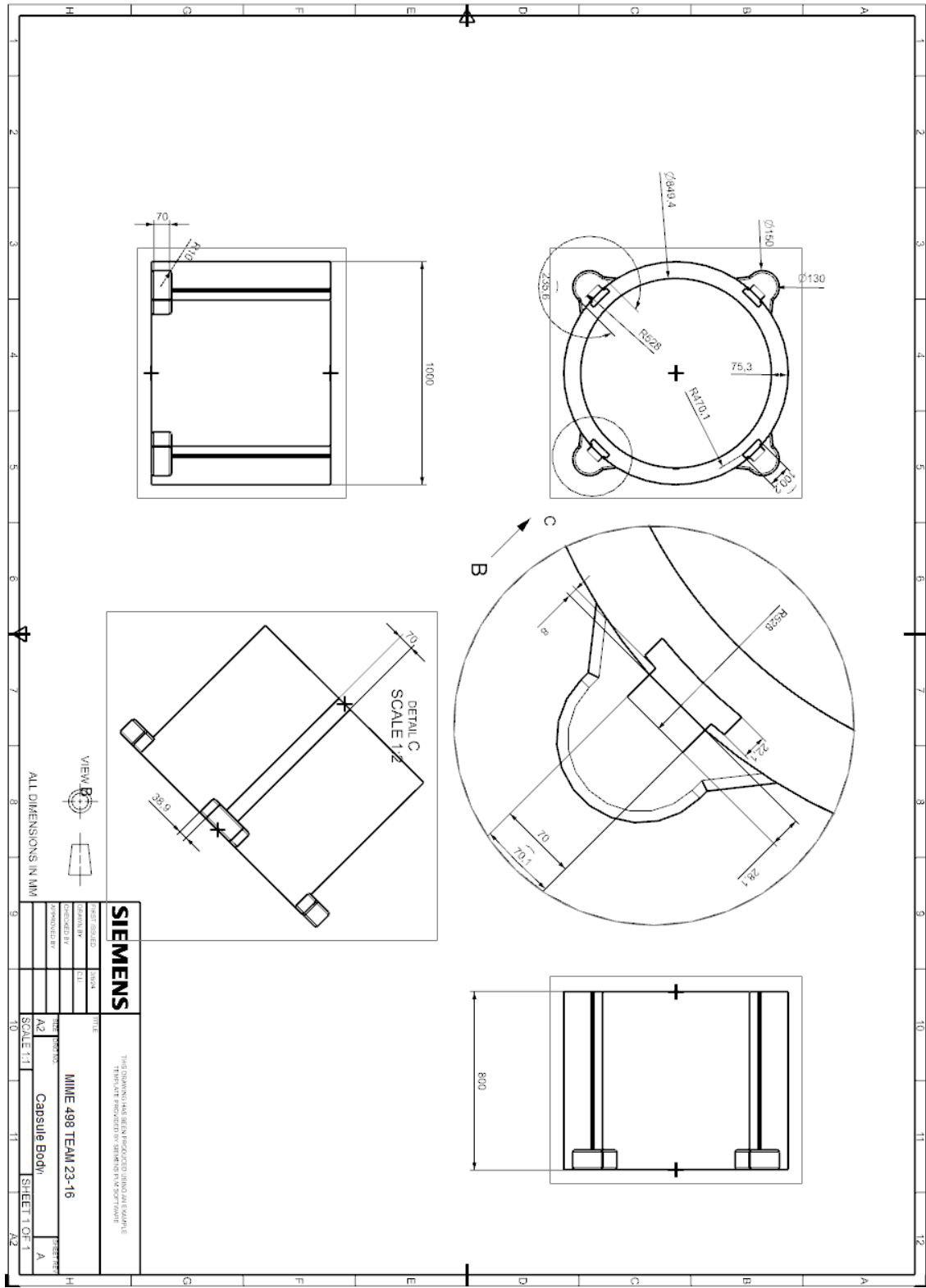


Figure 3. Drawing of External Sample Capsule Base.

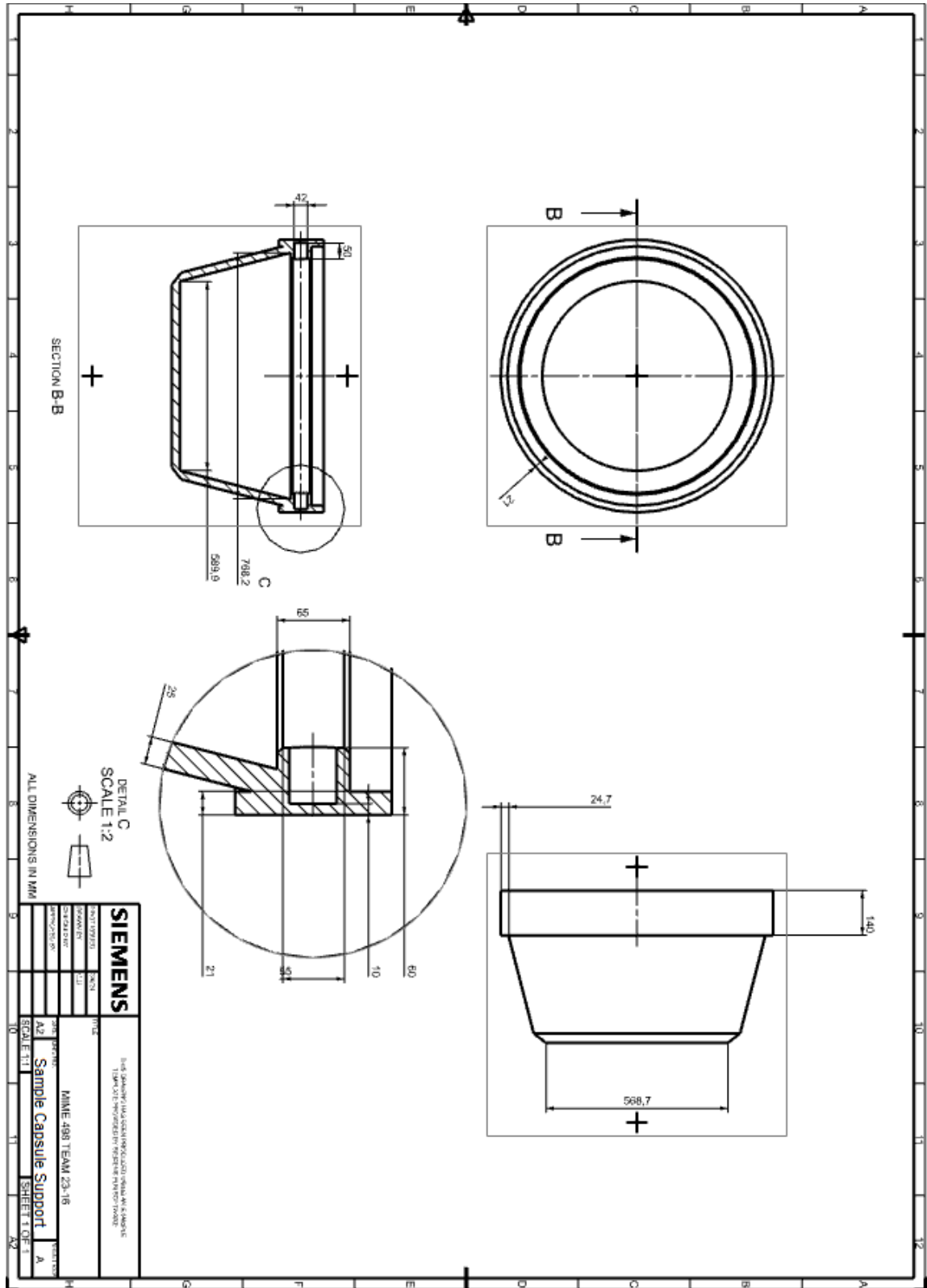


Figure 4. Drawing of Internal Sample Capsule.

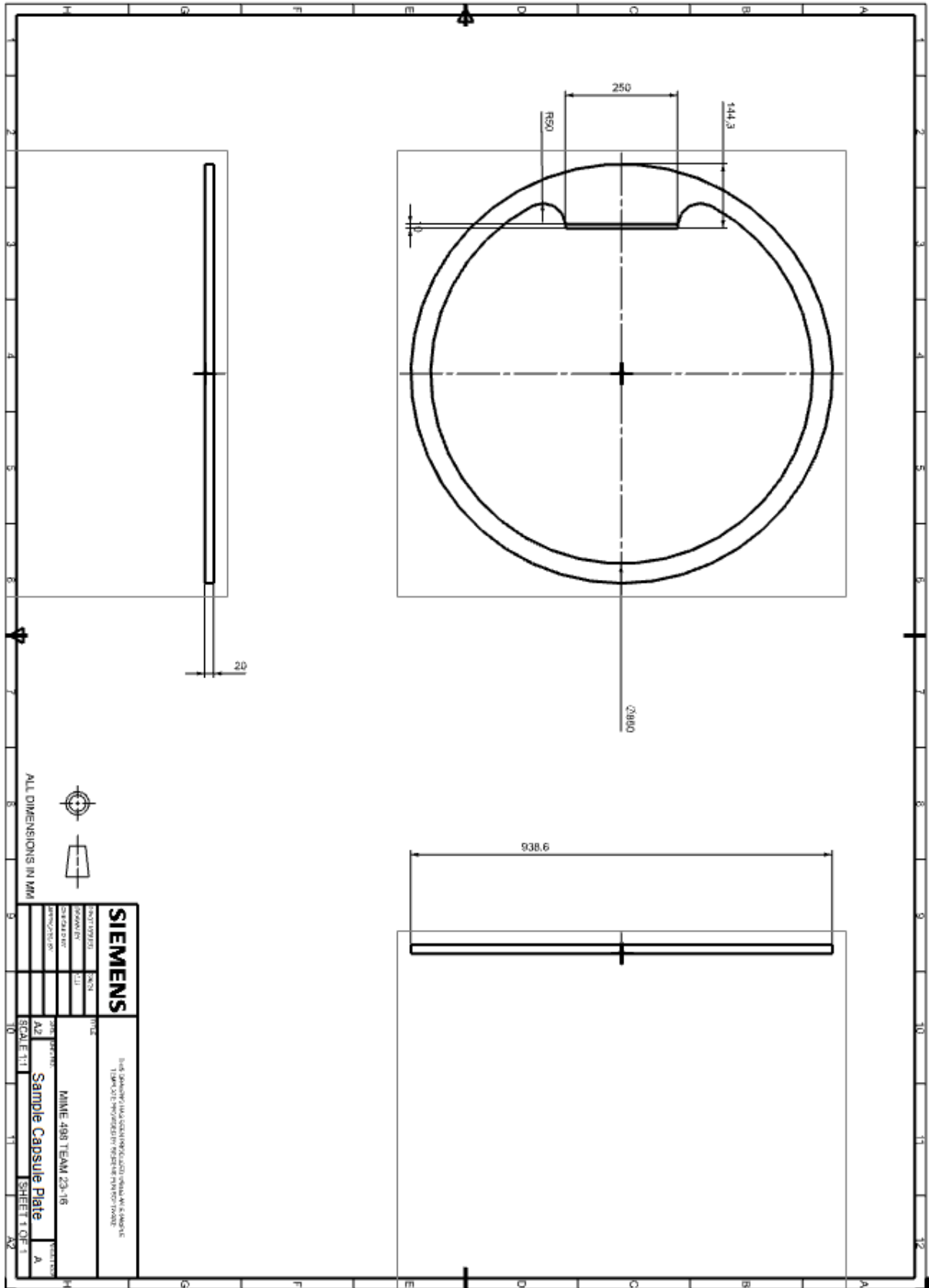


Figure 5. Sample Capsule Base Cover Drawing.

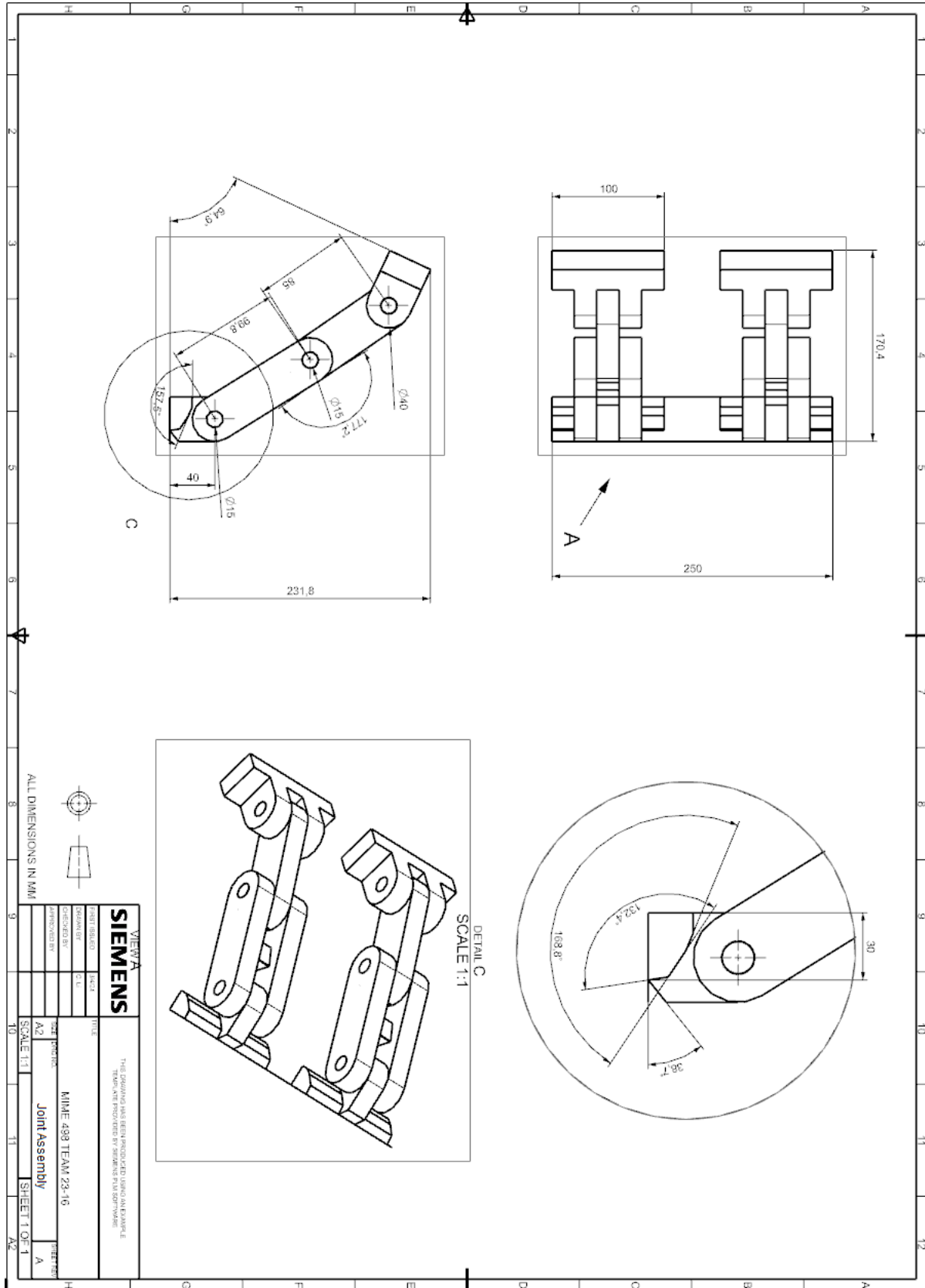


Figure 7. Drawing of Sample Capsule Joints.

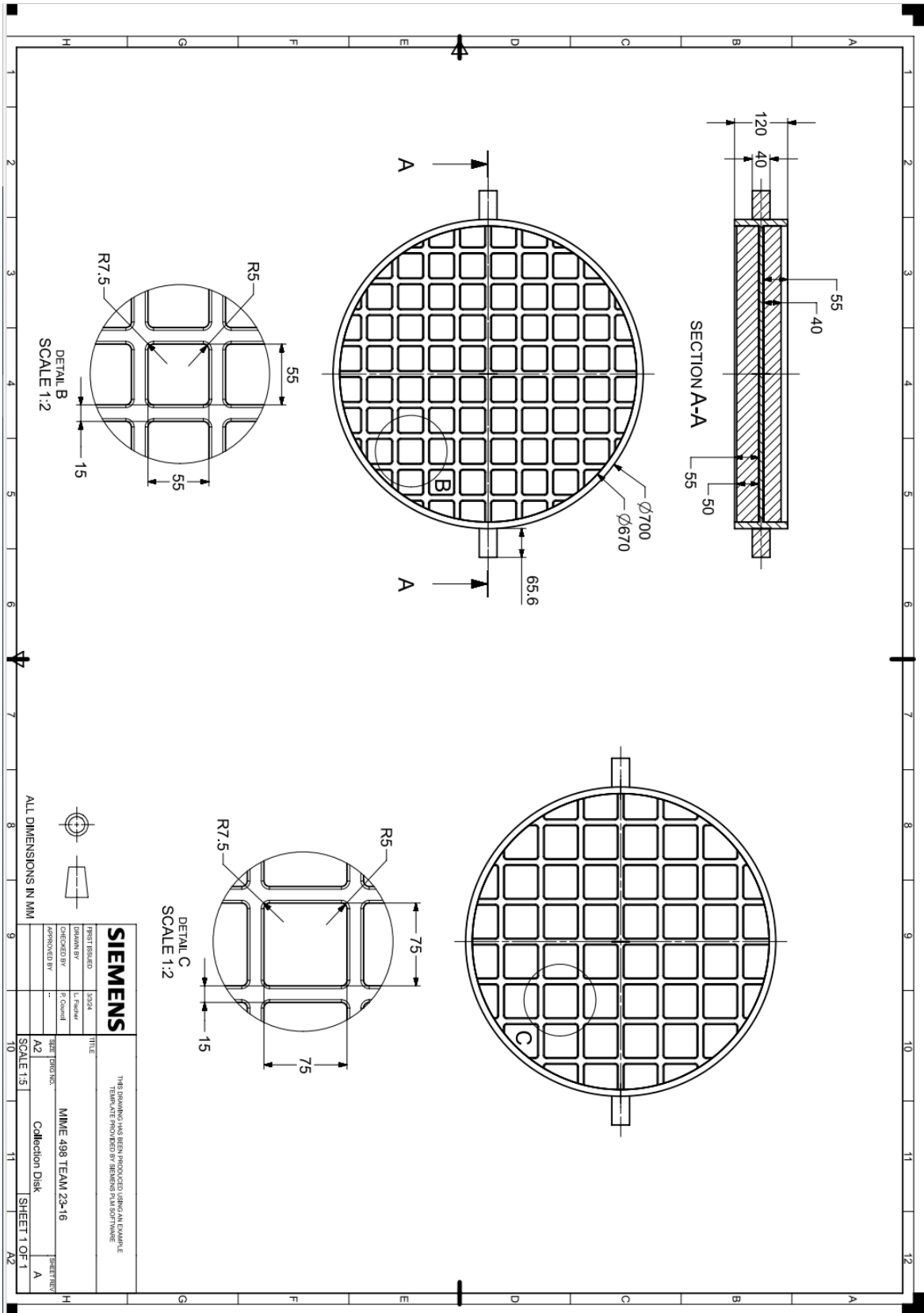


Figure 8. Drawing of Both Sides of the Collector Disk.

3. Bill of Materials

Table 1. Bill of Materials for the Disk, Drone, and ADCS Systems.

Team 23-16 Bill of Materials					
Description	Quantity	Units	Unit Cost (\$)	Cost (\$)	Source
Disk					
Titanium	8	1'x1'x1" Plate	3202.58	25620.64	https://www.onlinemetals.com/en/buy/titanium-sheet-plate
Aerogel	640	2" x 2" x 0.5" block	350	224000	http://www.buyaerogel.com/product/precision-silica-aerogel-large-block/
Total Number of Parts:	648	Total Cost (\$):		249620.64	N/A
ADCS (Altitude Determination and Control System)					
Star Tracker	1	# of units	231.43	231.43	OG star tracker kit - Shop - OG star tracker (ogstartech.com)
Sun Sensor	1	# of units	12000	12000	NSS Fine Sun Sensor - CubeSatShop.com
Earth/Horizon Sensor	1	# of units	14,900	14900	AI-SES IR Earth Sensor - Earth/Horizon Sensor SatCatalog
Gyroscope	1	# of units	Around 15000	15000	Space Grade Three Axis Fiber-Optic Gyroscope VOBIS - Get a price quote from Optolink (findlight.net)
Reaction Wheel	1	# of units	100000	100000	12-Nms-RW4-RW5-Data-Sheet-v3.pdf (rocketlabusa.com)

Magnetorquers	1	# of units	1286.17	1286.17	Cubesat Compact Magnetorquer CubeSat.Market
Total Number of Parts:	6	Total Cost (\$):		143417.6	N/A
Clamshell					
Clamshell Top	1	# of units	18912	18912	Xometry Quote
Clamshell Bottom	1	# of units	93492	93492	Xometry Quote
Disk Support	1	# of units	35264	35264	Xometry Quote
M 27 Screws	10	# of units	20.05	200.5	https://www.mcmaster.com/products/screws/thread-size~m27/
Total Number of Parts:	13	Total Cost (\$):		147868.5	N/A

4. Overall Design Process and Reflection

The team updated the drone body, clamshell, and disk to include more details and considered design for manufacture. External parts, such as cameras, an antenna for communication, screws, and side thrusters, were added to the drone to create a more realistic design that kept the function of the drone in mind. For example, the cameras will detect large particles and inform altitude control and scientists of the mission progress. The design of the sample capsule now includes a latch and inner compartment to ensure that the capsule will seal, be easily removable, and protect the internal components or sensors against any stray debris. The internal compartment will also provide more structural support to the base of the rotating collection disk, so the disk will not only have to rely on its two side rods for support during the collection phase. The disk's sharp edges along the grid pattern were rounded to decrease stress if impacted on these points and for better manufacturability. One side of the disk, side A, has smaller, shallower Aerogel segments to collect smaller particles. The other side of the disk, side B, originally included electromagnets, which the team removed due to interference with the communication systems and the complexity of powering the magnet. The current design of side B has deeper sections for holding more Aerogel to slow the larger particles it collects. Overall, the drone, capsule, and collector have improved structural strength and detail to provide a comprehensive design.