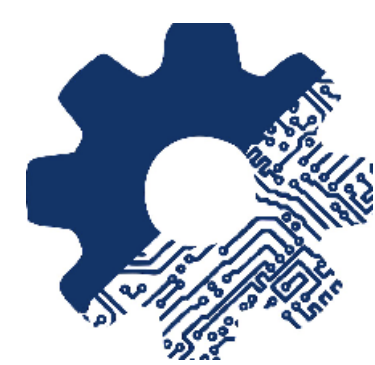


Untethered Shape Change in Real World Deployment



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Motivation

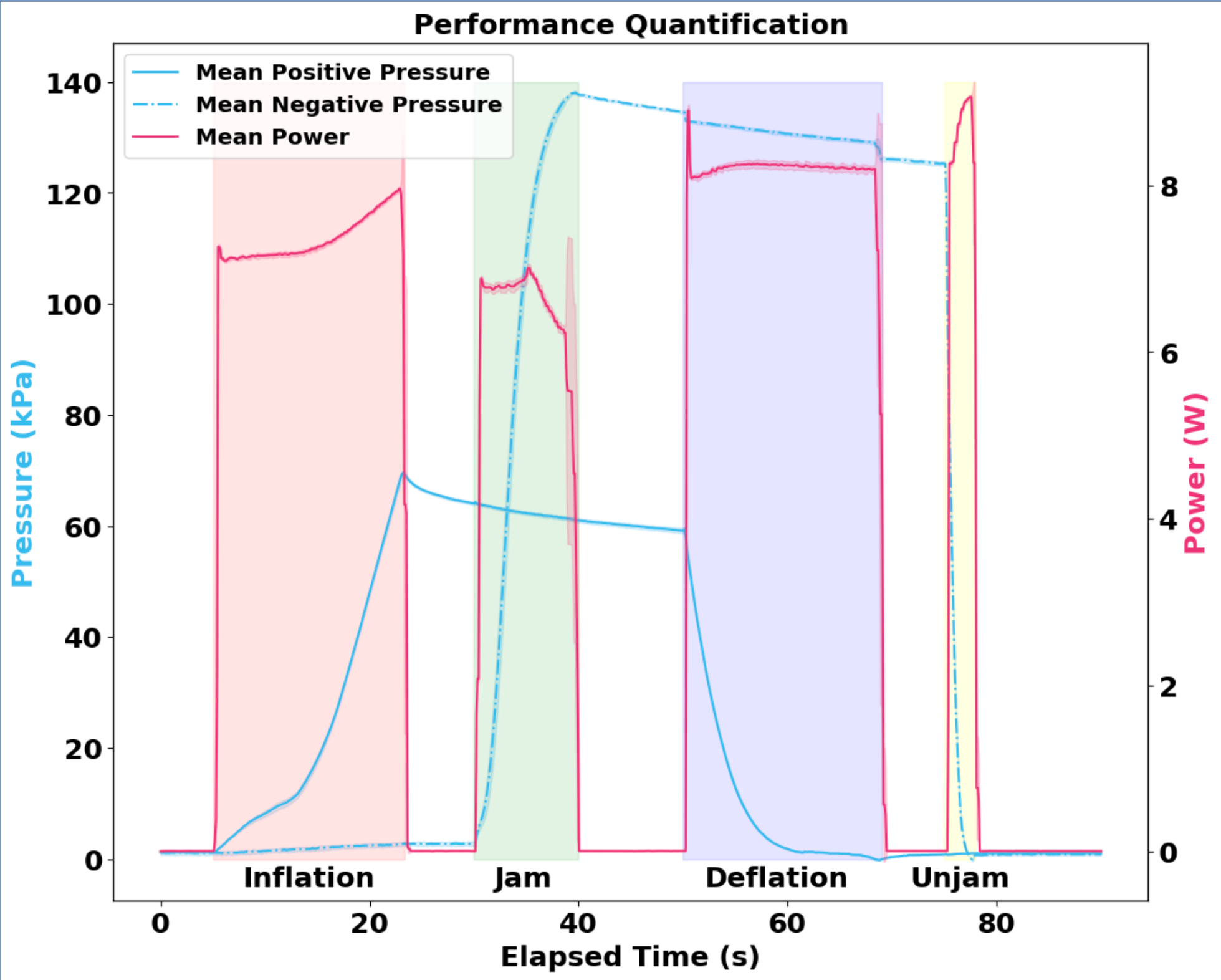
What makes a robot ready for real world deployment?

1. Low energy and temperature independent
2. Robust
3. Multiple gait and stiffness pairings (adaptable w/ multiple tools)

Right now, most shape-changing robots, such as our Amphibious Robotic Turtle, are tethered to a power generator, air compressor, and a laptop. Our research aims to implement and preserve these requirements, while taking it further by implementing an untethered system which proves viable in the field. The ultimate goal is for soft robots to accomplish tasks in the field, which implies limited human intervention; untethering is a vital step forward and one which is completely necessary for robots to be deployable.

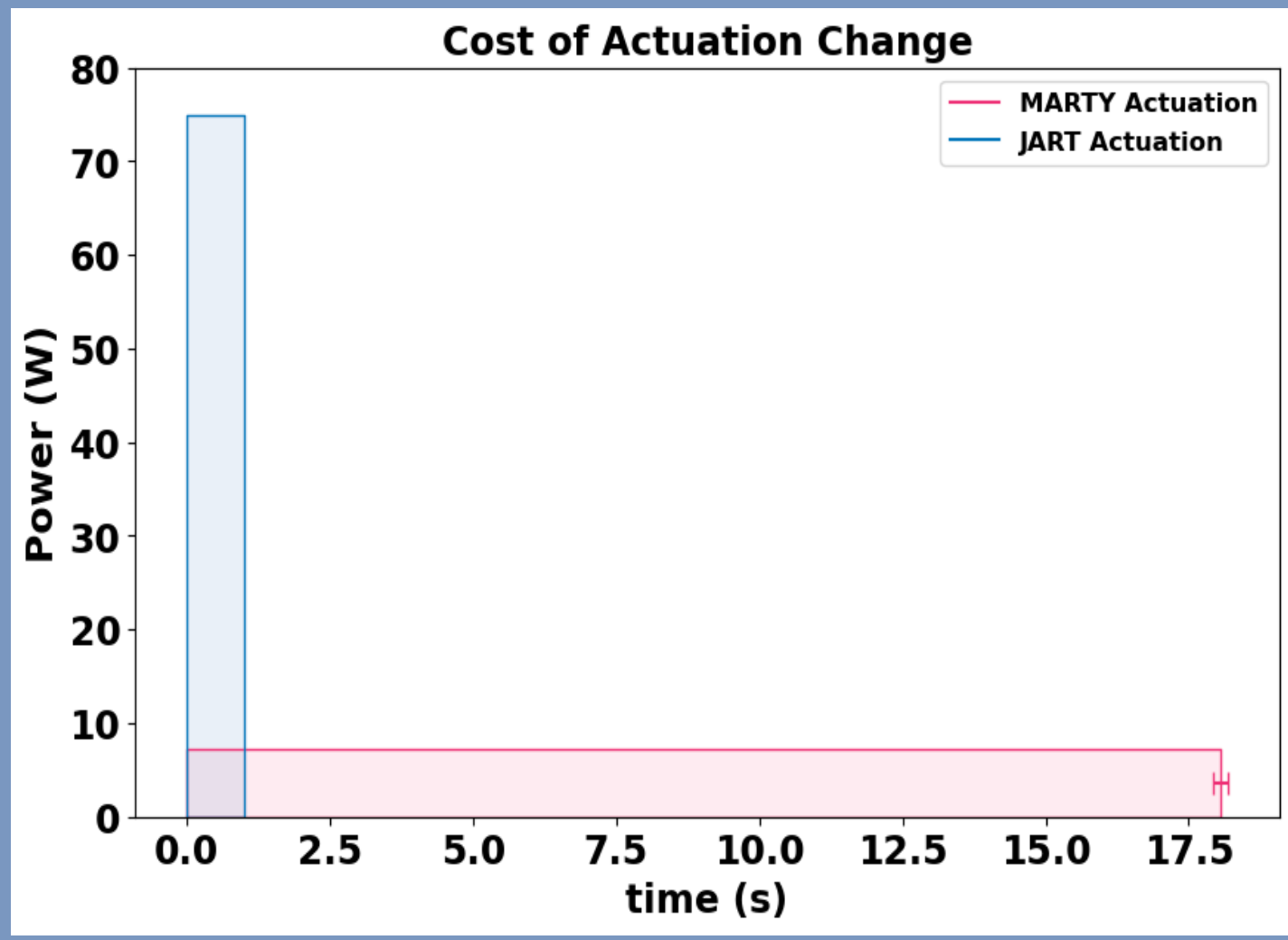
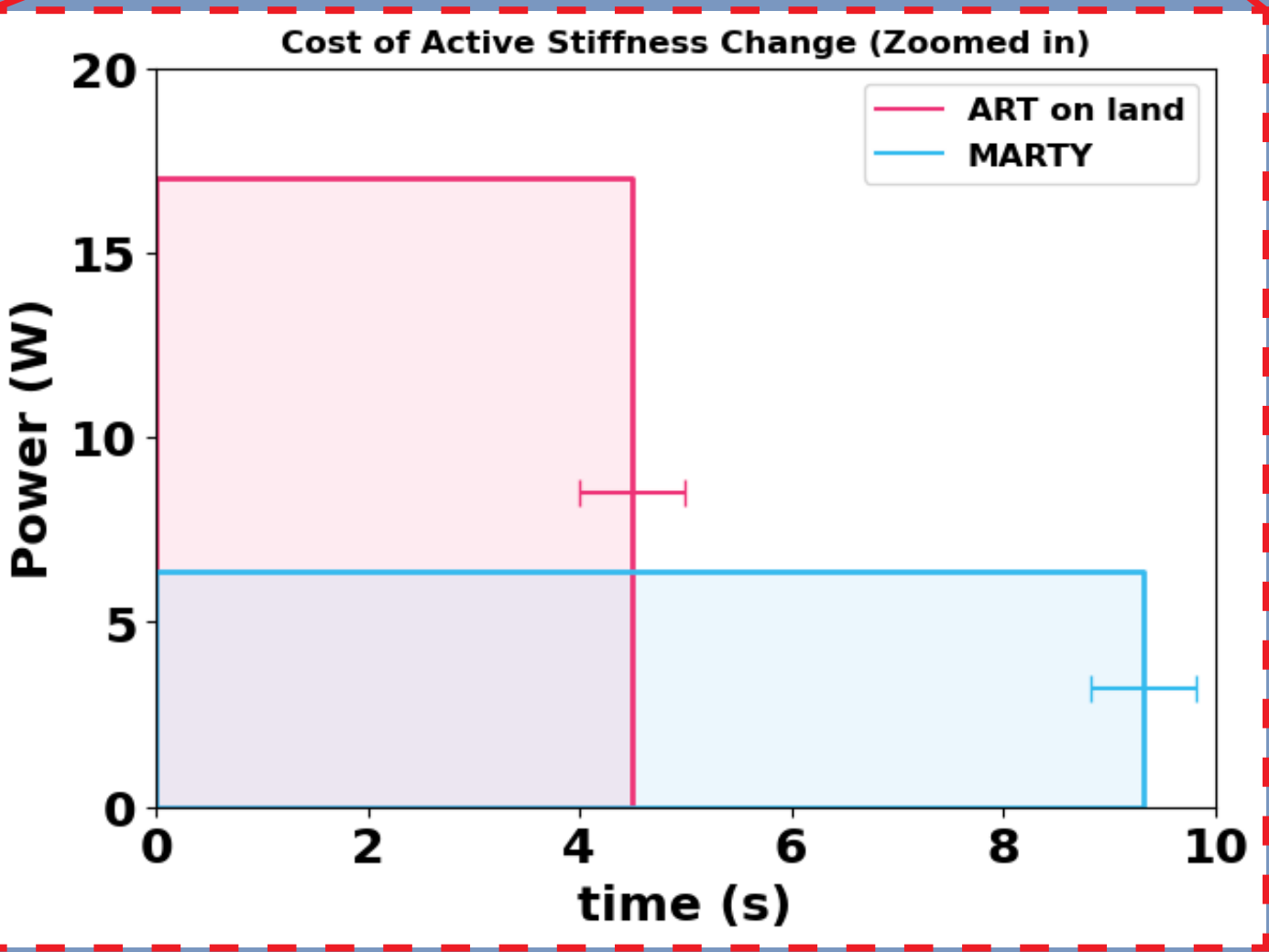
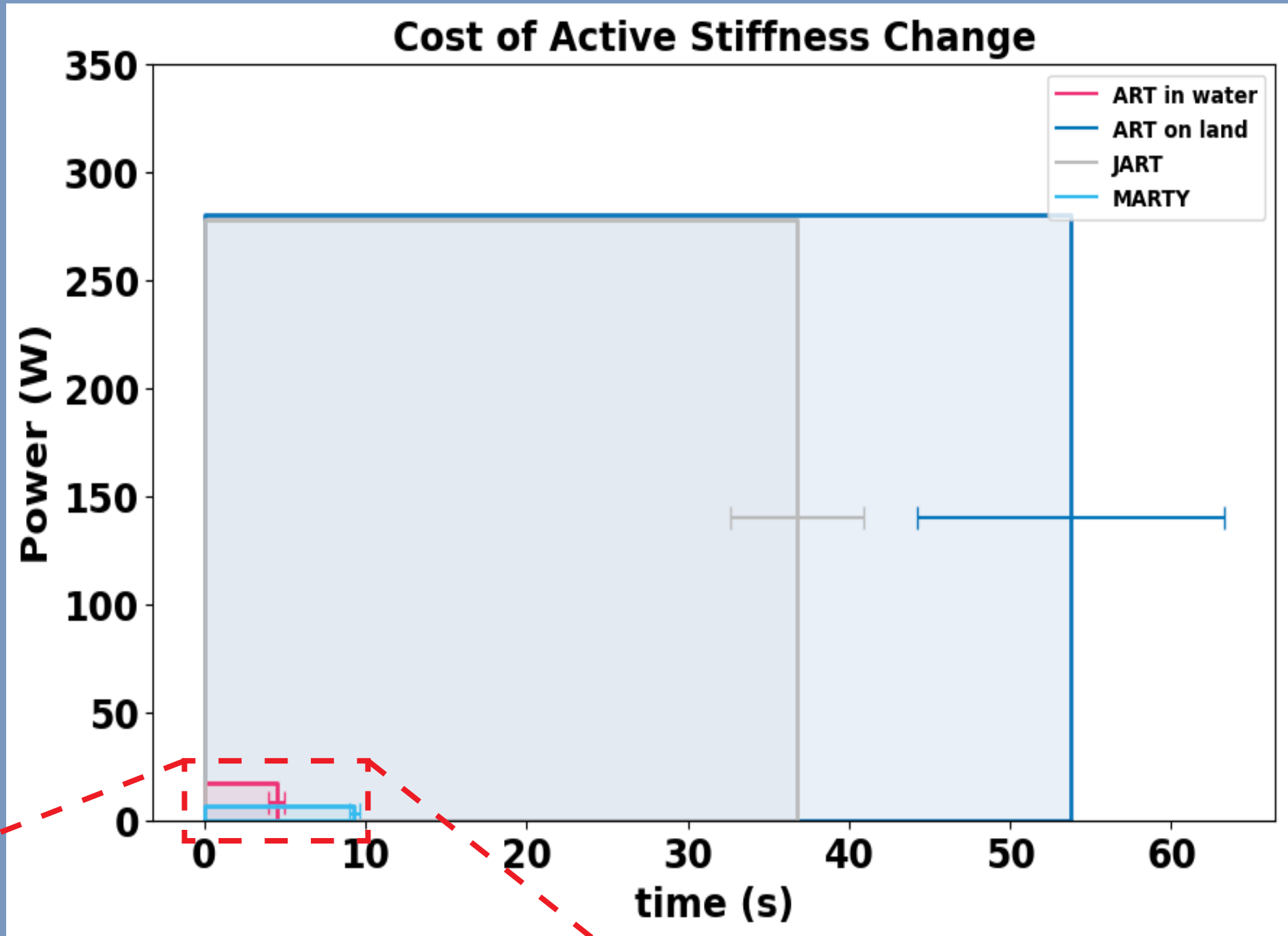
Untethered Performance

	Max Pressure (PSI)	Time (s)	Power Consumption (W)
Inflation	10	18	7.16
Jam	20	9	6.36
Deflation	0	18	8.04
Unjam	0	3	8.42

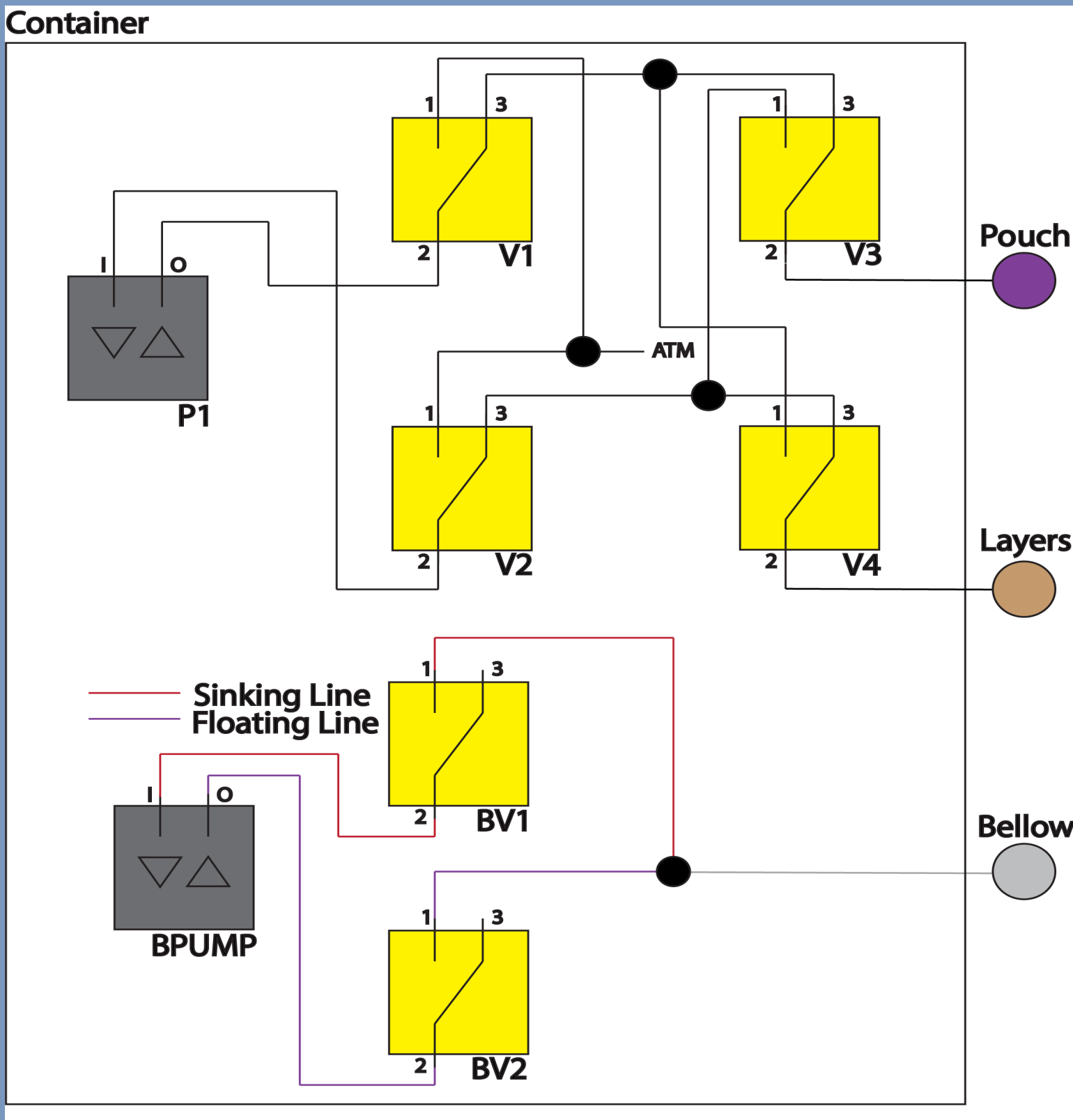


Cost of Morphing

$COM = E\alpha + E\beta + E\gamma$
Actuation Energy + Softening Energy + Stiffening Energy



Pneumatic Control Unit



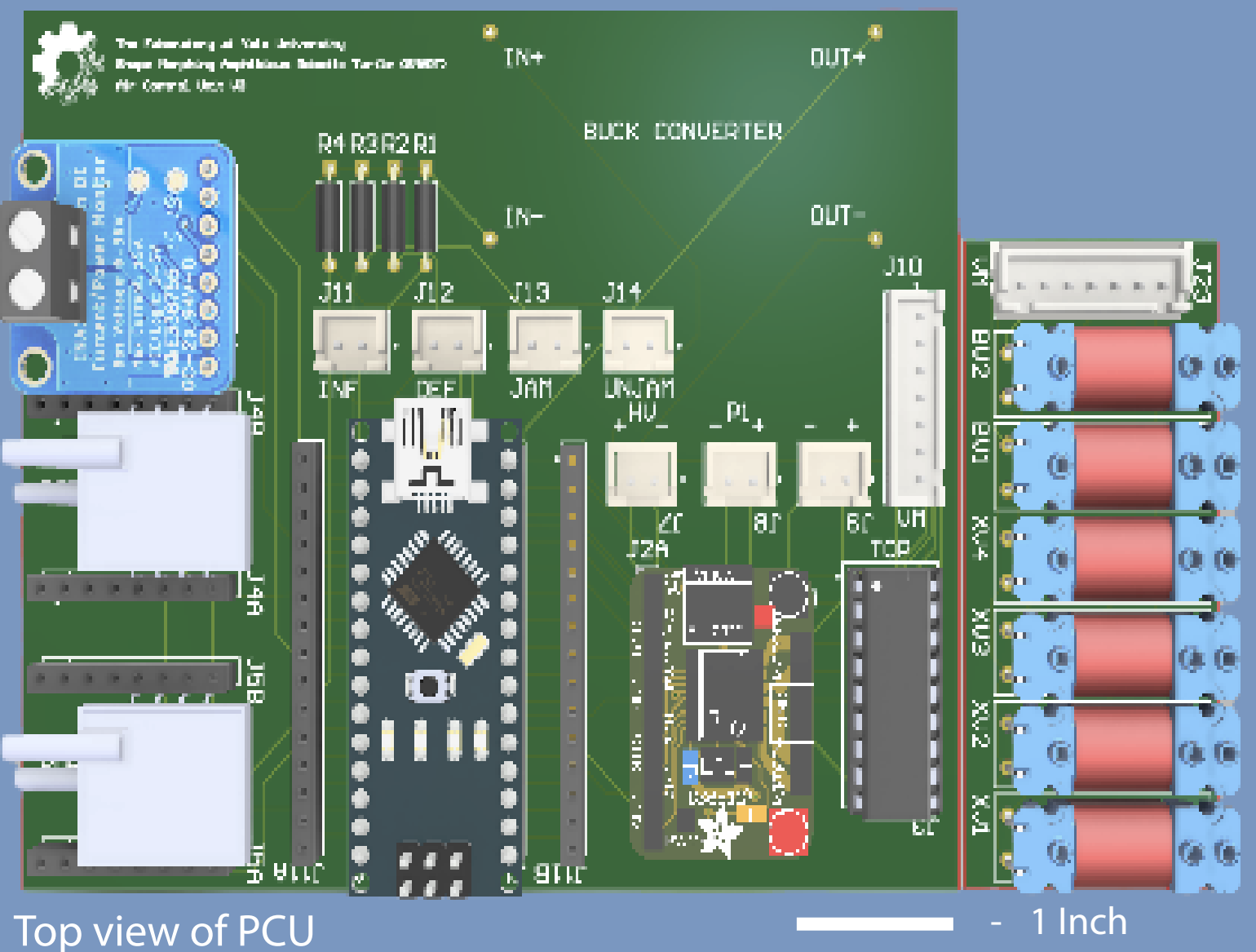
	V1	V2	V3	V4	P1
Inflation	0	1	0	0	1
Jam	1	0	0	0	1
Deflation	1	0	1	1	1
Unjam	0	1	1	1	0

Truth table for pneumatic system

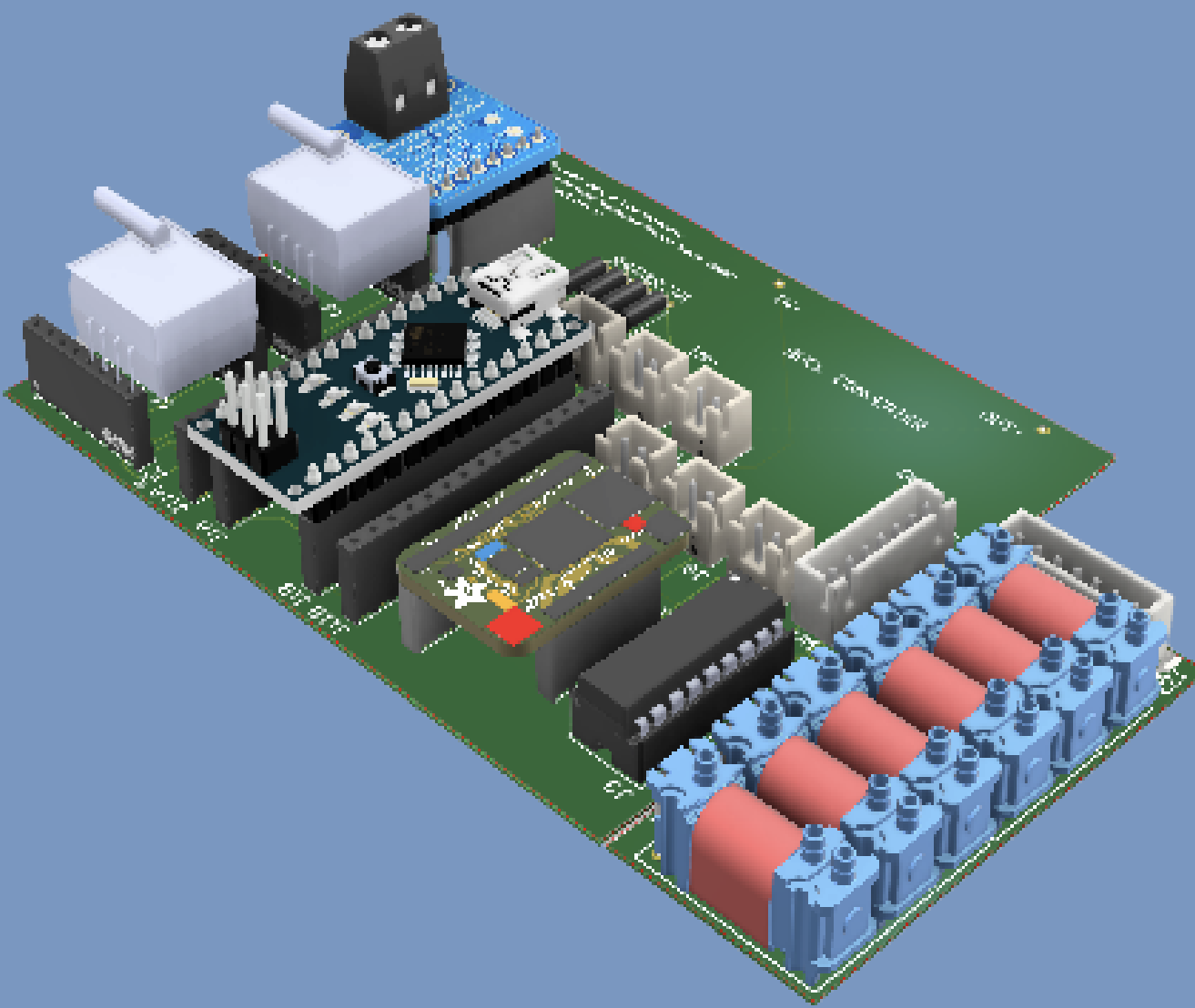
	BXV1	BXV2	BPUMP
Inflation	1	0	1
Deflation	0	1	1

Truth table for buoyancy system

Pneumatic connections between valves and pumps

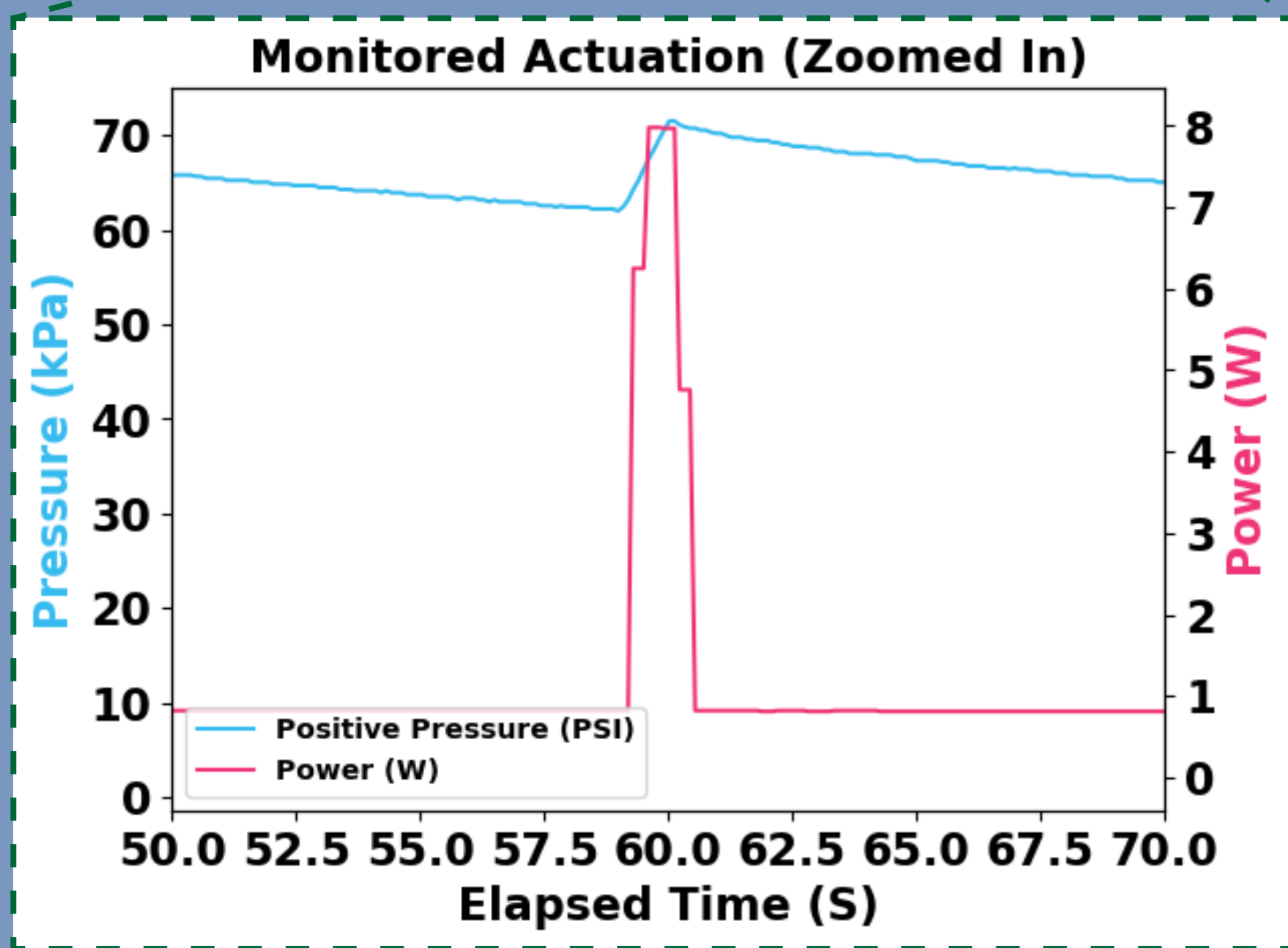
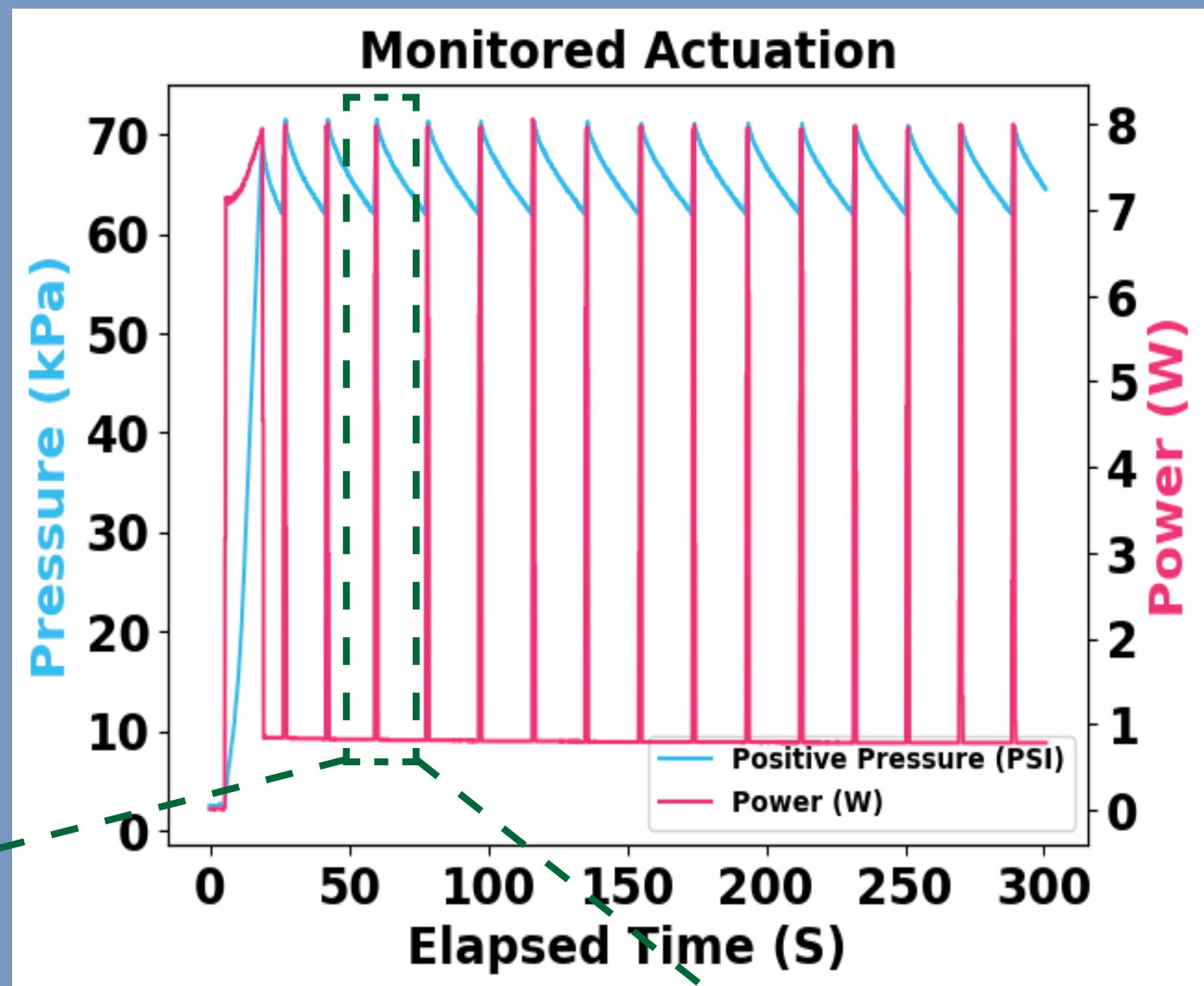
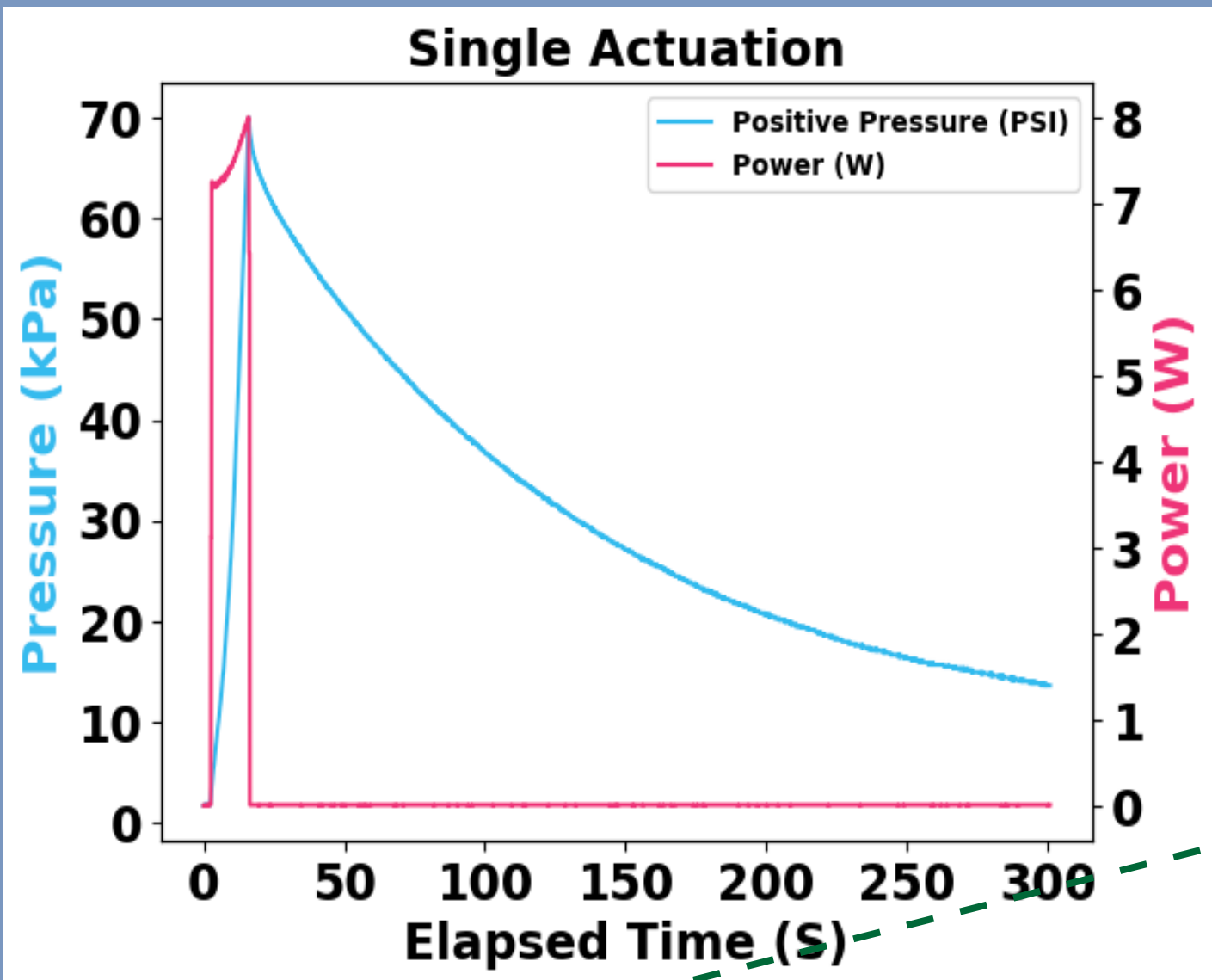


Top view of PCU



Isometric view of PCU

Robustness



Acknowledgements

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