

						(9 severe - 1 not severe)	(9 very likely - 1 not likely)	Severity * Likelihood		
ID	Category	Owner	Risk	Cause	Effects	Severity	Likelihood	Risk Score	Risk Prevention Strategy	Risk Mitigation Strategy
1	Societal	Team	Overworking team members	Setting our team values and norms at too high of a bar to reach	Never reaching our intended target and getting frustrated and angry with each other in the process	9	9	81	Make a schedule and stick to it, make team mates share projects so everyone can still work on what they want to work on	Penalize team mates that don't do enough/ do too much or do other team mates jobs
2	Technical	ME	Machine structure fails to fit on device after production.	improper measurements or failure to realize the correct constraints or an unforeseen one	need to remachine structure and reanalyse for the different dimensions	9	3	27	Proper measurements and validation of measurements during production.	Redevelop structure, use lessons learned. We may hit budget constraint.
3	Safety	ME	Structure flies off at high RPM experiencing significant damage.	structure not secured appropriately in the machine, Improper mounting or insufficient safety measures	potentially severe physical injury due to weight and/or needing to repair the device, property damage, death	9	3	27	Perform testing at low RPMs first to check for instability, then move onto higher RPMs in steps.	Redevelop product ASAP. May hit budget issues. Higher factor of safety for safety features/mounting
4	Tech	ME	Messed up housing tolerance, now part is too big	GD and T tolerancing failure	need to remanufacture/ potentially redesign one of the components if necessary	9	3	27	Make use of CNC machine for housing construction, keep tolerances as tight as possible, make a demo part from cheap material or scrap	Review tolerances with a specialist
5	Safety	ME	piece of the housing flies off while mill is operating	damaged housing, housing can't withstand the centripetal force or worn out component	potential physical injury and/or needing to redesign and manufacture the housing	9	3	27	Model the housing at speeds higher than 2000 RPM	build plexiglass cage to prevent injury during testing phase
6	Technical	EE	Faulty strain gauge components.	used components or unreliable supplier	incorrect or unstable readings, leads to unusable data	9	1	9	Order extra strain gauges in advance of a different manufacturer.	Reorder strain gauge components. This may risk us hitting budget constraints, creating a new risk in itself.
7	Technical	EE	Microcontroller programming fails to transmit data wirelessly.	error in the program or interference caused by the rotating components	forces the use of onboard data collection	3	3	9	Consult SMEs in advance, perform proper research before programming.	Use on board memory for data collection such as an SD card instead. (Design changes)
8	Technical	EE	Data Acquisition Module fails or is damaged.	device was dropped or mishandled in general during assembly	need to use a spare and if there isn't a spare due to cost need to have a cheaper backup plan	9	1	9	Have another DAQ on hold. This may cause us to hit budget constraints.	Reorder DAQ, which may hit budget constraints.
9	Resource	Team	Loss of bridgeport milling machine.	extreme damage to the head or frame of the machine		9	1	9		Design project for another milling machine.
10	Resource	PM	Loss of team member.	unforeseen circumstance removing them from the class	need to distribute the load across all teammates/see about getting another team member or addition help	9	1	9	make sure everyone is in good health/ isn't struggling	Spread work out among remaining team members.
11	Resource	Team	Loss of machine shop.	causing a fire/ getting banned from the machine shop		9	1	9		Find another machine shop.
12	Safety	ME	Cutting tool bit failure causes shrapnel to fly.	high tool loads, worn out tool or faulty tool, or improper machining	need to replace tool, replace/repair any damage components	9	1	9	Have a safety guide or checklist before operation, wear PPE.	Use machine shop safety incident procedures.
13	Safety	ME	Plexiglass safety hood failure.	improper analysis or larger than expected shrapnel needing to be stopped	potentially severe physical injury	9	1	9	Have a safety guide or checklist before operation, wear PPE.	Use machine shop safety incident procedures.
14	Tech	ME	loose wire connections inside housing	vibration caused during machining or mistake made during assembly	incorrect or unstable readings, leads to unusable data	9	1	9	rely more on solder connections	solder wire joints into the housing/ connecting part
15	Tech	ME	Strain gauges with poor adhesion, (heat or shake off)	too much heat for adhesive, improper prep of the surface	potentially damaged strain gauges, incorrect or unstable readings, leads to unusable data	9	1	9	Use more affective glue (UVS -10TS or BFR-2K)	sand surface of housing sensor is covering.

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16	Safety	ME	Backlash from the machine	damaged ball screw on the machines or if using a servo driven machine lag between input and motion	potentially broken tool and/or damage to the device	9	1	9	confirm the machine shop backlash prevention stuff is in working order	build a plexiglass cage around part to prevent injury during testing
17	Tech	EE	Battery doesn't survive rotation	battery housing isn't able to withstand centripital force/ faulty housing	battery acid contaminating the structure potentially damaging/ corroding components	9	1	9	Use more durable battery, phone batteries are versatile enough to work in space satellites	model its survival before testing, look at what it has been used in before
18	Design		Design is not completed by end of MSD	Inefficient use of time, bad luck, poor planning	Unhappy customer	1	9	9		Utilize guide to keep us on track and plan for extra time in case things go wrong
19	Usage/Design		Dynamometer can't hold the cutting tool in place during cutting	Faulty design	Injury, property damage, death	1	9	9	alarm built in if there are higher than predicted loads	Low RPM testing and benchmarking other tool holders
20	Resource	ME	not enough time to get the structure machined in time with the material selected	hardened materials	need to change design to utilize softer materials	9	1	9	specify ideal materials at design phase	if there is a need to use something else keep in mind any design parameters that may need to change accordingly
21	Societal		device isn't adaptable for next phase	doesn't fit to a machine it wasn't designed for	need to redesign the structure	1	9	9	document our research and process	have detailed documentation of all steps so that the knowledge base is already there
22	Safety		tool not inserted properly	careless when installing the tool into the structure	improper readings, damaged tool or device	3	3	9	detailed setup instructions	include pre-use checks
23	Resource	Team	Budget constraint reached.	planning oversight, spending frivolously or cost of comonents	need for more funding or need to make do with what is now available	3	1	3	Keep track of BOM, budget for risk and contingencies.	Try to get budget moved to \$2500. We can not exceed \$2500 as a strict customer requirement.
24	Data		Data is not accurate to the required precision	Improper sensor placement, incorrect conversion formulas	Unhappy customer, poor results when used	1	3	3	select sensors that have a proper data collection range	Peform early testing to ensure accurate results are being obtained
25	Data		Data is not able to be transmitted and viewed in real-time	Too difficult to arrange, too expensive	Inconvenient for user	3	1	3	save data to a form of flash memory	Benchmark other real-time data viewing devices
26	Design		Can't find a way to power the device that meets other constraints (size, etc.)	Too tight contraits, inefficient design	Device will have to be redesigned	1	3	3		Design dynamometer for spacial efficiency
27	Desgin		Instruction manual is not useful to the customer	Poor detail, too much detail, poor layout	Improper set-up or usage of device	3	1	3	Go through the setup with people outside our group with them following the manual	Have guide and customer proof-read
28	Technical		Measurement structure interferes with the electronics	natural frequency of structure causing resonance and thus a false reading or vibrating something loose	need to redesign the structure	3	1	3	analyse for natural frequency	select a material that had a natural frequency that is beyond that of what will be created when machining
29	Technical	EE	Runs out of power	run too long/battery wasn't recharged	can't collect data	1	3	3	add in an indicator light for low battery	analyse power requirements/make it clear in the manual how often to charge or change the battery
30	Technical	ME	tool beaks off in tool holder	high tool loads, worn tool, faulty tool	need to swap tool and check over the structure	1	3	3	add in warnings of high loads, check over tool before use	use a collet based tool holder so that the tool is easily removable
31	Resource	ME	can't get the main structure machined due to design	unmachinable design features	need to redesign the structure	3	1	3	have machining constraints defined at time of design	design to the machining constraints

