P13371 Risk Assessment

ID	Risk Item	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
	Describe the risk briefly	*What is the effect on any or all of the project deliverables if the cause actually happens?*	*What are the possible cause(s) of this risk?*			*L*S*	*What action(s) will you take (and by when) to prevent, reduce the impact of, or transfer the risk of this occurring?*	*Who is responsible for following through on mitigation?*
1	Motors break/burn out	Project will be delayed and we cannot test the system	Power surge/outage, programming/wiring error	1	3	3	If lead time is long, buy 1 extra motor, otherwise use the other 2 motors to test while 3rd is on order	Team
2	Motors don't operate within spec	Project will be delayed and tests would be inaccurate	Supplier issue	1	2	2	If lead time is long, buy 1 extra motor, otherwise use the other 2 motors to test while 3rd is on order	Team
3	Motors don't respond to user input	Can't control system	Programming/control/ wiring issues	2	2	4	Debug the software, and check wiring diagrams	Nick m / Bridget L
4	Motor doesn't meet resolution	Customer spec not met	Motor not controlled properly	1	3	3	Correctly spec out and properly control motor	Nick M / Bridget L
5	Motor has a lot of chatter	Noise in position	Controller issue, hydraulics provide improper damping	2	2	4	Tune motor control	Nick M / Bridget L
6	Lead screw breaks	Can't control 1 axis	Too much friction or torque in system, wrong thread size	1	1	1	Have extra lead screw lengths on hand	Avash J
7	Lead screw threads become stripped	Can't control 1 axis precisely	Lead screw can't handle torque, wrong thread size	2	2	4	Have extra lead screw lengths on hand	Avash J
8	Lead screw is not concentric	Increased vibration	Improper machining	1	2	2	Have extra lead screw lengths on hand	Avash J
9	Lead screw gives improper range of motion	Customer spec not met	Lead length is too short or improper pitch used	1	2	2	Have extra stock of lead screws	Keith S
10	Lead screw gives improper resolution	Customer spec not met	Pitch/Lead length is too large	2	2	4	Buy finer pitched lead screw	Avash J

12	Too much friction on lead screw	Backlash introduced into system	Threads don't align	2	2	4	Better machining	Avash J
13	Lead screw machinability	Hard to integrate into system	Lead screw selection	2	2	4	Buy lead screw that has good machinability	Avash J
14	Hydraulic leak	No manipulator movement	Rupture in pipe, improper seal	2	3	6	Make sure pipes are sealed properly	Keith S
15	Hydraulic fluid compresses/unresponsive to mechanical input	Backlash and reduced manipulator movement	Air introduced into system and sealing issues	3	2	6	Be sure system is properly bled, seal hydraulics properly	Jacob B
16	Hydraulic hoses bulge/rupture	Backlash and reduced manipulator movement	Pressure is too high	2	2	4	Use thicker walled pipes than required by design	Jacob B
17	Hydraulic provides inadequate resolution	Improper resolution for manipulator movement	Hydraulic diameters not designed properly	1	3	3	Make sure hydraulic pistons are designed properly	Jacob B
18	Thermal expansion within the hydraulic lines	Cause noise and change position repeatability	Heat generation due to friction, and 'large' changes in temperature	2	1	2	Have fluid with low thermal expansion	Jacob B
29	Break manipulator	Can't move pipette	Too much force	1	3	3	Order new part	Keith S
20	Too much friction within manipulator	Too much backlash	Choice of carriage and lubrication	2	2	4	Order carriages with low friction coefficient	Keith S
21	Improper manipulator movement	Backlash, chatter, vibration	Misaligment	2	2	4	Make sure parts are machined properly, proper consideration for mount parts	Keith S
22	Controls have a delay or slow response time	Backlash	Unoptimized control and system components unable to respond	2	3	6	Optimize control program to counter-act motor inductance	Nick M / Bridget L
23	Chips burn out	Can't control the system	Programming errors, wiring errors, feedback, unisolated contacts	3	3	9	Make sure we buy extra chips	Nick M / Bridget L
24	Bugs in UI Code	Improper control of system	Inexperience with programming language	3	2	6	Debug UI and ask for more experienced help	Nick M / Bridget L
25	Parts don't arrive on time	Delays entire project	Supplier problems	2	3	6	Find lead time and give adequate time for parts to arrive.	Team

26	Manufacturing tolerances	Parts won't fit properly	Supplier issue and improper design	2	2	4	Fit tolerances to solid modeling during planning phase	Team
29	Ability to manufacture	Backlash, vibration	Machining limitations, experience on machine	2	2	4	Plan ahead of time what parts will be machined vs purchased	Team
30	Part/equipment availability	Delay entire project	Back order	2	3	6	Check availability ahead of time	Team

Likelihood scale	**Severity scale**
1 - This cause is unlikely to happen	1 - The impact on the project is very minor. We will still meet deliverables on time and within budget, but it will cause extra work
2 - This cause could conceivably happen	2 - The impact on the project is noticeable. We will deliver reduced functionality, go over budget, or fail to meet some of our Engineering Specifications.
3 - This cause is very likely to happen	3 - The impact on the project is severe. We will not be able to deliver, or what we deliver will not meet the customer's needs.

"Importance Score" (Likelihood x Severity) – use this to guide your preference for a risk management strategy	
Prevent	Action will be taken to prevent the cause(s) from occurring in the first place.
Reduce	Action will be taken to reduce the likelihood of the cause and/or the severity of the effect on the project, should the cause occur
Transfer	Action will be taken to transfer the risk to something else. Insurance is an example of this. You purchase an insurance policy that contractually binds an insurance company to pay for your loss in the event of accident. This transfers the financial consequences of the accident to someone else. Your car is still a wreck, of course.
Accept	Low importance risks may not justify any action at all. If they happen, you simply accept the consequences.