Risk Item	ID	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
Cannot get ProMetal powder	**1**	Test results cannot be directly related to ProMetal process	ProMetal wont provide powder or not given enough leadtime to provide it	1	2	2	Contact ProMetal / Find Replacement powders	Team
Cannot get ProMetal binder	**2**	Test results cannot be directly related to ProMetal process	ProMetal wont provide binder or not given enough leadtime to provide it	2	2	4	Research alternative binders compatible with metal powders	Matt
Run out of ProMetal supplies	**3**	Cannot finish relating test results to ProMetal process	Careless with supply of powder/binder	1	2	2	Test with ProMetal powder/binder only when necessary, contact ProMetal to determine availablility of extra supplies	Team
Project goes over budget	**4**	Cannot complete project	Parts are too expensive	1	2	2	Research alternate suppliers for parts	Team
	5	Cannot complete project	Design includes too many high price items	1	2	2	Utilize alternative designs using cheaper parts	Team
Ordered parts do not arrive in time	**6**	Design cannot be assembled	Wrong part ordered	1	2	2	Maintain contact with suppliers / order parts as soon as need is recognized	Team
	7	Design cannot be assembled	Supplier send the wrong part	2	2	4	Maintain contact with suppliers / order parts as soon as need is recognized	Team
	8	Design cannot be assembled	Late ordering, unreliable supplier	2	2	4	Maintain contact with suppliers / order parts as soon as need is recognized	Team
	9	Design cannot be assembled	Delayed for weather	2	2	4	Maintain contact with suppliers / order parts as soon as need is recognized	Team
Wrong parts recieved	**10**	Design cannot be assembled	Team member orders wrong part	1	2	2	Have another member check order before sending, call suppliers as soon as errors are recognized	Team
	11	Design cannot be assembled	Supplier sends wrong part	2	2	4	Contact supplier as soon as parts are received to begin exchange process	Team
Cannot assemble the design	**12**	Cannot complete project	Interference between parts in design	1	1	1	Use 3D CAD modeling to ensure there are no intereferences between parts	Nick
Lifting mechanism binds	**13**	Cannot create multiple layers of powder	Lifting screws not synchonized properly	2	3	6	Design lifting screws with timing belts to ensure synchronous motion	Nick & Chris
Motor is too weak to move build platform	**14**	Design is not completed, failure to satisfy customer needs	Insufficient research into available Fab@Home parts, failure to order new parts if needed	1	3	3	Determine compatibility of Fab@Home parts, order larger motor if needed	Nick & Chris
No motor control	**15**	No motor control	Wrong wiring	1	2	2	Research motor control	Chris
	16	No motor control	Control software not designed properly	1	2	2	Research motor control	Chris
Build platform step is larger than marginal value	**17**	System fails to satisfy customer needs	Insufficient research into available Fab@Home parts, failure to order new parts if needed	1	3	3	Determine compatibility of Fab@Home parts, order new leadscrew if needed	Chris
Parts break	**18**	Cannot finish assembly, need to reorder/remachine parts	Poor design and insufficient analysis	1	2	2	Use FEA to analyze critical load bearing parts and design to avoid braekage	Nick
Powder density is not even throughout test specimen	**19**	Failure to satisfy customer needs	System is poorly designed	2	2	4	Build early, allow room for error	Team
	20	Failure to satisfy customer needs	System is not an improvement to ProMetals'	2	2	4	Follow through with risk assessment, early testing	Team
	21	Failure to satisfy customer needs	Testing procedure is not accurate	2	2	4	Accurate testing procedure, validate results	Carlos
Powder layer is uneven thickness	**22**	Spreader creates curved surface	Deflection of spreader	1	3	3	Use FEA to analyze spreader and design to avoid large deflection	Nick
	23	Powder is unevely distributed	Spreader head is not parallel to build platform	1	3	3	Take extreme care when mounting spreader head to ensure parallelism	Team
System cannot maintain accurate spreading depth	**24**	Cannot properly create test specimens	Deflection in spreader supports	1	2	2	Use FEA to analyze spreader supports and design to avoid large deflection	Nick
	25	Cannot properly create test specimens	Deflection in build platform and supports	1	2	2	Use FEA to analyze build platform and design to avoid large deflection	Nick
Surface is too rough for printing	**26**	System fails to satisfy customer needs	Poor choice of spreading/smoothing method	1	3	3	Test smoothing methods before choosing final concept	Jay

Risk Item	ID	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
Powder separates by size of particle	**27**	Becomes very difficult to spread layers of even density	Varied particle sizes in provided powder	2	2	4	Mix powder extensively before/during spreading	
Binder is too weak to hold powder together	**28**	Difficult/impossible to evaluate effectiveness of design	Cannot get ProMetal binder, alternative binder sources not researched	1	3	3	Research and test alternative binders to ensure metal powder compatibility	Matt
Test specimen crushes when picked up	**29**	Cannot evaluate specimen under microscope	Binder hold strength is too weak	2	2	4	Handle specimen as little as possible, build on a plate to ease transfer	
	30	Cannot evaluate specimen under microscope	Rough handling when transferring specimen	2	2	4	Handle specimen as little as possible, build on a plate to ease transfer	
	31	Cannot evaluate specimen under microscope	Insufficient time to let the binder cure	2	2	4	Allow sufficient cure time	
Cannot attach Ultrasonic Atomizer to powder trough	**32**	Cannot accurately spray binder, poor testing possibilities	Poor design of trough	1	2	2	Use correct material, lot of time spent on integrating binding application with rest of system	Matt
UA moves when being used	**33**	Cannot accurately spray binder, poor testing possibilities	Not attached correctly, poor design of trough	1	2	2	Use correct material, lot of time spent on integrating binding application with rest of system	Matt
Cannot Accurately control binder spray	**34**	Poor testing possibilites, part is not built correctly	Viscosity of liquid, not wired correctly	3	2	6	Testing and learning how to control UA	Matt
Trough door doesn't open	**35**	Powder cannot be spread	Spring (s) is too stiff or motor is too weak	2	2	4	Size motor and spring as close as possible, leaving some room for adjustability	Jay
Trought door won't stay closed	**36**	Powder is wasted; trough is rendered useless	Spring (s) is too weak	2	2	4	Size spring as close as possible, leaving some room for adjustability	Jay
Spreader head is too heavy (large deflection)	**37**	Trouble controlling density variation	Poor material selection or too much powder in hopper	2	2	4	Choose lightweight materials such as acrylic vs. steel	Jay
Powder gets clogged in hopper	**38**	Uneven or no powder distribution	Compacted powder in hopper before exit	1	2	2	Don't overlaod the hopper	Jay
Flapper doesn't open consistently	**39**	Trough doesn't spread powder consistently	Brass bearings aren't properly aligned	1	2	2	Keep components level and aligned properly when assembling/manufacturing	Jay