Risk Category	Risk Item	ID	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
Binder	Binder is too weak to hold powder together	1	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
Binder	Run out of binder in middle of testing	2	Failure to satisfy customer needs	Don't have enough binder, waste binder	1	2	2	Calculate volume needed and obtain enough binder	Matt
Binder	Test specimen crushes when picked up	3	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	Team
Binder	UA drips binder when not in use	4	Cannot build accurate test specimens, waste binder	Air getting into the tubing	3	1	3	Seal the tubing	Matt
Budget	Project goes over budget	5	Failure to satisfy customer needs	Parts are too expensive	1	2	2	Research alternate suppliers for parts	Team
Budget	Project goes over budget	6	Failure to satisfy customer needs	Design includes too many high price items	1	2	2	Utilize alternative designs using cheaper parts	Team
Budget	Project goes over budget	7	Failure to satisfy customer needs	High price items	2	2	4	Ask for increased budget	Chris
Communication	Cannot assemble the design	8	Cannot complete project	Interference between parts in design	1	1	1	Use 3D CAD modeling to ensure there are no intereferences between parts	Nick
Communication	Wrong parts recieved	9	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
Communication	Wrong parts recieved	10	Design cannot be assembled	Supplier sends wrong part	2	2	4	Contact supplier as soon as parts are received to begin exchange process	Team
Mechanical	Cannot attach Ultrasonic Atomizer to powder trough	11	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
Mechanical	Flapper doesn't open consistently	12	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
Mechanical	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
Mechanical	Lifting mechanism binds	14	Cannot create multiple layers of powder	Guide rails aren't parallel	1	3	3	Have solid supports and secure fastenings	Chris
Mechanical	Motor is too weak to move build platform	15	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
Mechanical	No motor control	16	Failure to satisfy customer needs	Wrong wiring	1	2	2	Research motor control	Chris
Mechanical	No motor control	17	Failure to satisfy customer needs	Control software not designed properly	1	2	2	Research motor control	Chris
Mechanical	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
Mechanical	Platform doesn't hold up consistantly	19	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
Mechanical	Powder density is not even throughout test specimen	20	Failure to satisfy customer needs	System is poorly designed	2	2	4	Build early, allow room for error	Team
Mechanical	Powder gets clogged in hopper	21	Uneven or no powder distribution	Compacted powder in hopper before exit	1	2	2	Don't overlaod the hopper	Jay
Mechanical	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
Mechanical	Spreader head is not mounted correctly	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
Mechanical	Spreader head is too heavy (large deflection)	24	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
Mechanical	System cannot maintain accurate spreading depth	25	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
Mechanical	Trough door doesn't open	26	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
Mechanical	Trough door won't stay closed	27	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
Mechanical	UA moves/rattles when being used	28	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
Scheduling	Build platform step is larger than marginal value	29	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 new leadscrew if needed	Chris
Scheduling	Cannot get model built in time	30	Failure to satisfy customer needs	Ordered parts do not arrive on time	1	3	3	Maintain contact with suppliers / order parts as soon as need is recognized	Team
Scheduling	Cannot get model built in time	31	Failure to satisfy customer needs	Not enough time allowed for troubleshooting	2	3	6	Build model early to allow for more troubleshooting	Team

Risk Category	Risk Item	ID	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
Scheduling	Cannot get model built in time	32	Failure to satisfy customer needs	Major system failure	2	3	6	Maintain contact with suppliers / order parts as soon as need is recognized / order the right parts	team
Scheduling	Cannot get ProMetal binder	33	Poor testing possibilities	ProMetal not given enough leadtime			0	Contact ProMetal early	Cormier
Scheduling	Cannot get ProMetal powder	34	Poor testing possibilities	ProMetal not given enough leadtime	1	2	2	Contact ProMetal early	Cormier
Scheduling	Ordered parts do not arrive in time	35	Cannot build model	Wrong part(s) ordered	1	2	2	Maintain contact with suppliers / order parts as soon as need is recognized	Team
Scheduling	Ordered parts do not arrive in time	36	Cannot build model	Supplier sends the wrong part	2	2	4	Maintain contact with suppliers / order parts as soon as need is recognized	Team
Scheduling	Ordered parts do not arrive in time	37	Cannot build model	Late ordering, unreliable supplier	2	2	4	Maintain contact with suppliers / order parts as soon as need is recognized	Team
Scheduling	Ordered parts do not arrive in time	38	Cannot build model	Delayed for weather	2	2	4	Maintain contact with suppliers / order parts as soon as need is recognized	Team
Scheduling	Parts are not machined	39	Cannot build model	Failure to machine many parts weekly	3	3	9	Maintain strict schedule for part machining	Team
Testing	Cannot accurately control binder spray	40	Cannot accurately spray binder, poor testing possibilities	Viscosity of liquid, other binding factors	3	2	6	Testing and learning how to control UA	Matt
Testing	Cannot acurately test part	41	Failure to satisfy customer needs	Testing procedure is not accurate	2	2	4	Accurate testing procedure, validate results	Carlos
Testing	Cannot acurately test part	42	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	Team
Testing	Cannot acurately test part	43	Cannot evaluate specimen under microscope	Insufficient time to let the binder cure	2	2	4	Allow sufficient cure time	Team
Testing	Cannot get ProMetal binder	44	Test results cannot be directly related to ProMetal process	ProMetal wont provide binder	2	2	4	Research alternative binders compatible with metal powders	Matt
Testing	Cannot get ProMetal powder	45	Test results cannot be directly related to ProMetal process	ProMetal wont provide powder	1	2	2	Find Replacement powders	Team
Testing	Powder separates by size of particle	46	Becomes very difficult to spread layers of even density	Varied particle sizes in provided powder	2	2	4	Mix powder extensively before/during spreading	Team
Testing	Run out of ProMetal supplies	47	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
Testing	Surface is too rough for printing	48	System fails to satisfy customer needs	Poor choice of spreading/smoothing method	1	3	3	Test smoothing methods before choosing final concept	Jay