MSD II Phase II Project Progress Review Agenda

Overview of meeting [2 min]

Overview of work done [10 min]

- Action items from Phase II
  - Working Model
  - Failure Modes Table: Customer Workaround
  - Control Diagram
  - Walking Distance vs. Steps
- Budget Tracking
- Changes to ER

Red Items [0 min]

- None

Yellow items [20-40 min]

- Upper Brace
- SD Card

Green Items [5-15 min]

- Administration
  - Updated Risk List
  - Updated Problem Tracking
- Mechanical
  - LCH Redesign
  - Slow Motion Deflection
  - Dorsiflexion Mobility: Lift Test
  - Comfort and Application Test
- Electrical Systems

Demo [10 min]

Summary of meeting [10 min]

- Action items
- Week 8 shared vision

Action Items - MSD II - Week 2 and Guide meeting -Week 4					
Item #	**Description**	**Responsible**	**Due Date**	**Close Date**	**Comments**
CM01	Develop a Working Model with sensitivity analysis and better understanding of importance.	GG/JG	Wk5	Wk4	JG's computer
A001	Redesign fasteners for 3D printed part	JG/TL	Wk5	Wk4	Threaded inserts
A002	Customer workarounds on failure table	TL	Wk5	Wk4	Think about it
A003	Research Autodesk Force Effect Motion	AP/GG	Wk5	Wk5	And try 123D Catch
A004	Edit end state shared vision	ME	Wk5	Wk3	Title and Nazareth nicety/ user feedback
A005	Control diagram for strap design	GG	Wk5	Wk4	Don't get hit by a bus
A006	Brainstorm wiring securement LCH	JG/ME/ NS	Wk5	Wk3	Add to problem tracking
A007	Test muscle above max operating psi	NS/TL	Wk5	Wk4	Find portable compressor
A008	Design lid for LCH IR sensor	JG/TL	Wk5	Wk4	Customer recommended
G001	Wrap up working model with recommendations	JG/NS	Wk5	Wk4	Put a bow on it
G002	Control diagram for strap design roughly 3/4"	GG	Wk5	Wk5	
G003	Find working distance vs. steps	NS	Wk5	Wk5	
G004	SD Card to problem tracking	ME	Wk5	Wk5	
G005	Left foot vs. right foot BOM analysis		Wk11		Not urgent

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rqmt. #	Importance	Source	Function	Engr. Requirement (metric)	Unit of Measure	Ideal Value	Marginal Value	Direction of improvement:	Comments/Status	Test (how are you going to verify satisfaction)
ER1	9	S1,CF1,CF2	Mechanical	Pressure to leg of AFO	mmHg	20	40	▼	0.39 and 0.77psi	pressure sensor
ER2	3	S1,CF4		Design failure factor of safety	FOS	1.3-1.8	1.3-4	X	Test whole muscle. Failure can be deflection	stress test
ER3	2	S1,CF4		Average skin temperature increase from use	°F	1	3	▼	compared to other comprssion socks/rigid orthotic	thermocouple
ER4	9	FT1,FT3,ST5		Torque to lift foot by Mckibben air muscle	Ft-lbs	3.7	2.2	▲		mechanics test
ER5	3	FT2,FT3		Dorsiflexion mobility with Mckibben air muscle	degrees	50	30	▲	We may not meet this	protractor
ER6	3	P1		Number of muscle flexes untethered	#	1500	1000	▲		tank life test
ER7	9	S2,D2	Electrical	Battery in water repellant case	IP Code	54	54	X	5-solid object, 4-water	Ingress protection code (IP)
ER8	9	S1,S2,D2		Sensors/controls water repellant	IP Code	54	54	X	5-solid object, 4-water	Ingress protection code (IP)
ER9	9	S1		Immediate max current	mA	200	400	▼		multimeter
ER10	3	P1		Time between charges	hours	8	6	▲		batteries used
ER11	3	ST3		Response time of Terrain Sensor	ms	100	200	▼		timer in microcontroller
ER12	9	ST1,ST2,ST4		Percentage of time object detected by sensors	percentage	90	80	▲		ruler
ER13	3	C3	Wearability	Average Time to put on AFO	min	3	5	▼		timer
ER14	9	FT4		Weight of AFO on leg	lbs	1	2	▼		scale
ER15	9	FT4		Weight of total AFO	lbs	8	13	X	includes compressed air	scale
ER16	9	CF1,CF5		Difference in knee flex	degrees	0	0	X		protractor
ER17	1	CF1,CF6		Aesthetically pleasing	Better/Same/Worse	Better	Same	▲	Comapred to old project	survey
ER18	9	CF1,CF7		Total running noise	dB	<40	<60	X	Measured by User	db sensor
ER19	9	C1		Added foot width	inches	0.19685	0.295	▼		measure
ER20	1	FT5		Audible Low Battery Alert	dB	70	100	X		db sensor
ER21	1	C4		Easy to interface system	1-5 scale	1	3	X	Done in Survey	survey

Problem Tracking

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	Identifying & Selecting Problem PSP 1	Analyzing Problem PSP 2	Generating Potential Solutions PSP 3	Selecting & Planning Solution PSP 4	Implementing Solution PSP 5	Evaluating Solution PSP 6	Owner
Rating	R1	R2	R3	Y4	Y5	G6	
CRITICAL	Muscle hold state will be inadequate to provide passive support	Muscle experiences small leaks	Redesign passive support method Implement loctite				Noah/Tyler
	Upper brace absorbes valuable strain during foot-lift	The root cause is that there is too much elasticity between the upper base and the upper strap.					Noah
MAJOR	Properly timing the articulation of the muscle.	We are currently using two presure sensors for stair identification, these could be used to identify location in the gait.	Adapting gait monitoring system to response on heelstrike and toe strike and not a precentage of the gait				Megan
	Correct terrain identification across users.	Consistancy is not seen aross user because the sensor is at a different location	This could be corrected during fitting by adjusting the threshold level in the code				Megan
	Ribbion wire connections may fail if snagged	The ribbion wire attachment in the lower component hoousing (LCH) is not robust mechanically	Ensure that the air hose length is less than the ribbion wire length, use a quick connector inside the LCH, redesign the LCH to secure the wires via O-ring pressure	Our plan is to redesign the LCH in such a way that the O-ring will apply pressure to the ribbion wires, we also plan to keep the air hose shorter than the ribbion wire supply line	The LCH was redesigned to the wire connections to the PCB leave the housing at a downward angle, ensuring the will not become disconnected. Also, the wires leave the housing through channels that seal with the lid connection, applying pressure so the wires won't snag		Tyler
	The lower PCB board is not properly sealed off from the environment	The lower PCB board component housing cavity, which contains the PCB, is not propoerly sealed off from the enviroment at all connection locations, which may impact the ingress protection requirement	Ensure O-Rings present wherever possible, ensure lids fit as closely as possible, use heat shrink on all wire connections	Our plan is to redesign the LCH in such a way that all connection locations and possible locations that debris could impact the board will be sealed off, in conjuction with the ribbon wire redesign	The LCH was redesigned with a additional second lid to cover the cavity that holds the IR sensor. Both the IR sensor and PCB lids have O-Rings present. The channels with the wires leaving the housing will be sealed off from the O-Ring		Tyler
	SD Card Functionality	The specific problem that would cause the SD card to not work is not yet known. Conectivity, levels, cold joints, and the program has been tested. Timing and SD card formating still remain to be tested.	By an externally fabricated SD card breakout board. Conect this to the current board.				Megan
ORDINARY	Weight of the AFO	Systems have not been optomized for weight saving, especially power.	Optomizing sub systems like power to achieve oue engineering requirements and reduce weight.				Adam
	Placement of Lower Attachment Strap	Strap interferes with adjustment of Velcro strap and makes it more difficult for users to put on and take off	Replace fishing line attachment with a strap Adjust length and orientation of attachment strap	Our plan is to implement an A-shaped strap that allow users to apply the AFO easier.	An A-shaped strap fixture has been implemented in lui of the fishing line attachment method.		Geni
	Full Day's Use	Air tank does not provide enough air to last for a full day's use	Reduce muscle size Purchase larger air tank	Selecting a larger tank that is composed of carbon fiber	Perform calculations that would verify that the larger tank would last for an entire day's use based on physical test with current tank		Noah
	Power Source	Source runs low too early or not enough current is drawn	Drain the battery to help analyze its power				Jared
ADDRESSED	Comfort of the AFO	Discomfort, near base of big toe bone, is felt by user when force is applied to lower part of AFO	Implement soft material as cusion Change the angle at which strap is attached at	Change the angle at which strap is attached at. Strap is currently sewn at 0 degrees of attachment point. Calculate an appropriate angle and make necessary adjustments	Sewed strap at 45 degrees of attachment point.	Three of the six team members have worn the device and completed the comfrot survey. The average comfort rating was at 1 out of a 0-10 pain scale with 0 being no pain and 10 being the worst amount of pain.	Geni
	Muscle strain will not provide required displacement	The root cause is that the required strain may be more than our optimized tank and muscle can deliver. Our AFO may also be a source of more strain than expected.	Perform additional testing to determine actual strain requirments. Brainstormed ideas inclue using a wider muscle, different sleeving, pulleys.	Our plan is to perform strain testing in MSD II phase I & II to find true strain requirments. We also plan to develop a Working Model kinematic simulation. If necessary we will build a wider muscle as advised by our customer.	A slow motion deflection video was made to find the required strain during the gait cycle Working model simulation was started. Preliminary integrated testing was performed to determine other sources of strain.	Slow motion deflection video found the required strain to be approx. 1 inch. Working model has the capacity to make similar calculations but has a steep learning curve. Preliminary integrated testing resulted in foot lift, but upper brace strain was noticed.	Noah

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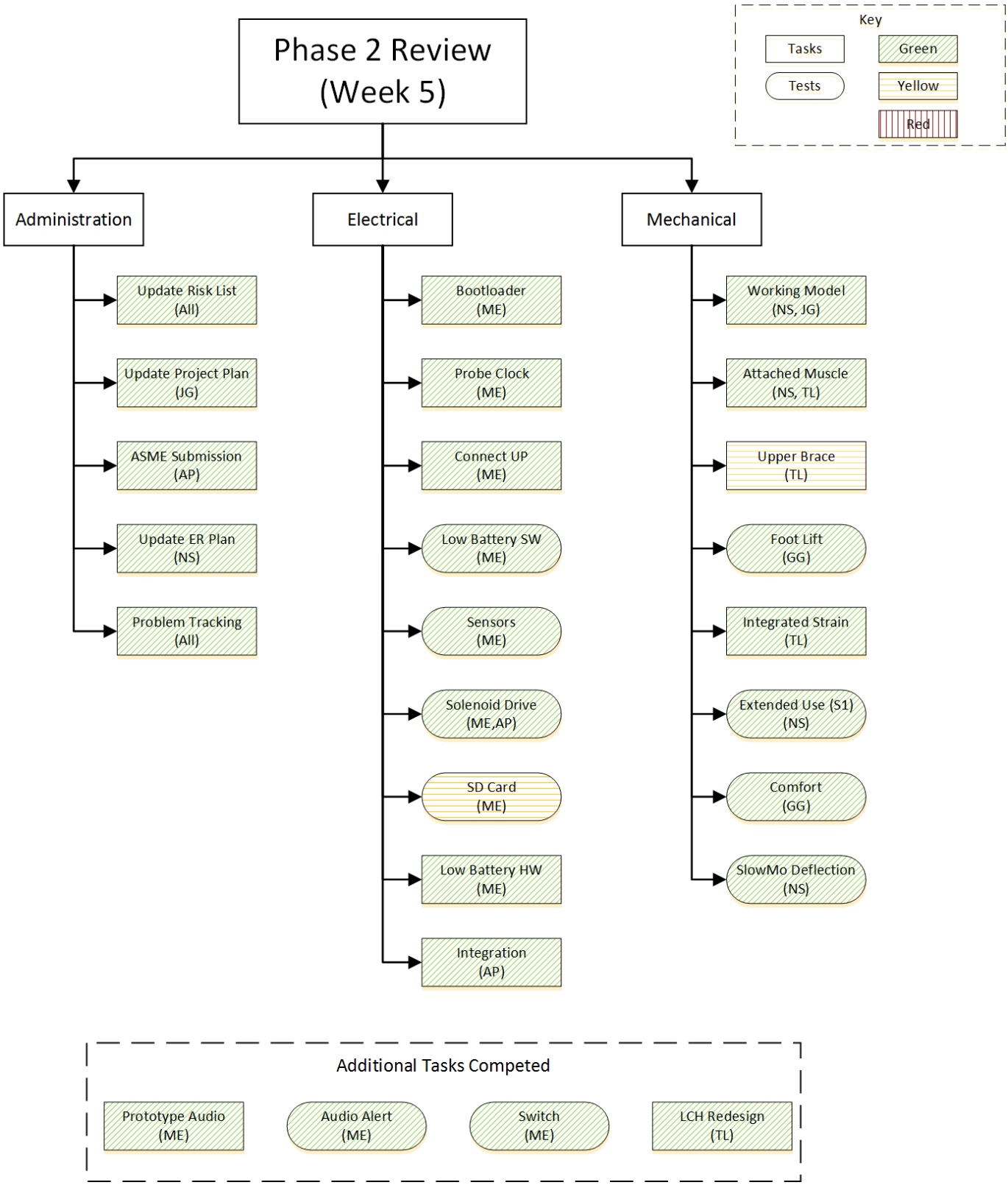

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