MSD-1 Interview Questions: 8/26/14

Intro Q's:

What are your expectations for this project?

-Functioning extrusion device capable of extruding high temperate plastics in pellet form

-Temperature feedback

Are there project specific time constraints, deadlines that we should be aware of (outside the Senior Design timetable)?

-No but it should be demonstrated at Imagine RIT

Besides yourself, who are other stakeholders in this project?

Who will be using this device/ technology?

-Starting next year, it could be used in the 3D printing classes, student design, MSD, industrial design, etc.

What are your priorities for this project?

Should have temperature control – avoid over heating polymers

In terms of deliverables, can you tell us the level of importance of customer needs from absolutely essential to "this would be *nice* to have"?

-See customer requirement sheet

Is there an Initial concept you have in mind? (Preconceived notions of a solution)

-Screw extruders, pushed to a hot barrel

-Having external power is okay, but it should still be used with the Makerbot controller

-Screw jamming is an issue to be addressed

-Micro extrusion screw is a good possibility – may be expensive

-Twin screw extruder – variable pitch and flight

-Look into machining one at the machine shop

Current solution Q's:

What are the particular problems associated with filament printing today?

-Soft filaments are difficult to successfully feed – very finicky

-Open architecture machines (Makerbot) when you change from one filament to another you get build up and it clogs the nozzles

-Want interchangeable nozzles because you'll want a bigger bead of plastic sometimes (carbon fiber – extremely high strength in the direction they are aligned)

-high temp materials can't be used

Where can we view, measure, tinker, with existing print heads and 3D printers? Are we given a 3D printer to use?

-the electronics that drive most of the makerbots are pretty standardized (read rumba/Rambo – control board that we can purchase with 5 or 6 motions for the stepper motors – temperature pins), USB attachment (repiter – free software will communicate through a USB)
-just build the printer head – power the heater, 12v for fan, temperature feedback and stepper motor control
-will provide us a microcontroller board
-need enough power to drive whatever stepper motor we've chosen – compatible with driver on the board (can do a gear motor)

Can we see the pellets that we will be working with?

One major risk associated with this project has to do with heat management. How do the best printers currently manage heat? What has been the most effective means of heat isolation and management?
-key trick with heat management do not want heat to travel back up to pinch rollers that are within the filament printer head right now – do not want heat to travel up (want to thermally isolate the heater barrel from the screw auger)
-we want to somehow want to make sure the heat does not travel back up – need to isolate it (ceramic isolator that doesn't conduct or we have active cooling, etc.)
-NOZZLE CHANGE: as the plastic is cooled down people will push a piece of wire to push through the extra plastic

What kind of electrical interfaces will we encounter (wiring, coils, circuits, etc.)?
-Rumba or Rambo and look at what voltages/amps are available for heating, stepper motor etc.

Do you require a hopper system for the plastic?
-Carry plastic around or have just enough for a certain amount and periodically add more
-gravity fed plastic through pipes in a hopper on the machines
-make note in your final report that we should dry our pellets before we use the 3d printer so that they don't boil

How much lead time will you need from us if we would like to run an experiment?
-a day before – schedule a time to show us how to use the makerbot

What kind of documentation are you looking for? (i.e. operation manual; 1 pg, 10 pg, 20pg)?
-key things – documentation that we turn in, view that from the prospective of the open source community (would we be able to build the extrusion head itself from the instructions)
-cad models and materials
-manual on how to operate (wiring printer head to standard makerbot to circuit boards)
-makerbot uses arduino but has standard outside drivers (standard 5 motions rumbo)
-focus on 5 motions, but there are ones with 6 motions
-we can control settings with software

If materials need to be changed, what is an ideal changeover time?
-Normally 5 or 10 minutes – not a huge deal as long as it doesn't require special tools or swear words per minute

Future solution Q's:

With ULTEM, PEI, and PPS after the material solidifies, can we reheat it?
-all thermoplastic can be reheated so we won't have to worry about this

Are there any materials we should anticipate using outside of the PRP?
-ULTEM is mentioned the most and he has a 50lb bag so won't have to purchase

What temperature do the printheads operate at currently? and what temperature should we anticipate using with the pellets?
-majority of these plastics are below 300, but higher temp plastics are between 350-380 (look up ULTEM to see what the molding temperature is)
-There are a lot of ways to heat something so we will do a fair amount of research on this topic

With regards to CAD Modeling software, we have experts with different products, should we stick to one specific software?
-we should stick to one software (he knows solidworks really well so we can get help from him)

Research suggestions (i.e. Universities, websites, keywords, other resources)?
-sending us the link for kickstarter, and Dublin
-"Been on a lot of wish lists, not a new thing"

In printer head design, are there any visible trends that you have noted?
-(does not apply to a non-filament based) because these makerbots can use any type of filament and depending on how the filament is made/feeding the pins could just keep spinning and not pick up the filament
-heat management is a huge thing!
-injection molder they have here is a plunger – no screw feed have to plunge reload retract reload have to stop printing in between each time

Closing Q's:

Should we avoid certain pathways that might distract us?
-Struggles with auger systems
    -nobody has used non-uniform pitch screw
    -plunger type system – if velocity can be controlled – retraction might prove difficult, might have to apply pressure from the other side

Best times to contact you? General schedule? Do you have office hours? Can we pick a time to meet weekly with John and yourself?
-Tuesday and Thursday 3-4:30 office hours – most likely meet at 4 pm on Thursdays

Alternate contacts?
-Mike Buffalin – part time in lab and institute hall, 3D printing – contact for use of facilities in Institute Hall
-John Bonzo

Can we gain swipe access to the lab?
-Done already – normal etiquette

What question should we have asked you that we didn't?
-not really

At the end of this year, what will this project look like for you to be content? In order to "wow" you?
-standalone extrusion head is okay
-wow would be incorporated into 3D printer, actually printing
-BFB 3000 machine, other non-makerbot printers to use the head with