**Team PRINT**

12:00pm, 3.2.2020, Ellicott Hall

Tyler Han begins intro

The goal: additive manufacturing solution to in-situ repairs

Research questions:

1. Existing manipulators
2. Extruder modified

Structures

6 DOF would be our best option

UR3e model universal robotic arms

3kg payload

…met with the lab manager already

Extruder

Mixture of premade parts and manufactured tip on campus

3D scanning

Time-of-flight errors in 10’s of mm

Planning

Iso-curves

Software

Testing

Thermal dissipation in extruder tip

Questions from David:

Two things that stuck out:

1. Research group that put oil on the filament…strongly advises against that. Not good to point oil on something that you put through a hot heater. Issues with adhesion.
2. Reference on orientation suggesting 90-deg is strongest and 0-deg is weakest…David says this should be the other way around, i.e. 90-deg should be weakest and 0-deg is strongest

Bouden extruder vs. direct extruder…team says they are set on this extruder

…team says they will mount hot and cold end on the arm

Nozzle shape…David can send pictures of printers that use a long nozzle

…David will send a sample to the team (mailing address?)

When you go to start testing…what are you going to print on?

…what are you going to try and repair?

…team says “probably PLA on PLA”

Question regarding tool path generation

…non-planar slicing has been researched, have some resources available

“How is this not just as good as filling the hole with putty?”

…for e.g. aerospace application, specific layup sequence at location of damage that might warrant need to repair with specific layup sequence

…have you considered carbon fiber PLA?...you could leverage the layup sequence perhaps

…side of aircraft is often composite…a patch might require some specific sequencing/layup

…TAPAS group (Europe?), thermoplastic composite

Carbon-fiber reinforced PLA

Mars rover, mixing metal LA with polymer LA

Consider looking into “Overloading” technique

Questions from Sarah:

3kg is heavy for spaceflight

Would not be able to implement this until 2030 or later

9 steps for something being ready for spaceflight

Maker space in STEM library…how will you make sure the temperature is where you need it to be during the extrusion process

…what are your metrics going to be?...will you have some sort of sensor?

(question of test procedures and associated test metrics)

…pass/fail criteria?

…team plans to have some temperature sensors

Question regarding the “lack of literature” statement in their Prospectus

Questions from Dr. Mitchell

SWaP numbers for your device?

Dimensions of hole

Logistics of arm…is this critical path?

Need more physics of printing…thermal, adhesion, surface stresses, etc.

Scheduling…need some sort of schedule slide…only 2 years to complete this effort

Questions from Kristan:

Budget seems low…you all have some resources that should be available

…beef up the budget

MOU’s vs. purchasing…IP issues/concerns there?

Keep in mind any issues regarding collaboration with outside groups…want to keep it clean if possible

Integration…keep in mind that all subteams need to be using the same units of measure

Think about perhaps an alternative thesis…could have publishable journal papers as independent chapters of your thesis

May need to work with Office of Tech Transfer to discuss any patent concerns…better to do this earlier than later