

Project Title: Multiphysics Characterization of Printed Smart Materials and Systems

Project Period: 07/01/2021 – 06/30/2022

Reporting Period: 07/01/2021 – 12/31/2021

PI: Zhangxian (Dan) Deng

Institute: Department of Mechanical and Biomedical Engineering, Boise State University

1. Summary of project accomplishments for the period just completed and plans for the coming reporting period.

Due to the impact of COVID, the shipment of the proposed MTS system has been delayed a couple of times. Currently, the delivery and installation are scheduled on 02/02/2022, 5 months later than the original plan. The PI has updated the project timeline accordingly (**Table 1**). Even though the proposed instrument is still unavailable, the PI has completed sample preparation, collected preliminary data, and submitted long-term proposals in the past reporting period. Achievements and future plans associated with each proposed task are presented in detail below.

Table 1 Original (grey) and updated (yellow) project timeline.

Task No. and Deliverables	Schedule												
	Q1			Q2			Q3			Q4			
1: Procurement & installation of the system	Grey	Grey	Grey					Yellow					
2: Training videos & standard test procedures			Grey	Grey				Yellow	Yellow				
3: Thermomechanical cycles of PLA/TPU				Grey	Grey	Grey	Grey		Yellow	Yellow	Yellow		
4. Young's modulus data of Galfenol						Grey	Grey	Grey	Grey	Grey	Grey	Yellow	
5. A full proposal ready for submission				Yellow	Yellow	Yellow						Grey	Grey

Task 1 & Task 2

Nothing to report.

Task 3

Achievement: (a) The PI's lab has printed dogbone samples of shape memory polymers (SMPs) using a fused filament 3D printer. In collaboration with Dr. Brian Jaques from the Micron School of Materials Science and Engineering at Boise State University, this team has preliminarily measured the thermomechanical loops of printed SMPs. The PI has identified the required force and temperature ranges for this type of tests. (b) The PI has initiated collaboration with Dr. Harish Subbaraman from the Department of Electrical and Computer Engineering at Boise State

and completed dielectric constant measurement of the printed SMPs. They have designed morphing antennas using the printed SMPs.

Plan: (a) The PI will use the SMP dogbone samples to conduct the onsite training. (b) The PI will publish the characterization result together with the morphing antenna prototypes on an IEEE journal.

Task 4

Achievement: (a) The PI received \$1,800 from the CAES Senior Design Grant Program to purchase magnetostrictive iron-gallium alloys (Galferol) samples. (b) In collaboration with Dr. Joshua Daw from the High Temperature Test Laboratory at Idaho National Laboratory and Dr. Dylan Mikesell from the Department of Geosciences at Boise State University, the PI has submitted a proposal titled “Multiphysics mechanics of magnetostrictive materials” to NSF Program of Mechanics of Materials and Structures (MoMS). This proposal is currently under review. The PI plans to use the proposed MTS load frame to characterize the temperature- and magnetic-dependent Young’s modulus of Galferol.

Plan: (a) The PI will complete the strain-stress loop measurements of the Galferol rod sample from room temperature to 200 Celsius by the end of this proposal.

Task 5

Achievement: (a) The PI has submitted a preproposal titled “On Demand Manufacturing of Smart Systems for Structural Health Monitoring” to the Idaho NASA EPSCoR office. This preproposal has been selected for National NASA EPSCoR competition.

Plan: (a) The PI’s group will lead the full proposal submission to the National NASA EPSCoR program by February, 2022. The PI will purchase a digital image correlation system for the proposed MTS system to enable contactless strain measurement.

2. Summary of budget expenditures for the period just completed

A total of \$85,358.82 has been spent to purchase the MTS system. The remaining \$14,641.18 will be used to hire a MS student in spring 2022 and summer 2022. More details of the budget expenditures can be found in the spreadsheet included in this submission.

3. Numbers of faculty and student participation resulting from the funding

Nothing to report

4. Patents, copyrights, and Plant Variety Protection Certificates received or pending

Nothing to report

5. Technology licenses signed and start-up businesses created

Nothing to report

6. Status of private part/industry partnerships

Nothing to report

7. Additional funding received and financial burn rate

Nothing to report

8. Any other pertinent information

Nothing to report

Title: Multiphysics Characterization of Printed Smart Materials and Systems
Award # 3742013
Fund 1850
Dept 13000
Cost Center 1001004
Project 2000002083

Start Date: 7/1/2021
End Date: 6/30/2022

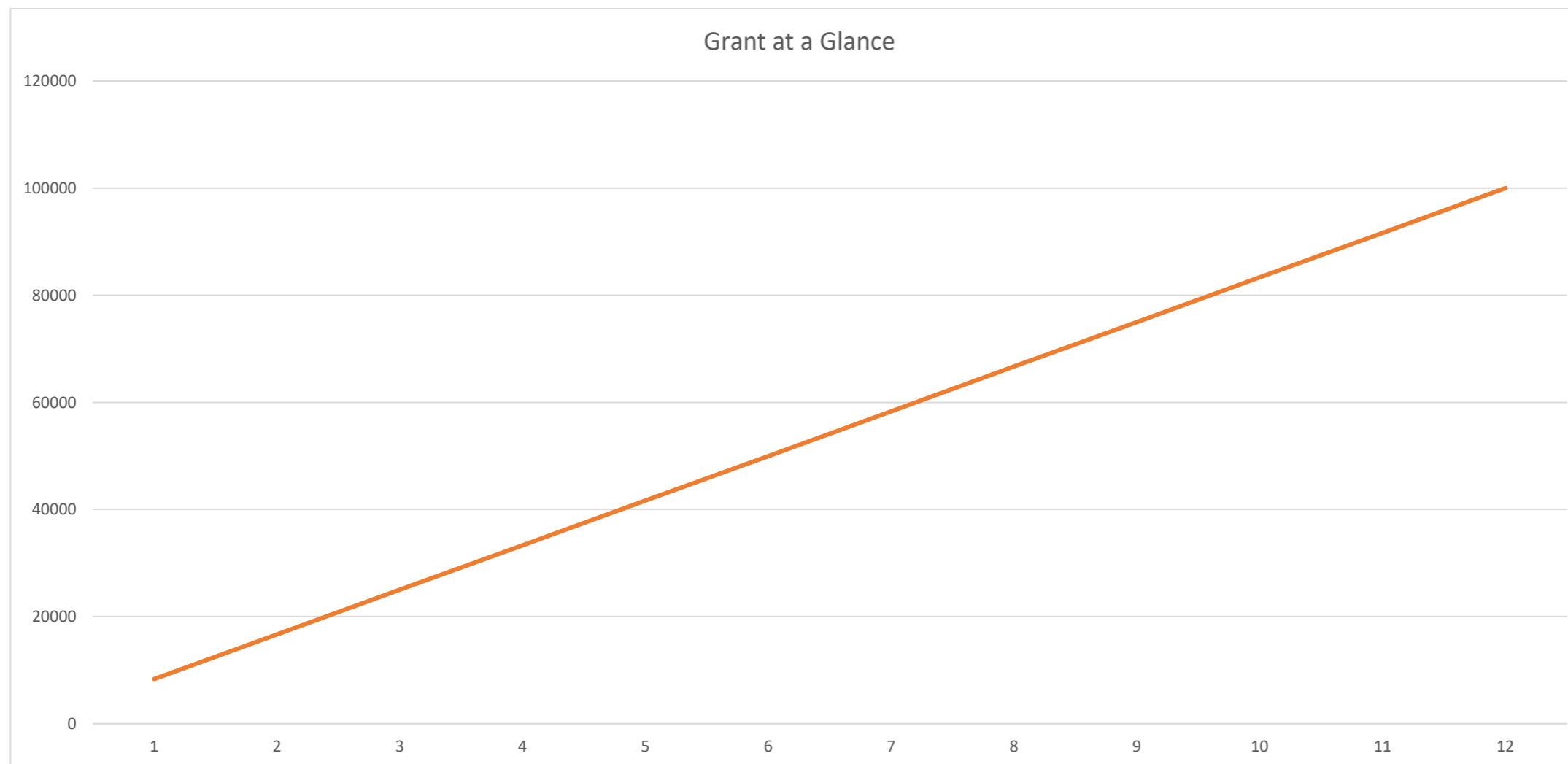
OSP # 9937
Award Files

Projection as of: 12/20/2021
Updated by: Jason Papka

PI: Dan Deng
Sponsor: Idaho State Board of Education

	Original Budget	PPM Budget	Life To Date Expense	Encumbered	Remaining Budget	% Remaining	Projected	Est Remaining Budget	% Remaining
Reg Sal		\$ -	\$ -	\$ -	\$ -	-	\$ -	\$ -	-
Irr Sal		-	-	-	-	-	-	-	-
Sum Sal		-	-	-	-	-	-	-	-
Stu Sal	\$ 12,206.00	12,206.00	-	-	12,206.00	100%	-	12,206.00	100%
Fringe	\$ 2,260.00	2,260.00	-	-	2,260.00	100%	-	2,260.00	100%
OE		-	-	-	-	-	-	-	-
Travel		-	-	-	-	-	-	-	-
Capital	\$ 85,534.00	85,534.00	-	85,358.82	175.18	0%	-	175.18	0%
Subcontracts		-	-	-	-	-	-	-	-
Student Costs		-	-	-	-	-	-	-	-
Total Direct	\$ 100,000.00	100,000.00	-	85,358.82	14,641.18		-	14,641.18	
F&A		-	-	-	-	-	-	-	-
Totals	\$ 100,000.00	\$ 100,000.00	\$ -	\$ 85,358.82	\$ 14,641.18	15%	\$ -	\$ 14,641.18	15%

F&A Type:
 F&A Rate:



[Refresh Data](#)
[Update Graph](#)
Total Budget
Monthly Expenses

