

LEVEL:	Middle School/High School	
NUMBER OF TEAMS:	One (1) team per school can participate at the MESA Day state competition. Three (3) teams can participate at MESA regional events.	
TEAM MEMBERS:	Two (2) to Four (4) Students per team	
OBJECTIVE:	Students will use the Human Centered Design model to design a 3D printed solution to meet a need of a member of their community.	
	Students will give a 5-8 minute pitch to a panel of judges that will include a question and answer period to discuss their design process and testing.	
MATERIALS:	3D printed object(s) must be made of ABS or PLA plastic.	

BACKSTORY:

Human-Centered Design is an approach in engineering that focuses on people and their specific needs. According to IDEO.org (http://www.designkit.org/human-centered-design), "Human-centered design is all about building deep empathy with the people you're designing for..." IDEO further suggests that Human-Centered Design consists of three phases.

- 1. Inspiration Engineers learn directly from their client in order to deeply understand their needs.
- 2. Ideation Analysis of what is learned from the client leads to design ideas and possible prototypes.
- 3. Implementation building of the final proposed solution knowing that it meets the needs of your client.

Additive Manufacturing (AM) is an appropriate name to describe the technologies that build 3D objects by adding layer-upon-layer of material, whether the material is plastic, metal, concrete or one day....human tissue. Common to AM technologies is the use of a computer, 3D modeling software (Computer Aided Design or CAD), machine equipment and layering material....

The term AM encompasses many technologies including subsets like 3D Printing, Rapid Prototyping (RP), Direct Digital Manufacturing (DDM), layered manufacturing and additive fabrication. AM application is limitless. Early use of AM in the form of Rapid Prototyping focused on preproduction visualization models. More recently, AM is being used to fabricate end-use products in aircraft, dental restorations, medical implants, automobiles, and even fashion products.

- <u>http://additivemanufacturing.com/basics/</u>



DESIGN PARAMETERS

- 1. Designs will be:
 - a. Designed using a CAD program.
 - b. Designed by students
 - c. Designed to meet the need of a community member.
- 2. All dimensions must be in millimeters (mm) in the design.
- 3. The maximum size of the design is $150 \times 150 \times 150$ mm total.
- 4. The design must be of student design.
- 5. Teams will prepare a "sales" pitch to demonstrate their design and convince a panel of judges that their design meets the needs of their client.

SPECIFICATION CHECK:

- 1. Immediately upon submission for competition, designs will receive a specification check to determine whether it conforms to material and design parameters. Any design which fails the specification check will be given a performance score of zero. Designs may not be modified for competition.
- 2. Designs must be ready for presentation prior to inspection. If designs are disqualified during inspection check, design changes will not be allowed. Only designs passing inspection will be allowed to participate in the presentation.
- 3. During specification check, teams will check in to the competition area and submit their design and Engineering Design notebook for impounding.
 - a. Essential components or scored components of the Engineering Design Notebook will be listed and included in a rubric on the reverse side of the score sheet.

TESTING PARAMETERS:

- 1. At least two (2) team members are required to be present during the pitch.
- 2. Teams should arrive at least 10 minutes before their pitch time to retrieve their designs from impound and prepare for their pitch. Designs must be present during the pitch.
- 3. When the judges are ready, they will ask the teams to begin.
- 4. When the pitch beings, judges will start the timer and notify teams when there is one (1) minute remaining and thirty (30) seconds remaining.
- 5. Teams that go beyond the 8 minute time will receive a 5 point deduction.
- 6. Judges will have the option of asking questions for clarification to assist with scoring.

SCORING CRITERIA:

- 1. Teams will be judged on:
 - a. Designed Accessory (50 points max)
 - i. Demonstration
 - ii. Product look, feel, and functionality
 - iii. Advantages of Solution
 - iv. Originality of the Design
 - v. Challenges and Solutions
 - b. Pitch of the Accessory (50 points max)
 - i. Client and Problem Description
 - ii. Proposed Solution
 - iii. Human Centered Design
 - iv. Advantages of Solution



- v. Presentation
- c. Engineering Notebook (Multiplier)
- 2. Teams will be judged on their pitch of their design, see score sheet for details.
- 3. The Final Score will be determined by multiplying the Performance Score by the Notebook Multiplier (N).
- 4. The Performance Score will be determined by adding together the points received for the Design and Pitch.
- The Notebook Multiplier will be determined by dividing the notebook score by the maximum points. (25 point maximum) If team does not submit a notebook their notebook multiplier will be .10. For example, if a notebook receives 20 points. The notebook multiplier will be .80 (20/25).



School:_____

Student Names:

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Specification Check (circle one):

Team has submitted an Engineering Design Notebook?*		No
Design is a maximum of 150 x 150 x 150 mm?	Yes	No
If team fails size requirement, they are disqualified (except during regional events)	Pass	Fail

Final Score:

Presentation (50 points)	+
Design (50 points)	*
Engineering Design Notebook	
*(If no notebook, multiply by .1)	=
Total (100 points)	

Lead Judge Signature:_____

Student Signature:_____

Comments:



Design:

Category	Exceptional	Excellent	Good	Fair
	(5 points)	(4 points)	(3 points)	(2 points)
Demonstration	The team expertly	The team explains	The team sufficiently	The team
	explains key features	key features and	explains key features	insufficiently explains
	and functions of the	functions of the	and functions of the	features and functions
	prototype. Team	prototype well. Team	prototype. Team	of the prototype.
	provided specific	provided good	provided adequate	Team provided
	evidence that the	evidence that the	evidence that the	inadequate evidence
	client(s) was able to	client(s) was able to	client(s) was able to	that the client(s) was
	use it with no	use it with no	use it with no	able to use it with no
	assistance from team.	assistance from team	assistance from team.	assistance from team.
Product look,	Excellent explanation	Good explanation of	Adequate explanation	Inadequate
feel, and	and specific examples	how design met the	of how design met the	explanation of how
functionality	of how client(s)	client(s) criteria for	client(s) criteria for	design met the
	criteria for	functionality,	functionality,	client(s) criteria for
	functionality,	elegance, aesthetics,	elegance, aesthetics,	functionality,
	elegance, aesthetics,	and cost effectiveness	and cost effectiveness	elegance, aesthetics,
	and cost effectiveness			and cost effectiveness
	were met			
Advantages of	The team clearly and	The team clearly	The team describes	The team mentions
Solution	completely describes	describes why their	why their design is	other design available
	why their design is	design is better than	better than current	on the market.
	better than current	current solutions on	solutions on the	
	solutions on the	the market	market	
	market			
Originality of	The design is 100%	The design is 100%	The design is a	The design is a copy
the Design	the students' design.	the students' design.	modification of a	of a product on the
	There is only one	There are 4 or fewer	product on the	market.
	other at max for sale	designs for sale.	market. There are	
			many choices	
			available for	
			purchase.	
Challenges	The team clearly	The team clearly	The team describes	The team mentions
and Solutions	describes challenges	describes challenges	some of the	challenges and
	they encountered and	they encountered and	challenges they	solutions but does not
	how they overcame	how they overcame	encountered and how	elaborate on them.
	them, Research helps	them.	they overcame them.	
	inform their decisions			
Total x 2				



Presentation:

Category	Exceptional	Excellent	Good	Fair
	(5 points)	(4 points)	(3 points)	(2 points)
Client and Problem Description	Client base is thoroughly defined and the problem the team is addressing clearly and specifically meets their needs	Client base is defined and the problem the team is addressing meets their needs	Client base is loosely defined and the problem the team is addressing broadly meets their needs.	The client base is abstract and the problem being addressed is loosely defined
Proposed Solution	A clear and complete description of the solution is provided	A clear and almost complete description of the solution is provided	An adequate description of the solution is provided	A inadequate description of the solution is provided
Human Centered Design	Team explains the design requirements and all requirements are directly linked to client input and feedback	Team explains the design requirements and there is a clear link to client input and feedback	Team explains the design requirements and they are mostly linked to client input and feedback	Team inadequately explains design requirements and lacks connection to client input and feedback
Potential of Design	Team provides an excellent description of next steps they need to undertake to bring prototype to the client	Team provides a good description of next steps they need to undertake to bring prototype to the client	Team sufficiently describes the next steps they need to undertake to bring prototype to the client	Team insufficiently describes the next steps they need to undertake to bring prototype to the client
Presentation	ALL students share equally in presentation. ALL voices heard & understood. Eye contact is distributed across the audience. Engineering Design Notebook well used as a visual aid.	All students share in presentation. Most voices heard & understood. Eye contact is mostly distributed across the audience. Engineering Design Notebook used as a visual aid.	Most students share in presentation. Some voices heard & understood. Eye contact is distributed across the audience. Engineering Design Notebook inadequately used as a visual aid.	Some students share in presentation. Some voices heard & understood. Eye contact is not distributed across the audience. Engineering Design Notebook not used as a visual aid.
			Total x 2	



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Comments/Suggestions: