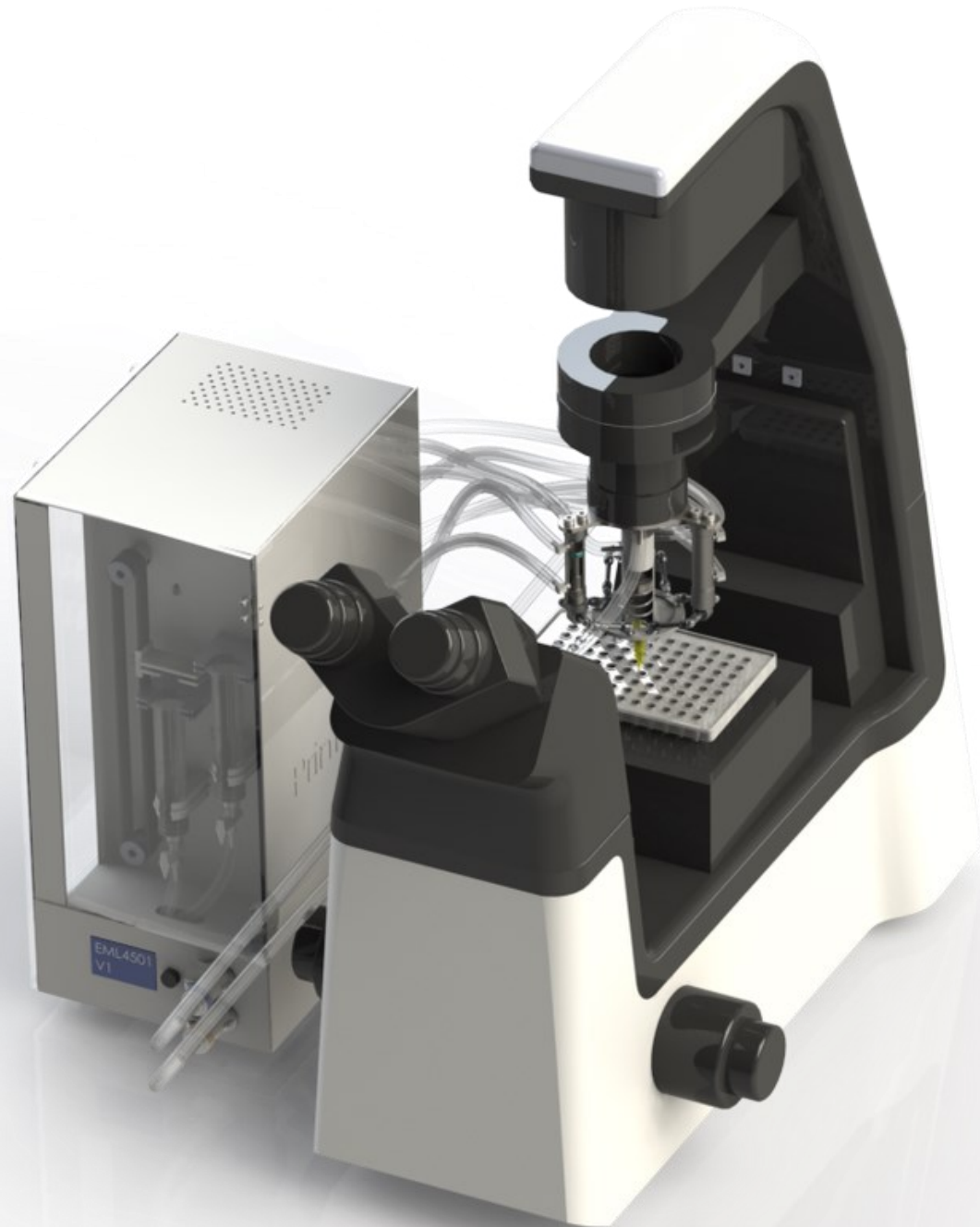


PRINTOLOGY

GROUP 1

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PRESENTATION OUTLINE

- Our Hedgehog Concept
- Product Overview
- Subsystem Analyses
- Highlights and Key Features
- Cost Overview

HEDGEHOG CONCEPT

- The Printology Bioprinter captures our passion for product versatility and our proclivity for a user-friendly printer while minimizing the costs associated with product development.

PRODUCT OVERVIEW

- Two syringes to avoid cross-contamination
- Three hydraulic cylinder for high precision linear movements
- Micropump used for cell delivery
- Belt-driven system used for cell retraction
- Remote power sources stored in secure enclosure
- All power sources compatible with Smoothieboard 5X

CELL DELIVERY AND RETRACTION

- Customer needs considered when selecting the concept for this subsystem were:
 - Feature Size (8)
 - Maximum Flowrate (11)
 - Alignment (12)
 - Tip Disposability (15)
 - Cell Vitality (20)
- Printology uses two syringes, one for cell delivery and one for cell retrieval
 - The use of two syringes minimizes the possibility for cross-contamination
 - The retraction needle can be lowered and raised as necessary using a pneumatic system
- Only one needle will be in the liquid-like solid at a time
 - Reduces instabilities in the printing medium



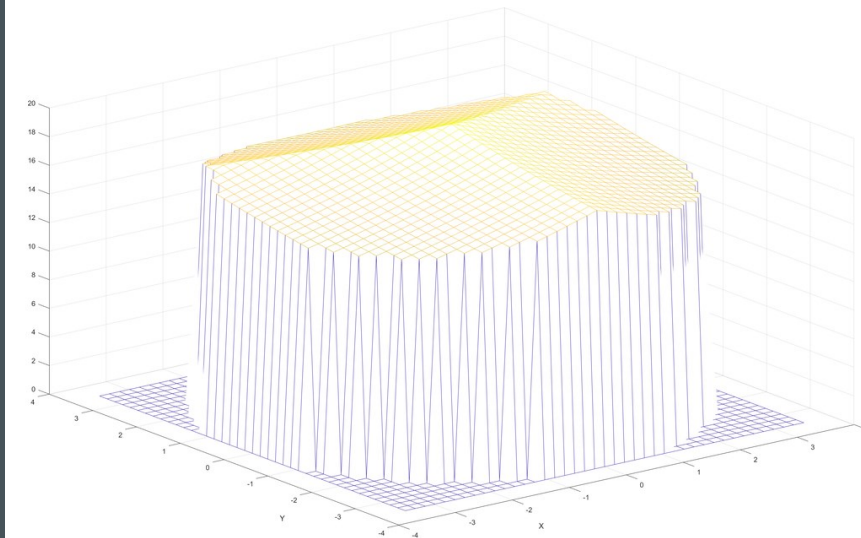
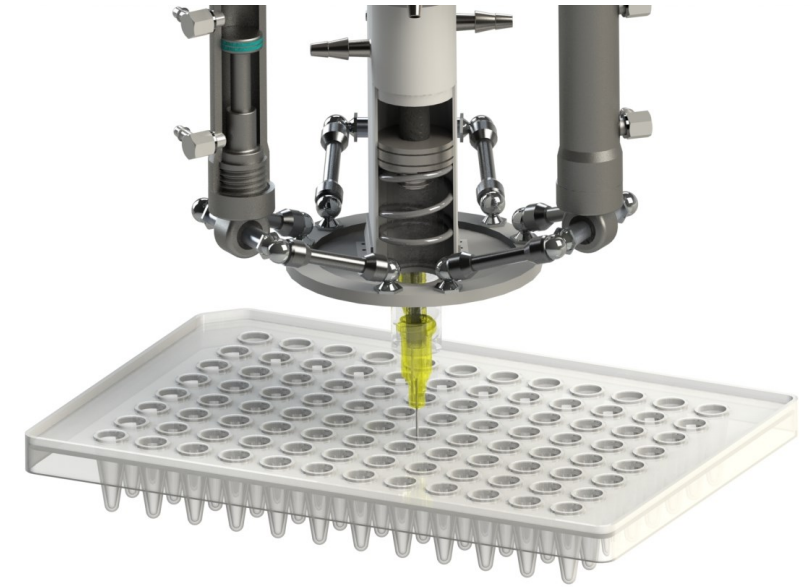
PRINT HEAD

- Customer needs considered when selecting the concept for this subsystem were:
 - Size (2)
 - Weight (3)
 - Linear Accuracy (4)
 - Linear Speed (5)
 - Maximum Print Extents (6)
 - Motion Must be Transmitted to Printer Stages from a Remote Source (7)
 - Cost (9)
 - Controllability (21)
- The attachment to the Nikon TI microscope was incorporated into the print head subsystem



PRINT HEAD

- The concept selected utilizes three hydraulic supports equally spaced about a circle such that each can extend and retract to move the syringe in the center
 - Each cylinder is connected to two magnetic rods to achieve the required degrees of freedom to maintain the needle normal to the stage of the microscope
- Magnetic ball and socket joints were used to accomplish the degrees of freedom required to print
- To ensure that the printer can print within an entire well of a 96-well plate, a program was used to identify the maximum print volume
 - Print Volume Dimensions:
 - Maximum Travel Along Z = 20 mm (stroke of hydraulic pistons)
 - Minimum Travel Along Z = 15.5 mm
 - Minimum Diameter = 7 mm



FLUID TRANSPORTATION SYSTEM

- Customer needs considered when selecting the concept for this subsystem were:
 - Cost (9)
 - Bioprinter Life (10)
 - Print Material (13)
 - No Metallic or Bio reactive Wear Debris Production (16)
 - Ability to Sterilize with Common Lab Methods (17)
 - Assembly/Disassembly by a Lab Technician (18)
 - Controllability (21)
- Two 30 mL syringes are used as fluid reservoirs
 - The total fluid storage capacity will allow for two complete print jobs that utilize the entire volume of a 96-well plate
- A micropump will be used to print cells with a high degree of precision
- A belt-driven system will be used to efficiently retract cells



FLUID TRANSPORTATION SYSTEM

- Flexible PVC piping will be used to transport the fluid from the remote systems mount to the printer stage
- All the fittings on the Printology Bioprinter will be quick-disconnect, to facilitate the experience for the user, and minimize the time required for assembly/disassembly
 - Using the same fittings throughout the printer can lead to incorrect connections, so all the fittings will be color-coded with their corresponding connections



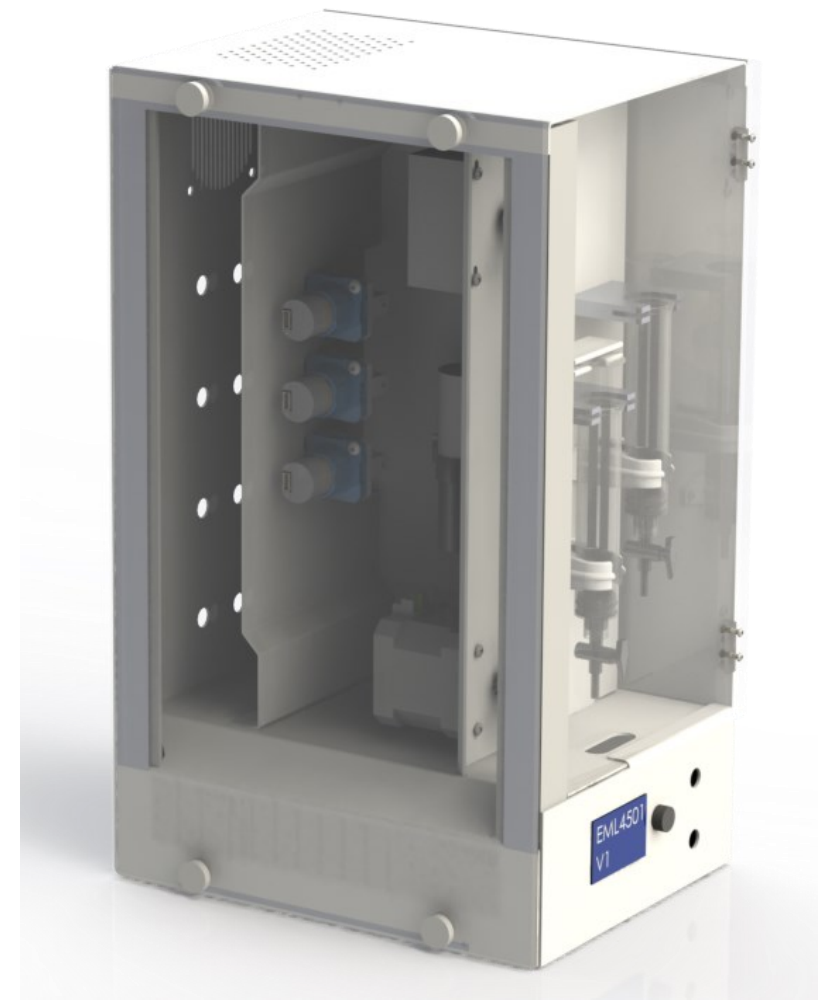
MOUNT FOR REMOTE SOURCES

- Customer needs considered when selecting the concept for this subsystem were:
 - Cost (9)
 - Assembly/Disassembly by a Lab Technician (18)
 - Operation in a Bio-Safety Clean Room Environment (19)
 - Projected Area (10)
- The mount will contain a clear front panel to allow visibility of fluid levels in the reservoirs



MOUNT FOR REMOTE SOURCES

- The tubing has been routed to facilitate access to the power sources such as motors, pumps and Smoothieboard if necessary
- A 12-volt power supply has been included to provide power to all the components
- Fans were included to maintain the temperature within the housing low enough to preserve cell vitality
 - One fan located near the pumps and motor
 - Another fan located below the panel near the power supply



DESIGN HIGHLIGHTS AND KEY FEATURES

- Distinct needles for extraction and retraction to minimize cross-contamination
- Hydraulic system for precise linear motion
- Transportation of fluid from a remote reservoir with visibility of fluid levels
- All remote power sources are secured in encasement with easy access to all power sources

COST ANALYSIS



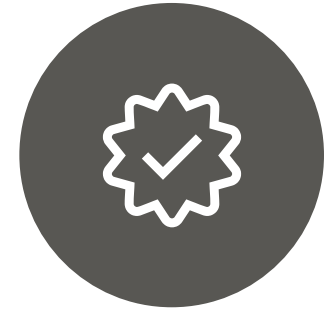
OTS PART COST
\$2047.91



RAW MATERIAL AND
MANUFACTURING COST
\$133.85



ASSEMBLY COSTS
\$397.60



TOTAL PRODUCT COST
\$2579.36

WHY PRINTOLOGY?

OUR DESIGN PROVIDES A USER-FRIENDLY PRODUCT WHILE MAINTAINING OUR TOTAL PRODUCT COST BELOW \$2600, ALL WITHOUT COMPROMISING PRODUCT FUNCTIONALITY. THIS PROVIDES A LARGE PROFIT MARGIN FOR OUR SPONSORS WHILE MEETING ALL THE CUSTOMER NEEDS.

THANK YOU

This brings us to the end of our presentation for the Printology 3D bioprinter.

All of us in Design Group 1 would like to sincerely thank the sponsors, faculty and staff for coming to watch our presentation, as well as for providing us with this exciting opportunity to explore 3D bioprinting design!
