

Frontiers in Additive Manufacturing

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Introduction

- Additive Manufacturing also known as 3-D Printing
- Process of joining materials to make objects from three-dimensional (3D) model data, usually layer by layer, is different from and has many advantages over traditional manufacturing processes.
- Additive Manufacturing provides a cost-effective and time-efficient way to create customized items

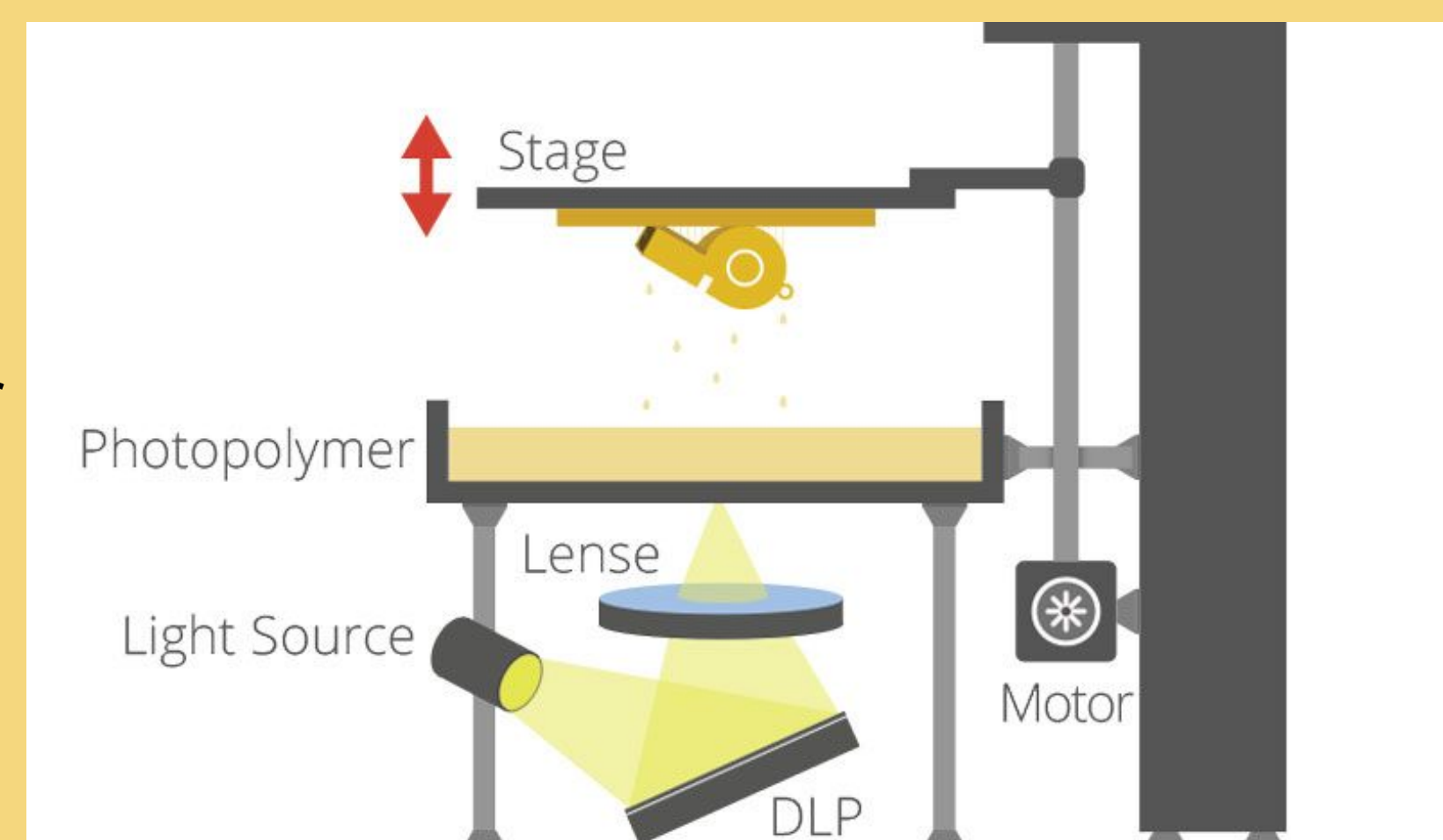
A Low-Cost Lightweight hand made by Additive Manufacturing that would be hard to make through traditional manufacturing processes
[Ref: 3d printing additive robotic hand science source]



Existing technologies/Strategies

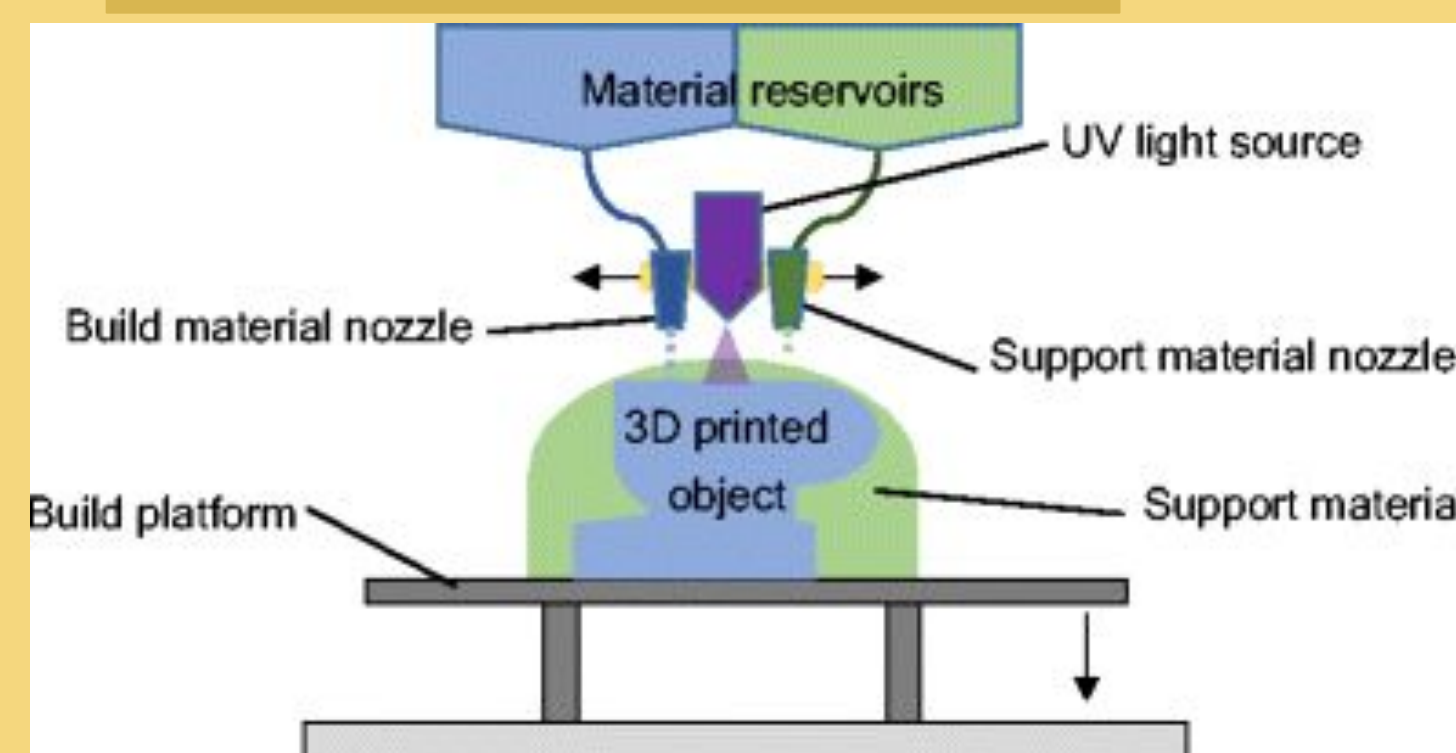
Stereolithography (SLA) Technology

- SLA Technology: Is the most widespread and adaptable, although is not the most effective it uses new resin to cover the surface and polymerize when exposed to the next layer of light.



After 3DP Lighting

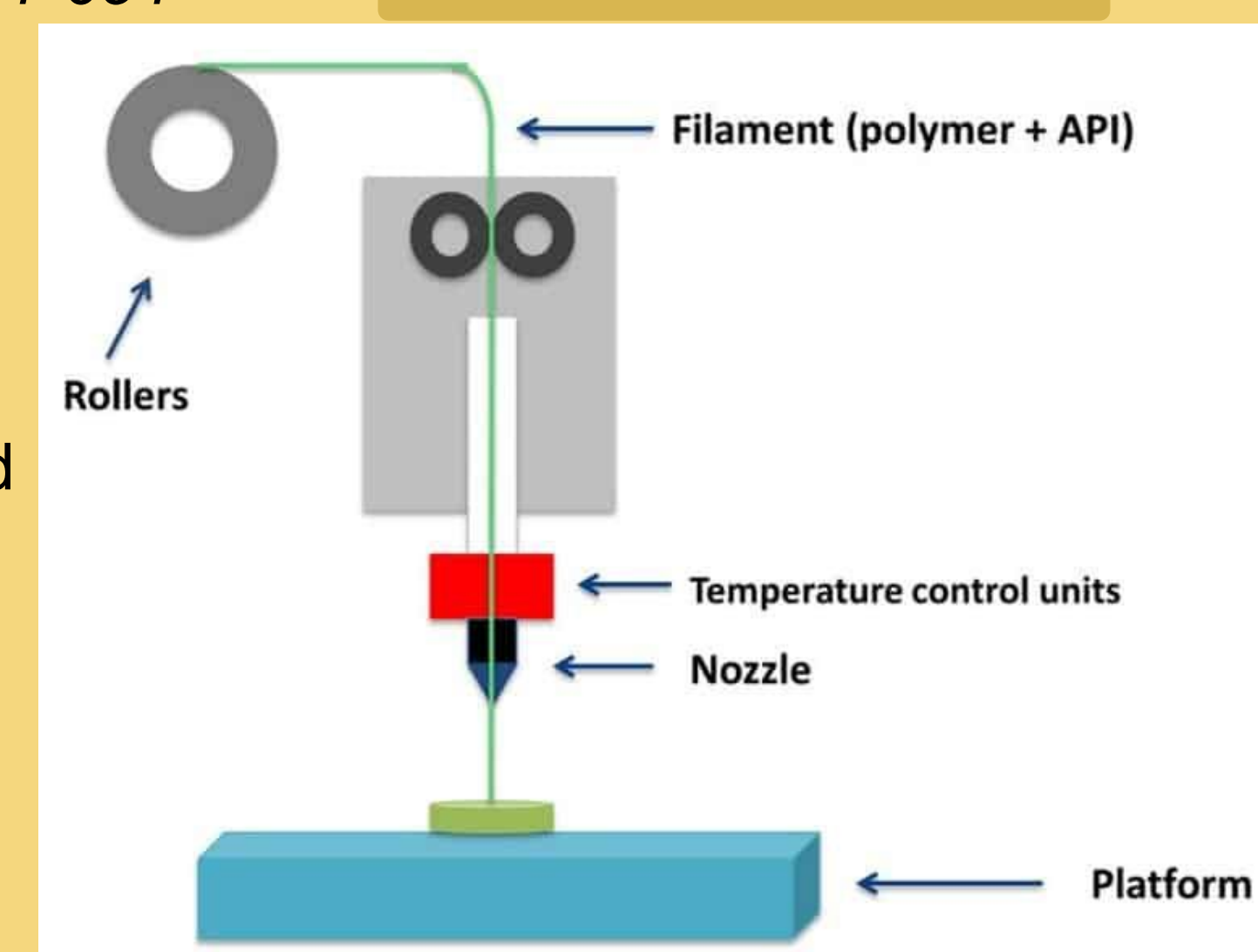
Multi-Jet Modeling (MJM)



After Pratik Sah, B.S. Chong, *Clinical Oral Investigations* (2018) 22:641-654

- MJM Technology: Creates a for fine end product, and will take up to a day. It uses polymer that are layered on a platform with a printhead, in droplet form.

Fused Deposition



After 3D Beginners

- FDM (Fused Deposition Modeling): Polymer is heated and finally sent through the nozzle of the machine

Driving forces for the new frontiers

- Additive Manufacturing will possibly become one of the more versatile forms of engineering already being used within automotive, aerospace, biomedical, and energy
- Enable printing lightweight, complex geometry components
- Printing prototype materials in small quantities
- Economic application: More economic benefits for materials that are expensive and hard to machine, decrease material waste
- Biological Application: It allows for the reconstruction of body components for each specific individual
- customized and personalized parts can be made on-demand easily, no need exists for special tooling in part fabrication
- Fast infield construction and repair
 - Ex: human habitat construction in dire or dangerous situations

Limitations

- Due to the stair-stepping effect their is relatively poor part accuracy in many components made by AM
- There is insufficient repeatability and consistency in the produced parts, and lack of qualification methodologies
- The database on materials fabricated and how they react is currently not broad enough with AM
- AM is although cost efficient for businesses, is very unfriendly and expensive to single families and local businesses.

Benefits

- Additive Manufacturing is very suitable for aerospace applications, as they deal with more precious materials as well as needing thousands of small pieces of technology.
- Additive Manufacturing has been adapted to selectively print human cells and special molecules in attempts to construct human organs
- Can manufacture the injection molds to reduce the time and the cost of new tool development. AM can also do the same procedure with metallic parts.
- A tool used in the design and development of automotive components to reduce manufacturing and product costs. It is able to make many components such as exhaust engine, drive shaft, and gear box.



J. Williamson, 2015. Illustrating the real-world benefits of additive manufacturing. *The manufacturer.com*

Conclusions

I believe that Additive Manufacturing is the future, whether through the biological field or in space, this new type of engineering with start and change the way we view our lives. Although there are some serious limitations, none of which are impossible to solve as time goes on. AM has the ability to create components at a fast pace to fit specific needs at a low price. And as more and more time passes the limitations on Additive Manufacturing will disappear.

References

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