Federal Aviation Administration

Additive Manufacturing (a thirty year evolution)

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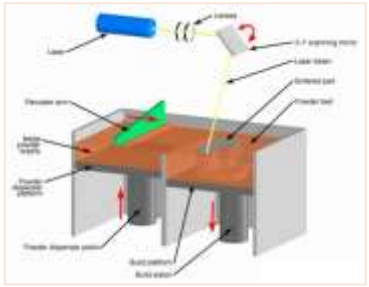
Additive Manufacturing (AM)



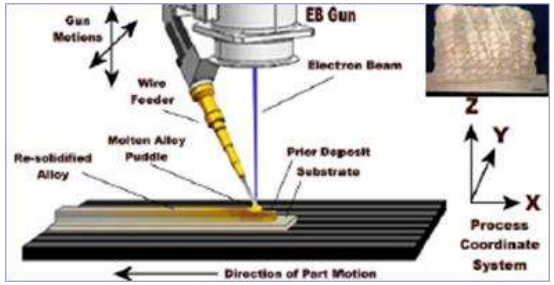
Additive Manufacturing (AM) --

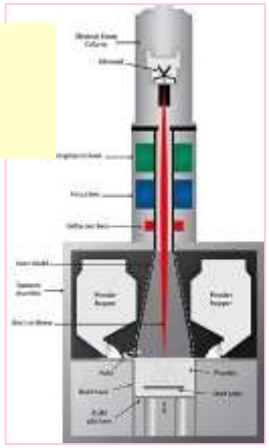
A process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to *subtractive manufacturing* methodologies

(***Ref: ASTM F2792 – 12a***)

By Source of Material:
Powder vs. Wire

By Source of Energy:
Laser vs. E-Beam





New Type and Production Certificates

Repair and Overhaul (MROs)

Aftermarket Parts (PMAs)

Evolution of AM Technology

Enablers for AM *acceleration:*

- Technology maturation
- 3-D computing capabilities
- AM patents expiration
- Reduced cost of equipment & raw materials
- Standardization

1984
Stereolithography Patent

1988
SLS Patent

1991-92
Commercialization of FDM, SLS etc.

2000
First high definition 3-D printer

2003
First safety-critical AM part enters service (military)

2009
FDM patent expires

2011
First 3-D printed drone

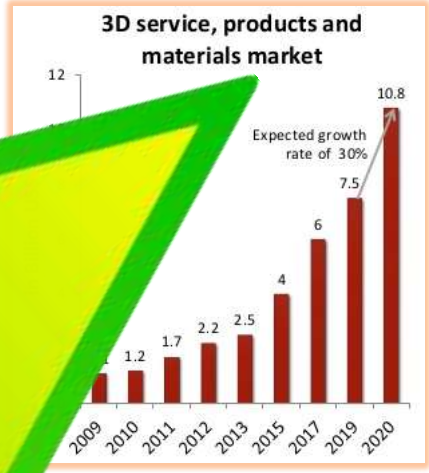
2013
AM announced as *breakthrough technology* by MIT

2014
SLS patent expires

2015
FAA approves first turbine engine AM part

2016
First flight test of safety-critical AM part (military)

2017
FAA approval of the first aircraft AM structural part



2017
AM spare parts printed for GA aircraft

Challenges/Opportunities

- Transform regulatory system to be agile using Performance Based Rules
- Utilize Safety Continuum and Risk Based Decision making to tailor certification requirements based on:
  - Performance
  - Complexity
  - Usage
- Promote organizational structure/procedures to foster innovation and early engagement to better position authorities
- Promote greater standards/policy collaboration among partners
- Emphasize applicant and approval holder responsibility
  - Compliance culture

QUESTIONS?