



Japan Created 3D-Printed Train Station

Source: [NYT](#)

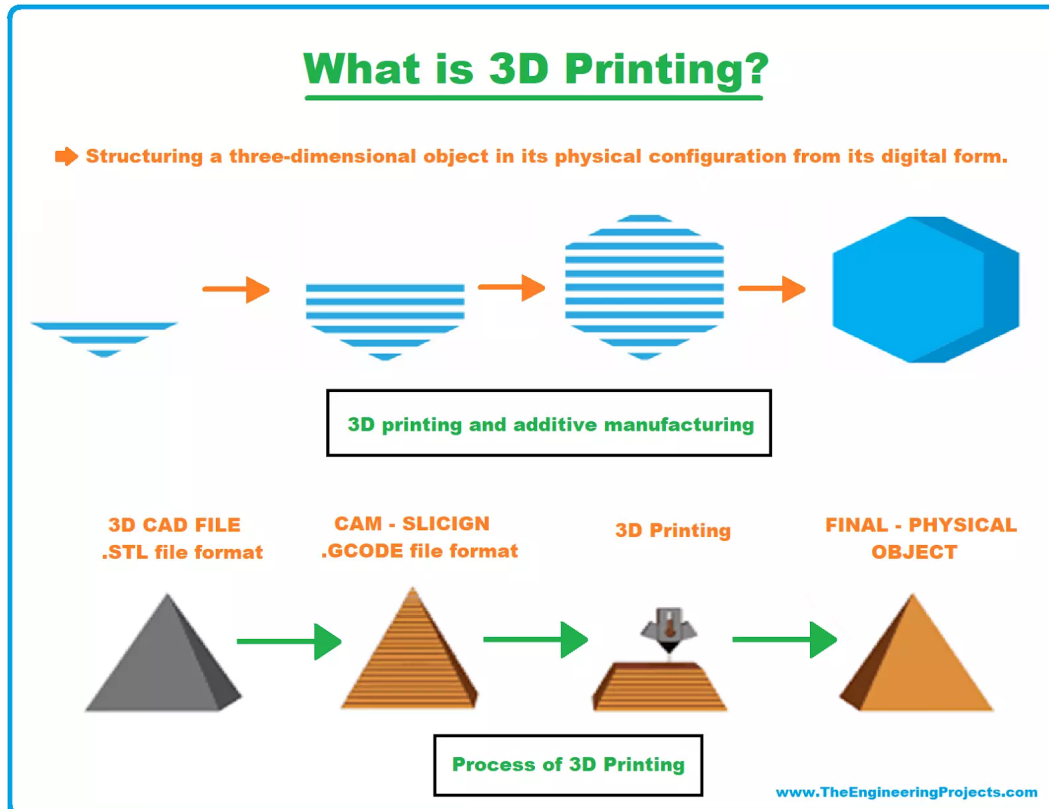
Why in News?

Japan has constructed the world's first **3D-printed railway station (Hatsushima Station)**, completed in just **6 hours** using [additive manufacturing \(3D printing\)](#) technology.

- The station's **3D-printed parts**, made with **special mortar reinforced with concrete**, were **transported by separate trucks to the construction site**, reducing labor needs and on-site construction time, which was then assembled in short time.

What is 3-D Printing Technology?

- **About: 3D printing or Additive Manufacturing (AM)**, is a process that creates 3-dimensional objects **by adding material layer by layer** based on a digital design.
 - It is the **opposite of traditional (subtractive) manufacturing**, which involves removing material from a solid block through cutting or drilling.



- **Working Mechanism:**
 - **Design & Conversion:** A **digital 3D model** is developed using **computer-aided design**

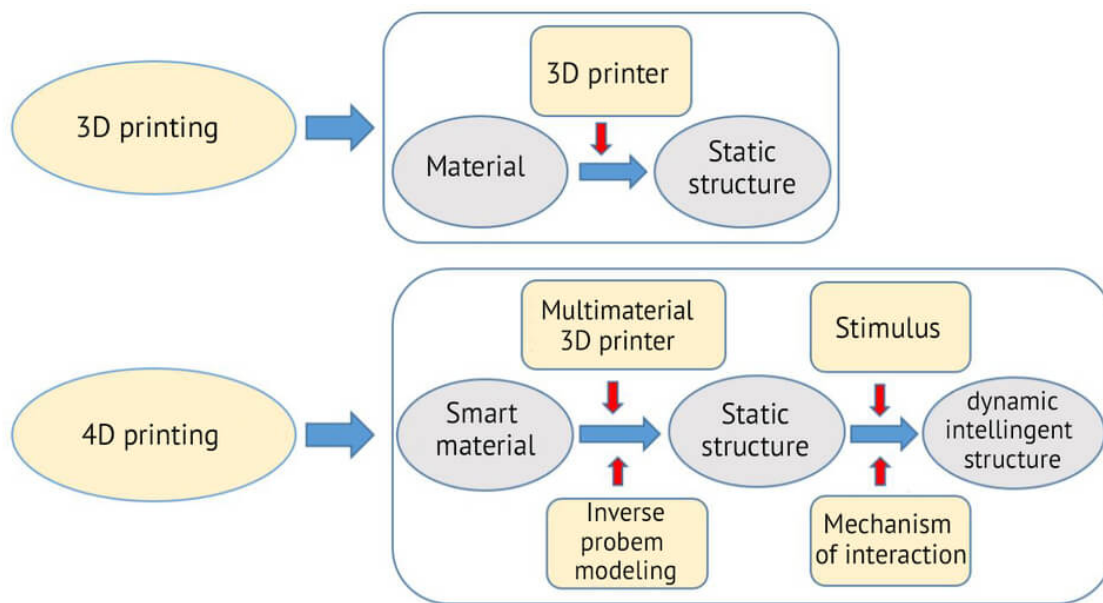
(CAD) software or 3D scanning. This model is then **sliced into thin layers** and converted into machine-readable G-code instructions.

- **Printing & Post-Processing:** Material (plastic, metal, etc.) is **deposited layer by layer** by the 3D printer to build the object as per the design. Post-printing, the **object is cleaned, cured, assembled, and tested for precision** and performance.
- **Materials Used:** It uses a variety of materials including **thermoplastics, metals and alloys, ceramics, and biomaterials** like bioinks for medical applications.
- **Common Methods of 3D Printing:** Common 3D printing methods include **Material Jetting, Directed Energy Deposition (DED), and Sheet Lamination**, which build complex objects layer-by-layer with precision.
- **Key Applications:**

Sector	Applications
Aerospace & Defence	Landing gears, thrust reverser doors, surveillance drones
Automotive	Engine parts, gearboxes, air inlets
Electronics	RFID devices, wearable tech, soft robotics
Healthcare	Surgical models, implants, customized instruments
Consumer Goods	Jewellery, toys, furniture, apparel, and even food products

What is 4D Printing Technology?

- **About:** 4D printing is an **advanced form of 3D printing** where objects made using **smart/intelligent materials (like hydrogels, active polymers)** can **change shape, structure, or properties over time** in response to **external stimuli** like heat, light, moisture, or pressure.
 - Unlike static 3D prints, **4D-printed objects can bend, self-assemble, repair, or transform autonomously**, enabling **dynamic and responsive structures** without the need for electronics or human intervention.
- **Key Applications:**
 - **Medicine:** Adaptive implants like **dissolvable stents and smart devices** that adapt to **body growth or temperature**, used in **life-saving surgeries** and **targeted drug delivery**.
 - **Clothing & Footwear:** Enables **adaptive wearables** that respond to environmental conditions, **military uniforms and sportswear** can adjust ventilation, color, or fit dynamically.
 - **Aerospace & Automotive:** NASA's 4D-printed smart fabrics for astronaut suits and intelligent materials for impact-resistant airbags and cooling aircraft engines.



UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Which one of the following is the context in which the term “Qubit” is mentioned?

- (a) Cloud Services
- (b) Quantum computing
- (c) Visible light communication technologies
- (d) Wireless Communication Technologies

Ans: (b)

Q. With the present state of development, Artificial Intelligence can effectively do which of the following?(2020)

1. Bring down electricity consumption in industrial units
2. Create meaningful short stories and songs
3. Disease diagnosis
4. Text-to-Speech Conversion
5. Wireless transmission of electrical energy

Select the correct answer using the code given below:

- (a) 1, 2, 3 and 5 only
- (b) 1, 3 and 4 only
- (c) 2, 4 and 5 only
- (d) 1, 2, 3, 4 and 5

Ans: (b)

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