3DNATIVES

An Overview of Additive Manufacturing

Exploring the 7 Families of 3D Printing Technologies

Elliot SALDUKAITE – July 12th 2023

3D
natives

An Overview of AM

Who am I?

3Dnatives' Digital/Technical Content Specialist

- The largest international online media platform on 3D printing and its applications

- In-depth analysis of the market

- Over 1 million unique visitors per month

- Currently available in English, French, Spanish, German, Italian

- 3Dnatives offers a variety of services such as a 3D printing price comparison engine, B2B consulting and B2B brand content, event management and much more!

An Overview of AM

An Overview of Additive Manufacturing

Exploring the 7 Families of 3D Printing Technologies

- Intro:
    - What Is additive manufacturing (AM)?
    - Why use AM?
    - How is AM different from subtractive manufacturing?

- Process:
    - How does AM work?

- 7 main families:
    - In which forms does AM come in?

- Mastering AM:
    - How to get better at using AM?

- The future of AM:
    - How will AM evolve and adapt?

3D natives

An Overview of AM

3D natives

Introduction

Defining AM

Additive manufacturing (AM), also known as 3D printing, is a process that creates three-dimensional objects by stacking layers of materials on top of each other, based on a digital design file (3D model).

An Overview of AM

Introduction

Advantages of Additive Manufacturing

- Allows for the creation of complex geometries

- Design flexibility
    - Customization & creation of unique parts
    - Doesn't require molds or tooling

- Can eliminate the need for assembly of multiple parts

- Reduces material waste and lead times

- Reduces costs

3D natives

An Overview of AM

Introduction

Additive vs. Subtractive

- Subtractive Manufacturing:
  - Removing material from a block or sheet:
    - Generates waste material
    - Limitations: complex shapes and designs

- Additive manufacturing:
  - Builds up material rather than removing it:
    - Can create complex shapes and geometries
    - Uses the exact amount of material
    - Can reduce material waste & save costs

3D
natives

3D PRINTING PROCESS

4 GENERAL STEPS TO MANUFATURE OBJECTS

An Overview of AM
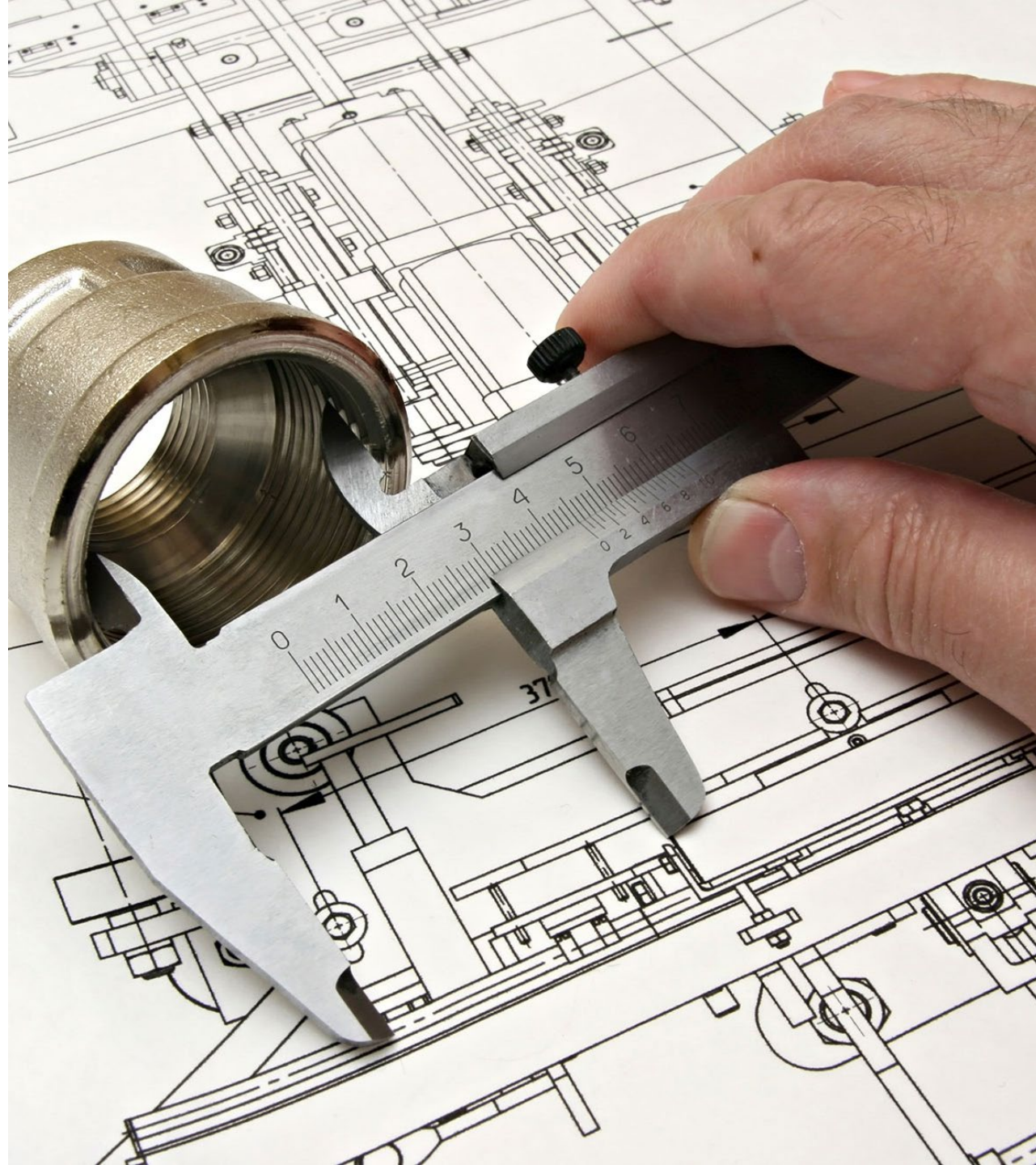
3D PRINTING PROCESS

CAD/3D Scanning/Online 3D Model Libraries

- Create a digital 3D model:

  - Computer-aided design (CAD)

  - 3D scanning

  - Online 3D model library

- The model is exported for the 3D

  printing preparation software (slicer)

  - Most used file formats:
    STL, 3MF and OBJ

3D natives

An Overview of AM

3D PRINTING PROCESS

Slicing

- Slicer: 3D printing software is used to convert the 3D model into a machine-readable code
  - Slices the digital model into thin layers
  - Generates instructions for the 3D printer
    - Based on the parameters specified by the user

3D natives

An Overview of AM
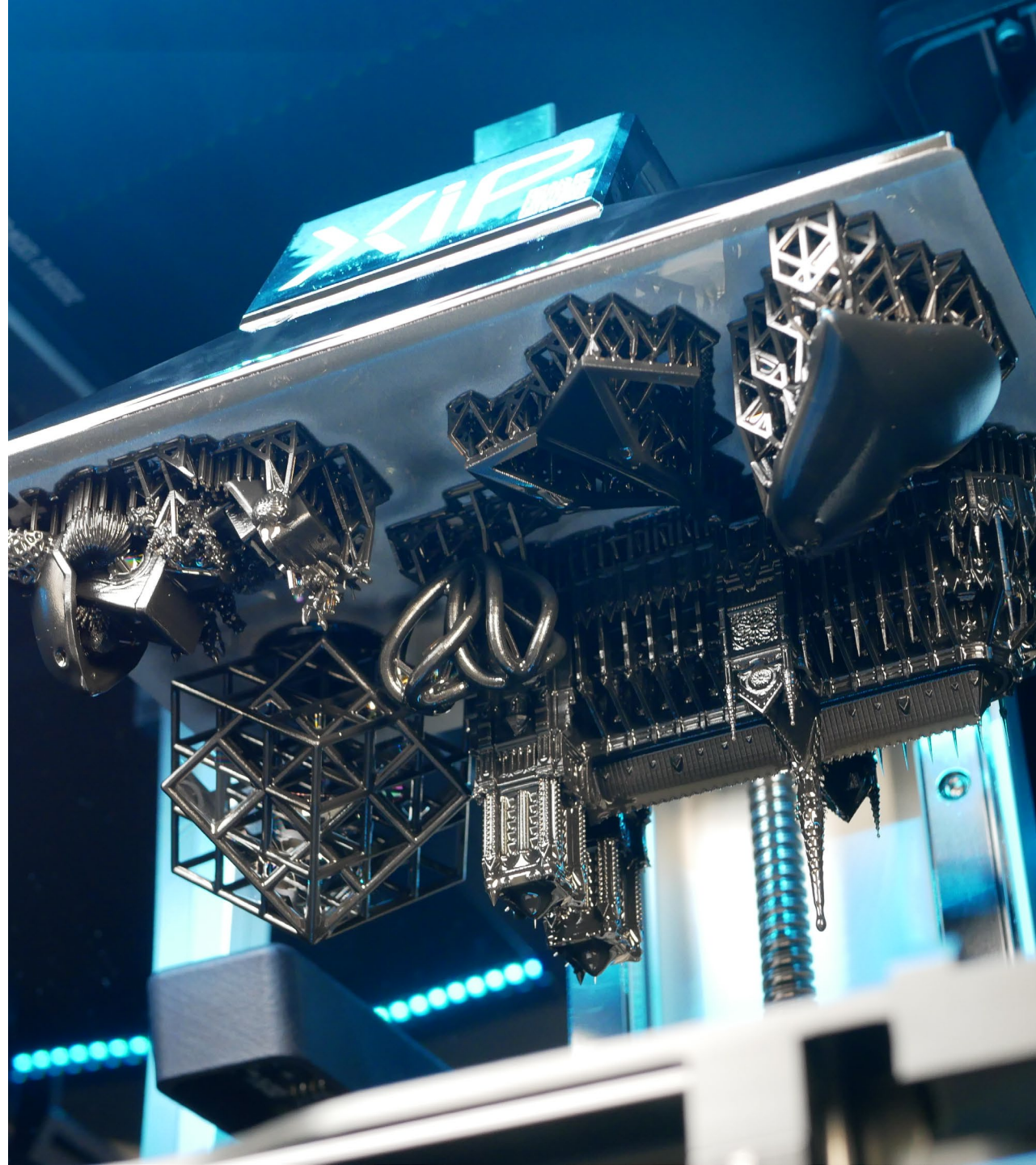
3D natives

Printing

(Includes Machine Set-Up & Part Removal)

- The 3D printer builds the object layer by layer according to the instructions generated by the software
  - It deposits, cures, melts, sinters or binds material (plastic, metal, ceramics, …) onto the build platform, into a vat of resin or on a bed of powder

An Overview of AM

3D PRINTING PROCESS

Post-Processing

(Assembly may be required before final use)

- Not always mandatory (depends on the technology and desired finish)

- Enables to achieve the desired finish or functionality

- Can include

  - Cleaning

  - Removing support structure

  - Sanding

  - Polishing

  - Painting, …

3D natives

The 7 Main Families of Additive Manufacturing

A GENERAL CLASSIFICATION OF THE TECHNOLOGIES AVAILABLE

An Overview of AM

3D natives

The 7 Main Families of AM

Material Extrusion

- Applications: prototyping, production parts, jigs and fixtures, molds and tooling

- Industries: automotive, aerospace, medical, consumer goods

- Most common technology: FDM/FFF

An Overview of AM
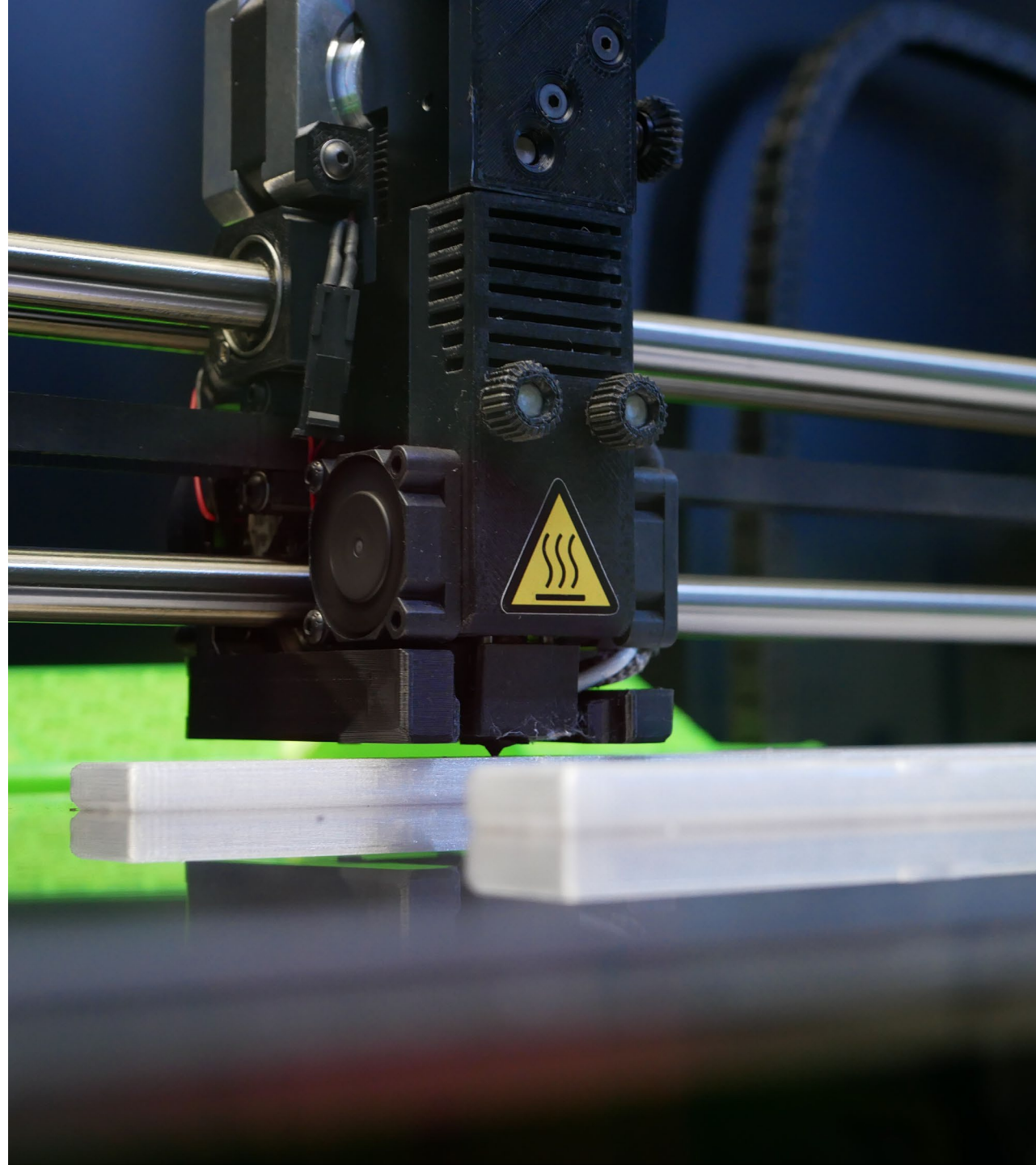
The 7 Main Families of AM

Vat Photo-polymerization

- Applications: prototyping, dental models, jewelry

- Industries: dental, jewelry, medical

- Most common technologies:

    - SLA

    - DLP

    - MSLA

3D natives
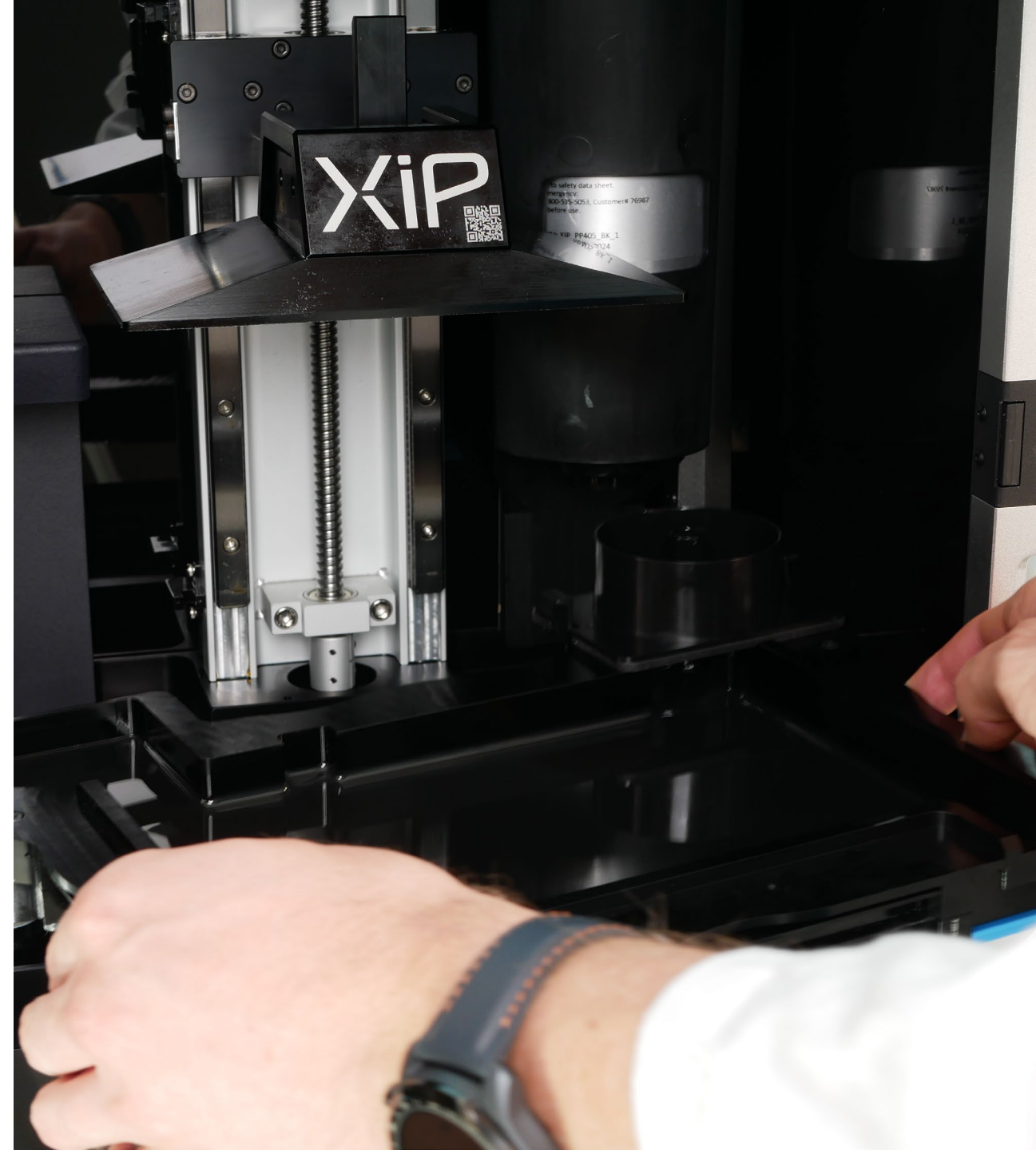
An Overview of AM

The 7 Main Families of AM

Powder Bed Fusion

- Applications: prototyping, production parts, aerospace components, dental prosthetics

- Industries: aerospace, medical, dental, automotive

- Most common technologies:

    - Polymer:

        - Selective Laser Sintering (SLS)

    - Metal:

        - Direct Metal Laser Sintering (DMLS)

        - Electron Beam Melting (EBM)

3D natives

An Overview of AM
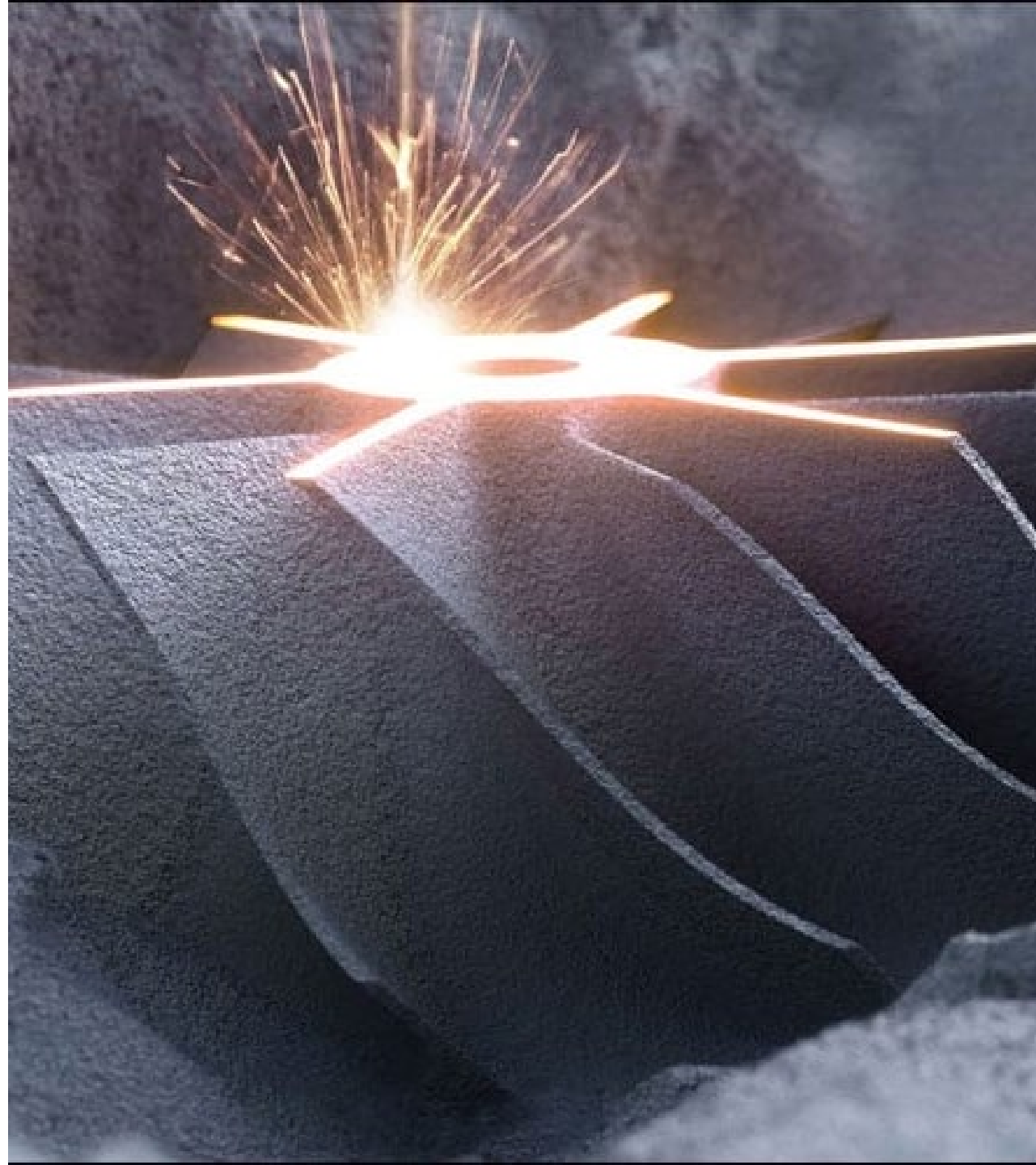
The 7 Main Families of AM

Binder Jetting

- Applications: prototyping, small parts, jewelry

- Industries: jewelry, consumer goods

- Most used materials:

  - Sand

  - Metals

  - Ceramics

3D
natives

An Overview of AM

3D natives
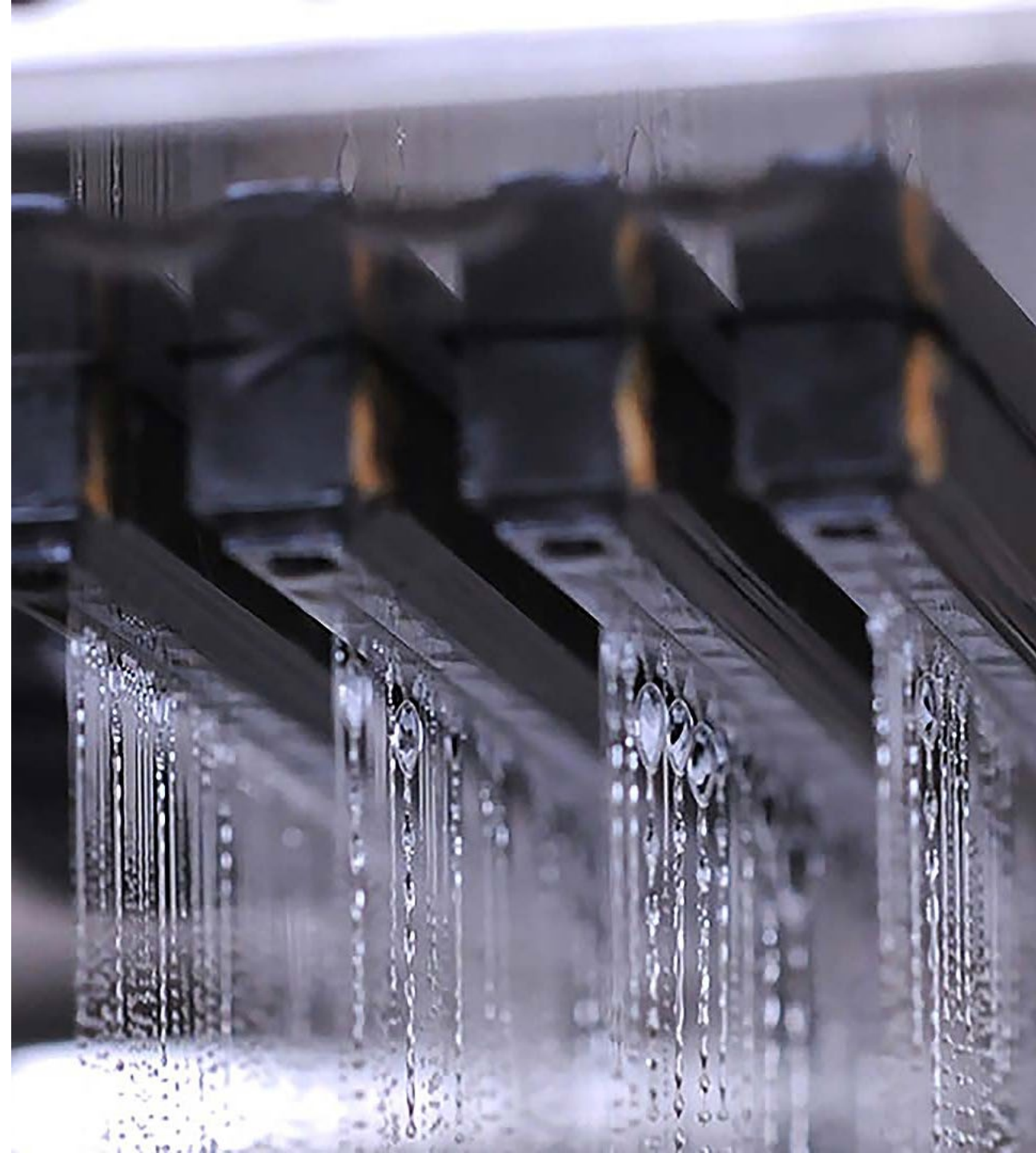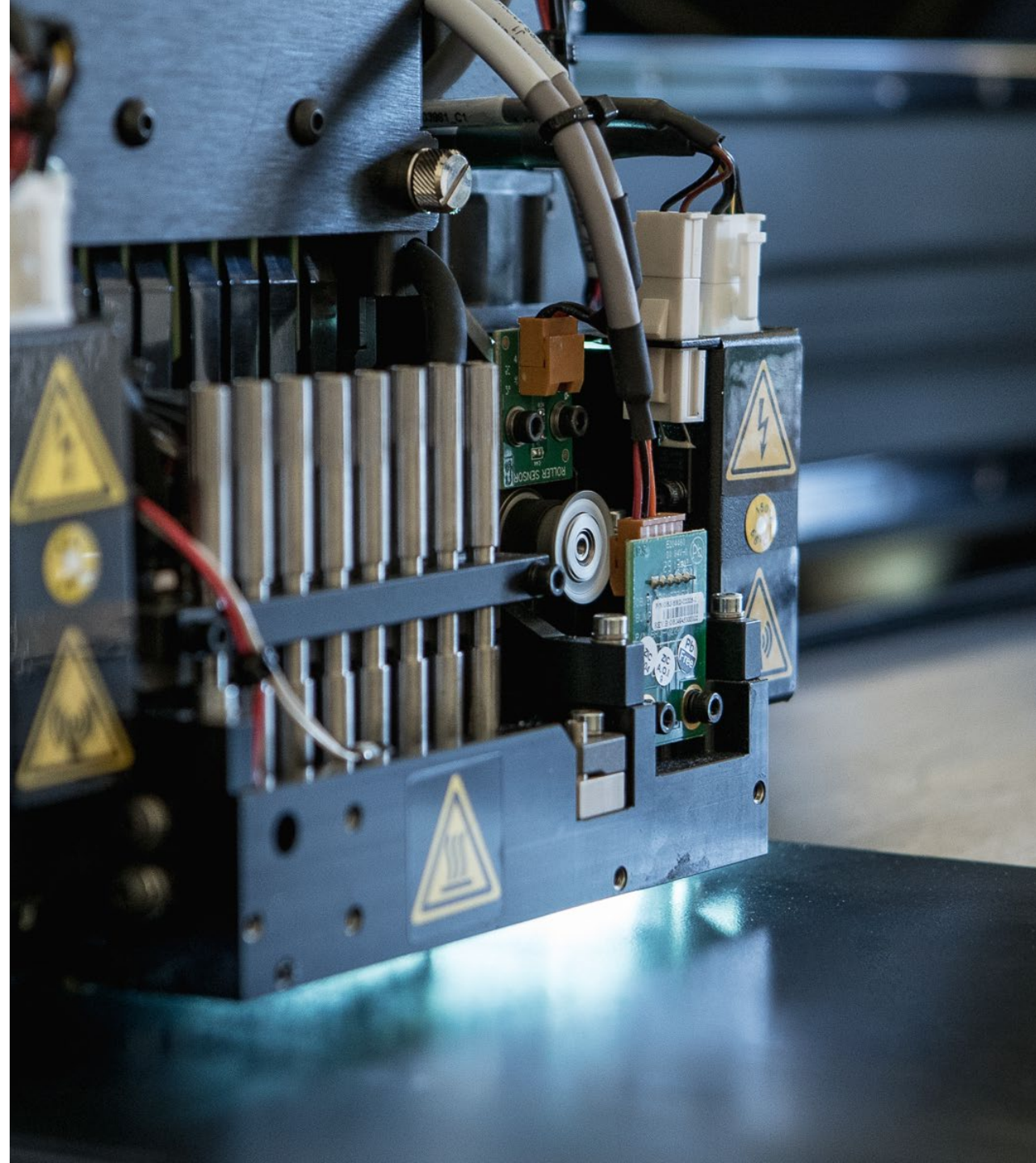
The 7 Main Families of AM

Material Jetting

- Applications: prototyping, small parts with high resolution and accuracy, dental models

- Industries: dental, medical, consumer goods

- Most common technologies:
  - Polyjet
  - MultiJet Printing (MJP)

An Overview of AM

The 7 Main Families of AM

Directed Energy Deposition

- Applications: repair, modification, adding features to existing parts

- Industries: aerospace, defense, automotive

- Most common technologies:

    - Electron Beam Additive Manufacturing (EBAM)

    - Laser Engineered Net Shaping (LENS)

    - Wire Arc (ex: Wire Arc Additive Manufacturing)

3D natives

An Overview of AM

The 7 Main Families of AM

Sheet Lamination

- Applications: prototyping, architectural models, packaging

- Industries: architecture, packaging, consumer goods

- Most common technology: Laminated Object Manufacturing (LOM)

3D natives

Mastering Additive Manufacturing

HOW TO SHARPEN YOUR SKILLSET AND
ENSURE BETTER, REPLICABLE PARTS

An Overview of AM

3D natives

Mastering AM

Main parameters and factors affecting quality and performance of 3D printed parts

- Layer height and thickness

- Print speed and temperature

- Material type and properties

- Part orientation and support structures

- Post-processing and finishing techniques

An Overview of AM

Mastering AM

Tips and best practices for choosing and using 3D printing technologies

• Determine the intended use and requirements of the part

• Research and compare the material compatibility of each 3D printing technology

• Consider the cost and availability of materials and equipment

• Test and optimize print settings and parameters

3D natives

The Future of Additive Manufacturing

A REFLECTION ON THE EVOLUTION OF AM AND ITS IMPACT

An Overview of AM
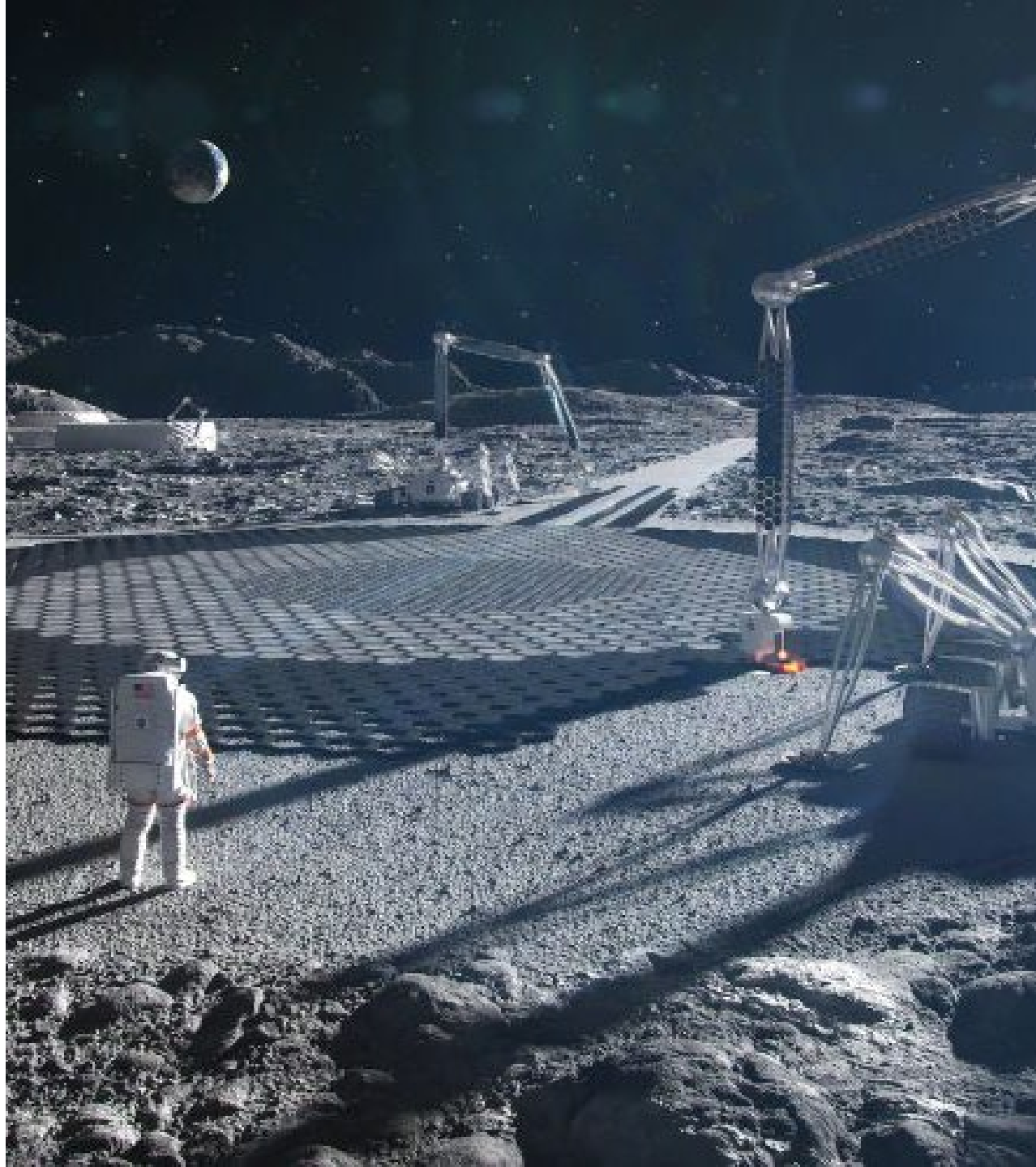
The Future of Additive Manufacturing

Current trends and developments in AM research and innovation

- Bioprinting and tissue engineering

- Large-scale and high-speed printing

- Hybrid and multi-material printing

- Sustainability and circular economy

- Outer space manufacturing

3D natives

An Overview of AM

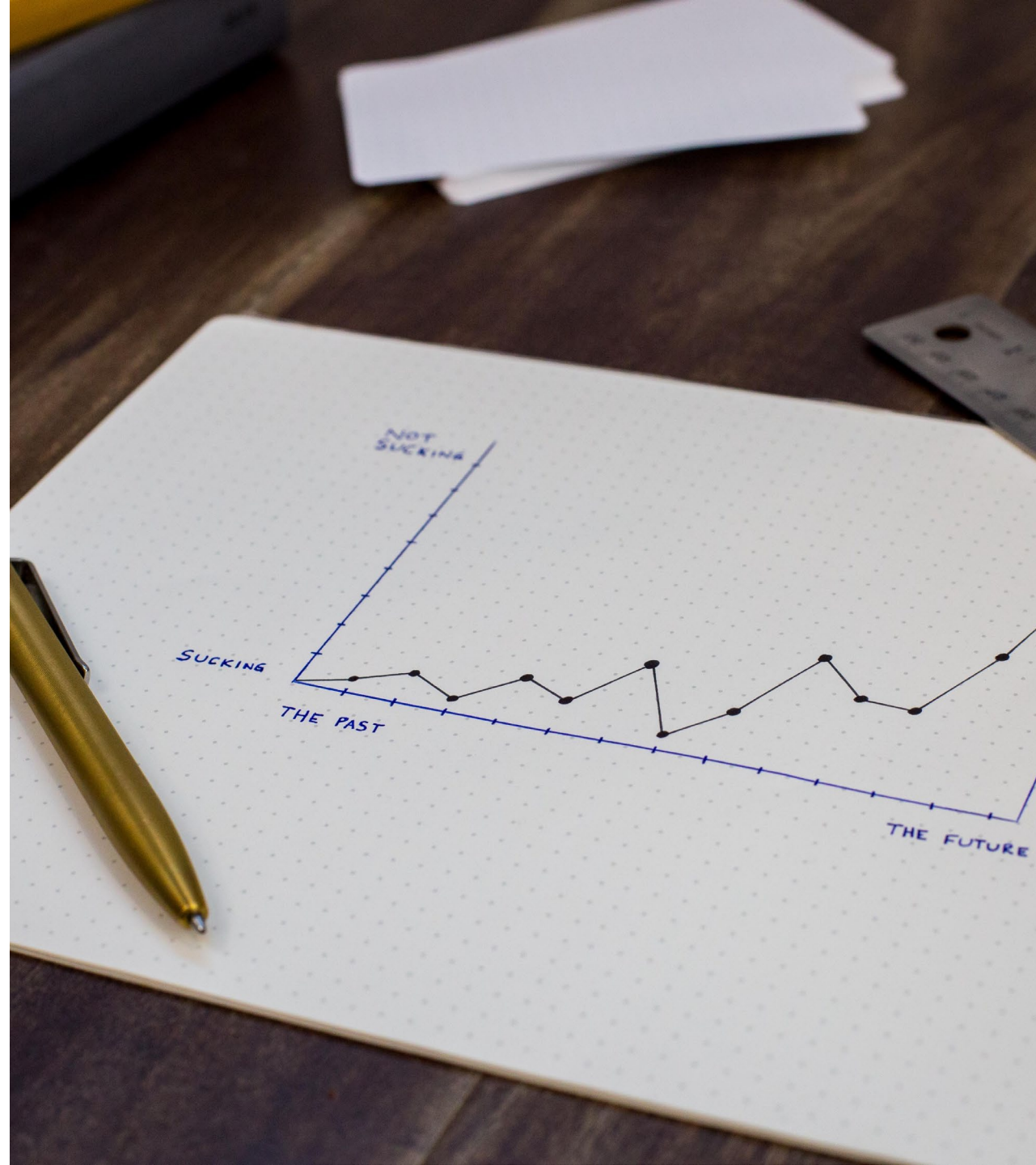The Future of Additive Manufacturing

Potential impacts and opportunities for society and the environment

- Reduced waste and emissions

- Localized and decentralized production

- Increased access to customized products and services

- Improved healthcare and medical treatments

3D natives

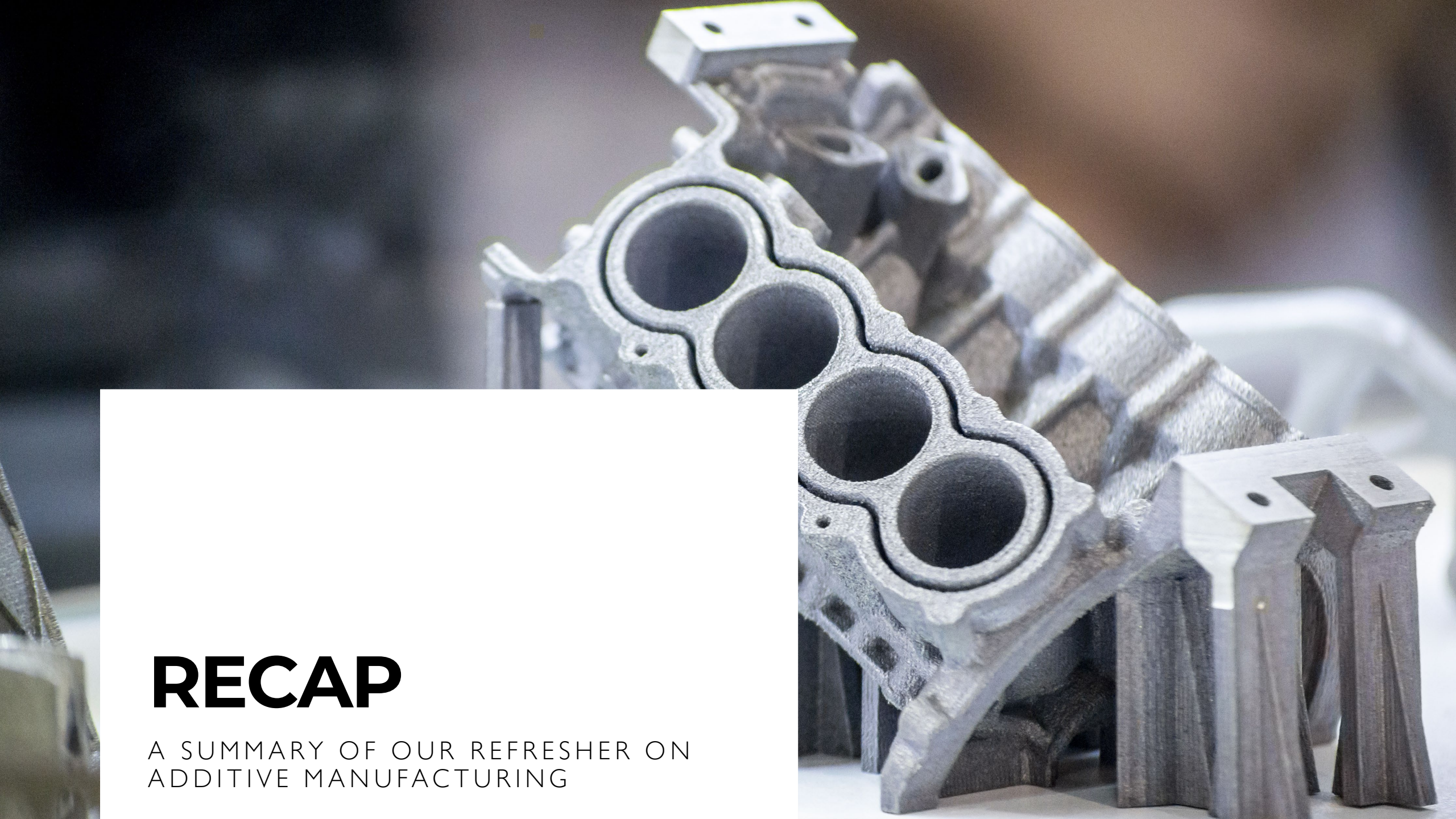**An Overview of AM**

The Future of Additive Manufacturing

Challenges and limitations to overcome for AM to become more widespread and accessible

- Cost and scalability of materials and equipment

- Lack of standardization and certification

- Intellectual property and regulatory issues

- Technological and skills gaps

3D natives

RECAP

A SUMMARY OF OUR REFRESHER ON
ADDITIVE MANUFACTURING

An Overview of AM

Recap

Additive Manufacturing and its benefits

- Definition and principles of AM

- Advantages over traditional manufacturing methods

- Potential for innovation and creativity

Recap

The 3D printing process & the 7 main AM families

- A general process consisting of four steps

  - CAD or 3D Scanning

  - Slicing

  - Printing

  - Post-Processing

- 7 AM families

  - Material Extrusion

  - Vat Photopolymerization

  - Powder Bed Fusion

  - Binder Jetting

  - Material Jetting

  - Directed Energy Deposition

  - Sheet Lamination

3D natives

An Overview of AM

3D natives

Recap

Applications and industries of 3D printing

- Aerospace

- Automotive

- Healthcare

- Jewelry

- Medical

- Construction...

THANKS / Q&A SESSION

Thanks for taking part in this technical refresher all about AM

3D natives

An Overview of AM

- [What Is Additive Manufacturing? - 3Dnatives](#)

- [3D Printing Materials Guide: Plastics - 3Dnatives](#)

- [3D Printing Technologies - 3Dnatives](#)

- [Additive and Subtractive Manufacturing: Complementary or Rivals? - 3Dnatives](#)

- [PBF vs. DED: Which Metal 3D Printing Process Should You Choose? - 3Dnatives](#)

- [Resins vs Powders: Which Material Family Should You Choose for 3D Printing?](#)

- [SLA vs DLP: Which Resin 3D Printing Process Should You Choose? - 3Dnatives](#)

- [Material Jetting vs. Binder Jetting: Which Jetting Process Should You Choose? - 3Dnatives](#)

- [PEEK vs PEKK: Which High Performance Material Should You Choose? - 3Dnatives](#)

- [Support Structures in 3D Printing: All You Need to Know - 3Dnatives](#)

- [STL vs. 3MF: Which Format to Choose for a 3D Model? - 3Dnatives](#)

Additional Resources

Curated content to refresh or extend your knowledge on AM

3D natives

An Overview of AM

Additional Resources

3DExplained video series

- A series of scientific vulgarization videos aimed to help better grasp AM knowledge

3D
natives