ADDITIVE MANUFACTURING AIDS: JIGS & FIXTURES

THE 3D PRINTING SOLUTIONS COMPANY™

Agenda

Section 1: The Stratasys Ecosystem

Section 2: Overview of Manufacturing Aids: Jigs and Fixtures

Section 3: Transforming the Manufacturing Floor

Section 4: Traditional Processes

Section 5: Challenges and Opportunities

Section 6: Customer Stories

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SECTION ONE

The Stratasys Ecosystem

The Stratasys Ecosystem

01

3D printers and 3D production systems

02

Stratasys Direct Manufacturing™

03

Industry expertise and specialized applications

04

Stratasys Strategic Consulting

05

Professional Services and Customer Support

06

Extensive range of materials

07

Design and engineering communities

08

Strategic partnerships

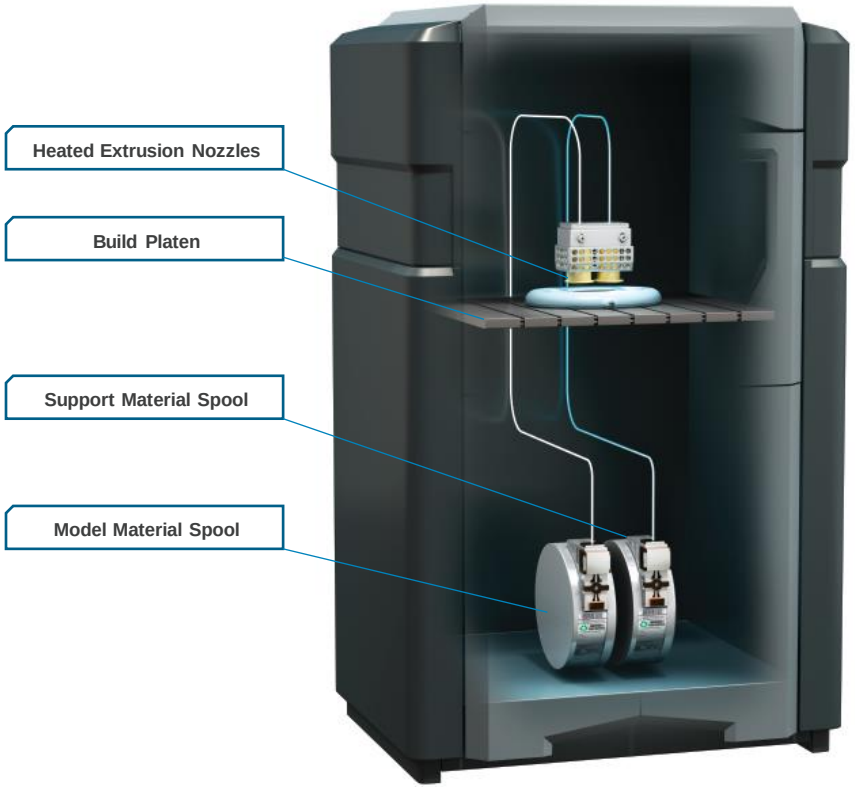
Our Solutions

Industry-Specific Applications

- Investments in advanced applications spark innovation in targeted industries
- Custom solutions, such as certified materials, are developed to fit unique needs of each industry
- Dedicated personnel have deep expertise in education, dental, medical, aerospace, automotive and manufacturing

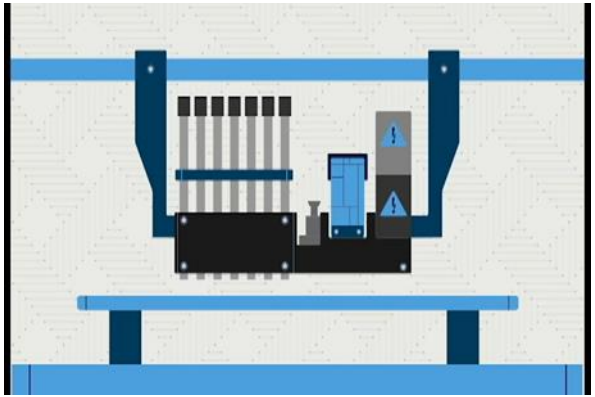
FDM® (Fused Deposition Modeling)

Thermoplastic filament is heated to a semi-liquid state and extruded across computer-controlled tool paths to build parts layer-upon-layer.



PolyJet™

PolyJet 3D Printing works similarly to inkjet printing, but instead of jetting drops of ink onto paper, PolyJet 3D Printers jet layers of curable liquid photopolymers on to a build platen.



SECTION TWO

Overview of Manufacturing Tooling: Jigs and Fixtures

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Jigs & Fixtures Definitions

Jigs

- Custom-made tools used to **guide & control the location and motion** of another workpiece during an operation. An example of a jig is a drill guide.
- Purpose is to provide repeatability, accuracy, and interchangeability as well as to maximize efficiency in the manufacturing of products.

Fixtures

- Devices used to **locate & hold a work piece in a fixed location** during either a machining operation or any other industrial process. Examples of fixtures are chucks and vises.
- Purpose is to maintain consistent quality, reduce cost of production, enable a variety of parts to be made to correct specifications.

Types of Jigs and Fixtures

General Purpose: Usually relatively inexpensive (off the shelf). Can be used to hold a variety of types and sizes of work pieces. (Examples: vises, chucks, clamps, collets, etc.)

Special Purpose: Designed and produced to hold a particular work piece for a specific operation on a specific machine or process.

Jigs and Fixtures: Departments

Quality Control - Tooling to aid in the inspection and QC process, specialty holding devices or measurement aids

Packaging & Logistics - Tooling designed for movement of parts within a facility or during shipment

R&D - Tooling used in the early phases of product development and manufacturing

General Manufacturing Floor

Health & Safety - Specialty tooling designed to aid worker safety and address ergonomic issues in the production environment

Assembly - Tooling for the assembly process, aiding workers to align and hold parts during assembly

Production - Parts and tools for the equipment used in the fabrication process

Jigs & Fixtures: Common Terminology

Production & Assembly

- Alignment Tools
- Holding Devices
- Feeders
- Hand Tools
- Check Tools
- Surrogate Parts
- End Effectors
- Milling Fixtures
- Drill Guides

Health & Safety

- Hand/Wrist Guards
- Holding Devices
- Bumpers and Guards
- Ergonomic conversion

Quality Control & Inspection

- Check Gauges
- Work Holding Devices
- Test Fixtures
- Go/No-Go Tools
- Surrogate Parts

Packaging & Logistics

- Surrogate Parts
- Tool Guards
- Dunnage Trays
- Thermoforming Molds
- Kit Boxes

SECTION THREE

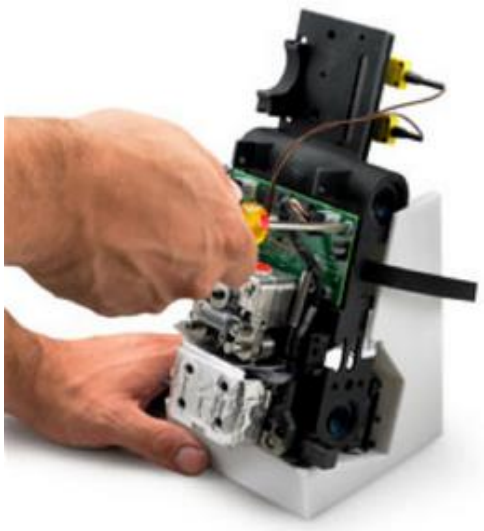
Transforming the Manufacturing Floor

Streamline Production Floor Workflows

3D printing jigs and fixtures optimize manufacturing by reducing cost and cycle time, while increasing product quality and repeatability.

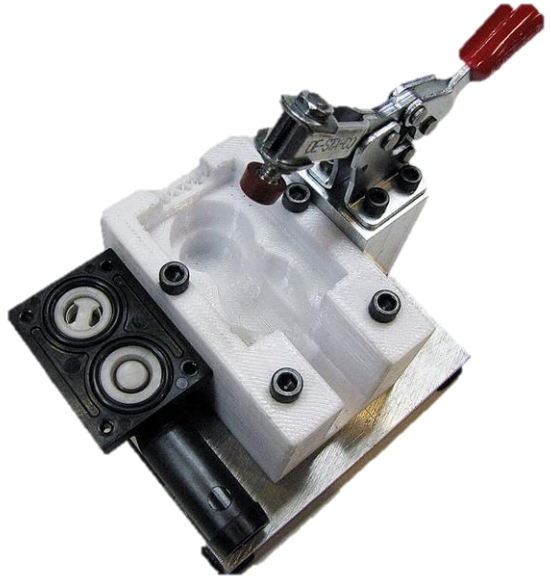
Most Important Considerations

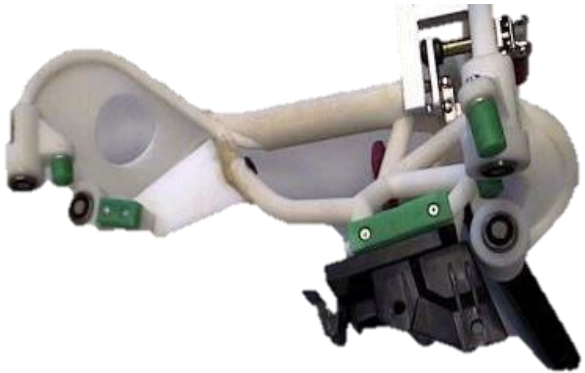
- Accuracy
- Durability
- Ease of use
- Workforce safety
- Economy in production
- Line flexibility



Objectives

- Ensure interchangeability and accuracy of parts manufactured
- Minimize the possibility of human error
- Permit the use of medium-skilled labor
- Reduce manufacturing time
- Allow production of repeat orders without retooling
- Custom, low-volume products





SECTION FOUR

Traditional Processes

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Traditional Processes

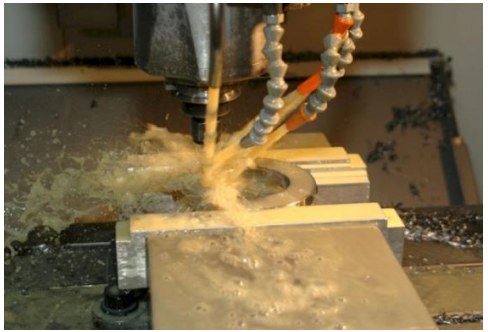
Fabrication Techniques:

- CNC
- Manual processes – welding, assembly

Typical Materials:

- Wood
- Plastic – Acetal/POM (Delrin®)
- Metals – Steel and Aluminum

Process and Assembly Time – Days to Weeks



SECTION FIVE

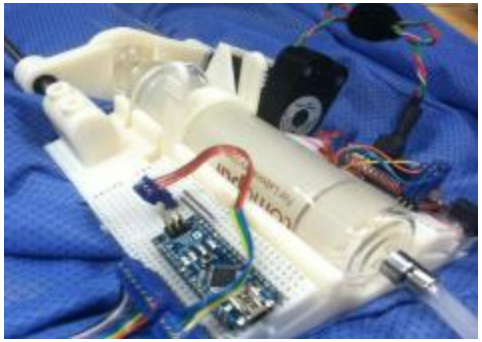
Challenges and Opportunities

Today’s Challenges

- Long machine set-ups
- Variation during assembly and fitting
- Complicated part-holding requirements
- Ease of handling and transportation
- Defects caught too far down production line
- Employee safety and ergonomics
- Cost, time, and storage prevents manufacturers from producing needed efficiency tools

Addressing Today's Challenges

- Complex geometries no longer a barrier
- Design flexibility
- Shorten set-up times
- Part consolidation
- Integrated features
- Improved ergonomics
- Simple duplication



Value Proposition

Increased Operational Efficiency:

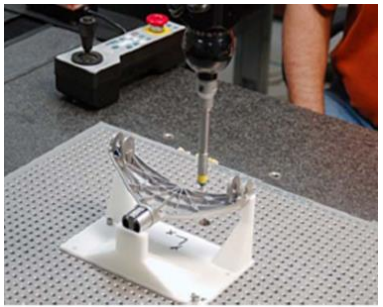
- Bring new manufacturing lines online faster
- Enable low-volume precision assembly
- On-demand tooling with digital inventory

Lower Costs:

- AM technologies have less material waste than machining
- Hybrid solutions allow for lowest cost
- Reduction in the cost of poor quality

Greater Design Freedom and Improved Performance:

- Consolidate several components to reduce tool complexity
- Integrate features – fastener, RFID, pockets, text, etc.
- Redesign for ergonomics or maximum functionality rather than manufacturability
- Customize to user and/or operation



Benefits of 3D Printing/Additive Manufacturing

Time & cost savings:

- **40-90% lead time reduction**
- **70-95% cost reduction**

Streamlined, efficient process

- Minimize PO & payment requirements
- Immediate response to needs from manufacturing floor

Digital inventory

- Reduction in storage space
- Quick replacement or design revision
- Simple duplication

Identifying the Best Fit Tools that:

- ✓ Are complex
- ✓ Have multiple components to consolidate
- ✓ Can be improved for better ergonomics
- ✓ Would benefit from weight reduction
- ✓ Require user or function customization
- ✓ Have low quantities (1-100+)

SECTION SIX

Customer Use Cases

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Opel

Optimized Assembly Floor Tools:

- Tooling is designed to last
- Created customized tools for workers and vehicle models
- Shortened design development times drastically

Reduced tooling costs up to 90%

Materials:

FDM Nylon 12 and ASA

Solaxis

Door Seal Assembly Jig:

- Allowed for a 4 second per cycle decrease, with over 250,000 cycles per year
- ROI on jig in 12 months based on time saved
- Integrated components - locking pins and feedback light

Weight savings – From 150 lbs to 28 lbs (>80%)

Time savings – 16-20 weeks to 3-5 weeks (>75%)

Materials:

ULTEM™ 9085 resin and FDM Nylon 12

Volvo Truck

Assembly and Manufacturing Aids:

- Improved overall plant flexibility and efficiency – reducing time and waste
- Using additive manufacturing for over 30 different internal tools
- Enables the equipment design team to be far more responsive, now able to create one-off and custom fixtures

Cost savings – As much as 99% savings

Time savings – 36 days to 2 days (94%)

Material:

ABS-M30

Genesis

Fabrication Tooling : End Effectors

- Part consolidation and integration of air lines directly into tool
- Ability to increase uptime with digital inventory and on-demand tooling
- Lower tool weight opens possibility to use smaller, less expensive robots

Weight savings – 35 lbs to 3 lbs (91%)

Time savings – 20 days to 3 days (85%)

Material:

ULTEM™ 9085 resin

Summary

Summary

- Reduction of tooling costs is a key part in manufacturing costs savings.
- Jigs & fixtures are a subset of the broader global tooling market**,** used throughout the manufacturing process in various departments.
- Many companies are adopting 3D printing to manufacture new jigs & fixtures, enabling lower costs, lighter tools, lower storage costs and customization to the specific requirements.
- FDM offers a significant value over traditional metal jigs and fixtures.
- FDM tooling can be a 1:1 replacement in many applications.
- Additive manufacturing provides design flexibility that removes the restrictions of traditional manufacturability.

More Information and Resources

www.Stratasys.com/Webinar-ManufacturingAids

- View webinar on-demand
- Download webinar slides
- Download application documents

www.Stratasys.com/Webinar-ManufacturingAids

Questions?

THANK YOU

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