

A spotlight beam shines from the top right corner of the slide, illuminating the title text.

*SPOTLIGHT ON:*  
INTRO TO  
3D PRINTING, PART 2

Intermountain 3D Inc

[www.intermountain3d.com](http://www.intermountain3d.com)

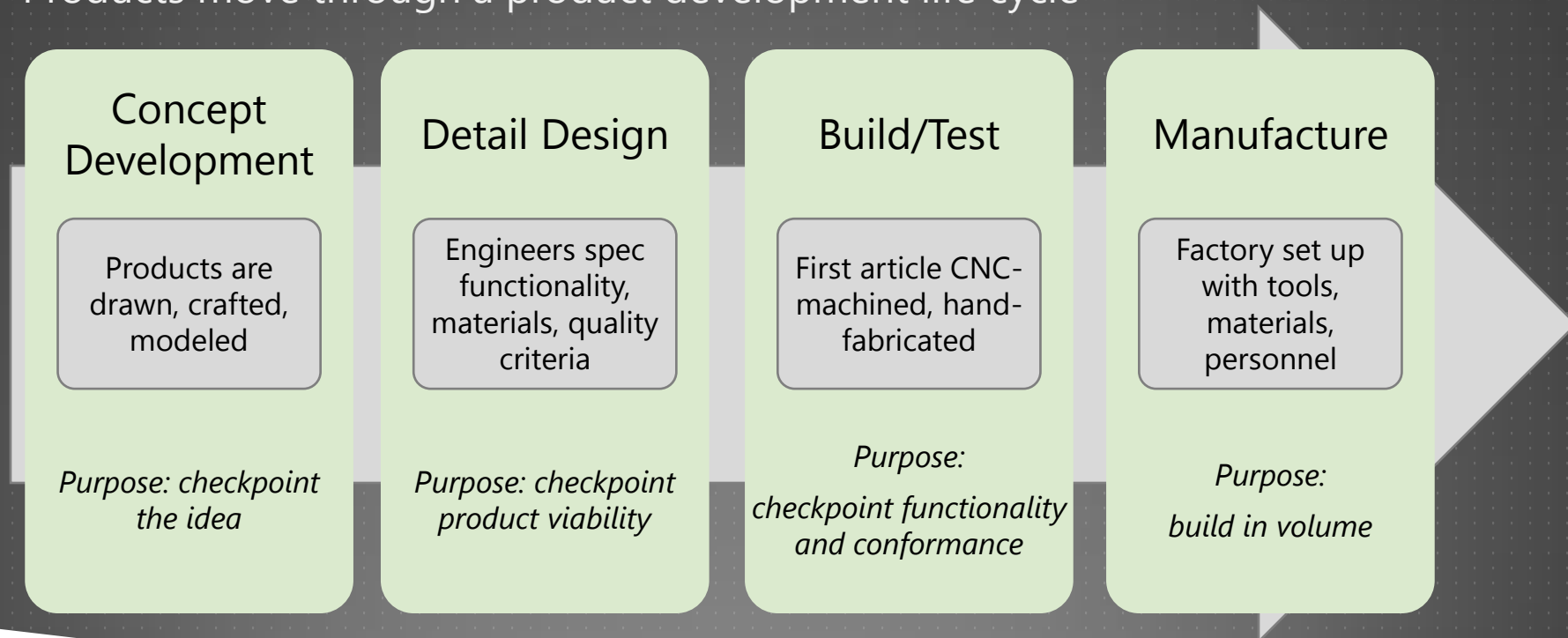
208.391.5570

Intro to 3D Printing

# PART 2: 3D PRINTING APPLICATIONS

# HOW ARE PRODUCTS DEVELOPED?

Products move through a product development life cycle



# 3D PRINTING IS USED IN EVERY STAGE OF PRODUCT DEVELOPMENT

## *Concept Development*

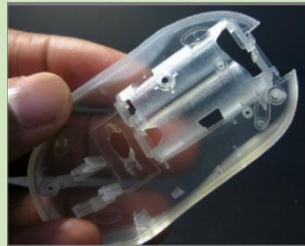
### Concept Models



Investors, marketing, customers can touch and feel the product

## *Design, Build, and Test*

### Design Verification



True snap-fit prototypes prove out design

### Functional Test



Functional prototypes allow full-testing

## *Manufacture*

### Rapid Tooling



Factory tools are quickly built to optimize volume production

### Production Parts



Specialized parts can be 3D production printed for end use

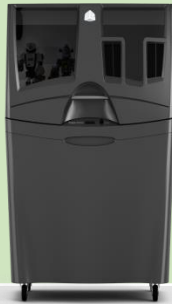
# DIFFERENT TECHNOLOGIES SERVE DIFFERENT PURPOSES

## Laminated Filament



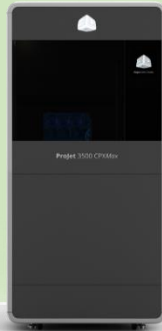
Good for: colorful concepts, fast

## Binder Jetting



Good for: accurate mono and color concept models

## Material Jetting



Good for: accurate and high resolution plastic parts in a variety of materials

## Stereo-lithography



Good for: accurate, high resolution, smooth surface finish, in variety of plastic materials

## Selective Laser Sintering



Good for: accurate, production-grade in a variety of plastic materials

## Direct Metal Sintering



Good for: accurate, production-grade in a variety of metal materials

Cost

# WHERE CAN YOU FIND ADDITIVE MANUFACTURING?

*THE SAME PLACES YOU FIND SUBTRACTIVE*

- ▶ Aerospace
- ▶ Automotive
- ▶ Healthcare
- ▶ Technology
- ▶ Architecture
- ▶ Jewelry
- ▶ Culinary
- ▶ Arts/Entertainment
- ▶ Education
- ▶ Energy



# EXAMPLE: AEROSPACE

- ▶ 3D printed parts can save airplanes significant weight, scrap, energy and fuel costs
- ▶ Shown: prototype of an Airbus A380 bracket (front) 3D printed in stainless-steel powder as a replacement for the standard cast steel bracket (back)
- ▶ Redesign eliminated material without sacrificing strength
- ▶ *GE plans to manufacture over 100K aviation parts by 2020*



Northwestern University case study, 2015  
Photo credit: Airbus Group Innovations

# EXAMPLE: AUTOMOTIVE

- ▶ Ergonomics, weight and aerodynamics are all critical to new car development
- ▶ Prototyping allows automakers to develop and evaluate new pieces without having to build tools to make test parts, saving time and money and allowing for greater innovation
- ▶ Shown: 2014 Chevy Malibu console refresh, installed and ready for test-drive
- ▶ *GM 3D prints over 20,000 parts today in their Rapid Prototyping Lab*

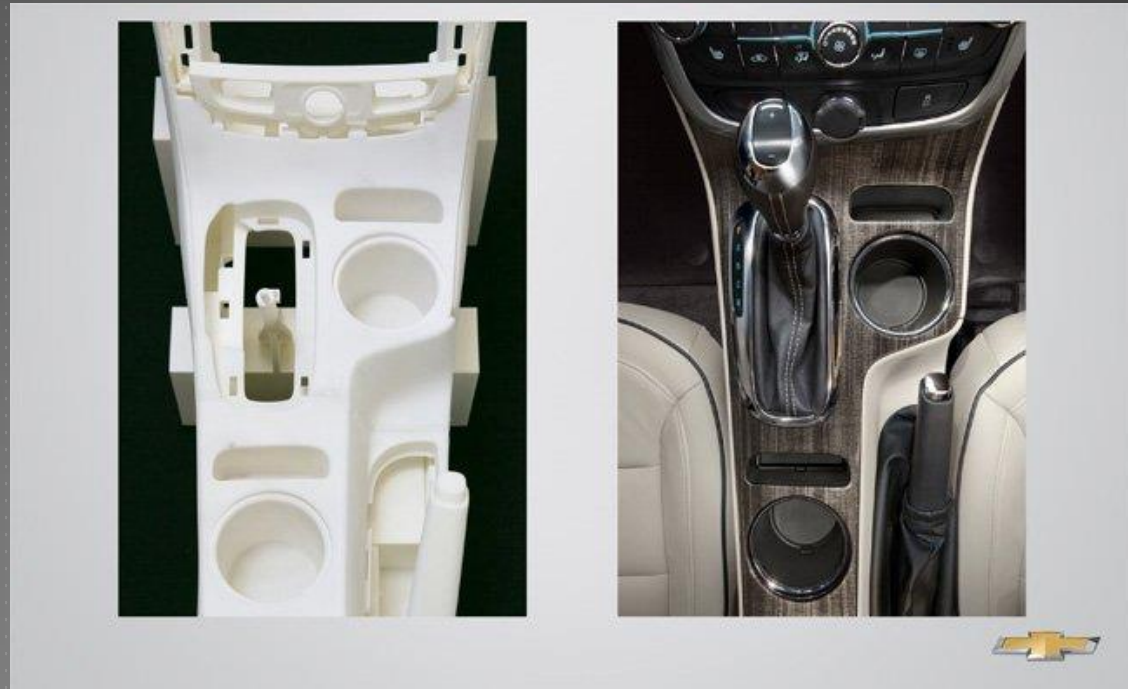


Photo credit: [www.gm.com](http://www.gm.com)



# EXAMPLE: HEALTHCARE

- ▶ 3D printing used in medical device manufacturing, surgical staging, patient-specific implants
- ▶ Accurate and realistic models from MRI and CT scans prepare teams for complex surgeries
- ▶ Personalized manufacturing promises customized fits and better outcomes from a range of devices
- ▶ *Align Technology makes over 80,000 Invisalign braces each year from 3D printed molds*



3D printed prosthesis fairing



Braces manufactured from 3D printed molds  
Photo credit: Align Technology



Hearing aid created from 3D printed mold



3D printed model heart for surgical practice and explanation

# other examples

Education



Art



Jewelry



Architecture



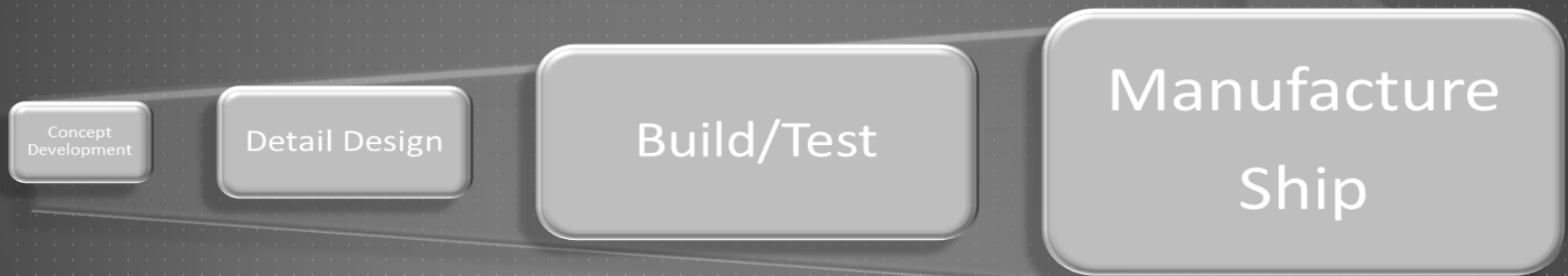
Product Development

Business of 3D Printing

# WHY USE 3D PRINTING?

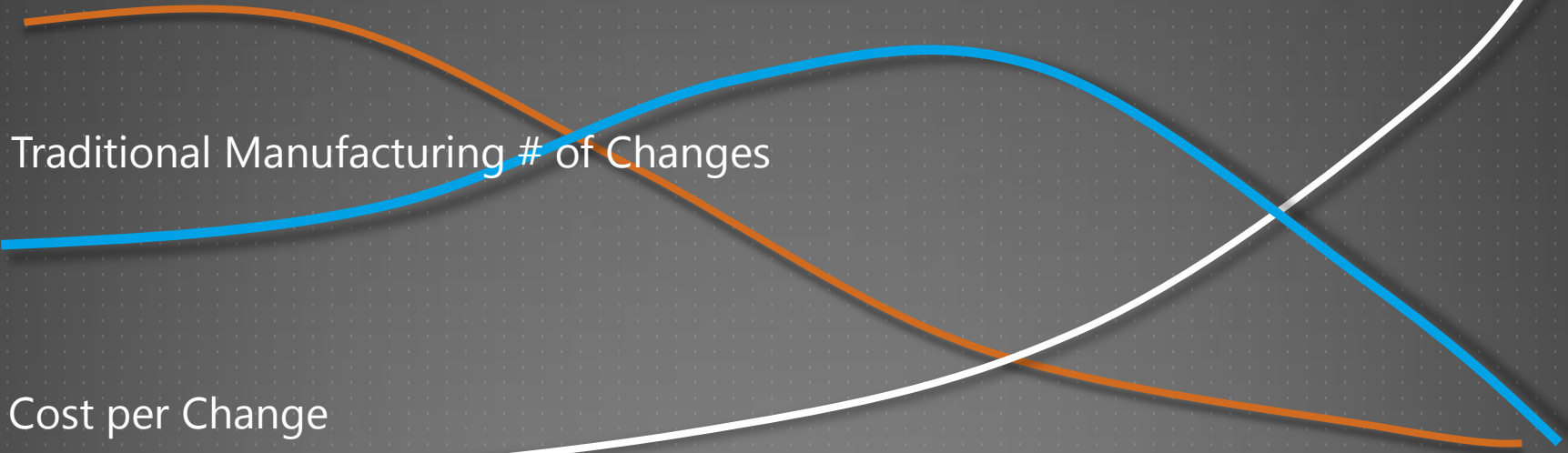
# TOTAL LIFE CYCLE COST REDUCTION

- ▶ Costs increase dramatically in the product life cycle the closer you get to manufacturing. Concept development can be the back of a napkin, but design uses engineering time; prototyping and testing are often done with handmade or expensively machined parts. When you commit to manufacturing, you incur the costs of tooling, factory space, and workers. Using concept models and prototyping verify the design before moving to expensive production tooling and factory costs.



Lowering costs means reducing the number of design changes late in the product life cycle when costs are high. 3D printing encourages a lot of changes in the concept and design phases, which reduces changes made later on.

3D Printing # of Changes



Traditional Manufacturing # of Changes

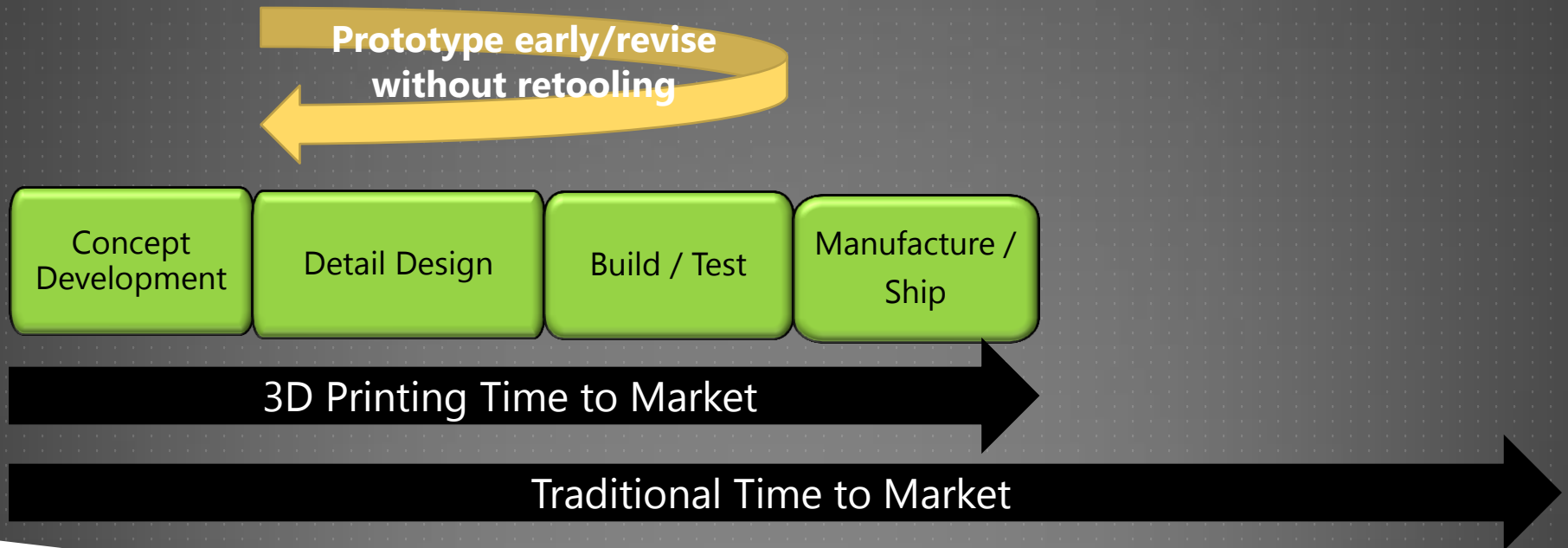
Cost per Change



Time

# DEVELOPMENT SPEED

- ▶ Rapid prototyping lets you quickly iterate designs to achieve maximal results

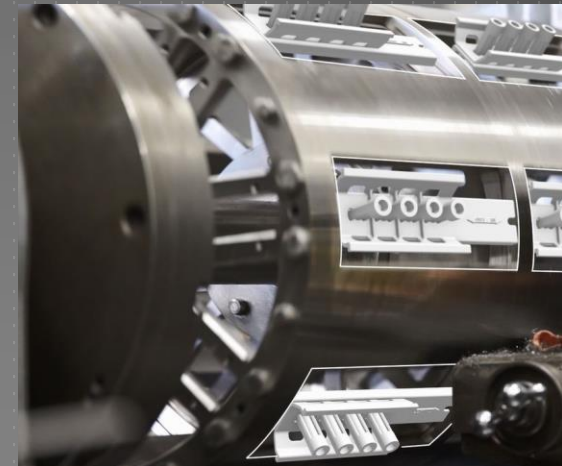


# ADDITIONAL ADVANTAGES OF 3D PRINTING

- ▶ *Optimized design.*  
Complex geometry is free with 3D printing—almost anything that can be designed can be printed. Part geometry is not limited by manufacturing constraints
- ▶ *Customized/personalized manufacturing.*  
More and more products will be designed to customer specifications because manufacturing of the final end-use parts will be done closer to the point of sale. 3D printing of production parts is being used in a wide range of industries, and is set to become an even larger portion of the manufacturing industry.



3D printed engine block



3D printed pistons installed in Idaho Steel food processing rotary former

# SUMMARY

- ▶ 3D printing is used throughout the product life cycle, for printed concept models, snap-fit and functional prototypes, and production parts
- ▶ There are several different 3D printing technologies, each one optimized for different points in the life cycle and for specific materials
- ▶ The industries that have fully integrated 3D printing into their manufacturing processes include aerospace, automotive and healthcare
- ▶ 3D printing helps reduce costs, speed up time-to-market, allow for geometrically complex part design, and facilitate personalized manufacturing



# ABOUT INTERMOUNTAIN 3D INC

Intermountain 3D was started in 2014 to bring commercial 3D printing capabilities to manufacturers, product designers and entrepreneurs in the pacific northwest.

## **Engineer to Engineer**

When you work with Intermountain 3D, you tap into decades of professional engineering experience, brought to bear on the specific problems and opportunities your project presents. More than just consulting, our engineers work with you to ensure what you envision is actually produced: in CAD drawings, prototypes, production parts, or design-for-manufacturing files.

You know your products; we know 3D design, prototyping and production. Whether you're a one-person shop or 200-people strong, Intermountain 3D is an extension of your team and focused on your success.

*Contact us to see how we can help*

