

## From Rapid Prototyping to Production

Japan Germany Industry Forum

Japan, November 2015



# 3D Printing is seen as one of the twelve potential economically disruptive technologies





### ",Enterprise 3D Printing" – we are on the "Slope of Enlightenment"





### EOS: Technology and Market Leader for Design-Driven, Integrated e-Manufacturing Solutions



• Family-owned, founded in 1989,

- Headquartered in Krailling near Munich, Germany
- Integrated solution provider for Additive Manufacturing
- Solution portfolio: Additive Manufacturing (AM) systems, materials (plastics and metals), software and services
- Complete end-to-end solutions: from part design and data generation to part building and post-processing
- EOS enables competitive advantages for a variety of industries, such as medical, aerospace, tooling, industry, lifestyle products and automotive
- EOS is committed to: Innovation – Quality – Sustainability



Dr. Adrian Keppler , Dr. Tobias Abeln , Dr. Hans J. Langer, Rudolf Nertinger, Christian Kirner (from left to right)

#### EOS Headquarters in Krailling, Germany



### **EOS: Global Presence**



#### EOS worldwide installed base

### >1,800 Systems

- <sup>1</sup>/<sub>3</sub> Metal systems
- Polymer systems
- >280 customers with more than 1 system

### EOS global footprint

- Customers in 51 countries
- EOS Sales & Service offices in 11 countries, distribution partners in 22 countries
- About 600 employees worldwide (70% Germany, 30% International)
- Strong patent portfolio: More than 700 active patents in nearly 100 patent families
- R&D Spendings of approx. 15% of Sales



# Laser sinter parts are produced by layer wise application of powder and exposure by laser



#### Additive Manufacturing – functional principle



#### Direct – generative – resource efficient

























### Sample Lattices



### Example EADS: Engine cover door hinge



### Reduced waste (in %)





### **Additional advantages**

- 65% weight savings
- Sums up to ~ 10kg per airplane
- Significant fuel / OPEX savings













### A conventional handling device was redesigned leveraging the possibilities of laser sintering



**Conventional design** 

Laser sintered design





- Hole gripper to pick up pieces out of an injection molding machine
- Four grippers mounted on a base plate
- Gripping mechanism operated by distributed compressed air
- Base plate being attached to a three axis robot













# Customization is believed to be a strong future trend for market differentiation



#### **Example customization**



#### **Customization of lamp**

#### Application

- Design lamp
- Customer can adapt the basis design of lamp within given parameters
- Customization 'front-end' available on internet platform

#### **Advantages**

- 'Mass customization' combines individualization and manufacturing possibility
- Absence of molds allows for complex geometries to be created without difficulty



### In the medical market, customization delivers high value for patient matched implants



#### **Example customization**



#### **Medical implants**

#### Application

- Patient matched implants
- Example hip implants, cranial implants and spine implants

#### Advantages

- Optimized patient match (e.g. size and strength of an accetabular cup)
- Improved functionality (e.g. enhanced design to stimulate bone growth)
- Reduced cost

### We see big OEMs to start setting up production

#### **Example General Electric Aviation**





- 100.000 additive parts will be manufactured by GE Aviation by 2020
- 1.000 lbs potential reduction in weight of a single aircraft engine through additive production
- 300 plus 3D printing machines currently in use across GE









**Summary** 

Industrial 3D Printing experiences quite a hype at present...

...however, the laser sintering technology is ready for operation – large OEMs start using it as production technology

Customization and freedom of design as well as cost and productivity advantages are key differentiators

Due to huge governmental efforts, the **technology** will experience a **sustained attention** globally



## Thank you for your attention!

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