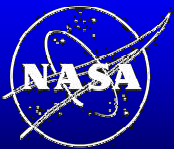


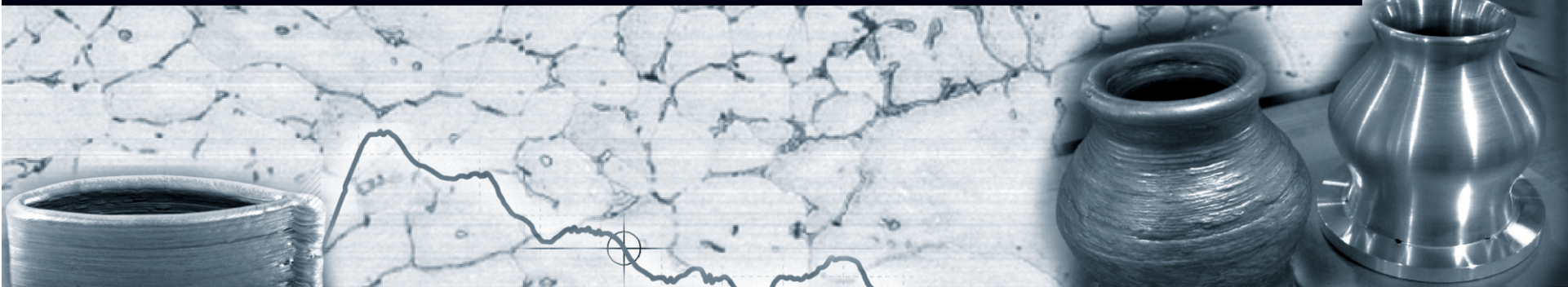


Electron Beam Freeform Fabrication:
*A metal deposition apparatus to build components
directly from CAD*

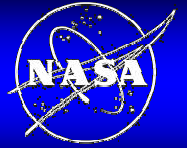


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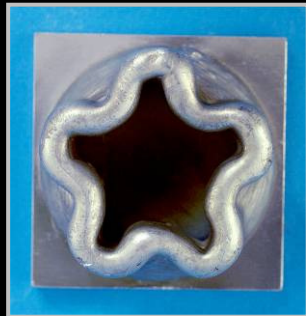


WBT Showcase | March 26-27, 2008 | Arlington, TX

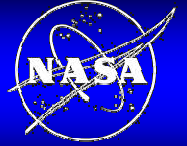


Who Needs EBF³? (Electron Beam Freeform Fabrication)

- When you need a metal part and you need it now
 - Not in stock off-the-shelf
 - Inaccessible locations
- When you need something that nobody makes
 - Prototypes / custom fabrication
 - Component-level repairs



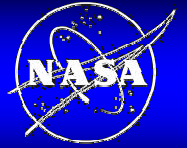
EBF³ Core Technology



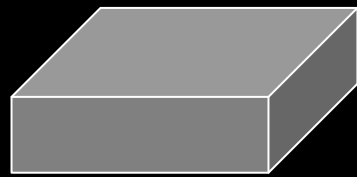
- **Rapid metal fabrication process**
 - Use as-built or with small amount of final machining
 - Material properties equivalent to wrought products
- **“Green” manufacturing**
 - Minimal waste products, low consumables
 - Efficient use of energy and feedstock



EBF³ as a Green Manufacturing Process

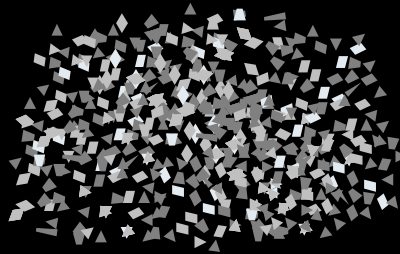


Conventional Machining:



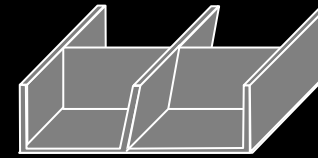
3000 lb.
forged billet

—



2850 lb. chips

=



150 lb. finish
machined part

20 : 1
buy-to-fly

Additive Manufacturing via EBF³:



200 lb.
rolled sheet

+



100 lb.
wire

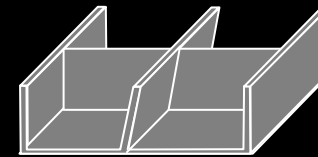
+ EBF³

—



150 lb.
chips

=

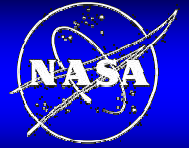


150 lb. finish
machined part

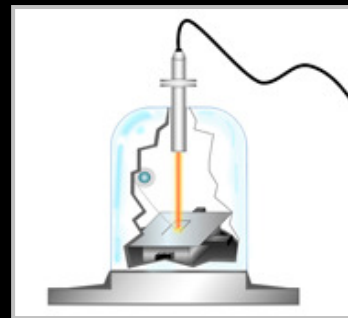
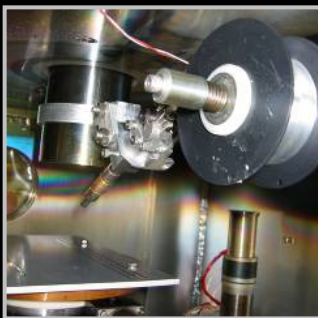
2 : 1
buy-to-fly

EBF³ saves significant resources over current methods:
raw materials, energy, fewer chemicals (cutting fluids), lead time = cost

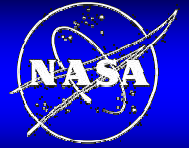
EBF³ Apparatus and Methods



- **US Patent #7,168,935, Issued on January 30, 2007**
 - Metal deposition apparatus to build components directly from CAD
 - Smaller-footprint, lower power apparatus
 - Safe operation
 - Prototype system demonstrated on aircraft in 0-g flight
- **Next generation prototypes under development**



In-House Development Team



Technology Champion Karen Taminger

Materials Researchers

- Rob Hafley
- Marcia Domack
- Eric Hoffman
- Keith Bird
- Sankara Sankaran
- Cindi Lach

Applications Engineers

- Kevin Watson (JSC)
- Dan Petersen (JSC)

Graduate Student

- Erik Nelson

Mechanical Technicians

- Richard Martin
- Jimmy Geiger

Systems Analysts

- David Mercer
- Bill Seufzer

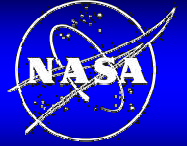
Graphics/Marketing

- Susanne Waltz

Partnership Specialist

- Susan Cooper

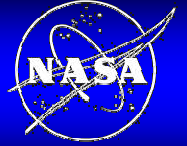
EBF³ Potential Applications



- **Aerospace**
- **Automotive**
- **Medical implants**
- **Tool & dies for casting/molding industries**
- **Sporting goods**
- **Repairs and fabrication in remote locations**



Licensees Sought for EBF³



- EBF³ currently ready for commercialization
- On-going research at NASA Langley to refine process
- Seeking licensees/partners to market and sell EBF³ systems
- For more information, visit [booth # 108](#)

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