



Innovation for Digital Fabrication

March 2012 - March 2014

*Coordination & support action
project 290559 ; theme NMP.2011.2.3-3*

Marcel Slot

*Océ-Technologies B.V
A Canon Group Company*



Diginova

Start of Diginova

- The digital age advances: industries as well as society need to adapt
- Digital technologies have changed whole industries & consumer behaviour
 - Music industry
 - Photography
 - Printing
 - Communication
 - ...
- Manufacturing is lagging behind ...
- Innovation with new materials: production technologies are often the bottleneck



Digital design → End-product

- Benefits: short runs, on-demand, zero-waste, no stock, decentralised, fast turnaround, distribute & print (instead of print & distribute), clean & green, ease of use

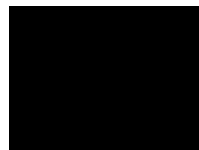
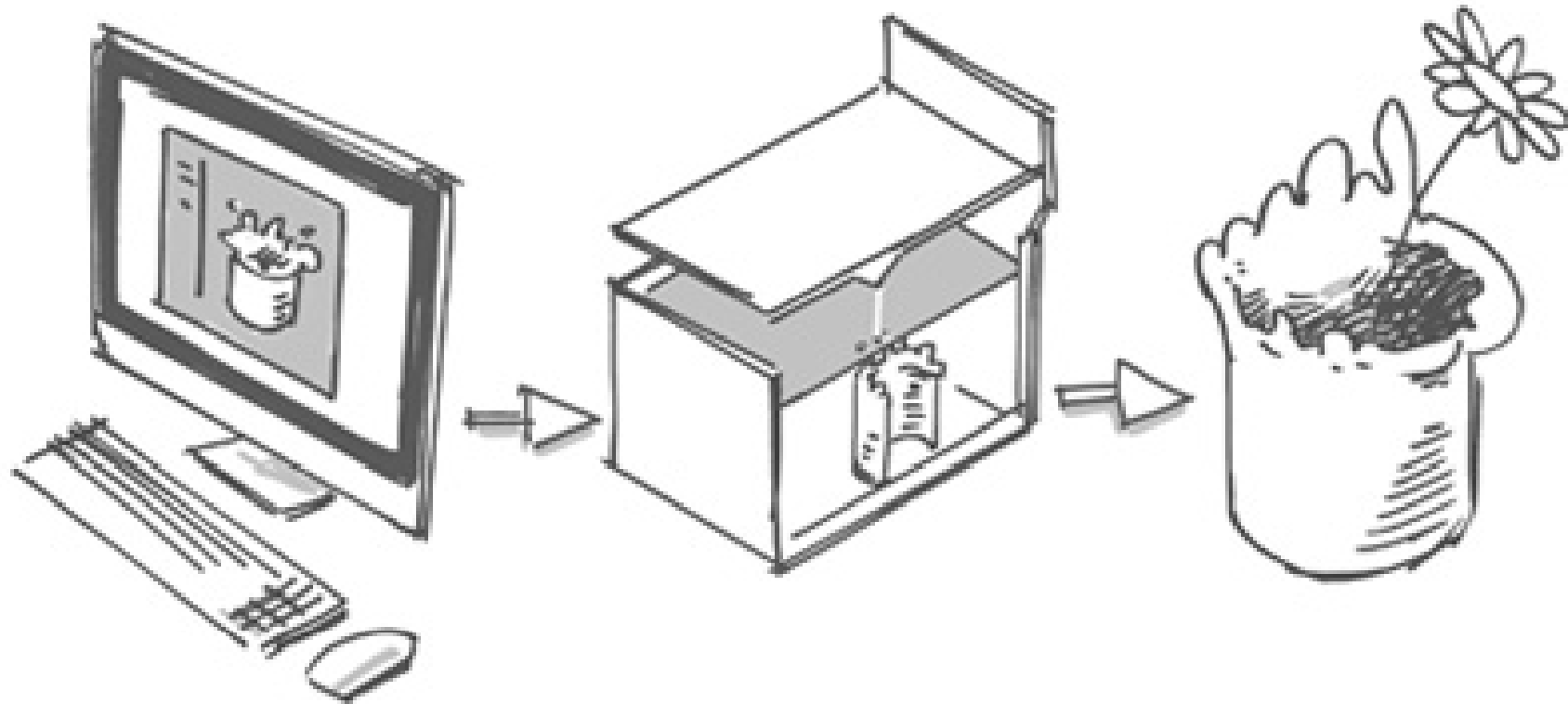


Concept of Digital Fabrication

*Transformation of digital designs directly
into physical products using computer
controlled-tools and processes*



Concept of Digital Fabrication





- **We have had an industrial revolution ...**
- **We have had a digital revolution ...**
- ***Now is the time for a digital industrial revolution***



Digital Fabrication: paradigm shift in manufacturing





What we believe and set out to do

Digital Fabrication: towards 'Industry 2.0'

Influence/coordinate EU programs towards new sustainable economic growth

- Clarify economic & societal relevance of 'Digital Fabrication' for Europe
- Deliver a strong **roadmap**, aiming for high impact and wide support
- Focus on both business value and technology

Connect to & involve others. Deliver common framework.

Connect to existing EU programs, research agendas, roadmaps

- Maximize impact
- Mobilize & build eco-systems

Diginova: partner overview



Diginova: partner overview



Scope of Digital Fabrication within Diginova

- *Matching manufacturing technology to key new materials*
- *On-demand manufacturing for customized products with potential for short production series* (down to 'series-of-one')
- *Shortening change-over times* to accommodate *flexible production*
- Using *additive manufacturing* methods to enable production of products comprising of more than one material using *minimal resources* with *no waste*
- Exploiting the *inherent freedom of design* in both geometry and material composition to produce products that are *more optimized for functional performance* and not hampered by limitations imposed by manufacturing processes

Technologies in scope

- ***Printing*** as a ***digital material deposition*** technology, including its use for three dimensional products.
- ***Laser processing*** as defined, clean and fast ***digital material modification*** technology
- ***Coating*** and coating sequences as large area ***material deposition for functional substrates***

Will our story be heard?



“Print me a Stradivarius”



How a new manufacturing technology will change the world



“The printed world”



Coverstory , February 2011

<http://www.economist.com/node/18114327>

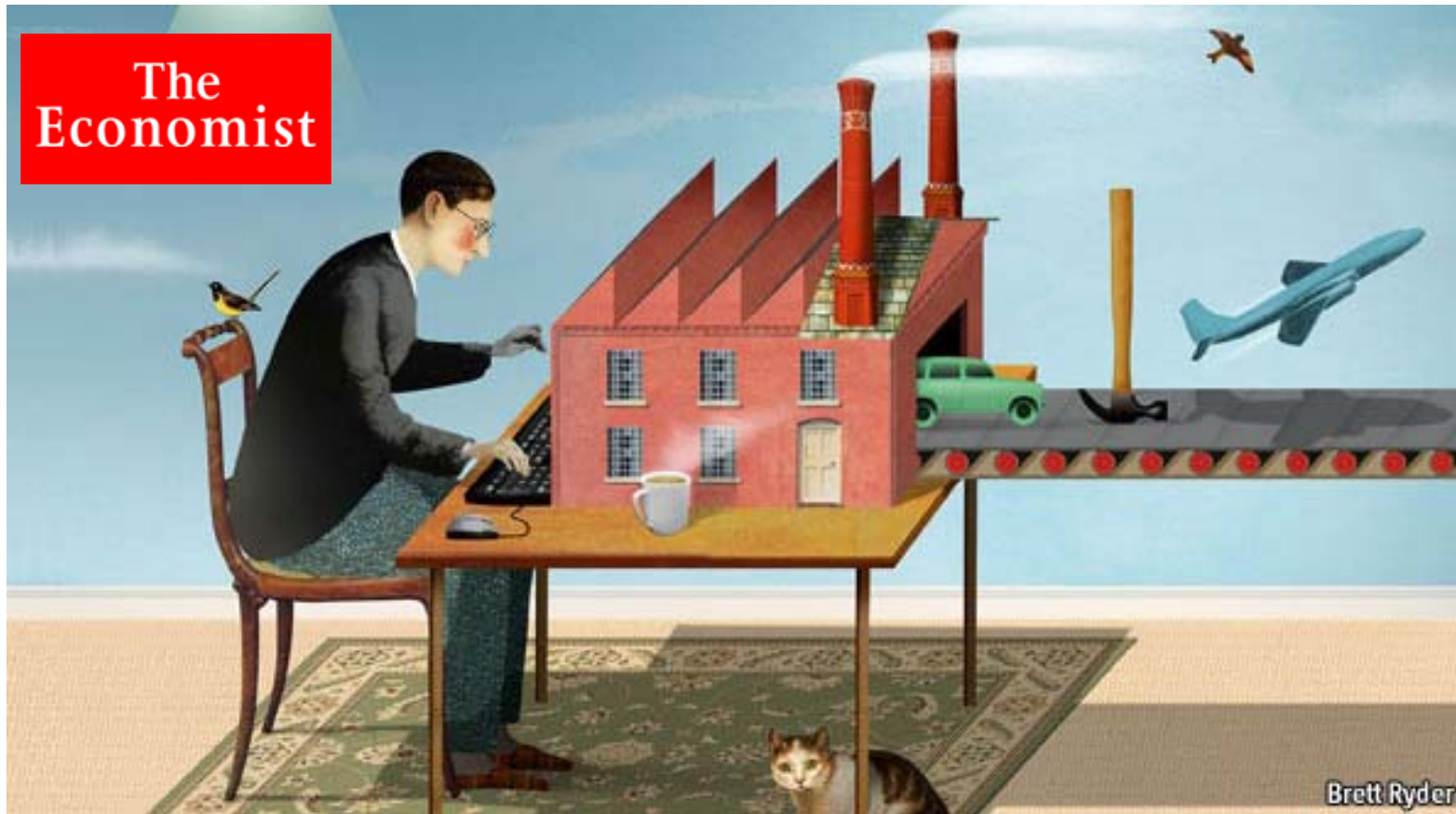


withinbb.com

“The third Industrial Revolution”



“The digitisation of manufacturing will transform the way goods are made—and change the politics of jobs too”



“Print me a phone”



- *New techniques to embed electronics into products*
- *Convergence of printed electronics & 3D printing*

**The
Economist**

July 28th, 2012

<http://www.economist.com/node/21559593>



Claudio Munez

3D printing the 'next revolution' in manufacturing: President Obama

By Joe McKendrick | February 12, 2013, 7:01 PM PST

17

Comments

11

 +1

more +

In his State of the Union address Tuesday night, U.S. President Barack Obama acknowledged the revival of the long-suffering U.S. manufacturing economy, and points to 3D printing as the technology that will create even more manufacturing opportunities.



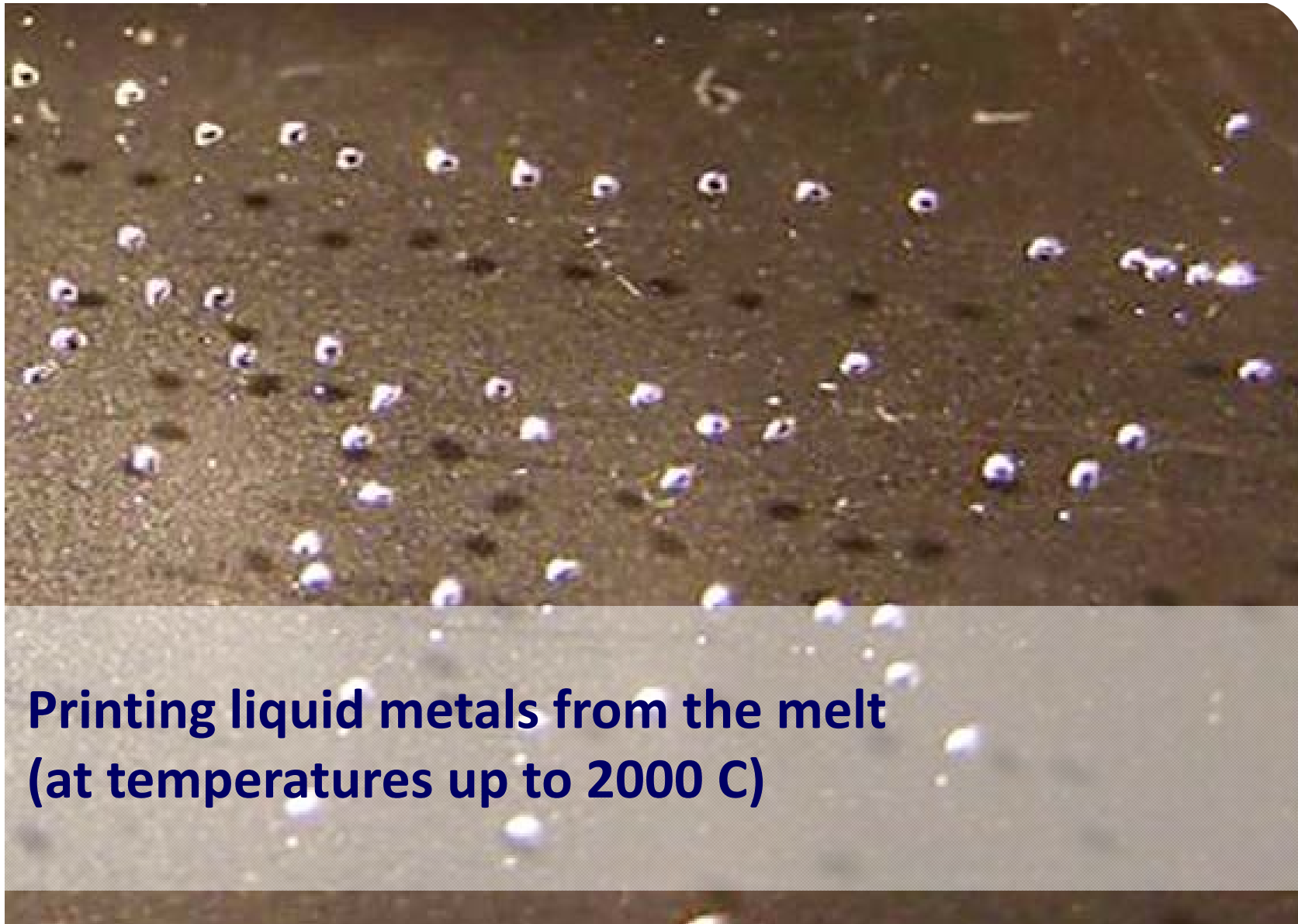
Here is an excerpt of the [speech](#):

"Our first priority is making America a magnet for new jobs and manufacturing. After shedding jobs for more than 10 years, our manufacturers have added about 500,000 jobs over the past three.

Caterpillar is bringing jobs back from Japan. Ford is bringing jobs back from Mexico. After locating plants in other countries like China, Intel is opening its most advanced plant right here at home. And this year, Apple will start making Macs in America again.

"There are things we can do, right now, to accelerate this trend. Last year, we created our first manufacturing innovation institute in Youngstown, Ohio. A once-shuttered warehouse is now a state-of-the-art lab where new workers are mastering the 3D printing that has the potential to revolutionize the way we make almost everything. There's no reason this can't happen in other towns. So tonight, I'm

Matching new manufacturing processes and materials: MetalJet an example



**Printing liquid metals from the melt
(at temperatures up to 2000 C)**

Océ Research example: MetalJet



Example movies: Jetting of Cu droplets



*Cu droplets 'bouncing of' glass:
poor wetting / adhesion*

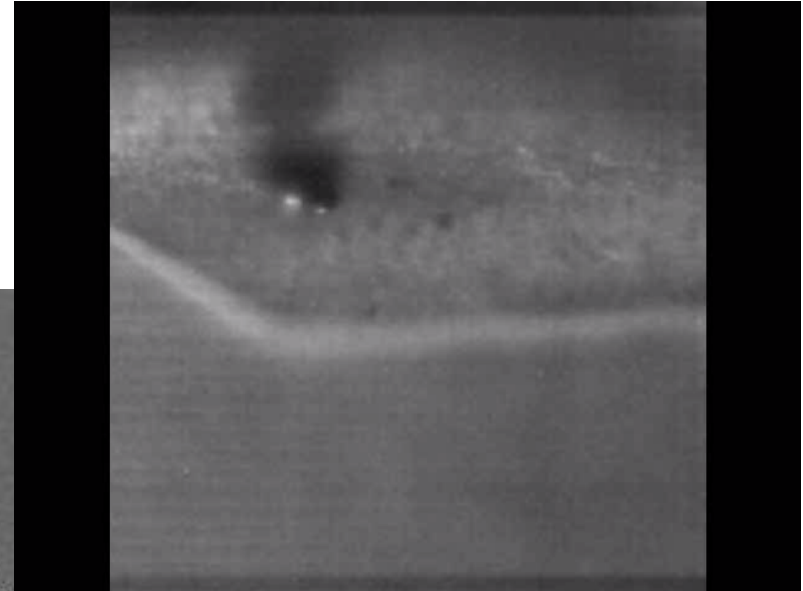
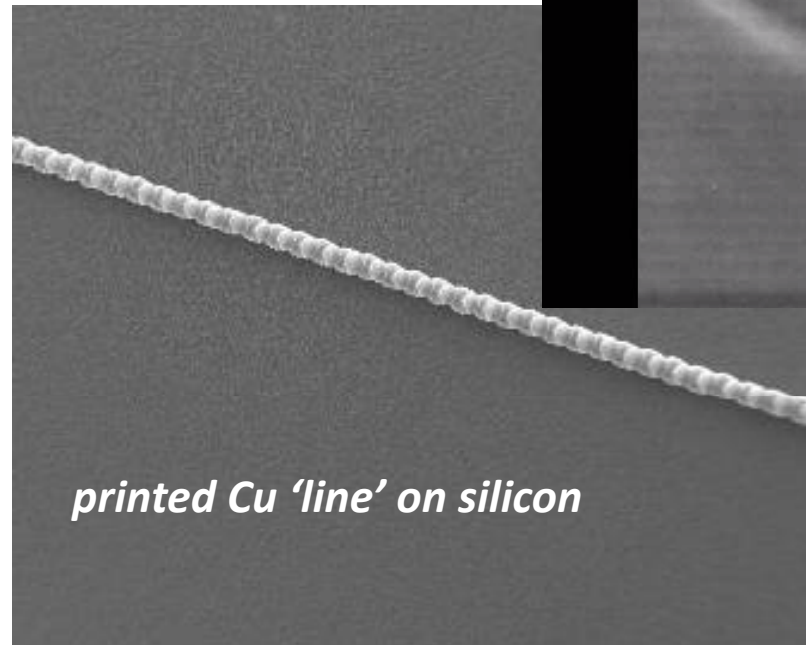
*Cu droplets on silicon surface :
good adhesion*

Océ Research example: MetalJet



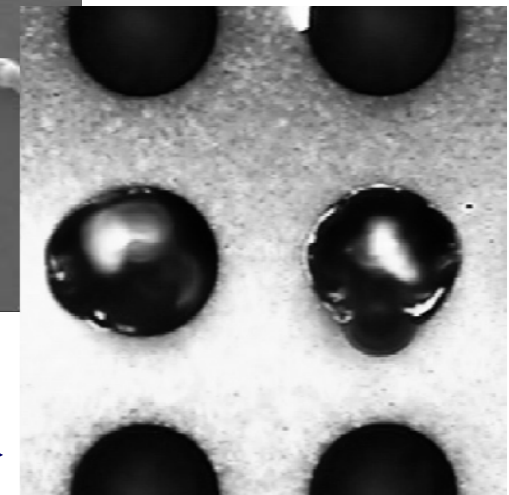
Examples of metals jetted

- Cu
- Ag
- Au
- ...
- Si



*Printed
miniature
logo*

*Filling of Through
Silicon Vias*





Take home messages



- Anything that can be “printed”, will be printed ...
- Anything that can be digital, will be digital ...
- Need for strong and coordinated European effort towards next-generation printing technologies

*“The best time to plant a tree was 30 yrs ago.
.... The second best time is now”*