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H2020- INFORMATION DAY

Factories of the Future – FoF-13-2016 Photonics laser-based production

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European Commission

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Photonics support to manufacturing

Background

- World market of laser-based manufacturing systems
  
  2012: 8 B€

- Expected growth rate (CAGR): 7% (from 2011 to 2020)

- EU market share 2012: 33% but in 2008: 39%
  
  due to fierce competition mainly from Asia

- → reverse the decline

- Large economic leverage effect in a wide range of industry
  
  e.g. automotive, aerospace, electronics, medical, consumer goods, etc.

  medical examples: pace makers, synthetic bones, endoscopes, stents, ...

- Need to keep European technology at the forefront of innovation

- Need to bundle forces on a European level addressing research issues efficiently and effectively
Laser systems for manufacturing: support in the past

Support in FP7 and H2020 via

- ICT Photonics programme
- Factories of the Future initiative (FoF PPP)
- Programme on Nanosciences, Nanotechnologies, Materials and new Production Technologies (NMP)

Examples of research themes in FP7 and H2020:

- Lasers for industrial processing:
  high peak/average power lasers, widely tuneable lasers, ultra-short pulse lasers, fibres and fibre lasers, diode lasers, component integration, new wavelengths and frequency conversion, remote processing, on-line adaptation of beam properties, process monitoring and related devices, synchronization of sources and devices, multiple beam processing

- Funding $\approx 80 \text{ M\$} \text{ Photonics and FoF (FP7 & H2020 2014, 2015)}$ (+ projects from NMP)
# Laser systems for manufacturing: support in the past

## Examples of projects in FP7:

<table>
<thead>
<tr>
<th>Project Acronym</th>
<th>Project Title</th>
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<tbody>
<tr>
<td>APPolo</td>
<td>Hub of Application Laboratories for Equipment Assessment in Laser Based Manufacturing</td>
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<tr>
<td>BRiDLE</td>
<td>BRiLLiant Industrial Diode LasEr</td>
</tr>
<tr>
<td>HALO</td>
<td>High power Adaptable Laser beams for materials prOcessing</td>
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<tr>
<td>IMPROV</td>
<td>Innovative Mid-infrared high Power source for resonant ablation of Organic based photovoltaic devices</td>
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<tr>
<td>ISLa</td>
<td>Integrated disruptive componentS for 2um fibre LAsers</td>
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<tr>
<td>QCOALA</td>
<td>Quality Control of Aluminium Laser-welded Assemblies</td>
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<tr>
<td>UV-Marking</td>
<td>Development of new UV laser for customization at industrial level trough high quality marking on different materials</td>
</tr>
<tr>
<td>LASHARE</td>
<td>Laser equipment Assessment for High impAct innovation in the manufactuRing European industry</td>
</tr>
<tr>
<td>RLW Navigator</td>
<td>Remote Laser Welding System Navigator for Eco &amp; Resilient Automotive Factories</td>
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<tr>
<td>TiSa TD</td>
<td>Ultrafast High-Average Power Ti:Sapphire Thin-Disk Oscillators and Amplifiers (under negotiation)</td>
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<tr>
<td>Ultrafast_RAZipol</td>
<td>Ultrafast Lasers with Radial and Azimuthal Polarizations for High-efficiency Micro-machining Applications</td>
</tr>
<tr>
<td>LIFT</td>
<td>Leadership in Fibre Laser Technology</td>
</tr>
<tr>
<td>ALPINE</td>
<td>Advanced Lasers for Photovoltaic INdustrial processing Enhancement</td>
</tr>
<tr>
<td>POLYBRIGHT</td>
<td>Extending the process limits of laser polymer welding with high-brilliance beam sources</td>
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**Examples of projects in H2020:**

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<tr>
<td>ADALAM</td>
<td>Sensor based adaptive laser micromachining using ultrashort pulse lasers for zero-failure manufacturing</td>
</tr>
<tr>
<td>COMBILASER</td>
<td>Combination of non-contact, high speed monitoring and non-destructive techniques applicable to LASER Based Manufacturing through a self-learning system</td>
</tr>
<tr>
<td>MASHES</td>
<td>Multimodal spectral control of laser processing with cognitive abilities</td>
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<tr>
<td>RADICLE</td>
<td>Real-time dynamic control system for laser welding</td>
</tr>
<tr>
<td>HIPERDIAS</td>
<td>HIgh throughPut LasER processing of DIamond and Silicon</td>
</tr>
<tr>
<td>ultraSURFACE</td>
<td>Ultra Dynamic Optical Systems for High Throughput Laser Surface Processing</td>
</tr>
</tbody>
</table>
FoF-13-2016 Photonics Laser-based production

a) "From design to piece" – Excellence in laser-based additive industrial manufacturing

- Research and Innovation Actions (RIA)
- Funding 15 million Euro

b) Rapid individualised laser-based production

- Innovation Actions (IA)
- Funding 15 million Euro
a) **RIA:** Additive industrial manufacturing *(laser-based)*

Market of AM in 2012: 1.7 B€ (materials, systems and services)  
(Roland Berger consulting)  
Expected Growth: 2018: 4.5 B€  2023: 7.7 B€  CAGR ~ 14.7%

**Challenges**

- Huge potential, advantages over conventional manufacturing:  
  highly flexible & customisable process, freedom of design, e.g. geometry,  
  material composition, intrinsic properties

- Currently used prototyping and smaller markets, e.g. medical  
  applications, rapid prototyping, repair

- HOWEVER: AM is not yet competitive on a larger scale

- Problems include: production speed and costs
Additive industrial manufacturing (laser-based)

Challenges:

- need to:
  - increase productivity
  - bring AM a significant step further towards industrial manufacturing

by better mastering all stages of the production process
AND their interaction

Note: complementing the topic FOF-1-2016
a) **RIA (ctd):** Additive industrial manufacturing (**laser-based**)  

**Scope:**

- **From design to final work piece:** Laser based additive industrial manufacturing of metallic materials  
- **all process chain steps may be addressed** (e.g. CAD, modelling, additive process, different materials in a single work piece, process control, QA, combination additive/subtractive, surface finish, etc)  
- **→ significantly improve the overall performance in terms of speed and costs** whilst producing high quality work pieces  
  - **at least two important steps and the links** between them  
    - laser based process  
    - metallic materials  

**MUST**

- address standardisation as appropriate  
- be driven by **concrete business cases**  
- contain outline of **business case and industrial exploitation strategy**  
- include relevant partners of the **value chain** in the proposal
a) **RIA (ctd):** Additive industrial manufacturing *(laser-based)*

**Expected impacts:**

- Reinforced **industrial leadership** in laser-based Additive Manufacturing
- Substantially improved **production speed**, improved **productivity** and substantially reduced **costs** of laser-based Additive Manufacturing

**Funding:**

- 2-4 million Euro per project *(other amounts possible)*

**Budget available:**

- 15 million Euro
b) **Innovation actions:** Rapid individualised laser-based production

**Challenge:**

- **Laser based manufacturing:**
  - backbone of modern production processes
  - highly accurate mass production
  - wide range of products, industries
  - highly flexible

- **Problem:** Changes of lots require interventions, down times

- **Trend to individualisation requires:**
  - a high degree of digitization
  - highly autonomous and automated tools and systems to reduce production time and costs
b) **Innovation actions (ctd):** Rapid individualised laser-based production

**Scope:**

- Development and set-up of **highly flexible high throughput pilot facilities** on the basis of **existing laser-based production processes**

- **Validation in real settings**

- **Advances needed in a number of aspects** (e.g., intelligent networking and machine cooperation, data handling, modelling, work piece handling, beam delivery, integration of different processes, monitoring, process control etc.)

- **Industry** driven

- Include the **key stakeholders** running the pilot facility

- **Outline business case and industrial exploitation strategy**
b) **Innovation actions (ctd):** Rapid individualised laser-based production

**Expected impacts:**

- More efficient, more flexible and higher throughput of individualised laser-based production.
- Improved competitiveness and strengthened Europe's market position of laser-based manufacturing industry (equipment and suppliers) and the end-user industry.

**Funding:**

- 2-4 million Euro per project (other amounts possible)

**Budget available:**

- 15 million Euro
For more information

- National Contact Points
  

- Participant Portal
  

- Horizon 2020
  

- Photonics21 and Photonics Public Private Partnership:
  