

# PROJECT PROFILE





Integrating design and production into a single end-toend process creates flexible manufacturing and a quicker response to market demands [Hyb-Man]

The Hybrid 3D Manufacturing of Smart Systems project (or Hyb-Man) will impact the European electronics manufacturing industry by delivering expertise in the individual technologies, integrating them into one, end-to-end hybrid 3D manufacturing process. This will create value in European manufacturing.

Producing today's electronic products is generally an assembly of separate parts: housings, structural elements, populated PCBs and discrete devices, brought together in a complex sequence of semiautomated steps and then tested as a complete assembly. Furthermore, the drive to reduce cost and improve quality has resulted in standardised components and sub-assemblies that are made into mass-produced products.

Unfortunately, this approach requires large, separate production lines for the sub-assemblies (such as PCB and housing); high investment levels for equipment/ tooling; and substantial labour overheads for the manufacturing of the final product, including handling, assembly, interconnect and process control. Furthermore, the value chain is fragmented, with substantial 'parts tourism' (components are often shipped over long distances to different process steps in the value chain). This increases lead-times and has a negative environmental impact. Moreover, in the past decades we have seen a major part of electronics mass-manufacturing migrate from Europe to Asia, where low-wage economies and the availability of human capital resonate well with the requirements of fixed-configuration, mass electronics-manufacturing.

# Implementing flexible, first-time-right production

Hyb-Man will respond to these drawbacks by developing innovative hybrid 3D manufacturing methods with the objectives of attaining high flexibility and first-time-right production. These methods are based on multi-material additive manufacturing (AM) – also referred to as 3D printing – as a core production technology, combined with automated assembly and the integration of electronic parts.

The project will first develop individual processes, and subsequently combine them into a single, integrated production chain that includes design rules, in-line testing and quality monitoring to a high-technology readiness level. The resulting production process will be highly flexible, because it is a digital process driven by data, which does not require product-specific equipment, tooling or moulds. This migration from tool-centricity to datacentricity is the key factor that impacts cycle times, process-setup costs and design/product flexibility.

Key project activities and deliverables will be:

- Developing end-user/product specifications from the LED lighting and automotive-sensor applications to be used to derive process and metrology requirements;
- Developing hybrid 3D manufacturing technologies which meet these requirements and are mutually compatible;
- Developing materials for electrical conductive, insulating and structural elements in parallel with these processes;
- Developing design rules for products and processes, based on the relationship between the processes, materials and product properties;
- Integrating these technologies and in-line control methods into a single, process-flow architecture, including the required hardware/ software to be used for process-tuning and optimisation;
- Producing demonstrators and prototypes for the LED lighting and automotive-sensor application use-cases, using the integrated process flow-architecture;
- Evaluating the demonstrators to provide feedback on the process performance and to identify improvements.

#### Key project competencies

To make AM suitable for electronic end-products, individual and combined processes, quality standards, reliability and integration with current methods, all of these need to be brought to a higher maturity level. The project consortium provides the technical competencies required across the complete value-chain: materials, processes, equipment, products and applications. This



#### **KEY APPLICATION AREAS**



Digital Life

## ESSENTIAL CAPABILITIES



Systems and Components : Architecture, Design & Integration ECS Process Technology, Equipment, Materials & Manufacturing

### PARTNERS

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V Henkel AG & Co KGaA. Neotech AMT GmbH XENON Automatisierungstechnik GmbH Eindhoven University of Technology Philips Lighting B.V TNO - Nederlandse Organisatie voor Toegepast

#### COUNTRIES INVOLVED



The Netherlands

#### **PROJECT LEADER**

#### **KEY PROJECT DATES**

Aeneas Office

44 rue Cambronne F-75015 Paris - France Tel. +33 1 40 64 45 80 Fax +33 1 40 64 45 89 Email penta@aeneas-office.org www.penta-eureka.eu

consortium will also have considerable market impact, not only on the integrated electronic end-products, but also on new materials, processes and equipment, software and simulation tools, as well as knowledge/design rules.

#### Flexible production creates key business advantages

Flexible production is achieved through the removal of product-specific tooling; the absence of large stocks of end products; local production; and formfreedom in production. This will lead to such substantial business benefits as:

- Faster response to changes in the market, with localised production and reduced component and tooling lead times;
- Increased product diversity by adopting flexible manufacturing technologies;
- Cost-effective manufacturing of small series and customer-centric (semi-bespoke) solutions;
- New product designs offering improved functionality and new form factors not previously possible.

Now, these business benefits will give European electronics-manufacturing companies the ability to maintain their leading position in the rapidly changing market for electronic products, which increasingly demand optimised and semi-bespoke solutions. The constraints of current manufacturing infrastructure, optimised for low-cost/high-quality products that are mass produced in enormous quantities in Asia, result in standardised components and product designs. They also lead to limited shape freedom and a rigid supply chain; as well as pressure to minimise variation and allow high fixed-manufacturing costs to be amortised over many produced units.

#### **Opportunities in flourishing** markets

The AM global market is expected to grow to €6.5 billion in 2016 and exceed €19 billion in 2020. Current developments in AM for medical, automotive and aerospace applications are significant. The global market for electronics manufacturing services was €1,200 billion in 2014, with an expected growth to €1,600 billion in 2019. Two important trends relevant to Hyb-Man are the increasing demand to produce embedded electronics; and the market penetration of printed electronics and hybrid systems – signifying integration of printed and silicon-based components. Products that combine both technologies will increasingly drive a printed-electronics market. Assuming hybrid manufacturing in Europe can capture 1% of the AM market, this would already represent a potential market value of €200m in 2020.

Finally, significant advances in information and communication technology, combined with sensor technology and robotics, open up new opportunities in what is called Internet of Things (IoT). This is a very wide market and includes consumer, industrial and government applications. It is estimated that by 2020, dozens of devices per human being will be connected to the internet. This means an annual growth of 20% and a potential value of €12 trillion in terms of IoT. The demand for connected devices spans multiple industries, and is also seen as an opportunity for reshoring manufacturing. Notably, Europe has potentially a full eco-system for IoT, ranging from market leaders in smart sensors, embedded systems, software, network vendors and telecommunication, to application integrators, dynamic small- and medium-sized enterprises and industrial early-adopters.

Penta (E! 9911), is EUREKA Cluster whose purpose is to catalyse research, development and innovation in areas of micro and nanoelectronics enabled systems and applications.

