List of European additive manufacturing related projects

These projects have received funding from the European Union Horizon 2020 Programme (H2020) under grant agreements number 636882 and 723560.

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Abbreviations

2PP	Two Photon Polymerisation
AM	Additive Manufacturing
AMT	Additive Manufacturing Technologies
AT	Austria
ATL	Automated Tape Laying
BA	Bosnia & Hercegovina
BE	Belgium
BFU	Beam Forming Unit
CAD	Computer-aided Design
CAM	Computer-aided Manufacturing
CAPP	Computer-aided Process Planning
CAx	Computer-aided Technologies
CH	Switzerland
CN	China
CT	Computer Tomography
CW	Continuous Wave
CZ	Czech Republic
DE	Germany
DED	Directed Energy Deposition
DK	Denmark
DLP	Digital Light Processing
EBM	Electron Beam Melting
ECM	Electro-Chemical Machining
ECVET	European Credit System for Vocational and Education Training

EDM	Electrical Discharge Machining
EQF	European Qualifications Framework
ES	Spain
FGM	Functionally Graded Material
FI	Finland
FoF	Factories of the Future
FR	France
GR	Greece
HR	Croatia
ICT	Information and Communications Technologies
IDDS	Integrated Design Decision Support
IE	Ireland
IM	Injection Moulding
IL	Israel
IPL	Intense Pulse Light
IPRs	Intellectual Property Rights
IT	Italy
KET	Key Enabling Technologies
LAM	Laser-based Additive Manufacturing
L-AMT	Lithography-based Additive Manufacturing Technology
LCM	Lithography-based Ceramic Manufacturing
LCP	Liquid-Crystal Polymer
LDS	Laser Direct Structuring
LE	Large Enterprise

LED	Light-Emitting Diode
LIFT	Laser Induced Forward Transfer
LMD	Laser Metal Deposition
L-PBF	Laser Powder Bed Fusion
LU	Luxembourg
MID	Moulded Interconnected Devices
MIM	Micro Injection Moulding
MOOC	Massive Online Open Courses
MRI	Magnetic Resonance Imaging
NdFeB	Neodymium-iron-boron
Ni	Nickel
NIR	Near Infrared
NL	The Netherlands
NO	Norway
OA	Osteoarthritis
OCT	Optical Coherence Tomography
OEM	Original Equipment Manufacturer
OER	Open Educational Resources
PEEK	Polyether ether ketone
PIM	Powder Injection Moulding
PKM	Parallel Kinematics Machine
PPA	Polyphthalamide
PPP	Public Private Partnership
PT	Portugal
RFID	Radio Frequency Identification
RIA	Research and Innovation Action
RIS3	Research and Innovation Strategies for Smart Specialisation
RM	Rapid Manufacturing
RO	Romania
RS	Serbia
RTD	Research and Technical Development
SDS	Shaping, debinding and sintering
SE	Sweden
SI	Slovenia
SK	Slovakia
SLM	Selective Laser Melting
SLS	Selective Laser Sintering
SME	Small and Medium Enterprise
SPiP	Smart Products-in-Package
TE	Tissue Engineering
Ti	Titanium
TR	Turkey
TRL	Technology Readiness Level
UK	United Kingdom
VC	Value Chain
VET	Vocational Education and Training

1 Preface

This document aims at presenting a list of European AM related projects. The cluster e-database with more details on these and more projects from other calls appears in the AM platform website: www.AM-platform.eu

This map constitutes an open working document, developed in the framework of FoFAM "Industrial and regional valorization of FoF Additive Manufacturing projects" (grant agreement no. 636882) and AM-motion "A strategic approach to increasing Europe's value proposition for Additive Manufacturing technologies and capabilities" (grant agreement no. 723560) projects.

Version: March 2017.

2 List of European AM related projects

The European Framework Programmes and H2020 have been supporting projects covering AM research and innovation. Relevant projects dealing with these technologies are described below.

2.1 Projects under FoF PPP

PhoCam

Project full title	**PhoCam: Photopolymer based customized additive manufacturing technologies**
FoF call topic	FP7-FoF.NMP.2010-2 - Supply chain approaches for small series industrial production
Project web site	www.phocam.eu www.cordis.europa.eu/project/rcn/94812_en
Project start-end date	01-06-2010 to 31-05-2013
Project budget (€)	€3,609,447 (€2,455,362 EU contribution)
Project coordinator	Technische Universitaet Wien (AT)
Consortium	In-Vision (AT); Broell (AT); DeskArtes (FI); Siemens (DE); Visitech (NO); Laser Zentrum Hannover (DE)

Project aim / summary:

Phocam aimed to develop innovative L-AMT which will facilitate the processing of photopolymer-based materials in the new factory environment. It brings together industrial expertise and knowledge in the fields of supply chain and quality management, software development, photopolymers and ceramics, high-performance light sources, as well as systems integration so as to provide a fully integrated process chain.

The consortium relied on two main techniques to process radiation-curable materials:

- Digital light processing (DLP) –to process ceramic-filled photopolymers, which will lead to the production of fully dense ceramic parts at the end of the process chain.
- Two photon polymerisation (2PP), to create high-resolution structures which have features in the range of 100-200 nm.

L-AMT are capable of making parts which have excellent surface quality and good feature resolution and which display high precision.

Sectors addressed	• Health • Others (textile)
VC stages addressed	• Process, Equipment, ICT
AM process addressed	• VAT photopolymerisation
Materials addressed	• Polymer • Ceramic
Non-technological activities addressed	• IPRs • Technology transfer

MAIN RESULTS

- **Hardware for ceramic processing using new LED based light engines** - Laboratory Prototype 2nd generation: A new equipment with extended build volume was developed. Austrian patent application A 901/2013. An **spin-off of TU-Wien** is now commercializing the technology developed within Phocam: Lithoz Gmbh (www.lithoz.com).

HYPROLINE

Project full title	**HYPROLINE: High Performance Production line for small series metal parts**
FoF call topic	FP7-FoF.NMP.2012-4 - High performance manufacturing technologies in terms of efficiency, robustness and accuracy
Project web site	www.hyproline.eu www.cordis.europa.eu/project/rcn/104393_en
Project start-end date	01-09-2012 to 31-08-2015
Project budget (€)	€4,017,939 (€2,538,000 EU contribution)
Project coordinator	TNO (NL)
Consortium	Höganäs Digital Metal (SE); Swerea IVF (SE); CCM (NL); TranscenData (UK); University of Birmingham (UK)

Project aim / summary:

Hyproline main objective was to strengthen the competitiveness of the European industry by introducing manufacturing methods, which allows companies to:

- Reduce time-to-market and number of rejects.
- Make more customized and innovative products with a higher market value.
- Make products > 20% more accurate with considerable savings (>30%) in consumption of waste metal, fluids and services.

By further developing the manufacturing process itself as well as by application work on materials, pre and post treatment of the parts produced and supporting software it adds capabilities to commercially available manufacturing systems, in terms of speed, product quality and versatility.

Sectors addressed	• Health • Aerospace
VC stages addressed	• Modelling, simulation • Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• Material jetting • Binder jJetting • Other (continuous AM in carrousel)
Materials addressed	• Metal • Polymer
Non-technological activities addressed	• Business, commercialisation, industrial exploitation

MAIN RESULTS

- **End user sales of CADfix with AM Hyproline module.** This comprises processing of point cloud data, comparing to CAD, calculate the rest milling volume and prepare G-code for post processing of the part. TRL=8; Time to market: 2016.
- **Capability to perform complex manufacturing jobs** with laser post processing. TRL=5; Time to market: 2017.
- **Application of product handling module** as part of integration in complex environments bringing new business opportunities to the SME involved. TRL=7; Time to market: 2017.
- **Various assignments for evaluation of metal powders and ceramic granules for AM** have been generated and is being exploited on a regular basis (a.o powder rheology measurements). TRL=7; Time to market: 2016.

AMAZE

Project full title	**AMAZE: Additive Manufacturing Aiming Towards Zero Waste & Efficient Production of High-Tech Metal Products**
FoF call topic	FP7-FoF.NMP.2012-4 High performance manufacturing technologies in terms of efficiency, robustness and accuracy
Project web site	www.amazeproject.eu www.cordis.europa.eu/project/rcn/105484_en
Project start-end date	01-01-2013 to 30-06-2017
Project budget (€)	€18,797,284 (€10,156,000 EU contribution)
Project coordinator	MTC (UK)
Consortium	Norsk Titanium (NO); European Space Agency (FR); Irepa Laser (FR); Concept-Laser (DE); Renishaw (UK); Trumpf Laser (DE); BCT (DE); Tecnalia (ES); ESI Group (FR); Granta Design (UK); Fraunhofer (DE); Airbus Defence and Space (DE); GE AVIO (IT); Volvo Technology (SE); Thales Alenia Space (FR); Short Brothers (UK); Atomic Energy Authority (UK); University of Manchester (UK); University of Birmingham (UK); Politecnico di Torino (IT); Ecole Polytechnique Federale de Lausanne (CH); Friedrich-Alexander-Universitaet Erlangen Nuernberg (DE); Cranfield University (UK); BAE Systems (UK); Swansea University (UK)

Project aim / summary:

The overarching goal of AMAZE is to rapidly produce large defect-free additively-manufactured metallic components up to 2 meters in size, ideally with close to zero waste, for use in the following high-tech sectors namely: aeronautics, space, automotive, nuclear fusion and tooling.

Four pilot-scale industrial AM factories will be established by 2016. Also, 50% cost reduction for finished parts, compared to traditional processing. AMAZE will dramatically increase the commercial use of adaptronics, in-situ sensing, process feedback, novel post-processing and clean-rooms in AM, so that:

- Overall quality levels are improved.
- Dimensional accuracy increased by 25%.
- Build rates are increased by a factor of 10.
- Industrial scrap rates are slashed to <5%.

Scientifically, the critical links between alloy composition, powder/wire production, additive processing, microstructural evolution, defect formation and the final properties of metallic AM parts will be examined and understood. This knowledge will be used to validate multi-level process models that can predict AM processes, part quality and performance. A sharp focus will also be drawn on pre-normative work, standardisation and certification, in collaboration with ISO, ASTM and ECSS.

Sectors addressed	• Aerospace • Automotive • Industrial equipment and tooling • Other (nuclear fusion)
VC stages addressed	• All VC stages
AM process addressed	• Powder bed fusion • Direct energy deposition
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Technology transfer • Education, training

MAIN RESULTS

- **New metal alloys** specifically tailored to the AM process or to address the requirements of key applications. TRL=around 3/4; Time to market: 2018.
- **Optimised, higher productivity AM processes** (both powder bed fusion and directed energy deposition) a**nd new methods of fixturing** (adaptive fixturing, built-in fixtures) **and finishing components** (laser polishing). TRL= around 5/6; Time to market: 2017.
- **New product designs** which exploit the benefits of the AM process using the latest design for AM software tools and topological optimisation. TRL= around 5/6; Time to market: 2018.
- **Computational model of AM processes:** powder bed fusion –SLM/EBM and DED-wire and powder feed. TRL= around 5/6; Time to market: 2018.
- **Higher productivity and efficiency AM factories:** optimised process flow based on meeting required production rate and application of lean principles. TRL = 5/6; Time to market: 2017-2018.

SL SMARTLAM

Project full title	**SMARTLAM: -Smart production of Microsystems based on laminated polymer films**
FoF call topic	FP7-FoF.NMP.2012-5 - High precision production technologies for high quality 3D micro-parts
Project web site	www.smartlam.eu www.cordis.europa.eu/project/rcn/104542_en
Project start-end date	01-10-2012 to 30-09-2015
Project budget (€)	€3,769,968 (€2,673,000 EU contribution)
Project coordinator	KIT (DE)
Consortium	Profactor (AT); University of Nottingham (UK); Fraunhofer (DE); Micrux Fluidic (ES); Design Led (UK); Martin Hedges (DE); Norbert Schlafli Maschinen (CH)

Project aim / summary:

SMARTLAM will create a new paradigm for process integration in rapid prototyping and rapid manufacturing of 3D micro products. The 3D-Integration approach (3D-I) combines new material properties with state of the art, scalable 3D technologies such as aerosol jet printing or different laser based processes for combined micro milling, microstructuring and surface functionalisation, micro welding and micro cutting. It will for the first time ever combine and improve state of the art 3D compatible technologies and integrates them in a innovative way in one machine, introducing groundbreaking concepts for application design and technology integration.

Sectors addressed	• Health • Consumer goods • Others (production)
VC stages addressed	• Modelling, simulation • Design • Process, equipment, ICT • Product
AM process addressed	• Material jetting • Sheet lamination
Materials addressed	• Polymer
Non-technological activities addressed	• Business, commercialisation, industrial exploitation

MAIN RESULTS

- **Flexible scalable manufacturing concept building on digital technologies:** to manufacture customizable products in small to medium series. By combining single modules for each step and connecting them the flexible and scalable approach could be proofed. It contributes to an easier and faster commercialization of new ideas, especially for multi-material micro components. TRL= 6. Time to market: N/A, OEM provider needed.
- **Sheet laminator:** proof of concept within the project involved stacking of layers of polymer foil with functional components, solutions for the in-line lamination had to be developed. A roll-based laminator proofed to be the most suitable answer to this problem. The machine provides the opportunity to pick up a polymer sheet, apply adhesive and precisely stack it on top of a second layer. A downstream curing process completes the lamination step. TRL= 8. Time to market: less than 1 year.
- **Specific software concept from rule based CAD design till automated model execution:** sophisticated database and execution software developed. It includes information on material properties, process parameters, machine data and quality marks based on the inspection of finalized parts. In combination with the CAD-system provides a starting ground for design modifications and adaption to available manufacturing modules, planning of processing routes and adaption of process parameters during the running production based on in-line measurements. TRL= 6. Time to market: approx. 2 years.

3D-HiPMAS	
Project full title	**3D-HIPMAS: Pilot Factory for 3D High Precision MID Assemblies**
FoF call topic	FP7-FoF.NMP.2012-5 - High precision production technologies for high quality 3D micro-parts
Project web site	www.3d-hipmas.eu www.cordis.europa.eu/project/rcn/104687_en
Project start-end date	01-10-2012 to 30-09-2015
Project budget (€)	€5,350,276 (€3,499,600 EU contribution)
Project coordinator	Hahn-Schickard (DE)
Consortium	LPKF (DE); Photonic Science (UK); Haecker Automation (DE); Radiall (FR); Pragma Industries (FR); Phonak (CH); Pole Europeen de Plasturgie (FR); CEA (FR); Plastipolis (FR); Ensinger (DE); Rayce (FR)

Project aim / summary:

Due to the high potential of miniaturization and integration, with regard to the innovation degree, quality and sustainability requirements, the 21st century looks forward to the integration of new functions on plastic parts to produce smart plastic products, as markets are requiring traceability, security, communication as well as ergonomics.

So called Molded Interconnected Devices (MID) basically combine all the features of molded plastic parts with electrical conductive circuitry and electronics components assembly directly on the plastic packaging. MID lead finally to highly integrated multi-material and multifunctional 3D compact systems. With a 20% of growth per year since 2008, MID is the tomorrows converging technology for electronics and plastics.

To achieve advanced high precision and high quality 3D micro systems, the EU industry is facing the following MIDs bottlenecks:

- To be able to manufacture high precision 3D micro-parts integration plastics and electronics, including 3D plastic system carrier, 3D-conductive tracks and 3D electronics component assembly.
- To be able to reduce the manufacturing cost by 50% in order for EU industry to be competitive with low-wage countries.
- To provide the industry with reliable, robust and in-line controlled manufacturing processes for plastics and electronics converging technologies.

3D-HiPMAS will overcome these challenges by providing the EU industry with a pilot factory based on 4 key technological building blocks enabling the manufacturing of low costs and high precision 3D multi-materials parts:

A. 3D high precision plastics micro-parts.
B. 3D high definition conductive tracks.
C. 3D precision electronics components assembly.
D. 3D reliable and robust online monitoring and quality inspection system.

These four technologies will be integrated in order to launch the future EU pilot factory.

Sectors addressed	• Health • Automotive • Consumer goods • Electronics • Energy • Other (communication, transportation, life sciences)
VC stages addressed	• Materials • Process, equipment, ICT • Product
AM process addressed	
Materials addressed	• Metal • Polymer
Non-technological activities addressed	• Education/training • Business, commercialisation, industrial exploitation • Technology transfer

MAIN RESULTS

- **Flexible 3D high precision MID platform.** MID R&D and manufacturing platform established. The technology focuses mainly on the building blocks "3D system carrier", "3D metal patterning" and "3D high precision assembly". All relevant process steps are available at Hahn-Schickard in Stuttgart. The customer has access to either the complete process or just single process step. It includes design, mould making, injection moulding, laser structuring, cleaning, metal plating, assembly and test plus quality control and inspection tools. Not only produce large quantities, also small and medium series. TRL=6.
- **High-performance plastics for Laser Direct Structuring (LDS).** Production of 3D micro parts by LDS requires plastic materials. To meet the thermal requirements in MID processes, high temperature polymers as PPA, W and PEEK are chosen. By development of the new thermoplastic compounds named TECACOMP® LDS within the project it is now possible to manufacture ultra-fine structured micro-parts with pitches of up to 70 micron and below. TRL=8.
- **Ultra-fine pitch 3D micro structures by LDS.** New processing unit for a LDS system was developed. A special laser source, a new, highly dynamic scanner, and optimized optical elements deliver the required precision and performance. TRL=6.
- **New improved metal plating processes for ultra-fine pitch LDS MID.** With the new developed LDS system metal line pitches up to 70 µm on 2D substrates and below 150 µm on 3D substrates can be realized. The metallization process starts with the selective deposition of electroless copper. In the project the new layer systems using palladium/gold or silver as surface finish have been developed. TRL=6.
- **Joining processes on advanced 3D MID system carriers.** The new technology with fine pitch metal lines on MID substrates enables the assembly of smaller components like fine pitch bare dies and the high accuracy assembly of micromechanical and micro optical devices. TRL=5.

Project full title	**HiPR: High-Precision micro-forming of complex 3D parts**
FoF call topic	FP7-FoF.NMP.2012-5 - High precision production technologies for high quality 3D micro-parts
Project web site	www.cordis.europa.eu/project/rcn/105489_en
Project start-end date	2012 to 2015
Project budget (€)	€5,013,745 (€3,317,932 EU contribution)
Project coordinator	D'Appolonia (IT)
Consortium	Fraunhofer (DE); TNO (NL); Mi-Me (IT); Fritz Stepper (DE); 3R Technics (SK); Heliotis (CH); Bohler Edelstahl (AT); Philips (NL)

Project aim / summary:

The primary goal of HiPr is to develop and integrate all necessary base technologies which create the basis to control and monitor the condition of micro-tooling for complex high-precision 3D parts. This will be achieved by developing and integrating: in-depth process and material knowledge, in-line measurements, real-time predictive maintenance. Proof will be given on pilot production lines in industrial settings. The knowledge-based HiPr results are also applicable in different sectors, leading to low defects, despite customisation trends.

Sectors addressed	• Automotive • Consumer goods • Electronics
VC stages addressed	• Modelling, simulation • Process, equipment, ICT • Post-processing
AM process addressed	
Materials addressed	• Metal
Non-technological activities addressed	• Business, commercialisation, industrial exploitation • IPRs

MAIN RESULTS

- **Press micro-manufacturing pilot line.** The line is composed by three main parts. The system before the press guides the fed metal strip through a list of sensors to measure a list of parameters that could affect the subsequent steps. The stamping tool had been re-designed, in order to find space to put sensors inside it. Thanks to these sensors (temperature, strain, force...) the stamping process is monitored, at the scale of every single punch. The third part is about quality check: two Optical Coherence Tomography (OCT) systems measure the 3D features of the produced parts to see if they are in line with max tolerances. The HiPr OCT is able to follow the production speed and measure 100% of components, up to 250 strokes/min. TRL=5.
- **Sensorized precision tool for metal stamping.** Two main features: the advanced integration of sensors, for a continuous and real time monitoring of process parameters and an innovative production cycle. The tool has been designed to integrate into it around 30 sensors, for acquiring signals of forces, temperatures, strain, sound and pressures from every punch. TRL=6.
- **Mechanical properties measurement system.** The measurement system of input material, before it enters the press is fundamental to get deeper knowledge of the process parameters. The most innovative measurement system is that of mechanical properties. The metal strip passes through a dedicated sensor, which measures the induced eddy currents. In parallel, mechanical properties of the material have been tested on several strip samples. TRL=5.

Project full title	**HI-MICRO: High Precision Micro Production Technologies**
FoF call topic	FP7-FoF.NMP.2012-5 - High precision production technologies for high quality 3D micro-parts
Project web site	www.hi-micro.eu www.cordis.europa.eu/result/rcn/177882_en
Project start-end date	01-10-2012 to 30-09-2015
Project budget (€)	€5,150,146 (€3,499,997 EU contribution)
Project coordinator	KU Leuven (BE)
Consortium	Universität Bremen (DE); Danmarks Tekniske Universitet (DK); Technische Universität Chemnitz (DE); Klöckner Desma (DE); Xaar Technology (UK); Polyoptics (DE); LayerWise (BE); X-TEK Systems (UK); Formatec Technical Ceramics (NL); Sophion Bioscience (DK)

Project aim / summary:

The Hi-Micro project intends to realise an innovative approach for the design, manufacturing and quality control of tool inserts to achieve significant breakthrough in mass production of precision 3D micro-parts, through further developing both enabling manufacturing technologies, including AM, micro electrical discharge machining (micro-EDM), micro electro-chemical machining (micro-ECM) and micro-milling, and unique metrology and quality control methods such as computer tomography (CT) metrology and digital holography. It will further bolster the performance of industrial equipment for mass production of precision 3D micro-parts, through modular design of tool insert units with improved thermal management capability, development of on-machine handling system and in-line quality control device. Activities will run over the entire value chain of mass production of precision 3D micro-parts, from product and tool insert design, manufacturing of tool inserts, micro injection moulding (micro-IM) processes, to the production equipment and quality control in the whole production chain.

Hi-Micro project will provide radical innovations and major breakthroughs as follows:

- Development of design and tolerance guidelines for advanced micro manufacturing of components (nominal size <1mm).
- Tool inserts with complex internal features for conformal thermal management in MIM and micro powder injection moulding (micro-PIM).
- Processing technologies and equipment for manufacturing of 3D micro-parts with increased precision and accuracy to ensure smaller tolerances for the products.
- Metrology methods for complex internal structure and high-speed inline quality control.

Sectors addressed	• Health • Consumer goods
VC stages addressed	• Modelling, simulation • Design • Process, equipment, ICT • Product
AM process addressed	• Powder bed fusion
Materials addressed	• Metal • Ceramic
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IRPs • Technology transfer

MAIN RESULTS

- **3D printed mould inserts:** 3D metal printing technologies for producing µIM and µPIM mould tool inserts. Several critical issues, e.g. down facing and minimum feature size, in powder-bed based 3D metal printing have been investigated and mould inserts for two part demonstrators have been produced and successfully verified. TRL=8.
- **CT:** metrology machine with Nanofocus source. New calibration phantom and multi-material CT reconstruction engine implemented in a new CT metrology machine for micro-parts metrology. TRL=8.
- **Micro-IM platform:** novel uIM production platform for Micro-IM integrated with a high speed metrology system for mass production of 3D micro parts. TRL=7.

Project full title	**AMCOR: Additive Manufacturing for Wear and Corrosion Applications**
FoF call topic	FP7-FoF.NMP.2012-7 - Innovative technologies for casting, material removing and forming processes
Project web site	www.amcor-project.eu www.cordis.europa.eu/project/rcn/105488_en
Project start-end date	2012 to 2015
Project budget (€)	€4,770,044 (€3,000,000 EU contribution)
Project coordinator	TWI (UK)
Consortium	VITO (BE); Bosch Rexroth (NL); VCST (BE); BCT (DE); SKM Informatik (DE); Ideko-IK4 (ES); Skoda Power (CZ); Sirris (BE); Olympus Technologies (UK); Etalon Research (UK); Danobat (ES); EKIN (ES); DENYS (BE); Sulzer Metco (CH)

Project aim / summary:

To develop and demonstrate Laser Metal Deposition (LMD) industrial manufacturing systems for the deposition of Functional Graded Material coatings for wear and corrosion protection. The overall aim of the AMCOR project is to develop and demonstrate a flexible and automated manufacturing process for the repair, coating and near net shape production of components composed of functionally graded materials (FGMs).

AMCOR offers a step change in the performance and reliability of components for extended in-service life across a broad range of industries where wear is a key problem.

Sectors addressed	• Automotive • Construction • Other (oil and gas)
VC stages addressed	• Modelling, simulation • Materials • Process, equipment, ICT • Post processing
AM process addressed	• Direct energy deposition
Materials addressed	• Metal • Ceramic
Non-technological activities addressed	• No non-technological activities addressed

MAIN RESULTS

- **LMD FGM CAD-CAM Software:** Software plugin to SKM D-CAM software for LMD deposition for industrial manipulators and gantry systems. TRL=7. Time to market: mid 2017.
- **Tomographic flow sensors for powder flow measurement:** opto-mechanical hardware, coding and procedures knowhow for LMD powder flow sensor. The device can measure relative powder flow density across a 3-beam and coaxial nozzle and measure the powder-gas beam focus focal point. TRL=6. Time to market: end 2017.
- **Manufacturing, repair, or surface coating for broaches:** know-how on the use of LMD for the repair of broaching tools. No repair solution had previously been found prior to AMCOR. TRL=6-7. Time to market: mid 2017 – further validation trials required.

Project full title	**OPTICIAN2020: Flexible and on-demand manufacturing of customised spectacles by close-to-optician production clusters**
FoF call topic	FP7-FoF.NMP.2013-6 - Mini-factories for customised products using local flexible production
Project web site	www.optician2020.eu www.cordis.europa.eu/project/rcn/109550_en
Project start-end date	01-10-2013 to 30-09-2016
Project budget (€)	€5,770,513 (€3,614,999 EU contribution)
Project coordinator	EURECAT (ES)
Consortium	Alcom (SI); IBV (ES); Indo Optical (ES); Knowledge Integration (UK); Lens World (CH); Melotte (BE); Óptica Pita (PT); Satisloh Photonics (CH); 3TRPD (UK)

Project aim / summary:

Optician2020 will develop distributed manufacturing assets in mini-factories clustered in urban areas combining short series manufacturing technologies and ICT tools for design, process automation and on-line real time delivery management of personalised spectacles, a fashionable product combining health prescription, functional performance and aesthetical requirements. The key enabling technologies to be deployed are:

- Additive manufacturing, for polymeric and metallic frames.
- Advanced coating technologies, for short series lens coating.
- Automated procedures, for personalisable frames catalogue design.
- Scanning devices, for end-user anthropometric data capture.

ICT tools will be used to improve the efficiency, adaptability and sustainability of the production systems and their integration within the proximity mini-factory business model. It requires continuous change of processes related to the management of distributed manufacturing assets and to the personalised manufacturing of spectacles in which the consumer can select frame materials and also finishing both in frame and lenses.

Sectors addressed	• Health • Consumer goods
VC stages addressed	• Modelling, simulation • Design • Process, equipment, ICT • Post processing • Product
AM process addressed	• Powder bed fusion
Materials addressed	• Metal • Polymer
Non-technological activities addressed	• Standardisation • Business, commercialisation, industrial exploitation

MAIN RESULTS

- **ICT-based mini-factories platform management.** Platform managing the personalised spectacles manufacturing and delivery through a network of available production sites, under the criteria of delivery time, costs, proximity and environmental impact. TRL=7.
- **Metallic/polymeric frame AM manufacturing and finishing.** Adapted SLM-based additive manufacturing for metallic/polymeric frames, suitable post-processing for polishing and decoration. TRL=7.
- **Design and 3D personalized frame model creation.** Automated design process for developing catalogues of personalisable spectacles. TRL=7.

CassaMobile A FACTORY ON THE GO

Project full title	**CASSAMOBILE: Flexible Mini-Factory for local and customized production in a container**
FoF call topic	FP7-FoF.NMP.2013-6 - Mini-factories for customised products using local flexible production
Project web site	www.cassamobile.eu www.cordis.europa.eu/project/rcn/109055_en
Project start-end date	01-09-2013 to 31-08-2016
Project budget (€)	€8,747,873 (€5,650,000 EU contribution)
Project coordinator	Fraunhofer IPA (DE)
Consortium	University of Stuttgart (DE); Critical Manufacturing (PT); Materialise (BE); TNO (NL); Schunk (DE); Colandis (DE); Peacocks Medical Group (UK); Sciprom (CH)

Project aim / summary:

Advanced production equipment and innovative systems are needed to enable fast and cost-effective manufacturing of customised products at the location of need, at the required time. Within CassaMobile a mobile, flexible, modular, small-footprint manufacturing system in a 20' ISO-container that can be easily configured for different products and processes is developed. The container format allows transport to provide on-site manufacturing anywhere, enabling the benefits of localised service delivery without duplication of equipment at multiple locations.

The integrated modular manufacturing system with standard interfaces allows an easy exchange of process modules. Each module is equipped with its own control equipment and features a self-description, which in combination with the machine control system allows automatic configuration of the whole assembly system. An AM module enables the system to "3D print" customised components of virtually any shape. In-process inspection improves accuracy, reduces waste and eliminates manual quality control tasks. A pick and place module allows assembly of discrete components. Other processes, such as finishing, cleaning and sterilisation, can be easily integrated as additional process modules.

The concept will be demonstrated by three use cases: bone drill guides for orthopaedic surgery, medical orthotics and individual industrial gripping products.

Sectors addressed	• All sectors
VC stages addressed	• Process, equipment, ICT
AM process addressed	• Material extrusion
Materials addressed	• Polymer
Non-technological activities addressed	• Standardisation • Business, commercialisation, industrial exploitation • IPRs

MAIN RESULTS

- **Report:** modular mini-factory system architecture.
- **Report:** a modular and (re)configurable design of a container mini-factory.
- **Prototype:** prototype of task-driven adaptive automation system for rapid reconfiguration.
- **Report:** container-integrable modular machine design.
- **Prototype:** prototype of AM process module with automation interfaces.
- **Prototype:** table-top system for dispensing and precision pressing operation.

ADD · FACTOR

Project full title	**ADDFACTOR: ADvanced Digital technologies and virtual engineering for mini-Factories**
FoF call topic	FP7-FoF.NMP.2013-6 - Mini-factories for customised products using local flexible production
Project web site	www.addfactor.eu www.cordis.europa.eu/project/rcn/108701_es
Project start-end date	01-09-2013 to 31-08-2016
Project budget (€)	€8,933,064 (€5,499,959 EU contribution)
Project coordinator	SYNESIS (IT)
Consortium	Materialise (BE); IBV (ES); Consiglio Nazionale delle Ricerche (IT); TNO (NL); SUPSI (CH); PFI (DE); UCS (SI); RSscan International (BE); AnyBody Technology (DK); Officina Ortopedica Michelotti (IT); Peacocks Medical Group (UK); Vibram (IT); New Millenium Sports (ES); Grey Mer (IT); KMWE (NL)

Project aim / summary:

ADDFactor proposes the mini-factories concept, which is conceived to be an innovative solution for most of the actors involved in the whole supply chain: the relationship between retailers and the manufacturing technologies will be considered and characterized by a new production framework concept, founded on central knowledge-based design and local distributed manufacturing. Project focus on two different levels of manufacturing solutions, which will be placed: at retail environment and at district level.

Sectors addressed by the project	• Health • Consumer goods • Other (sports)
Value chains segments addressed	• Modelling, simulation • Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• Powder Bed fusion • Material extrusion • Sheet lamination
Materials addressed	• Metal • Polymer
Non-technological activities addressed	• Standardisation • Business, commercialisation, industrial exploitation • Technology transfer

MAIN RESULTS

- **Data capturing tool:** integrated system for data gathering, to provide a scalable set of (combined) body. It allows the integration of 3 different typologies of biometric data, 3D scanning, pressure data distribution and inverse kinematics. This guarantees a complete understanding of dynamics and kinematics from the users in order to better personalise, also in function, the target products. TRL=6. Time to market: 2017.
- **AM machine at district level:** flexible and auto-configurable production line. It comprises an AM machine of the carousel type where continuous AM (in-line polymer laser sintering) is done, combined with other techniques such as inspection, Pick & Place robot and unloading modules. Multiple building boxes are moving around in the carousel in a parallel manner. TRL=6. Time to market: 2016.
- **AM machine at retailer:** ultra-fast and auto-configurable machine at local (retail) level for orthopedic insoles and heles. The 3D printing machine is a new solution which has been developed considering the specific production along with the requirements of the target products. The identified solution is also able to better guarantee the mechanical properties necessary for these applications. TRL=6. Time to market: 2017.

ManSYS	
Project full title	**ManSYS: Manufacturing decision and supply chain management system for additive manufacturing**
FoF call topic	FP7-FoF.NMP.2013-9 - Advanced concepts for technology-based business approaches addressing product-services and their manufacturing in globalised markets
Project web site	www.mansys.info www.cordis.europa.eu/project/rcn/108896_en
Project start-end date	2013- 2016
Project budget (€)	€4,405,531 (€2,925,000 EU contribution)
Project coordinator	TWI (UK)
Consortium	Materialise (BE); LPW (UK); BCT (DE); Poly-Shape (FR); Berenschot (NL); TNO (NL); AIDIMME (ES); Smith & Nephew (UK); Wisildent (IT); GE MTC (TR); Twocare (IT)

Project aim / summary:

ManSYS aims to develop and demonstrate a set of e-supply chain tools; to enable the mass adoption of AM. This will allow businesses to identify and determine the suitability of AM for metal products, and subsequently manage the associated supply-chain issues and 'facilitating' open product evolution. The e-supply chain solution combines all aspects of AM including; multiple build platforms (Laser and Electron-Beam technologies), modelling, post-processing (Machining, Finishing and Heat-Treatment) and 3D scanning techniques. This gives a 'press-button' solution to the production of new products. The integrated solution offers a knowledge driven manufacturing process with significant production benefits; customisation, automation, self-management and reduced material usage and waste.

Sectors addressed by the project	• Health • Aerospace
Value chains segments addressed	• All VC stages
AM process addressed	• Powder bed fusion
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Business, commercialisation, industrial exploitation

MAIN RESULTS

- **Supply chain architecture:** integrated AM supply chain – from order intake to part delivery - able to track quality of the production process and produced part, based on clear definitions of activities, roles and responsibilities. TRL=5-6. Time to market: mid 2017,
- **AM Knowledge Database:** website/platform combining (links to) knowledge databases, guidelines and suggested standards on the assessment of quality of metal AM parts, processes and materials, including protocols for certification. TRL=5-6. Time to market: end 2016.
- **Decision making tool:** a software tool giving intelligent feed-back on part design, process, material selection and economics for end-users, service bureaus and OEMs. TRL=5-6. Time to market: mid 2017.

Stellar

Project full title	**STELLAR: Selective tape-laying for cost effective manufacturing of optimised multi-material components**
FoF call topic	FP7-FoF.NMP.2013-10 - Manufacturing processes for products made of composites or engineered metallic materials
Project web site	www.stellar-project.eu www.cordis.europa.eu/project/rcn/109190_en
Project start-end date	31-08-2013 to 31-08-2016
Project budget (€)	€4,007,208 (EU Contribution €2,774,266)
Project coordinator	Netcomposites (UK)
Consortium	Toyota (BE); Airborne (NL); HBW Gubesch (DE); AFPT (DE); CGTech (UK); ESI (FR); Montanuniversität Leoben (AT); Fraunhofer IPT (DE);

Project aim / summary:

The aim of the Stellar project is to develop the manufacturing process for high-speed placement of carbon, glass and polymer fibre reinforced matrices, in selected locations in a composite structure, to provide the optimum reinforcement, weight and cost profile within a part.

The use of composite materials in structural components is becoming well established in a range of applications, and the materials can offer significant benefits in mechanical properties, weight and through-life environmental impact. However, whilst some hybrid structures do exist, these are typically combinations of relatively isotropic materials, which only go part of the way to optimising the amount of materials used in the structure. The ideal structure has different combinations of composite materials in predetermined locations in a hybrid multi-material structure, but to date this has not been achievable because cost-effective manufacturing processes have not been available.

The concept of this project is therefore to develop the design methodologies, manufacturing processes, equipment and control systems needed for localised placement of different fibre-reinforced thermoplastic composite tapes onto different substrates, creating locally reinforced components that are fully weight-optimised. To achieve this, the project will focus on development of the Automated Tape Laying (ATL) process to selectively place reinforced thermoplastic tapes in 3 manufacturing routes:

- Selective reinforcement of existing components.
- Direct additive manufacture of components.
- Manufacture of selectively reinforced tailored blanks for compression moulding.

The manufacturing process developed will have a significant effect on the weight of structures, as for the first time it will allow different reinforcement fibers (polymer, glass, carbon) to be used synergistically in the same thermoplastic polymer matrix, to produce hybrid multi-material structural components with optimised performance and weight.

Sectors addressed	• Aerospace • Automotive
VC stages addressed	• All VC stages
AM process addressed	
Materials addressed	• Polymer
Non-technological activities addressed	• Business, commercialisation, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- Automated tape laying technologies and control systems. TRL=7.
- New molding technologies. TRL=7.
- Improved composite programming. TRL=7.
- Thermoplastic tapes and compatible compounds. TRL=7.

NextFactory

Project full title	**NextFactory: All-in-one manufacturing platform for system in package and micromechatronic systems**
FoF call topic	FP7-FoF.NMP.2013-11 - Manufacturing of highly miniaturised components
Project web site	www.nextfactory-project.eu www.cordis.europa.eu/project/rcn/108892_en
Project start-end date	01-09-2013 to 31-08-2017
Project budget (€)	€4,758,207 (€3,483,177 EU contribution)
Project coordinator	Fraunhofer IPA (DE)
Consortium	Microsemi (UK); Sunplugged (AT); Profactor (AT); Cellasys (DE); Heliotis (CH); TIGER Coatings (AT); Unitechnologies (CH); University of Greenwich (UK); Acreo Swedish ICT (SE); ARTTIC (FR)

Project aim / summary:

The mission of the NextFactory project is to develop and validate a new type of all-in-one manufacturing technology combining, for the first time, in a single piece of equipment, 3D freeform printing and ultra-precision 3D assembly. This highly flexible and scalable facility will empower microsystem manufacturers - and in particular SMEs - to effectively produce highly miniaturised Smart Products-in-Package (SPiPs) both in small series and high-throughput production of large parallel batches. The project is driven and led by SME-owned use cases in medical, environmental and food processing, which represent an optimal combination of challenging requirements and high visibility for the new approach, providing a strategic direction to the project and validating the operability for a large variety of products:

- Oral sensors, requiring a one-piece-at a time customization.
- Microsensor chips for oxygen monitoring in closed compartments.
- Complex solar modules with circuits and capacitors.

They will also be used for a proof-of-concept demonstration.

The impact expected from this development will be, depending on the use case, a 10 to 100fold reduction of the SPiP production lead time at low cost and with almost zero waste, inducing a paradigm shift in SPiP design & development and thereby freeing an unprecedented innovation potential in manufacturing intensive industries.

Sectors addressed	• Health • Other (food processing, environmental)
VC stages addressed	• Modelling, simulation • Process, equipment, ICT • Product
AM process addressed	• Material jetting
Materials addressed	• Metal • Polymer
Non-technological activities addressed	• Standardisation • Business, commercialisation, industrial exploitation • Technology transfer

MAIN RESULTS

BOREALIS

Project full title	**BOREALIS-The 3A energy class Flexible Machine for the new Additive and Subtractive Manufacturing on next generation of complex 3D metal parts**
FoF call topic	H2020-FoF-02-2014 - Manufacturing processes for complex structures and geometries with efficient use of material
Project web site	www.cordis.europa.eu/project/rcn/193449_en
Project start-end date	01-01-2015 to 01-01-2018
Project budget (€)	€7,986,625 (€5,968,875 EU contribution)
Project coordinator	Prima Industrie (IT)
Consortium	SUPSI (CH); IRIS (IT); Politecnico di Torino (IT); TNO (NL); Fraunhofer (DE); Framos (DE); Irida (GR); Globotics Industries (CH); Opi Photonics (IT); Diad Group (ES); Sintea Smart (CH); Synesis (IT); Panepistimio Patron (GR); GE Avio (IT); Prima Electro (IT)

Project aim / summary:

Borealis project presents an advanced concept of machine for powder deposition additive manufacturing and ablation processes that integrates 5 AM technologies in a unique solution. The machine is characterized by a redundant structures constituted by a large portal and a small Parallel Kinematics Machine (PKM) enabling the covering of a large range of working cube and a pattern of ejective nozzles and hybrid laser source targeting a deposition rate of 2000 cm/h with 30 sec set-up times. The machine is enriched with a software infrastructure which enable a persistent monitoring and in line adaptation of the process with zero scraps along with number of energy and resource efficiency optimization policies and harvesting systems.

Borealis focuses on new manufacturing challenges coming from complex product machining in the field of aerospace, medtech and automotive. Project targets a TRL 6 and will provide as outcome of 3 years work 2 complete machine in two dimensions a lab scale machine and a full size machine which are foreseen to be translated into industrial solution by 2019.

Sectors addressed	• Health • Aerospace • Automotive
VC stages addressed	• All VC stages
AM process addressed	• Laser based AM and substractive manufacturing
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IPRs

MAIN RESULTS

- **Machine:** Large AM machine for additive and subtractive manufacturing (metal parts) equipped with a multiple nozzles powder ejection system and a smart sensing system for inline loop control. This machine will allow the realization of large components with AM technologies, high level of customization, increased productivity vs current AM technologies, energy footprint certification. TRL=4. Time to market: 2021.
- **Laser Head:** Flexible revolver head equipped with two laser sources (continuous wave for metal sintering and pulsed for ablation) and a multiple nozzles system for powder ejection. Functionally graded material (variable composition, variable density...), integration of several processing steps (AM, heat treatment, surface finishing,...). TRL=5. Time to market: 2019.
- **Process Monitoring Infrastructure:** (Near) real time multi-sensorial monitoring solution integrated with the machine control software architecture. It will allow zero faulty parts, process accuracy, process parameters optimization, defect detections, tolerance monitoring, component measurement. TRL=5. Time to market: 2020.

Project full title	**ToMax:Toolless Manufacturing of Complex Structures**
FoF call topic	H2020-FoF-02-2014 - Manufacturing processes for complex structures and geometries with efficient use of material
Project web site	www.tomax-h2020.eu www.cordis.europa.eu/project/rcn/193185_en
Project start-end date	01-01-2015 to 01-01-2018
Project budget (€)	€3,157,986 (100% EU funded)
Project coordinator	Technische Universitaet Wien (AT)
Consortium	In-Vision Digital Imaging (AT); Lithoz (AT); Deskartes (FI); Cycleco (FR); Universidad Politécnica de Madrid (ES); R2M Solution (IT); Osram (DE); Rauschert (DE); International Syalons (UK)

Project aim / summary:

Lithography based additive manufacturing technologies (L-AMT) are capable of fabricating parts with excellent surface quality, good feature resolution and precision. ToMax aims at developing integrated lithography-based additive manufacturing systems for the fabrication of ceramic parts with high shape complexity. The focus of the project is to unite industrial know-how in the field of software development, photopolymers and ceramics, high-performance light-sources, system integration, life cycle analysis, industrial exploitation and rewarding end-user cases. The consortium will provide 3D-printers with high throughput and outstanding materials and energy efficiency. Targeted end-use applications include ceramics for aerospace engineering, medical devices and energy efficient lighting applications. By relying on L-AMT, ToMax the following objectives are targeted:

- Methods which are 75% more material efficient with respect to traditional manufacturing.
- Are 25% more material efficient with respect to current AMT approaches by using computational modelling to optimize geometries and by providing recyclable wash-away supports.
- Methods which are 35% more energy efficient that current AMT approaches by developing 50% faster thermal processing procedures.
- Incorporate recycling for the first time in L-AMT of engineering ceramics. ToMax will develop energy-efficient machinery and processes, with a focus on manufacturing of alumina, silicon nitride and cermet parts with complexity.

Sectors addressed	• Health • Aerospace • Other (lighting)
VC stages addressed	• Modelling, simulation • Materials • Process, equipment, ICT
AM process addressed	
Materials addressed	• Polymer • Ceramic
Non-technological activities addressed	• Business, commercialisation, industrial exploitation

MAIN RESULTS

- **High-throughput AMT system** for processing high performance polymers and ceramics. Potential customers are 3D-printing end users who want to establish lithography based additive manufacturing for production purposes. TRL=6. Time to market: 2018.
- **High-end light engine with automation and controls.** Development of high-power light engine for lithography based AMT. TRL=6. Time to market: 2018.
- **Software tools for advanced support generation.** software approach for generating support structures for parts manufactured by AMT. The focus is on lithography based approaches. The software works within Deskartes' 3D data expert framework. TRL=7. Time to market: 2017.

Project full title	**REPROMAG: Resource Efficient Production Route for Rare Earth Magnets**
FoF call topic	H2020-FoF-02-2014 - Manufacturing processes for complex structures and geometries with efficient use of material
Project web site	www.repromag-project.eu www.cordis.europa.eu/project/rcn/193433_en
Project start-end date	2015-2017
Project budget (€)	€5,726,365 (100% EU funded)
Project coordinator	OBE (DE)
Consortium	Fotec (AT); PT+A (DE); Hage (AT); Lithoz (AT); TEKS (FR); Siemens (DE); Sennheiser Electronic (DE); Technische Universitaet Wien (AT); University of Birmingham (UK); Montanuniversitat Leoben (AT); Institut Jozef Stefan (SI); NPL Management (UK); Steinbeis Innovation (DE)

Project aim / summary:

The overall objective of the REProMag project is to develop and validate an innovative, resource-efficient manufacturing route (SDS process) for Rare Earth magnets that allows for the economically efficient production of net-shape magnetic parts with complex structures and geometries, while being 100% waste-free along the whole manufacturing chain. The new Shaping, Debinding and Sintering (SDS) process for Rare Earth magnets is an innovative automated manufacturing route to realise complex 3D- and multilayered parts; resulting in a significant increase in the material efficiency of at least 30% during manufacturing; while at the same time allowing additional geometrical features such as threads, cooling channels, small laminations/segments (e.g. to increase the efficiency of electrical motors) and structural optimisations such as lightweight-structures or the joint-free realization. The SDS process allows a new level of sustainability in production, as the energy efficiency along the whole manufacturing chain can be increased by more than 30% when compared to conventional production routes. Moreover, the used raw material is 100% recycled and can be again recycled in the same way at the end of the lifetime of the products. In short, the innovative REProMag SDS process has the potential to manufacture complex structures of high quality and productivity with minimum use of material and energy.

Sectors addressed	• Aerospace • Automotive • Consumer goods • Electronics
VC stages addressed	• Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• Material extrusion • LCM process
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Technology transfer

MAIN RESULTS

- **Industrial production of hard magnets** based on Neodymium-iron-boron (NdFeB) with complex geometrical features 100% waste free from recycled material in a circular industry in large quantities. It will allow to produce large parts that are free of defects, to reduce production costs by 50%, and to deliver a demonstrated production methodology. TRL=5. Time to market: end of 2017.
- **Prototype scale without tooling.** Fast proof of concept (prototyping) or small production quantities. TRL=3. Time to market: mid 2018.
- **Applicability of the production method** for Ti- and Ni-based alloys, ferrites (magnetic material), alloys with complicated microstructures (e.g. where longer diffusion processes and or liquid phase sintering required). Less raw material consumption, new applications/miniaturisation. TRL=3-5. Time to market: end 2017.

FoFAM

Project full title	**FoFAM: Industrial and regional valorization of FoF Additive Manufacturing projects**
FoF call topic	H2020-FoF-07-2014 – Support of the enhancement of the impact of FoF PPP projects
Project web site	www.fofamproject.eu www.cordis.europa.eu/project/rcn/193434_en
Project start-end date	01-01-2015 to 31-12-2016
Project budget (€)	€348,210 (100% EU funded)
Project coordinator	PRODINTEC (ES)
Consortium	TNO (NL); ERRIN (BE); TWI (UK);

Project aim / summary:

AM has been highlighted as a key technology with potential for creating sustainable high value European-based employment, addressing societal issues and supporting environmental sustainability. The processes based on AM span many industries, including automotive, medical, aeronautics, defense, capital and consumer goods and do-it-yourself concept, energy, etc. Moreover, AM has demonstrated to possess the capability to generate future revenues, to develop novel disruptive business models, not seen up to date, that could help to keep manufacturing in Europe competing with emergent countries. All those are heavyweight reasons for Europe to make specific efforts to define a plan of action in the field.

On this basis, FoFAM project takes up the challenge of clustering developments on AM technologies and associated regimes to develop a strategy to ensure AM industrial deployment. It aims to enable the integration of AM key outcomes under the PPP "Factories of The Future" (FoF) to push them to market by promoting synergies and identifying appropriate mechanisms to stimulate exploitation, transfer and coordination among all key actors.

For a complete success strategy not only technology stakeholders but also policy makers at European level and, more importantly, at regional level, should also be involved. In this sense, the project includes high involvement of European regions to ensure an efficient use of structural funds associated to them. Effective cross-sectorial and cross-national interactions will be pursued by promoting alliances in alignment with the research and innovation strategies for manufacturing smart specialisation of European regions (RIS3).

Sectors addressed	• Health • Aerospace • Consumer goods • Electronics
VC stages addressed	• All VC stages
AM process addressed	• All AM processes
Materials addressed	• All materials
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialization, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- **AM roadmap:** roadmap that reflects the opportunities and market trends identified in combination with the AM related technologies capabilities and enablers localised within the projects and the EU regions. Both technological and non-technological actions (i.e standardisation, education...) needed to be implemented for the AM market deployment will be included.
- **AM database:** open e-database to facilitate knowing the current ecosystem around AM: existing knowledge, developments, capabilities, policies... Main characteristics:
  - Available at AM platform website: www.AM-platform.com for future sustainability.
  - 3 main sections: AM related projects, regions and actors.
  - Option to classify by sector, value chain segment (modelling, design, process...), AM process, material, non-technological activities...
  - Open to any AM related stakeholder/project/region which would like to be included.
- **AM FoFAM network:** a network of stakeholders connected and involved in projects to improve interactions, communication and exploitation around sectorial VCs for market deployment, facilitating the creation of clusters around existing/new VCs; establishing contacts with key organisations...

Project full title	**CAxMan: Computer Aided Technologies for Additive Manufacturing**
FoF call topic	H2020-FoF-08-2015 – ICT-enabled modelling, simulation, analytics and forecasting technologies
Project web site	www.caxman.eu www.cordis.europa.eu/project/rcn/198363_en
Project start-end date	09-01-2015 to 31-08-2018
Project budget (€)	€7,143,300 (100% EU funded)
Project coordinator	SINTEF ICT (NO)
Consortium	Fraunhofer IGD (DE); DFKI (DE); IMATI (IT); CIMNE (ES); Arctur (SI); BOC (AT); Missler (FR); Jotne (NO); Stam (IT); Trimek (ES); Tronrud (NO); Novatra (FR)

Project aim / summary:

The objectives of Computer Aided Technologies for AM (CAxMan) are to establish Cloud based Toolboxes, Workflows and a One Stop-Shop for CAx-technologies supporting the design, simulation and process planning for additive manufacturing. More specifically the objectives are to establish analysis-based design approaches with the following aims:

- To reduce material usage by 12% through introducing internal cavities and voids, whilst maintaining component properties
- To optimize distribution and grading of material for multi-material AM processes.
- To facilitate the manufacture of components which are currently impossible or very difficult to produce by subtractive processes (e.g., cutting and abrasive operations).
- To enhance analysis-based process planning for AM including thermal and stress aspects, and their interoperability with the design phase.
- To enable the compatibility of additive and subtractive processes in production in order to combine the flexibility of shape in AM with the surface finish of subtractive processes.

Sectors addressed	• All sectors
VC stages addressed	• Modelling, simulation • Design • Process, equipment, ICT • Post processing • Product
AM process addressed	• All AM processes
Materials addressed	• Metal • General materials
Non-technological activities addressed	• Standardisation • Business, commercialisation, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- A **cloud portal**, built on the infrastructure from the FP7 FoF IP www.cloudflow.eu, in form of a marketplace for Cloud applications and services addressing the design, analysis and production chain for AM. The Cloud based solution will address the specificities of additive manufacturing allowing the user to use less material by adding cavities and voids and more appropriate support structures taking thermal stresses and deformations into consideration. TRL=5-7. Time to market: 2018.
- An ecosystem of **algorithmic toolkits** for AM will be established during the life time of the project. A number of the RTD-partners already have software libraries available under Open Source licenses (as well as commercial licenses). These will be augmented by foreground from CAxMan targeting AM. Time to market: mid 2017.
- **Extensions of ISO 10303** (STEP) Part 242 edition 2, and to ISO/ASTM52915 addressing AM. The benefit it will bring is the standardization of the representations needed for efficient analysis based design of products for additive manufacturing, and the product life time management of such products. TRL=TRL of Standards. Time to market: mid 2017.

SYMBIONICA

Project full title	**SYMBIONICA: Reconfigurable Machine for the new Additive and Subtractive Manufacturing of next generation fully personalized bionics and smart prosthetics**
FoF call topic	H2020-FoF-10-2015 – Manufacturing of custom made parts for personalised products
Project web site	www.symbionicaproject.eu www.cordis.europa.eu/project/rcn/198346_en
Project start-end date	01/10/2015 to 01/10/2018
Project budget (€)	€7,305,000 (€4,908,750 EU contribution)
Project coordinator	SINTEA (IT)
Consortium	Ottobock (DE); Medacta (CH); University of Sheffield (UK); Iris (IT); SUPSI (CH); ITI (UK); Globotics (CH); Irida (GR); Framos (DE); Prima Industrie (IT); Opi Photonics (IT)

Project aim / summary:

SSymbionica project focuses on the manufacturing of personalized bionics, smart endoprosthetics and exo-prosthetics that require geometric and functional customization. The Symbionica concept integrates an innovative machine performing deposition of advanced materials and subtractive processes along with a supply chain distributed co-engineering platform for advanced design and full personalization involving all relevant stakeholders, design and engineering of the products and through-life services.

Symbionica manufacturing solution is conceived as a multi-material AM machine for material deposition and ablation, flexible and reconfigurable in the working cube, the material processing, the technology and the manufacturing strategy, with an advanced closed loop control methodology for product and process quality monitoring. This way Symbionica products are manufactured in one processing step, complex in shape, 3D structured and joint free.

The Cooperative Design Platform will guarantee seamless data integration, reverse engineering from patient and parametric design to couple patient specific parts to standard ones.

At the end, a Bionic Through-life Sensing System will support the patient to approach and gradually become comfortable with the prosthesis by assisting him with an exercise plan, a physiology monitoring platform and an on-line prosthesis data collection.

The Symbionica consortium involves 3 LE, 6 SME and 2 RTD partners from 5 EU countries embracing the Medtech value chain from the patient and prosthetist to the technology providers of the mechatronics modules, IT solutions and control platforms.

Sectors addressed	• Health
VC stages addressed	• Modelling, simulation • Design • Process, equipment, ICT • Product
AM process addressed	• Material jetting • Material extrusion • Direct energy deposition
Materials addressed	• Metal • Polymer
Non-technological activities addressed	• Education, training • Business, commercialisation, industrial exploitation • Technology transfer

MAIN RESULTS

- **Hybrid machine:** Reconfigurable Machine for the new Additive and Subtractive Manufacturing of next generation fully personalized bionics and smart prosthetics. It will ensure the capability to process all the different materials use for prosthesis, thus reducing production cost of customized solution. Symbionica will offer super light structure, energy efficient process modulation, high power with high beam quality laser source and a fully adaptive process planning to minimize any energy loss. TRL=5. Time to market: 2021.
- **Prosthetics designed for AM with a bionic through-life sensing system:** design and manufacturing of a medium-small sculptured and structural parts characterized by a high level of customization in terms of shape (design is based on pre-implantation sensors data related to the anatomical characteristics of the patient), internal structure (homogeneous where needed, variable density where useful to reduce weight) and surface requirement (controlled porosity, superficial micro texturing to ensure adhesion to organs). As a result, it will be also possible to nest sensor systems in the prosthetics along using smart materials. TRL=5. Time to market: 2021.
- **Co-engineering platform:** it has the objective of translating any 3D representation of an object in an executable file ready for Numerical Controllers of AM machines. It constitutes a framework integrating the CAD-CAM-CAPP chain that multiple users in multiple sites can utilize. The 1st step is to translate a 3D scan, CT or MRI into a processable 3D CAD; the file will be analyzed by the platform-CAD generator module to identify, in cooperation with the patients and the doctors, the prosthesis model and typology to be personalized. Successively the prosthesis is customized by the co-engineering platform-CAD development module, thus customizing the components of the assembly to fit the physical and functional characteristics of the patient.

KRAKEN

Project full title	**KRAKEN: Hybrid automated machine integrating concurrent manufacturing processes, increasing the production volume of functional on-demand using high multi-material deposition rates**
FoF call topic	H2020-FoF-01-2016 – Novel hybrid approaches for additive and subtractive manufacturing machines
Project web site	www.cordis.europa.eu/project/rcn/205448_en
Project start-end date	01-10-2016 to 30-09-2019
Project budget (€)	€4,711,586 (100% EU funded)
Project coordinator	AITIIP (ES)
Consortium	TWI (UK); CSEM (CH); Acciona Infraestructuras (ES); Centro Ricerche FIAT (IT); Pininfarina (IT); Teamnet Group (RO); Leica Geosystems (CH); Vero Software (UK); Arasol (ES); Dimitrios Karadimas (GR); Alchemie (UK); Espace 2001 (LU); CECIMO (BE); Autonomous Systems (RO)

Project aim / summary:

KRAKEN will develop a disruptive hybrid manufacturing concept to equip SME and LE with affordable all-in-one machine for custom design, production/reparation and quality control of functional parts (made in aluminum, thermoset or both materials combined from 0,1 m till 20 m) through subtractive and novel additive technologies in vast working areas without floor space requirements. New additive technologies targeting large areas using aluminium grades as well as thermoset materials will be validated at lab scale and in relevant environments and finally integrated and combined for the demonstration in industrial relevant environments.

Sectors addressed	• All sectors
VC stages addressed	• All VC stages
AM process addressed	• Material extrusion
Materials addressed	• Metal • Polymer • Hybrid materials
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- **Prototype.** New additive and hybrid technologies targeting large areas using aluminium grades as well as thermosets materials. TRL=6.

LASIMM

Project full title	**LASIMM: Large Additive Subtractive Integrated Modular Machine**
FoF call topic	H2020-FoF-01-2016 – Novel hybrid approaches for additive and subtractive manufacturing machines
Project web site	www.cordis.europa.eu/project/rcn/205464_en
Project start-end date	01-10-2016 to 30-09-2019
Project budget (€)	€4,868,262 (100% EU funded)
Project coordinator	EWF (BE)
Consortium	BAE Systems (UK); Fosters&Parners (UK); Vestas Wind Systems (DE); Cranfield University (UK); Global Robots (UK); Loxin2002 (ES); Delcam (UK); Instituto Superior Tecnico (PT); HZG (DE)

Project aim / summary:

The LASIMM project aim is to develop a large scale flexible hybrid additive/subtractive machine based on a modular architecture which is easily scalable. The machine will feature capabilities for additive manufacture, machining, cold-work, metrology and inspection that will provide the optimum solution for the hybrid manufacturing of large engineering parts of high integrity, with cost benefits of more than 50% compared to conventional machining processes.

For large scale engineering structures material needs to be deposited at a relatively high rate with exceptional properties and excellent integrity. To ensure this the machine is based on wire + arc additive manufacture for the additive process. A unique feature of the machine will be the capability for parallel manufacturing featuring either multiple deposition heads or concurrent addition and subtraction processes. To facilitate parallel manufacturing the machine architecture is based on robotics. To ensure that the surface finish and accuracy needed for engineering components is obtained for the subtractive step a parallel kinematic motion robot is employed. This robot is also used for application of cold work by rolling between passes. This ensures that material properties can be better than those of forged material.

A key part of this project is the development of ICT infrastructure and toolboxes needed to programme and run the machine. The implementation of parallel manufacturing is extremely challenging from a software perspective and this will be a major activity within the project.

Sectors addressed	• Aerospace • Automotive • Other (architecture, engineering)
VC stages addressed	• Modelling, simulation • Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• Other (Wire Arc AM)
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IPRs

MAIN RESULTS

- **Software:** ICT framework and toolboxes for first time right integrated hybrid manufacturing. TRL=6.
- **Prototype:** final machine design with additive and subtractive elements of the manufacturing process. TRL=6.

OPENHYBRID

Project full title	**OpenHybrid: Developing a novel hybrid AM approach which will offer unrivalled flexibility, part quality and productivity**
FoF call topic	H2020-FoF-01-2016 – Novel hybrid approaches for additive and subtractive manufacturing machines
Project web site	www.openhybrid.eu www.cordis.europa.eu/project/rcn/205504_en
Project start-end date	01-10-2016 to 30-09-2019
Project budget (€)	€1,510,338 (100% EU funded)
Project coordinator	The Manufacturing Technology Centre (UK)
Consortium	Siemens (DE); WEIR Group (UK); Fraunhofer IPT (DE); Mikron Agie Charmilles (CH); ESI Group (FR); HMT (UK); GUDEL (CH); TWI (UK); BCT (DE); EWF (BE); Centro Ricerche FIAT (IT); ESI Software (DE); Picasoft (FR)
Project aim / summary: The OPENHYBRID project will overcome the technical and commercial barriers of current hybrid manufacturing systems to deliver a single manufacturing system capable of undertaking a wider range of processes in a seamless automated operation. The new system will offer unrivalled flexibility in terms of materials, including the ability to switch between powder and wire feed-stock within a single part. Moreover the process can be fitted to a diverse range of platform to produce parts from 2 cm to 20 m in length. The capability of the OPENHYBRID approach will be validated through the production of industrial demonstrators from the power generation, automotive and mining equipment sectors.	
Sectors addressed	• Aerospace • Automotive
VC stages addressed	• Modelling, simulation • Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• Direct energy deposition
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IPRs
MAIN RESULTS	
• Hybrid manufacturing platform. TRL=6.	

Project full title	**AM-Motion: A strategic approach to increasing Europe's value proposition for Additive Manufacturing technologies and capabilities**
FoF call topic	H2020-FoF-05-2016 – Support for the further development of Additive Manufacturing technologies in Europe
Project web site	www.am-motion.eu www.cordis.europa.eu/project/rcn/205499_en
Project start-end date	01-11-2016 to 31-12-2018
Project budget (€)	€993,053 (100% EU funded)
Project coordinator	PRODINTEC (ES)
Consortium	TNO (NL); CEA (FR); ERRIN (BE); TWI (UK); IDEA Consult (BE); Airbus Operations (ES); Materialise (BE); Siemens (DE); D'Appolonia (IT); EPMA (BE); CECIMO (BE); Brainport Development (NL);

Project aim / summary:

The overall objective of the AM-Motion CSA is to contribute to a rapid market uptake of AM technologies across Europe by connecting and upscaling existing initiatives and efforts, improving the conditions for large-scale, cross-regional demonstration and market deployment, and by involving a large number of key stakeholders, particularly from industry.

By doing this, the AM-Motion project has the ambition to develop a strategy and set up the pillars for its efficient implementation that, ultimately, will contribute to reinforcing the European ecosystem of AM.

Sectors addressed	• Health • Aerospace • Consumer goods • Electronics
VC stages addressed	• All VC stages
AM process addressed	• All AM processes
Materials addressed	• All materials
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- **Map** of AM actors, projects, programmes initiatives national, regional and EU. To be incorporated in AM e-Tool from FoFAM project.
- **AM roadmap:** including both technological and non-technological actions (i.e standardisation, education...) needed to be implemented for the AM market deployment.
- **AM app.**
- **Policy recommendations.**
- **Models of business collaboration/implementation.**
- Identification of **employer needs** regarding AM skills and **educational implementation model.**
- **Legal, EHS, standardisation and IPR** frameworks & actions.

ModuLase
MODULAR LASER PROCESS HEAD

Project full title	**ModuLase: Development and Pilot Line Validation of a Modular Re-Configurable Laser Process Head**
FoF call topic	H2020-FOF-13-2016 - Photonics Laser-based production
Project web site	www.modulase.eu www.cordis.europa.eu/project/rcn/205598_en
Project start-end date	01-09-2016 to 01-09-2019
Project budget (€)	€2,458,465 (€2,184,565 EU contribution)
Project coordinator	TWI (UK)
Consortium	Q-SYS (NL); ULO OPTICS (UK); AIMEN (ES); EWF (BE); Centro Ricerche FIAT (IT); SODECIA (DE); Graham Engineering (UK)

Project aim / summary:

ModuLase aims to develop, validate and demonstrate a rapidly re-configurable laser process head that:

- Is capable of welding, cladding and cutting, through the use of three modular end-effectors.
- Includes intelligent sensor technologies for in-process monitoring.
- Is linked to an intelligent system, in order to achieve adaptive process control, quality assurance, and semi-automated process parameter configuration.

The ModuLase re-configurable laser process head system will be compatible with existing and future fiber-delivered laser process systems. The uniqueness of this approach is in the development of a technology which allows the process head system to perform welding, cladding and cutting operations, with a changeover time of <1' between processes.

Sectors addressed	• Aerospace • Automotive • Energy
VC stages addressed	• Process, equipment, ICT
AM process addressed	
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IPRs

MAIN RESULTS

- **To develop a Beam Forming Unit (BFU) for Tailoring Laser Beam Energy Distribution.** The adaptable optical elements of the BFU will be capable of delivering a wide range of laser beam energy distributions, suitable for welding, cutting and cladding applications. A range of high-value goods, e.g. those made from advanced materials (advanced alloy steel, titanium, aluminium, etc.) will be covered.
- **To develop End-Effectors for Welding, Cladding and Cutting Applications.** Three rapidly interchangeable end-effectors will be developed to cover welding, cutting and cladding applications. The end-effectors will have a plug and play system to allow them to be changed on the end of the process head within a time of 1 minute.
- **To develop a Co-Axial In-Process Quality Assurance System.** A process monitoring system suitable for welding, cladding and cutting processes will be developed. It will be embedded into the ModuLase system, in order to assure process stability and also enabling to reduce additional time and costs involved in the process.
- **To develop Software Package and Integrate it with Process Head.** The ModuLase process head will incorporate several 'Smart' aspects, including: automate adjustment of laser beam energy profiles (through opto-mechanical components in the laser process head), process monitoring and adaptive control, automated end-effector changing and (semi) process automation. As such, a software package is required to interface with other parts of the wider laser processing system and for human interface.
- **To validate the Flexibility of the ModuLase system for Welding, Cladding and Cutting at a Pilot Facility**, to demonstrate adaptability for industrial applications.

ENCOMPASS

Project full title	**ENCOMPASS: ENgineering COMPASS**
FoF call topic	H2020-FOF-13-2016 - Photonics Laser-based production
Project web site	www.encompass-am.eu www.cordis.europa.eu/project/rcn/205599_en
Project start-end date	01-09-2016 to 30-09-2019
Project budget (€)	€4,040,371 (100% EU funded)
Project coordinator	The Manufacturing Technology Centre (UK)
Consortium	Fraunhofer (DE); Renishaw (UK); University of Liverpool (UK); Rolls-Royce (UK); ITP (ES); DePuy (IE); ESI Software (DE); Altair Engineering (UK); EWF (BE); Centro Ricerche FIAT (IT)

Project aim / summary:

The ENCOMPASS project principally aims to create a fully digital integrated design decision support (IDDS) system to cover the whole manufacturing chain for a laser powder bed fusion (L-PBF) process encompassing all individual processes within in. The ENCOMPASS concept takes a comprehensive view of the L-PBF process chain through synergising and optimising the key stages. The integration at digital level enables numerous synergies between the steps in the process chain and in addition, the steps themselves are being optimised to improve the capability and efficiency of the overall manufacturing chain.

ENCOMPASS addresses the three key steps in the process chain: component design, build process, and post-build process steps (post-processing and inspection). The links between these stages are being addressed by the following five interrelations:

- Between the design process and both the build and post-build processes in terms of manufacturing constraints/considerations to optimise overall component design.
- Between the design process and build process component-specific L-PBF scanning strategies and parameters to optimise processing and reduce downstream processing.
- Between the design process and the build and post-build processes in terms of adding targeted feature quality tracking to the continuous quality monitoring throughout the process chain.
- Between the build and post-build processes by using build specific processing strategies and adaptation based on actual quality monitoring data (for inspection and post-processing).
- Between all stages and the data management system with the integrated design decision support (IDDS) system. By considering the entire AM process chain, rather than the AM machine in isolation, ENCOMPASS will integrate process decision making tools and produce substantial increases in AM productivity, with clear reductions in change over times and re-design, along with increased 'right-first time', leading to overall reductions in production costs, materials wastage, and over-processing. This will lead to higher economic and environmental sustainability of manufacturing, and re-inforce the EU's position in industrial leadership in laser based AM.

Sectors addressed	• Health • Aerospace • Automotive
VC stages addressed	• Modelling, simulation • Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• Powder Bed Fusion
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Education/training • Business, commercialisation, industrial exploitation • IPRs

MAIN RESULTS

- Software: IDDS system. TRL=6.
- Prototype.

PARADDISE

Project full title	**PARADDISE: A Productive, Affordable and Reliable solution for large scale manufacturing of metallic components by combining laser-based ADDItive and Subtractive processes with high Efficiency**
FoF call topic	H2020-FOF-13-2016 - Photonics Laser-based production
Project web site	www.cordis.europa.eu/project/rcn/205478_en
Project start-end date	01-09-2016 to 30-09-2019
Project budget (€)	€3,761,403 (100% EU funded)
Project coordinator	Tecnalia (ES)
Consortium	Ibarmia Innovatek (ES); Siemens (DE); Precitec (DE); GKN Aerospace (NO); Michelin (FR); Universidad del País Vasco (ES); RWTH Aachen University (DE)

Project aim / summary:

The overall objective of PARADDISE project is to rationalize, to structure and to make available to the stakeholders of manufacturing value chain the knowledge and the tools for combining two antithetical processes: LMD and Machining (milling and turning). The project will develop expert CAx technologies, smart components and monitoring and control systems tailored for the hybrid process in a cost-effective way and with structured knowledge about LMD process. The PARADDISE solution will offer a synergetic combination among: the high flexibility for the designs and for the materials to be used, the high material efficiency and the high savings in material resources and its associated costs of the LMD operations; and the high accuracy, the high robustness and the high productivity of subtractive operations.

The solution will be integrated in the 'ZVH45/1600 Add+Process' hybrid machine from IBARMIA manufacturer (PARADDISE partner), which is already available in the market as well as at TECNALIA's facilities (PARADDISE coordinator). Thus, the PARADDISE project will conceive a process-machine-tools solution.

By means of this combined manufacturing process, large scale manufacturers of value-added metallic components will be able to achieve high quality and high productivity with a minimum use of material and energy resources when manufacturing those parts, which will lead to a reduction in manufacturing costs. In that way, the PARADDISE project intends to boost and to spread the use of LMD technology along the life cycle of value-adding metal components.

Sectors addressed	• Aerospace • Automotive
VC stages addressed	• Modelling, simulation • Process, equipment, ICT
AM process addressed	• Direct energy deposition
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- Hybrid solution for efficient and affordable production of large scale metallic parts. TRL=6.
- Closed loop control system for hybrid AM&SM manufacturing. TRL=6.
- Smart LMD head. TRL=6.
- Smart powder feeder. TRL=5.
- Monitoring system for metal LMD process. TRL=6.
- Database for metal LMD and machining processses. TRL=6.
- CAx technologies for hybrid manufacturing. TRL=6.
- Metal powder recycling system. TRL=6.
- International standards on test methods and procedures for the characterization of aerospace parts produced by AM technologies. TRL=6.

Project full title	**MAESTRO: Modular laser-based additive manufacturing platform for large scale industrial applications**
FoF call topic	H2020-FOF-13-2016 - Photonics Laser-based production
Project web site	www.maestro-project.eu www.cordis.europa.eu/project/rcn/205398_en
Project start-end date	01-10-2016 to 30-09-2019
Project budget (€)	€3,995,906 (100% EU funded)
Project coordinator	Centre Technique Industriel de la plasturgie et des composites (FR)
Consortium	University of Birmingham (UK); CEA (FR); Electro Optical Systems (DE); III V LAB (FR); Ohnmacht & Baumgartner (DE); Centro Ricerche FIAT (IT); Alstom Transport (FR); Gemmate Technologies (IT); Altair Engineering (FR)

Project aim / summary:

MAESTRO aims to develop and combine with existing SLM techniques five innovations that will constitute the basis of a highly competitive manufacturing value chain:

- A single pre-process software for a numerical chain combining all mandatory steps and configurations of SLM together with its related pre- and post-processes.
- Hybridization of SLM with MIM.
- Adaptive process control of SLM.
- System level integration of a modular platform.
- Open access to an easy-to-use demonstration platform to reinforce to EU leadership in AM.

These innovations will enable SLM to overcome the current limitations (speed, productivity, costs) to address large scale markets: productivity will be improved by 30%, cost reduced by 30% with quality towards zero defect. The performances of the MAESTRO platform will be assessed through a substantial number of demonstrators.

Sectors addressed	• Aerospace • Automotive • Electronics • Other (railway)
VC stages addressed	• All VC stages
AM process addressed	• Powder bed fusion
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Legislation • Education, training • Business, commercialisation, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- SLM single pre-process software.
- Hybrid MIM/SLM manufacturing techniques.
- SLM adaptive process control.
- System-level integration of modular platform.
- Platform demonstration.

DREAM

Project full title	**DREAM: Driving up Reliability and Efficiency of Additive Manufacturing**
FoF call topic	H2020-FOF-13-2016 - Photonics Laser-based production
Project web site	www.dream-euproject.eu www.cordis.europa.eu/project/rcn/205518_en
Project start-end date	01-10-2016 to 30-09-2019
Project budget (€)	€3,242,435 (100% EU funded)
Project coordinator	Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali (IT)
Consortium	Electro Optical Systems (DE); Universitatea Transilvania Din Brasov (RO), Bewarrant (BE); MIND4D (RO); POLY-SHAPE (FR); ADLER (FR); RB (IT); Ferrari (IT)

Project aim / summary:

The aim of DREAM is to significantly improve the performances of laser Powder Bed Fusion (PBF) of titanium, aluminium and steel components in terms of speed, costs, material use and reliability, also using a LCA/LCC approach, whilst producing work pieces with controlled and significantly increased fatigue life, as well with higher strength-to-weight ratios.

DREAM targets the development of a competitive supply chain to increase the productivity of laser-based AM and to bring it a significant step further towards larger scale industrial manufacturing.

In order to upscale the results and to reach an industrial relevant level of productivity, the project is focused on the following four main challenges

- Part modeling and topology optimization.
- Raw material optimization to avoid powder contamination.
- Process optimization, including innovations of the control software of the AM machine, to enable high throughput production.
- Setup of laser-PBF of nanostructured titanium alloys with unchanged granulometric dimension for an additional push to higher productivity, since nanostructured metal powders can be sintered with lower energy input and faster speed.

The project, thanks to the three end-users involved, is focused on components for prosthetic, automotive and moulding applications to optimize the procedure for three different materials, respectively titanium, aluminium and steel.

Sectors addressed	• Health • Automotive • Industrial equipment and tooling • Other (manufacturing)
VC stages addressed	• All VC stages
AM process addressed	• Powder Bed Fusion
Materials addressed	• Metal
Non-technological activities addressed	• Standardisation • Business, commercialisation, industrial exploitation • IPRs

MAIN RESULTS

Project full title	**HiperLAM: High Performance Laser-based Additive Manufacturing**
FoF call topic	H2020-FOF-13-2016 - Photonics Laser-based production
Project web site	www.hiperlam.eu www.cordis.europa.eu/project/rcn/205763_en
Project start-end date	01-11-2016 to 01-11-2019
Project budget (€)	€3,756,256 (100% EU funded)
Project coordinator	ORBOTECH (IL)
Consortium	National Technical University of Athens (GR); TNO (NL); Oxford Lasers (UK); P.V. NANO CELL (IL); FLEXENABLE (UK); PRAGMATIC PRINTING (UK); KITE INNOVATION (UK)

Project aim / summary:

IPERLAM is an SME driven Research and Innovation Action (RIA) well-aligned to the FoF Initiative. It aims to demonstrate superior resolution, cost and speed performance, featuring Laser-based Additive Manufacturing (LAM) to replace the existing traditional subtractive manufacturing processes. HIPERLAM focuses on two key applications: RFID antenna and fingerprint bio-sensors. The high resolution printed conductive lines will be achieved by using Laser Induced Forward Transfer (LIFT) and Selective Sintering techniques applied on nano-particle metallic inks.

Sectors addressed	• Automotive • Consumer goods • Electronics
VC stages addressed	• Materials • Process, equipment, ICT
AM process addressed	• Direct energy deposition
Materials addressed	• Metal • Other (nano-particle metallic inks)
Non-technological activities addressed	• Technology transfer

MAIN RESULTS

HyProCell

Project full title	**HyProCell: Development and validation of multiprocess hybrid production cells for rapid, individualized laser-based production enabled by ICT**
FoF call topic	H2020-FOF-13-2016 - Photonics Laser-based production
Project web site	www.hyprocell-project.eu www.cordis.europa.eu/project/rcn/205596_en
Project start-end date	01-11-2016 to 30-10-2019
Project budget (€)	€6,163,607 (€3,937,331 EU contribution)
Project coordinator	LORTEK (ES)
Consortium	Technology Transfer Systems (IT); ABB (CH); POLY-SHAPE (FR); RAMEM (ES); Autodesk (UK); SmartFactory (DE); Fraunhofer ILT (DE); ADIRA (PT); HAMUEL (DE)
Project aim / summary: HyProCell develops and validates integrated multiprocess hybrid production cells for rapid individualized laser-based production. The cells include laser-based additive and subtractive manufacturing machines, ensuring a fully finished product from incoming raw materials.	
Sectors addressed	• Aerospace • Automotive • Energy • Industrial equipment and tooling
VC stages addressed	• Process, equipment, ICT • Product
AM process addressed	• Powder bed fusion • Direct energy deposition • Other (selective laser melting)
Materials addressed	• Metal
Non-technological activities addressed	• Business, commercialization, industrial exploitation • IPRs
MAIN RESULTS	

2.2 Projects under Framework Programme calls

Project full title	**COMPOLIGHT: Rapid Manufacturing of lightweight metal components**
FoF call topic	FP7-NMP.2007.3.4-1 – Rapid manufacturing concepts for small series industrial production
Project web site	www.cordis.europa.eu/project/rcn/89909_en
Project start-end date	01-01-2008 to 31-12-2011
Project budget (€)	€682,654.80
Project coordinator	Danish Technological Institute (DK)
Consortium	MB Proto (FR); Euro Heat Pipe (BE); Flying CAM (BE); Hydrauvision (NL); Marcam Engineering (DE); Sitex 45 (RO); FJ Industries (DK); Open Engineering (BE); Fraunhofer (DE); Sirris (BE); TNO (NL)

Project aim / summary:

The project adresses many of the current challenges in RM of metal parts through general improvements of design, production and quality of RM metal parts. The objectives of CompoLight are to:

- Gain new knowledge about light metal items produced via RM.
- Make it easier for the customer to include the concept of RM in production.
- Increase the use of RM for certain products in the industry.
- Reduce the time it takes for a product to reach the market.
- Reduce the costs and error output related to RM.

This will be achieved by:

- Setting up rules of design to aid product designers.
- Setting up guidelines and simulation software that can support the end-user's work before the RM production, as well as predict the quality and the mechanical properties of the item.
- Developing CAD software for the design of lightweight items with inner structures.
- Researching on how RM can be integrated into conventional production methods.
- Improving the control of the surface quality of RM items.

Sectors addressed	• Automotive • Consumer goods • Industrial equipment and tooling
VC stages addressed	• Modelling, simulation • Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• Powder Bed Fusion • Binder jetting
Materials addressed	• Metal
Non-technological activities addressed	• Business, commercialisation, industrial exploitation

MAIN RESULTS

- Efficient techniques and interfaces for an improved data handling of structured parts allowing to process and prepare very large CAD files. TRL 8.
- Software for the automated design and generation of complex lightweight structures with a structure size < 100µ. TRL 8.
- Automated design and handling of internal structures for porous parts. TRL 8.
- Hydraulic block for Hydrauvision. TRL >9.
- Frame for the Flying CAM helicopter. TRL >9.

SASAM

Project full title	**SASAM: Support Action for Standardisation in Additive Manufacturing**
FoF call topic	FP7-NMP.2012.4.0-2 - Support for standardisation needs
Project web site	www.sasam.eu www.cordis.europa.eu/project/rcn/104749_en
Project start-end date	01-09-2012 to 28-02-2015
Project budget (€)	€682,654.80
Project coordinator	TNO (NL)
Consortium	Siemens (DE); Sintef (NO); AIJU (ES); PrintedJewelry (NL); ViaMéca (FR); MBProto (FR); Sirris (BE); Materialise (BE); Layerwise (BE); Inspire (CH); University of Loughborough (UK); CETIM (FR); Eni Saint Etienne (FR); ULPGC (ES); NEN (NL); UNM (FR); SIS (SE)

Project aim / summary:

SASAM's mission is to drive the growth of AM to efficient and sustainable industrial processes by integrating and coordinating Standardisation activities for Europe by creating and supporting a standardisation organisation in the field of AM.

The mission of the SASAM project is to promote the growth of AM to become a family of efficient and sustainable industrial manufacturing processes by integrating and coordinating standardization activities within the European AM community and other stakeholders. This will be realized primarily in coordination with ISO/TC261, but also through collaboration with ASTM F42 and the recently initiated CEN/Cenelec STAIR platform for additive manufacturing.

Sectors addressed	• All sectors
VC stages addressed	• All VC stages
AM process addressed	• All AM processes
Materials addressed	• Metal • Polymer • Ceramic
Non-technological activities addressed	• Standardisation • Education, training • Business, commercialisation, industrial exploitation

MAIN RESULTS

- **Listing of 120 stakeholders interest and priorities:** materials, sectors, processes...
- **Resume of existing AM standardisation related roadmaps report** describing what test are already done and where additions need to be made (headings of chapters/topics identified). TRL 6.
- **Public roadmap for AM standardisation**, open for all to be used and contribute to. TRL 8.

Project full title	**iBUS: An integrated business model for customer driven custom product supply chain**
FoF call topic	FP7-NMP-35-2014 - Business models with new supply chains for sustainable customer-driven small series production
Project web site	www.h2020ibus.eu www.cordis.europa.eu/project/rcn/196843_en
Project start-end date	01-09-2015 to 31-08-2019
Project budget (€)	€7.440.361,25 (€6.271.207 EC contribution)
Project coordinator	University of Limerick (IE)
Consortium	Fábrica de Juguetes (ES); Juguettos Central de Compras (ES); MCOR Technologies (IE); Manopt Systems (IE); Dassault Systems (UK); Universitaet Paderborn (DE); AIJU (ES); Cartamundi Digital (BE); SHH (CZ)

Project aim / summary:

The overall objective for iBUS is to develop and demonstrate by 2018 an innovative internet based business model for the sustainable supply of traditional toy and furniture products that is demand driven, manufactured locally and sustainably, meeting all product safety guidelines, within the EU. The iBUS model focuses on the capture, creation and delivery of value for all stakeholders – consumers, suppliers, manufacturers, distributors and retailers.

The main focus of iBUS is to drive sales for EU traditional toy and furniture manufacturers by leveraging internet based technologies, focusing on safe products, quality, design and innovation. In this new iBUS model consumers become designers, designing, customising and placing orders for their own products online in the iBUS cloud. They will be supported by embedded services in iBUS, developed in the main by SME Technology providers. These services include augmented reality design assistants, design verification tools for compliance with EU product safety guidelines, analysis of environmental footprint and additive manufacturing/3D printing of the customised products. Subsequently, parametric engineering design principles will take the design from concept to demand. This demand will then be synchronised and optimised across the supply chain, supported by the embedded supply chain optimisation tools, to produce sustainable demand driven production and supply plans. Manufacturers will then produce the furniture and toys in small scale series production driven by the actual customer demand. Suppliers will have visibility of, and make decisions based on, end-customer demand. Likewise customers will have visibility of their orders through all stages of production and delivery. The infrastructure will be cloud based using internet and social media technologies, allowing interaction and collaboration, but also accessible to home-based or small business users, promoting social inclusion.

Sectors addressed	• Consumer goods
VC stages addressed	• All VC stages
AM process addressed	• All AM processes
Materials addressed	• Polymer
Non-technological activities addressed	• Standardisation • Legislation • Business, commercialisation, industrial exploitation • IPRs • Technology transfer • Other (safety)

MAIN RESULTS

- Customised product design virtual environment for customers.
- AM & rapid tooling process suitable for products customisation .
- Supply and demand network.
- Integrated business model platform.

DiMAP — DIGITAL MATERIALS FOR 3D PRINTING

Project full title	**DIMAP: Novel nanoparticle enhanced Digital Materials for 3D Printing and their application shown for the robotic and electronic industry**
FoF call topic	H2020-NMP-07-2015 - Additive manufacturing for tabletop nanofactories
Project web site	www.dimap-project.eu www.cordis.europa.eu/project/rcn/198812_en
Project start-end date	01-01-2015 to 31-09-2018
Project budget (€)	€4,997,351.25 (100% EU funded)
Project coordinator	Profactor (AT)
Consortium	Stratasys (IL); KIT (DE); Borealis (AT); TIGER Coatings (AT); FESTO (DE); Philips Lighting (NL); Universitat Linz (AT); SOREQ NRC (IL); CIRP (DE); PV NANO CELL (IL); TECNAN (ES)

Project aim / summary:

The DIMAP project focuses on the development of novel ink materials for 3D multi-material printing by PolyJet technology. We will advance the state-of-the art of AM through modifications of their fundamental material properties by mainly using nanoscale material enhanced inks. This widens the range of current available AM materials and implements functionalities in final objects. Therefore applications will not be limited to rapid prototyping but can be used directly in production processes. DIMAP will show this transition in two selected application fields: the production soft robotic arms/ joints and customized luminaires.

In order to cope with these new material classes the existing PolyJet technology is further developed and therefore improved. The DIMAP project targets at the following objectives: additive manufactured joints, additive manufactured luminaires, ceramic enhanced materials, electrically conducting materials, light-weight polymeric materials, high-strength polymeric materials, novel multi-material 3D-printer and safe by design.

With the development of novel ink materials based on nanotechnology improvement of the mechanical properties (ceramic enhanced and high strength polymeric inks), the electrical conductivity (metal enhanced inks) and the weightiness (light weight polymeric materials) are achieved. Based on the voxel printing by PolyJet these new materials lead to a huge broadening of the range of available digital material combinations.

Further focus points during the material and printer development are safe by design approaches, work place safety, risk assessment, collaboration with EU safety cluster and life cycle assessment. An established roadmap at the end of project enables the identification of future development needs in related fields order to allow Europe also in the future to compete at the forefront of the additive manufacturing revolution.

Sectors addressed	• Electronics • Others (robotics)
VC stages addressed	• All VC stages
AM process addressed	• Material jetting
Materials addressed	• Metal • Polymer • Ceramic
Non-technological activities addressed	• Business, commercialisation, industrial exploitation • IPRs • Technology transfer • Other (nanosafety)

MAIN RESULTS

- **Application requirements** derived from the demonstrators and requirements for all ink types based on specifications made for demonstrators defined. TRL=4.
- **Novel polyjet inks:** Ceramic and metal nanoparticle enhanced inks as well as high strength polymeric inks were developed and characterized. First printing trials with a PolyJet 3D printer were sucessfully performed. First foamable nanoparticles for light weight polymeric inks were sucessfully synthesized and the foaming behaviour was monitored. TRL=4.
- **Curing procedures:** Curing strategies for the novel ink systems were developed. Strategies include UV, (N)IR and IPL curing and sintering. TRL=4.
- **Novel multi-material 3D printer:** An experimental printer capable of printing multi-material models was established. First simulation of digital materials performed. TRL=4.
- **Demonstrators:** Design and manufacturing of test structures for additively manufactured pneumatic actuators with commercially available materials in a standard PolyJet printer. TRL=4.

FAST

Project full title	**FAST: Functionally Graded Additive Manufacturing Scaffolds by Hybrid Manufacturing**
FoF call topic	H2020-NMP-07-2015 - Additive manufacturing for tabletop nanofactories
Project web site	www.project-fast.eu/en/home www.cordis.europa.eu/project/rcn/198809_en
Project start-end date	01-12-2015 to 31-11-2019
Project budget (€)	€4,916,750 (100% EU funded)
Project coordinator	Maastricht University (NL)
Consortium	Fraunhofer IST (DE); Nadir (IT); GESIM (DE); PROLABIN & TEFARM (IT); Abalonyx (NO); Tecnalia (ES); PolyVation (NL); University of Padova (IT)

Project aim / summary:

AM market has grown with trends higher than 20% every year in the last 10 years. Their fast uptake is due to different innovative factors such as no shape limits in manufacturing process, full customisation on the single artefact, localised production and no waste material. In particular the ability to print any shape allows to design the products not following the constricting conventional manufacturing processes but just focalising on their function. This “Design for Function” feature is one of the main drivers for AM uptake on a wider scale production and the limited number of “functional” materials that can be printed or the limit in controlling gradient and surface properties are showing to be an important barrier. This is particularly true in manufacturing of tissue engineering (TE) scaffolds where the technology has a promising growth over the last decade. Scaffolds production for tissue regeneration is one of the main fields where the “Design for Function” feature of AM make the difference relative to the other production techniques if in the production process all the needed “Functions” can be introduced: mechanics, geometry (porosity and shape), biomaterial, bio-active molecules and surface chemical groups. The FAST project aims to integrate all these “Functions” in the single AM process. This integration will be obtained by the hybridisation of the 3D polymer printing with melt compounding of nanocomposites with bio-functionalised fillers directly in the printing head and atmospheric plasma technologies during the printing process itself. Final objective of the project is to realize a demonstrator of the proposed hybrid AM technology in order to achieve a small pilot production of scaffolds for bone regeneration with the novel smart features to be tested in some in-vivo trials.

Sectors addressed	• Health
VC stages addressed	• Materials • Process, equipment, ICT • Product
AM process addressed	• Material extrusion
Materials addressed	• Polymer • Ceramic • Bio-materials
Non-technological activities addressed	• Education, training • Business, commercialization, industrial exploitation • Technology transfer

MAIN RESULTS

- New AM technology combining new extrusion bases systems able to blend different materials with plasma technology. TRL=7.
- Scaffolds generated by the newly developed hybrid technology, able to mimic more closely the physic-chemical and mechanical properties of bone. TRL=4.
- In vitro and in vivo validation of regenerated bone in a critical defect not able to heal by itself. TRL<3.

A_MADAM	
Project full title	**A_MADAM: Advanced Design Rules for Optimal Dynamic Properties of Additive Manufacturing Products**
FoF call topic	H2020-MSCA-RISE-2016 - Research and Innovation Staff Exchange
Project web site	www.mfkv.kg.ac.rs/a_madam www.cordis.europa.eu/project/rcn/206769_en
Project start-end date	01-01-2017 to 31-12-2020
Project budget (€)	€468,000
Project coordinator	Faculty of Mechanical and Civil Engineering in Kraljevo (RS)
Consortium	University of Bologna (IT); Studio Pedrini (IT); Plamingo (BA); Topmatika (HR)

Project aim / summary:

The industrial deployment of AM technologies is hindered by a gap that exists between the excellent research and its exploitation in industry. The research knowledge about the AM technologies is published in scientific journals and in conference proceedings, in form suitable for researchers. On the other hand, industrial and mechanical designers use sets of design rules, which represent condensed and comprehensive form of the research findings that are easy to follow. The lack of sets of design rules for AM technologies is one of important reasons why engineers often prefer conventional technologies to AM.

The proposed project intends to use the research capacities and partnerships developed in previous EU funded projects to carry out systematic studies of dynamic mechanical properties (fatigue, fracture mechanics and impact resistance) of products manufactured by AM with the goal to establish the proper rule sets for design of products. Since the aim of the project is to "translate" the research findings into engineering rules, the consortium consists of two universities and three SMEs that use AM technologies for rapid prototyping, rapid manufacturing and rapid tooling. The project activities will be realized as two-way transfer of knowledge between the industrial and academic partners.

Sectors addressed	• All sectors
VC stages addressed	• Design • Materials
AM process addressed	• Selective laser sintering
Materials addressed	• Polymer • Metal
Non-technological activities addressed	• Standardisation • Education, training • Technology transfer

MAIN RESULTS

- **Rules for optimal design** of metal products manufactured by SLS, with respect to their fatigue behaviour and to their impact resistance.
- Publication of a **rulebook and digital repository of optimal design rules** for products manufactured by SLS, which will include the already known optimal design rules for static mechanical properties, but also the established optimal rules for dynamic mechanical properties.

Project full title	**BAMOS: Biomaterials and Additive Manufacturing: Osteochondral Scaffold innovation applied to osteoarthritis**
FoF call topic	H2020-MSCA-RISE-2016 - Research and Innovation Staff Exchange
Project web site	www.risebamos.eu www.cordis.europa.eu/project/rcn/207034_en
Project start-end date	01-01-2017 to 31-12-2020
Project budget (€)	€828,000 (€639,000 EU contribution)
Project coordinator	University of Las Palmas de Gran Canaria (ES)
Consortium	University College London (UK); Universidade do Minho (PT); Royal National Orthopaedic Hospital NHS Trust (UK); Xi'an Jiaotong University (CN); Shaanxi Hengtong Intelligent Machine (CN); Zhejian University (CN)

Project aim / summary:

Osteoarthritis (OA) is a degenerative joint disease, typified by a loss of quality of cartilage and changes in bone at the interface of a joint, resulting in pain, stiffness and reduced mobility. BAMOS particularly addresses the challenges in OA treatment by providing novel cost effective osteochondral scaffold technology for early intervention of OA to delay or avoid the joint replacement operations. This project has the potential to relieve pain in patients with OA improving their quality of life by keeping people active. It fits with the scope of EU Societal Challenges to encourage the provision of improved clinical care for patients in the field of healthcare, especially for elderly patients.

Novel biopolymeric composites, processed by additive manufacturing, will be characterized and tested as well as coatings on titanium scaffolds. Also, thermal welding technique will be used to join the cartilage component with the bone component to form an osteochondral unit.

Sectors addressed	• Health
VC stages addressed	• Modelling, simulation • Design • Materials
AM process addressed	• Vat photopolymerisation • Material extrusion • Direct energy deposition • Other (EBM)
Materials addressed	• Metal • Polymer • Ceramic • Bio-materials
Non-technological activities addressed	• Standardisation • Legislation • Education, training • Business, commercialization, industrial exploitation • IPRs • Technology transfer

MAIN RESULTS

- Report on clinical specifications of osteochondral scaffolds and the clinical delivery procedures to be used. TRL=4.
- New osteochondral scaffold biomaterials that can provide appropriate mechanical environment for support bone and cartilage formation simultaneously. TRL=4.
- Innovative additive manufacturing techniques to produce patient-tailored osteochondral scaffold for large osteochondral defect repairs. TRL=4.
- Assessment of the osteochondral scaffolds in both in vitro disease relevant model and in vivo clinical animal model. TRL=4.
- Training of early stage researchers in the context of collaborative research, equipping them with the advanced knowledge and expertise to tackle grand societal healthcare challenges and enabling them to building the world class scientific research profile.

2.3 Other EU projects

3DPRISM 3D Printing Skills for Manufacturing	
Project full title	**3DPRISM: 3DPRinting Skills for Manufacturing**
FoF call topic	Erasmus+ Programme/Strategic Partnerships for vocational education and training
Project web site	www.3dprism.eu
Project start-end date	01/11/2015 to 31/01/2018
Project budget (€)	€337,350
Project coordinator	University of Sheffield (UK)
Consortium	Florida University (ES); CECIMO (BE); EXELIA (GR); CIMEA (IT)

Project aim / summary:

3DPRISM aims to improve the quality of VET and the employability of learners, with outputs that emphasize on the applied aspects of 3D printing. To this end, the consortium comprises partners from the areas of VET, manufacturing, training R&D, and certification & accreditation regulation, thus laying the ground for the creation of a sustainable link between skills supply and demand in the advanced manufacturing sector. In this sense, the combined expertise and aligned interests of partners will deliver outputs that will empower VET providers to accurately monitor and respond to ongoing and emerging challenges in manufacturing, so as to equip the workforce with much demanded 3D printing skills in the job market. 3DPRISM will also provide learners with online learning materials (i.e. MOOC and open educational resources), and provide evidence and recommendations for the advancement and development of policies in skills-related aspects of advanced manufacturing and 3D printing. It will also establish a network for a follow-up project on certification and accreditation of 3D printing programmes and courses.

Sectors addressed	• Other (advanced manufacturing)
VC stages addressed	• All VC stages
AM process addressed	• All AM processes
Materials addressed	• All materials
Non-technological activities addressed	• Education, training

MAIN RESULTS

- Compendium for existing and emerging 3D printing occupational profiles in the manufacturing sector (achieved).
- VET programs and courses guide for 3D printing occupations in the manufacturing sector (expected).
- Learning units and resources for initial and continuous VET programs on 3D printing manufacturing jobs (expected).
- EU-level quality, recognition and integration enablers (recommendations paper to support policy-making, plan to form a 3D PRISM outputs-inspired collaboration network, validation of project training materials) (expected).

METALS
MachinE Tool ALliance for Skills

Project full title	**METALS: MachinE Tool ALliance for Skills**
FoF call topic	Erasmus+ Programme/Sector Skills Alliances
Project web site	www.metalsalliance.eu
Project start-end date	01/11/2015 to 31/10/2018
Project budget (€)	€858,080
Project coordinator	CECIMO (BE)
Consortium	Institute of Technology and Education of the University of Bremen (DE); German Machine Tool Builders' Association Youth Foundation (DE); Detmold Government Department 45 (DE); The Machine Tool Institute (ES); Advanced Manufacturing Technologies (ES); TKNIKA (ES); AFOL Metropolitana (IT); UCIMU-SISTEMI PER PRODURRE (IT); ECOLE - Enti COnfindustriali Lombardi per l'Education (IT)

Project aim / summary:

The EU metalworking machine tool industry is a key enabling and advanced manufacturing sector supplying high-quality products to industries such as the automotive, aerospace, energy and medical devices. AMT provide new opportunities and challenges for the sector, whose competitiveness relies on the knowledge and skills of its workforce in designing, producing, operating and maintaining highly-customized and innovative machines.

METALS' objective is to increase the competitiveness of the EU machine tool industry by equipping its workforces with the AM-related skills that will be increasingly needed on the shop floor.

Sectors addressed	• Industrial equipment and tooling
VC stages addressed	• Design • Materials • Process, equipment, ICT • Post processing • Product
AM process addressed	• All AM processes
Materials addressed	• Metal
Non-technological activities addressed	• Education, training

MAIN RESULTS

- Detailed analysis of current and future (2025) occupations and skills in key areas of the machine tool industry influenced by AM.
- Curriculum at EQF level 5 for the machine tool industry meeting high quality assurance guidelines requirements and aligned with principles outlined by the European Credit system for Vocational Education and Training (ECVET).
- E-learning materials available in English, German, Italian and Spanish, provided on a METALS-developed e-learning platform freely available to learning and workers in the machine tool sector.
- Endorsement and recognition tools to support policy-making process in education and training (Memorandum of Understanding, Position Paper).

Interreg Sudoe SAMT SUDOE	
Project full title	**SAMT SUDOE: Spread of Additive Manufacturing and Advanced Materials technologies for the promotion of KET industrial technologies in plastic**
FoF call topic	Interreg Sudoe/Axis 1: Research and innovation
Project web site	www.samtsudoe.eu
Project start-end date	27-09-2016 to 30/06/2019
Project budget (€)	€994,827 (€746,120 EU contribution)
Project coordinator	AIJU (ES)
Consortium	CEIV (ES); IVACE (ES); CENTIMFE (PT); CNR-ICMCB (FR)

Project aim / summary:

The project aims at developing links and synergies between enterprises, R&D centres, clusters, higher education and R&D governmental & regional institutions to promote new KETs in SUDOE space.

Particularly, AMT (3D printing) and advanced materials will be the project focus in order to boost advanced production systems, nanotechnology and advanced materials in industrial sectors present in SUDOE space such as plastic processors and mould industries.

Plastic and mould sector within SUDOE space faces a number of common problems which hinders their ability to compete in a global market: difficulty to be involved actively and efficiently in R&D activities, troubles to incorporate innovations developed in universities and R&D institutions, problems to update technology and develop a skilled workforce.

The project brings together a remarkable group of organisations having extensive knowledge and expertise in AM, plastic and mould technologies and has been structured to respond to regional challenges and achieve project objectives: To transfer new KETs (AMT and advanced materials) and facilitate their implementation throughout the regions present in the project.

These new technologies will be spread over the plastic processor and mould industries, which are well established technological industries that work within a broad range of sectors including the automotive, health, creative industries, textile, clothing and footwear and consumer goods industries. It will be done through four main activities:

- Specialised roadmaps on existing technologies.
- Transnational collaborative SAMT web Platform.
- Creation of training material in the form of Open Educational Resources (OER).
- Development of Multi- KET demonstrators.

Sectors addressed	• All sectors
VC stages addressed	• All VC stages
AM process addressed	• All AM processes
Materials addressed	• All materials
Non-technological activities addressed	• Education, training • Technology transfe

MAIN RESULTS

- Specialised roadmaps on existing technologies.
- Transnational collaborative SAMT web platform.
- Creation of training material in the form of OER.
- Development of Multi-KETs demonstrators.

These projects have received funding from the European Union Horizon 2020 Programme (H2020) under grant agreements number 636882 and 723560.