



June 29, 2016

Prospectus for

**Swedish Arena for Additive Manufacturing of Metals**

and invitation to

**Official start meeting and seminar August 25<sup>th</sup> 2016 09:00-18:00 at Swerea KIMAB, Kista**

This invitation is sent to all participants who have showed interest in the arena. However, the arena and seminar are open to all interested parties so please feel free to distribute to colleagues and business partners.

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## **Executive summary**

This is an invitation to interested industrial companies and other organizations active in research and innovation to participate in the “Swedish Arena for Additive Manufacturing of Metals” (The Arena). The Arena is intended to create an active and open forum between participating industries, institutes, universities and other interested organizations within the field of additive manufacturing of metals (metal-AM). The Arena’s ambition is to be a meeting point for all key players and together develop the future of metal-AM in Sweden. The goal is to form an arena where leading companies and research partners in the Swedish manufacturing industry meet and join forces with metal powder producers, equipment manufacturers, tool shops and other subcontractors to create a strong position for Sweden in this rapidly growing field.

The aim of the Swedish Arena for Additive Manufacturing of Metals is to:

- Develop a strong network in metal-AM between the participating partners
- Monitor and contribute to the development of technology and knowledge
- Provide easy access to test and demo platforms in metal-AM
- Support and accelerate industrialization of metal-AM

Our goal is to create a national arena for open innovation to enable innovative product development and manufacturing to support applied R&D in industrial metal additive manufacturing. Our detailed proposal for the scope and framework of the Arena is described in this prospectus as a basis for decision on the official Arena start-up meeting August 25, 2016.

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## 1. The Arena proposal

This is an invitation to industry to participate in the “Swedish Arena for Additive Manufacturing of Metals” (the Arena). This initiative is based on our belief that Sweden's strengths in advanced manufacturing, powder metallurgy, metal powders and additive manufacturing (AM) technology give us a unique opportunity to take a world leading position in metal additive manufacturing.

Through multi-disciplinary collaborations and an open minded climate, the Arena aims to promote Swedish industries’ competitiveness in the field of AM. Our ambition with the arena is to support applied R&D and enhance knowledge and information transfer in industrial metal-AM to enable innovative product development based on this new technology. Our approach is to have a strict focus on the industrialization of metal AM for new niche industrial products based on existing and new industrial materials. The Swedish Arena for Additive Manufacturing of Metals offers:

- A strong network in metal-AM between the participating partners
- A vehicle to monitor and contribute to the development of technology and knowledge
- Easy access to test and demo platforms in metal-AM
- Support in the industrialization of metal-AM

The Arena is intended to create an active and open forum between participating industries, institutes, universities and other interested organizations within the field of additive manufacturing of metals (metal-AM). The Arena will be an active and open meeting point for research and innovation where key players together develop the future of metal AM. Once the Arena is officially started, our ambition is that the program will continue to grow with more industry, institute and academia partners.

From discussions during two Arena planning meetings with industry, the following research & innovation focus areas have been highlighted.

1. Quality considerations in additive manufacturing
2. From prototyping to industrial production
3. Correlation between raw material and final properties
4. Qualification of new alloys and alloy development
5. Remanufacturing applications

We propose that these five subjects will form the basis for setting-up the initial program for the Arena which is to be decided by the arena board upon program start-up.

### 1.1. The Arena membership

A membership in the Arena gives participating companies and research organizations an opportunity to take part in an initiative to make Swedish industries competitive and leading in metal-AM technology and industrialization. Sweden was once an early adaptor of AM and now has class leading AM suppliers. AM has the potential to make Swedish industries competitive through high value manufacturing that will create growth, uniqueness, jobs and export opportunities.

We propose two categories of membership in the program, **basic** and **active** members.

**Basic membership** is intended for companies that are keen to closely follow the development within metal additive manufacturing, uphold a strong network with other industrial companies in the field and have access to the technical knowhow and test and demo capabilities of the core research partners in the arena.

**Active membership** is intended for companies that want to take an active part in the arena, including voting rights on funding allocation of the arena financing, organization and other steering group appointments. It is the ambition of the Arena to apply for strategic funding from one or several innovation programs and the intent is that the active members will be able to have a say in such matters.

The funding from the basic membership fees will mainly be used for AM technology monitoring and dissemination, including networking activities and seminars as well as a regular metal-AM newsletter. The additional funding from the active membership fees will be used to finance specific studies and projects in metal-AM. The results from this work will be open to active members only if not otherwise decided by the participating companies. It is the intent to seek leverage by pursuing co-funding from other sources in order to develop the activities of the Arena further.

In summary, our proposal is to build the Arena based on the following corner stones:

**1. Basic membership**

- *A fast track* to industrial metal additive manufacturing knowledge with priority access to the test and demo capabilities of the arena
- Regular *newsletters* with our evaluation of the progress in research and innovation in metal additive manufacturing
- *Networking* and technology dissemination by member days and member website

**2. Active membership**

- *Control* of the strategic direction of the arena by voting rights at annual meeting, including election of the board
- *Participation* in the active members Technical Group where new proposals for projects, investments and other initiatives are prepared, including initiation of applications for national, regional and EU funding
- *Eligibility* to participate in the individual arena active members research and technology projects as decided by the Technical Group

**1.1. Financing**

The Arena is intended to be a long term investment and financed through multiple sources.

Sources intended for financing are:

- Membership program
- Regional funding agencies (Regionförbundet, IUC, etc.)
- National funding agencies (Vinnova, Tillväxtverket, etc)
- International funding agencies (EU, etc.)
- Direct company funding of specific projects and activities

Based on other member concepts and the experience from Swerea in the formation of dedicated focus groups we propose the following fee structure:

Basic members: 5 to 50 KSEK/year depending on number of employees

Active members: 10 to 150 KSEK/year depending on number of employees

Research organizations: 50 KSEK/year

The Arena initiative was started by the core R&D partners Swerea, Chalmers and University West. However, once the Arena is up and running, we will invite other research organizations to participate in the Arena.

## 1.2. Organization and management

The governance of the Arena will be controlled by the active members. An annual meeting will be held each year to which all members are invited although only active members have voting rights. The annual meeting should appoint a board with a minimum of seven members, four from industry and three from the core research partners. Chairman of the board should be from one of the industrial representatives. The board is responsible for the allocation of the yearly member fees and the board shall also appoint a management team for the arena, which shall include representatives from all three core research partners.

We have used the existing LIGHTer industrial member program as a base model in our proposal on how to structure the Arena member program. LIGHTer was formed to create a leading multi-branch industrial lightweight arena in 2013. It is now established with a large member base and a well-functioning working model. The Vinnova strategic innovation program (SIP) Lightweight is based on the LIGHTer strategic research and innovation agenda from 2014. Although it is probably not possible to get funding from Vinnova for a new strategic innovation program in metal additive manufacturing, we believe that the Arena will be in a good position to work with Vinnova and several of the already existing SIP's to secure future research funding.

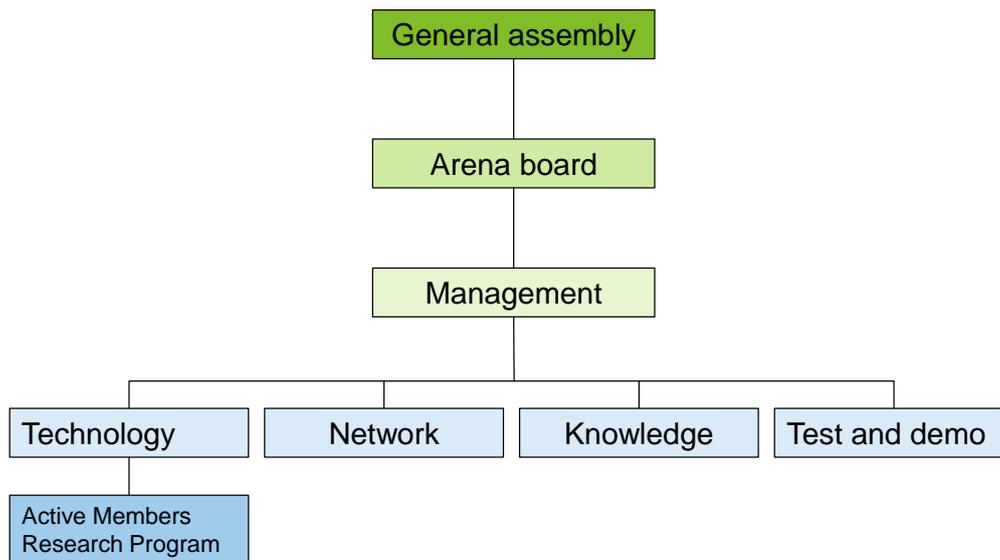


Figure 1: Organization overview of the arena terms

### 1.3. Membership agreement and IPR

A proposal for a membership agreement is presented in Appendix 2. The format of the agreement is based on the Swedish LIGHTer arena which was established in 2012 and is now an established program with more than 209 members, The document in Appendix 2 will need to be formally approved by the founding meeting of the Arena on August 25, 2016.

Activities and actions within the arena will generate knowledge and results with the objective to increase the competitiveness of Swedish industries on an international market. Concurrently, the Arena stands for an open minded network that will conduct international research results that might be publishable and publically interesting.

Specific project agreements concerning secrecy and IPR rights will be applied for each research activity within the active member program to handle IPR issues for those activities that are funded by a specific group of companies. Separate agreements will also be used for all direct contract work within the Arena.

An important task for the Arena is to coordinate activities within the scope of AM of metals. The Arena shall be a hub for AM research in metals for Swedish industries. Activities that are within the field of AM of metals, but is outside of the Arena are denoted associated activities. The aim of associated activities is to find synergies and knowledge transfer between organizations, projects, and AM activities. Such activities may be associated to the Arena in different levels, and the Arena board will take decisions on associated level and set up guidelines for such activities.

### 1.4. The industrial network of the Arena

The proposal for the creation of an industrial member program “Swedish Arena for Additive Manufacturing of Metals” is based on our vision that based on our strengths in advanced manufacturing, powder metallurgy, metal powders and additive manufacturing technology, Sweden has the potential create a world leading position in metal additive manufacturing.

Despite of the strong growth in metal AM installations around the world, there are a number of hurdles that need to be overcome before the new technology will make a major impact in manufacturing industry. Challenges include:

- AM supply chain
- Higher build rates
- Larger build volumes
- Available materials
- Equipment flexibility
- Effective post process finishing
- Effective raw material recycling

There are additional obstacles to be overcome but the list above illustrates the key challenges ahead.

In the Arena, we aim to attract industry that strives to have a leading position in its field, including:

- Advanced products / advanced manufacturing
- Metallic powders and PM metallurgy equipment
- Metallic additive manufacturing equipment, including post-processing
- Companies that specialize in prototype and special tools manufacture
- Indirect AM of functional prototypes and components via castings

Although there may be competitive issues in some areas, our belief is that the creation of a strong and unique national effort will be to the benefit to all.

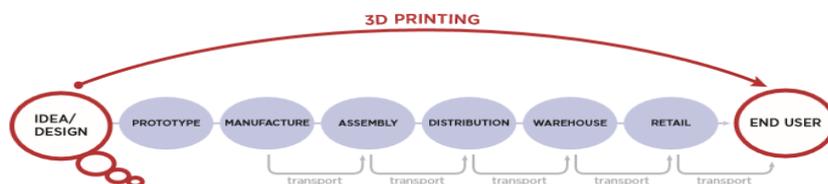


Figure 2: AM supply chain interruption. Source: <https://opsession.wordpress.com/>

## 1.5. Arena infrastructure

Through the research partners within the arena, members have access to state of the art equipment for AM-production, as well as skilled professionals with extensive knowledge of materials, processes and expertise within and adjacent to AM, such as powder metallurgy, production technology and materials characterization. The entire infrastructure is available for the members as test and demo platforms for joint multi-client research projects and bilateral projects on a contract basis.

A short description of the current status of metal-AM technology is presented in Appendix 1, A1. The following metal AM equipment is available, pending delivery or planned at the core research partners:

Powder bed fusion:

- SLM 125HL (SLM Solutions GmbH), at Swerea
- S12-AX (Arcam, special concept), at Swerea
- SLM machine, in preparation Chalmers
- EBM A2X (Arcam), at University West

Directed energy deposition:

- Robotized welding technologies used for AM with wire and blown powder including sensors, monitoring and control equipment; in operation at University West

Binder jetting:

- S-Max Tech Specs (ExOne GmbH) for sand moulds and cores, indirect method for casting of metal at Swerea
- Research platform for testing and development of binder jetting methods, at Swerea

Vat photopolymerization:

- CeraFab 7500 (Lithoz) stereo lithography machine for ceramic powder suspensions, at Swerea

### Support equipment for metal additive manufacturing

Research in metal AM requires a number of other equipment and competencies outside of the direct AM deposition technologies. Key technologies that already exist at the core research partners include:

- Powder manufacturing (gas atomization) and characterization
- Surface chemical analysis of powder surfaces
- PM process laboratory, including HIP capabilities
- Thermal analysis lab, simultaneous TG/DTA/DSC and dilatometry analysis
- Robotized thermal spray cell
- Simulation tools and materials modeling
- Materials characterization and mechanical and corrosion properties
- 3D scanning and CAD capabilities

A more detailed description of the core R&D partners is given in Appendix 1, A2. Other Swedish research organizations and companies active in metal-AM are briefly presented in Appendix 1, A3 and A4.

## 2. Contact information

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## Appendix 1

### A.1. Metal Additive Manufacturing – Current Status

#### a. Short description of the technology

ASTM defines additive manufacturing as “a process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies”. ASTM categorizes additive manufacturing into seven process categories.

1. **Binder jetting**, —an additive manufacturing process in which a liquid bonding agent is selectively deposited to join powder materials.
2. **Directed energy deposition**, —an additive manufacturing process in which focused thermal energy is used to fuse materials by melting as they are being deposited.
3. **Material extrusion**, —an additive manufacturing process in which material is selectively dispensed through a nozzle or orifice.
4. **Material jetting**, —an additive manufacturing process in which droplets of build material are selectively deposited.
5. **Powder bed fusion**, —an additive manufacturing process in which thermal energy selectively fuses regions of a powder bed.

6. **Sheet lamination**, —an additive manufacturing process in which sheets of material are bonded to form an object.
7. **Vat photopolymerization**, —an additive manufacturing process in which liquid photopolymer in a vat is selectively cured by light-activated polymerization.

Today, all technologies except for the last one can be used for additive manufacturing of metals, however new technologies will probably be developed in the future. Material jetting and sheet lamination is still on the research state. Metal AM is often only associated with the use of metal powders as feedstock as in powder bed fusion, but in direct energy deposition a metal wire can also be used. The proposed arena is initially based on powder bed fusion, binder jetting and direct energy deposition and the technologies are, therefore, described in some more detail below.

In **powder bed fusion** the most common technique is Selective Laser Melting (SLM). It is interesting to note that many leading manufacturers are based in Europe. The main suppliers are EOS, Concept Laser, SLM Solutions, 3D Systems, Renishaw and Realizer. The main competitor to SLM today is Electron Beam Melting (EBM) in which the Swedish company Arcam is the only supplier today. There are fundamental differences between the SLM and EBM technologies, which will have a strong influence on the properties of the final component, but there are also major differences between the different SLM concepts on the market. The impact of the technology is still small with only about 2 500 installations worldwide, 30 % of which are used solely for R&D, but the yearly growth is a staggering 70 %. The main applications today, apart from pure prototyping, are in medical implants and in aerospace with titanium and titanium alloys as the main materials used. In recent years, new applications have been identified based on primarily superalloys and tool steels.

For **binder jetting**, the main application today related to metals is 3D printing of sand moulds and cores for metal casting. This technology is commercialized by companies like ExOne and Voxeljet. ExOne has also developed a binder jetting machine for direct metal printing. The technique printed object needs to be sintered followed by infiltration with a liquid melt. Höganäs has formed a separate company, Digital Metals, for manufacturing of small, high precision 3D parts based on a binder jetting concept. Here the printing process is followed by a sintering.

**Direct energy deposition** is based on more traditional industrial technologies like welding deposition, but with an advanced control system in order to build 3D-geometries. There are machine suppliers like Optomec, BeAM, Trumpf, Sciaky and DMG Mori, but the technology is also used by advanced welding manufacturers who have gained in-house knowledge

## b. Key areas in need of development

In spite of the strong growth in metal AM installations around the world, there are a number of hurdles that needs to be overcome before the new technology will make a major impact in manufacturing industry. Challenges include

- Higher build rates
- Larger build volumes
- Available materials
- Equipment flexibility
- Effective post process finishing
- Effective raw material recycling

Several other obstacles are of course also present, but this list suffices to motivate the building of an arena.

## **A.2. Core research partners within the Arena**

### **a. Key research groups and research leaders**

The core research organisations are Chalmers University of Technology (CTH), University West (HV) and Swerea with the following key research groups:

- Surface and Microstructure Engineering Group at CTH, Lars Nyborg and Eduard Hryha
- Product and production development, Wingquist Laboratory at CTH, Rickard Söderberg
- Production Technology West (PTW) at HV, Per Nylén and Lennart Malmsköld
- Additive manufacturing group at Swerea IVF, Seyed Hosseini & Elis Carlström
- Material and process development group at Swerea KIMAB, Annika Strondl & Joakim Ålgårdh
- Cast design group at Swerea SWECAST, Sten Farre

Depending on competence needed in the Arena, other research groups will also be involved.

### **b. Key competences**

The core research partners in the arena have long experience and knowledge of material and process development for metals and metal components, with a special focus on powder and casting metallurgy. Successful collaboration in many research projects has been the base for this initiative.

The “Surface and Microstructure Engineering Group” at the Department of Materials and Manufacturing Technology at **Chalmers** have a long history of research in the field of powder metallurgy (PM) with primary focus on powder manufacturing and further powder consolidation process development, powder and PM consolidated components characterization as well as thermodynamic and kinetic simulations of alloy composition for different sectors of powder metallurgy. As the powder is the base material in powder bed additive manufacturing, extremely fast process on the particle level (deposition – melting – solidification) emphasizes vital importance of the base powder properties (chemical and physical) for successful AM fabrication of the high-performance components. This is realized by application of the advanced surface characterization tools for surface chemical analysis of the powder surface on the nano-level, where available infrastructure is combined with developed methods and a skilled research group. In general, the group has a history of more than 40 years in the area of powder metallurgy with more than 200 papers published in the field.

**University West (HV)** has experience within robotised laser-based AM using metal wire and powder (blown powder nozzle) as well as thermal spray methods. Main research areas are control of wire process (10 years) and metallurgy and process development of blown powder

(3 years), and process development of thermal spray layers (20 years). The wire-based research has resulted in industrialised AM in aerospace industry. The thermal spray process provides considerable flexibility in terms of multilayer systems with which to meet multifunctional requirements. HV has studied applications in aerospace, alternative energy systems and corrosive environments. The next step towards rapid fabrication by AM is “Near Net-Shape Forming by Thermal Spraying”. In this technique, the multi-layered system is sprayed on a substrate specimen that has same size and shape as the component to be produced. After spraying, the substrate specimen is removed so that the remaining part is only the multilayer system (produced entirely by thermal spraying).

In the **Swerea** group there are three subsidiaries that have large activities in the field of Metal AM. Swerea IVF has unique research- and development activities concerning new AM processes which have resulted in patents, patent applications and formation of new companies. One example is a research project on binder jetting leading to the spin-off company Fcubic, now Digital Metal since 2012 owned by Höganäs. IVF has also been pioneer in using powder rheometry to characterize the flowability of metal powders and to understand the correlation between flowability and fundamental powder properties such as surface chemistry, particle roughness, size distribution. Swerea KIMAB has been working in the field of powder metallurgy (PM) for a very long time and has an extensive process and powder characterization laboratory, including gas atomization and HIP-capabilities. Experimental trials are coupled to thermodynamic and kinetic simulations and verification by metallography as well as mechanical and corrosion testing. The research is performed in close collaboration with the Swedish powder producers and end-users. Swerea SWECAST is using indirect AM for metals, with a sand printer for preparation of casting moulds and cores. They have a deep knowledge in metal casting, sand properties and related aspects.

Of course, all of these institutions collaborate in numerous projects in Metal Additive Manufacturing and in related topics. Additionally, industrial research assignments are performed, both confidential and open.

Other available competences usable for AM research at the core research partners include design aspects, topology optimization, 3D scanning, production planning, LCA, non-destructive testing, mechanical and corrosion testing, process control systems, just to mention some activities.

### **A.3. Research groups in Sweden**

A national research agenda for additive manufacturing was written during 2014 with contributions from many research organisations and industries. The AM laboratory at Mid Sweden University (MSU), Östersund was initiated 2003 and is today one of the most comprehensive university laboratory for AM focusing on medical applications and process development. As well, it is until recently the only university in northern Europe equipped with the EBM method, EBM A2 (Arcam AB).

Örebro University has together with Lasertech LSH, Karlskoga and Saab AB purchased an Arcam A2X machine. The equipment is placed at Lasertech LSH and complement the existing 3D printers from EOS for polymers and metals, respectively. They are part of TTC (Tillverkningstekniskt centrum), which also have equipment for tomography.

Stockholm University (SU) has carried out systematic activities since 2009 in the field of AM focusing on tailored microstructures and is equipped with an Eosint M270 (EOS GmbH) SLM machine.

The various Swerea institutes are active in the field of material- and production technique. Swerea KIMAB possesses the only research equipment in Sweden for atomization of metal powders and has a long experience and deep knowledge and is well equipped in powder- and material characterization. Swerea IVF is equipped with a SLM machine, SLM 125HL (SLM solutions GmbH) for metals and a stereo lithography machine for ceramic powder suspensions, CeraFab 7500 (Lithoz). There is also a combination of resources in related fields that support the development of the AM processes and evaluation of the materials produced, including expertise in understanding the correlation between fundamental powder properties and powder flowability, geometrical deviation determination with a 3D scanner attached to a robot, and evaluation of the surface roughness and surface characteristics by white light interferometer. Swerea SWECAST is equipped with a sand printer for preparation of casting moulds and cores, S-Max (ExOne GmbH) and a 3D scanner. They have a deep knowledge in metal casting, sand properties and related aspects.

University West, Trollhättan, is the leading team in Sweden and in Europe in the field of metal wire-based AM using laser welding equipment. It also has long experience in other welding technologies for AM, and the most recent technology is blown powder. The researchers also have experience in thermal sprayed claddings for AM.

The Department of Materials and Manufacturing Technology at Chalmers University of Technology (CTH) is the leading team in Sweden and in Europe in the field of powder metallurgy. Powder metallurgy research group at Chalmers have developed infrastructure, methods and expertise on powder consolidation process development and simulation, characterisation of the powder surface chemistry, thermodynamic and kinetic simulations of the processes happening during powder consolidation and materials characterization. Some of the first Arcam trials were made in the basement at Chalmers and the collaboration continued with research support, MSc-students and PhD-students (one of them currently at Swerea KIMAB and coordinator of the Arena).

KTH, University West and Swerea KIMAB have all just installed A2X machines from Arcam and are collaborating on research and sharing experiences.

Other research groups around Sweden are currently starting up AM activities on metals and will contribute with important interdisciplinary research to the Arena.

#### **A.4. Swedish industry in Metal Additive Manufacturing**

Sweden has a long experience of metal powders and has approximately 25% of the world market with companies like Höganäs, Sandvik, Carpenter Powder Products, Erasteel Kloster and Uddeholm. Also small companies have started based on the knowledge of powder metallurgy for example Metec Technologies, Damsteel, Diamorph and Metasphere Technology.

On the equipment side Sweden has two additive manufacturing suppliers, Arcam and Digital Metal, who were both pioneers with their processes and started their development at Chalmers and Swerea IVF, respectively. Quintus Technologies, at that time ASEA Sweden, was one of the first companies in the world selling hot isostatic pressing facilities. Hot isostatic pressing

can be used to consolidate powder in near-net-shape capsules and to improve the properties of components made by additive manufacturing.

Many companies in Sweden are using AM for prototypes and a few companies are using it for production of metal components today (e.g. Siemens, GKN). A few new AM companies have started; Exmet with amorphous metal and VBN Components with wear resistant material. Sandvik is just building up an AM-center with many different processes in order to evaluate the potential for production of different components after development. However, not all companies are investing in their own machines and have expressed needs for test and demonstration facilities. Lasertech with an EOS M290 and an Arcam A2X is the only metal AM service provider in Sweden at the moment, to our knowledge.

## Appendix 2

# Swedish Arena for Additive Manufacturing of Metals - Organization, Structure and Membership Agreement

### Introduction

This document describes the member program and membership agreement for the Swedish Arena for Additive Manufacturing of Metals, in the following referred to as the “Arena”.

### Background

The Arena is based on an initiative from Swerea, Chalmers and University West to create an active and open forum between participating industries, institutes, universities and other interested organizations within the field of additive manufacturing of metals (metal-AM). The Arena’s ambition is to be a meeting point for all key players and together develop the future of metal-AM in Sweden.

The aim of the Swedish Arena for Additive Manufacturing of Metals is to:

- Develop a strong network in metal-AM between the participating partners
- Monitor and contribute to the development of technology and knowledge
- Provide easy access to test and demo platforms in metal-AM
- Support and accelerate industrialization of metal-AM

The objective of the Arena is to create a vehicle for open innovation to enable innovative product development and manufacturing to support applied R&D in industrial metal additive manufacturing.

### Membership

The Arena is a national Swedish initiative and is open to all companies, research institutes, universities and other organizations active in Sweden, i.e. being registered as a legal entity in Sweden. For companies, such as equipment suppliers, and other organizations outside of Sweden, membership will require a board decision.

Membership in the Arena means taking part in a national initiative to strengthen Sweden’s future position in metal-AM with the objective to create a leading position based on the Swedish industries existing strengths in advanced manufacturing, powder metallurgy, metal powders and additive manufacturing technology.

There are two levels of membership available in the Arena, *basic membership* and *active membership*.

*Basic members* will have access to part of the Arena program and is intended for organizations that want to follow the development within additive manufacturing in metal, develop a network with other industrial and research organizations in the field and to have easy access to the technical knowhow and test and demo capabilities of the core research

partners in the arena. In addition to the above, *active members* will also have access to the research and technology work performed within the Arena and voting rights on funding allocation of the arena. It is the Arena's ambition to apply for strategic funding from one or several innovation programs and the active members will have a say in such matters.

A more specific description of membership in the Swedish Arena for Additive Manufacturing of Metals is given below:

Basic members:

- Right to participate in the Arena annual member meeting, although with no voting rights
- Right to participate in the Arena yearly workshop and seminar at no cost
- Easy access to the Arena network
- Access to the quarterly Arena member news letter
- Marketing of your company on the Arena homepage and brochures by having your company logo included
- Access to the Arena member only web page with information on
  - Current projects and other news and activities in metal AM
  - Reports from key seminars and conferences in metal AM
  - Upcoming seminars and conferences in metal AM
  - News regarding calls for research projects in metal AM
- 25 % discount on all courses and seminars performed within the Arena

Active members:

- All rights of basic members
- Right to participate in the Arena annual member meeting with full voting rights
- Right to nominate candidates to the Arena board
- Right to participate in the active members Technical Group in which decisions are taken on scope and budget for the active members research and technology project portfolio, including final results
- Right to participate in all other activities in the Technical Group, including input on new proposals for projects, investments and other initiatives within the Arena, including initiation of applications for national, regional and EU funding

## Membership fee

The membership fee is paid in cash and is used 100 % to finance the work in the Arena. However, the three core research partners (Swerea, Chalmers and University West) will make their active member contribution as in-kind to cover the organization and administration of the arena. The in-kind contributions will be reported to the board and will be based on costs according to Vinnova guidelines.

A membership agreement will be signed between each member organization and the Swedish Arena for Additive Manufacturing of Metals. Swerea KIMAB will be the administrative host of the Arena. An outline of the membership agreement is presented at the end of this document. Membership fees will be invoiced yearly and the first year of operation will be 2017.

The membership fee structure is similar to the LIGHTer program and is presented below:

| Company size        | Basic        | Active        |
|---------------------|--------------|---------------|
| Number of employees | Basic member | Active member |
| < 50                | 5 KSEK       | 20 KSEK       |
| 51 < 250            | 10 KSEK      | 40 KSEK       |
| 251 < 500           | 15 KSEK      | 75 KSEK       |
| > 500               | 50 KSEK      | 150 KSEK      |

To become a member of the Swedish Arena for Additive Manufacturing of Metals, please fill in and sign the Membership Agreement present in this document and send by mail to:

Annika Strondl  
Swerea KIMAB  
Box 7047  
16407 Kista

Please note that an approval by the board will be required for organizations that are not legally represented in Sweden.