

SFA Advanced Manufacturing – Period 2021-2024

Call for Project Proposals 2020

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Abbreviations

IR	International Reviewer
PI	Principal Investigator
PM	Program Manager
SC	Steering Committee
SFA	Strategic Focus Area
TFA	Technical Focus Area

1 Introduction

In its Strategic Planning 2021-2024 for the ETH Domain, the ETH Board decided that three Strategic Focus Areas initiated in the period 2017-2020 will be continued during the period 2021-2024 in order to realize their full potential. One of these three is the Strategic Focus Area Advanced Manufacturing (SFA-AM).

For the program of the SFA-AM in the period 2021-2024, the Steering Committee (SC) of the SFA-AM reviewed the five Technical Focus Areas (TFAs), which were determined for the period of 2017-2020, and defined four TFAs for the coming four-year period. These four TFAs provide continuity of the current program, but broaden at the same time the scope, as they include all advanced manufacturing technologies as well as all applications targeted with these manufacturing technologies.

This document describes the objectives of this strategic initiative, the definition and scope of the four new TFAs, the organization and governance of the initiative as well as the project proposal submission and selection process.

2 Background and objectives

The use of new powerful digital tools is changing the way how we live and how we work. This change also impacts the Swiss industry, which is a key factor for the prosperity and a driver for innovation in Switzerland. The advances in computer and data science also open up great opportunities in the development of new technologies, in particular in the field of manufacturing.

The SFA-AM addresses these opportunities for technology development. It combines measures of research projects, of capacity buildup and technology platforms as well as of knowledge and technology transfer. Thereby, the SFA-AM enables cutting-edge research and the development of new and disruptive technologies in the field of advanced manufacturing.

Furthermore, the SFA-AM fosters the collaboration of scientists and research groups of the ETH Domain across the four participating institutions ETH Zürich, EPFL, PSI and Empa. It will therefore contribute to secure the leading position of the ETH Domain in research and technology development in the domain of advanced manufacturing.

The SFA-AM program has the objective to enable and fund research projects that typically ...

- (i) use and apply the results of basic research to develop new and disruptive technologies,
- (ii) are pre-competitive, hence often many years away from a commercial application in industry,
- (iii) request larger consortia of partners with complementary competences and capabilities,
- (iv) are challenging and take several years in order to demonstrate groundbreaking results and
- (v) need higher amounts of funding due to the larger consortia and the longer project duration.

3 Technical Focus Areas of the program in the period 2021-2024

The scope of the SFA-AM program in the period 2021-2024 and in particular of this call includes all material topics and sub-topics of advanced manufacturing. However, the SC decided to define specific Technical Focus Areas (TFAs) to emphasize key aspects and future challenges in the field of advanced manufacturing.

The first two TFAs of the program in 2021-2024: "TFA I – Manufacturing Technologies" and "TFA II – Functionality Integration" address the technologies to fabricate components or products – the first predominantly individual manufacturing technologies, the second manufacturing technologies that enable the integration of specific and often combined and complex functionalities into products.

The two further TFAs of the period 2021-2024: "TFA III – Sensing Technologies" and "TFA IV – Intelligent Systems and Advanced Automation" address the new possibilities of the digitalization to better control individual manufacturing processes as well as complete supply and value chains.

The research projects funded by the SFA-AM in the period 2021-2024 should address key challenges in one of these four TFAs, which are described in the following sections. The project proposals can either address challenges that have already been a topic in a running SFA-AM funded research project or pick up on new challenges and topics to complement the research activities of the period 2017-2020.

3.1 TFA I – Manufacturing Technologies

The progress in information technology has enabled the development of advanced and new manufacturing technologies, including but not limited to additive manufacturing, coating and printing, light induced and laser processing, machining, forming, joining and assembly as well as fabrication of nano-scale materials and devices. This TFA covers all advanced manufacturing technologies. The development of new technologies requires mastering the interplay of all three factors of a technology: materials, processes and equipment. The TFA calls for research proposals addressing advanced manufacturing processes and their interplay with materials and equipment.

3.2 TFA II – Functionality Integration

Today, not only expensive specialty products, but also consumer products, need to provide several different functionalities in addition to be competitive. A key question is how to add or integrate functionalities in a product? This question is not only relevant for the development and design of the product, but also for its manufacturing, commercialization, maintenance, and recycling. Adding a functionality to a product can be realized by combining different materials (multi-materials or hybrid materials), by adding structure to the product, often at different scales (multi-scale structures or metamaterials), or to integrate components, e.g. electronic devices or biological structures into the product. This TFA calls for research proposals in the area of new fabrication technologies for multi-functional products using multi-materials, multi-scale structures or metamaterials or that enable an efficient integration of functional components into products.

3.3 TFA III – Sensing Technologies

Smart sensing technologies are key enablers of advanced manufacturing. Sensors that monitor key process parameters provide information to better control the process and thus improve the quality of the produced materials and parts. Distributed sensing in machines not only allows for more reliable and customizable fabrication processes, but also enables the early detection of failures by predictive maintenance. Sensor systems are also increasingly being fitted in the work piece itself, so that each product can provide its blueprint and report its manufacturing status. This TFA calls for research proposals in the area of smart sensing technologies dedicated to advanced manufacturing, where sensors either are integrated into the fabrication machines for monitoring and control purposes, or are integrated in products for increased functionalities, efficient testing, and better traceability.

3.4 TFA IV – Intelligent Systems and Advanced Automation

Advanced manufacturing technologies as mentioned in the TFAs I and II are important building blocks for a fully integrated digital value and supply chain. However, it is not only the process of material transformation, which will provide new benefits and competitive advantages. For a highly efficient supply chain, companies need in addition intelligent systems and machines with advanced automation, which are fully integrated in such digital supply chains, including design of materials and products, manufacturing, distribution and end-of-life of products. This TFA calls for research proposals in the area of intelligent systems and advanced automation dedicated either to individual manufacturing processes or to complete and integrated value chains. The scope of the TFA includes topics like computer-based design, machine learning, process control, sustainability, autonomous systems as well as the simulation of materials, processes and products.

4 Project selection process

4.1 General conditions

Proposals may be submitted by Principal Investigators (PI) or co-PIs of the four participating ETH institutions, in particular, but not limited to, by professors, lab heads or group leaders at one of the four participating institutions. Research projects conducted in the SFA-AM Program in 2021-2024 will generally run for 48 months.

Projects that involve research institutions outside the ETH Domain, e.g. universities of applied science, and/or industrial partners are welcome, if these partners can contribute to the success of the research project. However, the activities of these project partners will not be funded by the financial means of this strategic initiative of the ETH Domain.

4.2 Project selection criteria

The research activities in the SFA-AM should address a key challenge in at least one of the TFAs described above. Such a challenge may be a concrete and pressing technical problem in advanced manufacturing to which the solution is not known, but that can be tackled by one or a few consortia of Swiss research groups. The formulation of the challenge shall be narrow enough to allow focused research, but broad enough to allow for different routes to a solution, to impact several areas of technology and to involve several groups of researchers. The formulation of the challenge is such that the problems to be solved are quantified.

Below you find the criteria that the Steering Committee of the SFA-AM will use to evaluate and select the project proposals.

1. Topic

- a. *Thematic fit: The project proposal is related to at least one of the four Technical Focus Areas.*
- b. *Industrial importance: It addresses a key challenge that is of high importance for the successful industrial application of advanced manufacturing technologies.*

2. Approach

- a. *Fundamental research: The solution to the problem is subject to or based on new fundamental research in engineering sciences and allows for high impact publications.*
- b. *Engineering education: The project drives the education of engineers at the cutting edge of advanced manufacturing.*

3. Objectives

- a. *Far-reaching objectives: The objectives of the project are far-reaching and measurable. They exceed the state of the art significantly.*
- b. *Early breakthrough: One milestone is demonstrating significant breakthrough after 24 months.*

4. Results

- a. *Tangible solutions: The solutions are tangible and/or are demonstrated with functional demonstrators.*
- b. *Applicable results: Results can be applied in Swiss companies by start-ups and/or by direct transfer and will have a positive impact on the Swiss industry.*

5. Feasibility

- a. *Technical feasibility: The objectives are realistic and technically achievable. The project plan is reasonable and the approach is suitable to achieve the objectives.*
- b. *Suitable competences: The competences of the project consortium are suitable and complete to meet the project plan.*
- c. *Adequate resources: The resources that are requested by the project consortium are adequate to meet the project plan.*

6. Use of Funds

- a. *Project consortium: The project is carried out by a consortium of PIs from different ETH institutions.*
- b. *Talent hiring: Most of the budget is used for hiring young talents (doctoral students, postdocs).*
- c. *Equipment purchase: The amount for the purchase of equipment does not exceed 20 percent of the total project funding and the purchased equipment is made available to PIs across the ETH Domain.*

4.3 Project selection process and schedule

A two-stage submission procedure is applied: pre-proposals are submitted first, followed by full proposals upon invitation. All project proposals are to be submitted in English. Applicants must use the Word document template that will be made available on the SFA-AM web pages (www.sfa-am.ch) to prepare the project proposals.

For full proposals, the applicants need to provide a detailed project plan including information about the project organization, the project schedule with work packages and deliverables as well as a financial plan. Further information on how the detailed project plan needs to be prepared, will be provided in due time by the Program Manager (PM) of the SFA-AM.

The following schedule is planned for the SFA-AM call for proposals in 2020.

Date	Action	Who
15 June 2020	Issuing of the Call Document / Invitation to prepare pre-proposals	PM
<i>June – Aug.</i>	<i>Preparation of pre-proposals</i>	<i>PI</i>
13 July 2020	Online Workshop for PIs to present project ideas and find partners	PM / PI
28 Aug. 2020	Deadline to submit pre-proposals	PI
<i>Sep. / Oct.</i>	<i>Evaluation and selection of pre-proposals</i>	<i>SC</i>
9 Oct. 2020	Decision about pre-proposals / Invitation to prepare full proposals	SC / PM
<i>Oct. / Nov.</i>	<i>Preparation of full proposals</i>	<i>PI</i>
30 Nov. 2020	Deadline to submit full proposals	PI
<i>Dec. / Jan.</i>	<i>Evaluation and selection of full proposals (including international reviews)</i>	<i>SC / IR</i>
22 Jan. 2021	Decision about full proposals / Information of the project consortia	SC / PM
<i>Feb. – Apr.</i>	<i>Project preparation</i>	<i>PI</i>
1 Feb. 2021	Earliest start of research projects (latest start on 1 May 2021)	PI

5 Budget, allocation of funds and funding regulations

The SFA-AM budget to fund research projects in period from 2021 to 2024 is in total CHF 11.9 million. It will be a competitive and open call for project proposals with no pre-defined budgets of the participating institutions. The SFA-AM Steering Committee will nevertheless make sure that the funds are reasonably shared among the four institutions.

Only project consortia of labs from at least two different ETH institutions will be funded. Project consortia that involve PIs from more than two ETH institutions will be favored. The SFA-AM will transfer the funds that have been granted for projects to the home institutions of the PIs and co-PIs. The home institutions in turn will assign the transferred SFA-AM funds to the appropriate labs or groups of the PIs or co-PIs.

Costs will be funded in accordance to the Funding Regulations of the SNSF. The social security contributions will be paid as blanket amounts. The flat rates for the employer's social security contributions are 16% of the relevant annual gross salary. The funded personnel costs are independent of the number of years of employment. The personnel costs that are funded by the SFA-AM in the period 2021-2024 are as follows:

	Annual Gross Salary	Social Security Contribution	Total Annual Funding
Doctoral Students	CHF 55'000	CHF 8'800	CHF 63'800
Postdocs	CHF 90'000	CHF 14'400	CHF 104'400

The personnel costs mentioned above must be used to prepare the financial plan of a project proposal. The SFA-AM funds are operated and controlled by the respective internal processes of the home institution of the concerned PI or co-PI, as stipulated in the respective guidelines for research projects.

6 Organization and governance

The governance of the initiative shall enable focused research with a minimum of overhead. As a governing body of the SFA-AM, a Steering Committee (SC) has been formed.

6.1 Steering Committee

The SC is composed by two representatives per ETH institution: ETHZ, EPFL, Empa, PSI, and currently five and maximum seven experts from industry.

The representatives from the ETH institutions are:

- Prof. Dr. Detlef Günther, ETH Zürich
- Prof. Dr. Christofer Hierold, ETH Zürich
- Prof. Dr. Christian Enz, EPFL
- Prof. Dr. Andreas Mortensen, EPFL
- Prof. Dr. Gabriel Aeppli, PSI
- Prof. Dr. Frithjof Nolting, PSI
- Dr. Pierangelo Gröning, Empa
- Dr. Lars Sommerhäuser, Empa (PM)

The industry representatives are:

- Dr. Andreas Hafner, Senior Innovation Manager, BASF Schweiz AG (Chairman)
- Evert Dijkstra, Managing Director, Phonak Communications AG
- Dr. Olivier Greim, R&D Director, Rolex SA
- Samuel Schär, CEO Advanced Materials, Bühler AG
- Urs Gribi, Managing Director, ABB Turbo Systems Ltd.

The tasks of the SC are:

- The SC evaluates the pre-proposals for compliance with the selection criteria (see section 4.2) and invites for full proposals.
- The SC organizes the evaluation and takes decisions on the full project proposals and allocation of funds. The SC defines and follows a strict guideline how to handle conflicts of interests, in case that a member of the SC is involved in a project consortium as PI or co-PI in order to avoid that a SC member can influence the decision processes regarding the projects or project proposal he is directly involved in.
- The SC meets at least once a year to discuss progress in the projects, corrective actions.
- The SC reports annually and after the end of the initiative to the ETH Board by reports addressing scientific progress and financial aspects.

6.2 *Knowledge and Technology Transfer*

A key objective of all project consortia must be to publish the results of their research activities in scientific magazines and other publications with high impact. Furthermore, the PIs and scientists in the project teams have the task to present the project results at leading national and international conferences.

In addition, the SFA-AM will organize information, outreach and community building events. At these events, the research projects and their results will be presented to a larger audience that includes not only representatives from academia, but also from industry.

If PIs, co-PIs or other authors publish or present results of research projects that are funded by the SFA-AM, they must acknowledge the funding source of the project as follows: "Project funded by the program of the Strategic Focus Area Advanced Manufacturing (SFA-AM), a strategic initiative of the ETH Board".

6.3 *Reporting*

The projects deliver yearly scientific progress reports and one final report to the SC, referring to the achievement of the milestones and deliverables. Yearly financial reports and a final financial report after conclusion of the projects are additionally submitted to the SC.

The SC prepares and submits annual reports (aggregated project reports) to ETH Board at the end of each calendar year. At the end of the complete four-year period, the SC prepares and submits a final scientific and financial report (aggregated project reports) to the ETH Board.

6.4 *Co-ordination and Program Manager*

Administrative tasks to co-ordinate this strategic initiative are run at Empa by the Program Manager (PM) of the SFA-AM: Dr. Lars Sommerhäuser: +41 (58) 765 4787 or lars.sommerhaeuser@empa.ch.

All pre-proposals and full proposals must be submitted to the Program Manager by email using the provided Word template for SFA-AM project proposals and respecting the deadlines mentioned in section 4.3.