



## Trans-Atlantic Modelling and Simulation for Cyber-Physical Systems

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# newsletter 1

## The TAMS4CPS project - A strategic research agenda for Trans-Atlantic collaboration

The first newsletter issued by the TAMS4CPS project will feature a general overview about the project, first outcomes of the activities undertaken so far as well as an outlook on coming activities.

## Motivation and Outputs

For nearly two decades, an ever-increasing speed of change in economy and society can be observed. This change comes along with the definition of grand societal challenges like globalisation, security, resource constraints, climate and demographic change, and others. These challenges exert an increasing pressure on public and private actors in economy, society and policy to adapt to this

changing environment to remain successful and competitive. An excellent science base as well as a close collaboration between researchers worldwide is one precondition to approach these grand challenges successfully.

The TAMS4CPS project aims to tackle this need by contributing to stronger pan-European collaboration across value chains and technology levels creating open innovation eco-systems and stimulating consensus building. Fostering collaborative research with the US will be an excellent opportunity to advance European capabilities and ultimately uplift innovation capacities and competitiveness across all economic sectors.

This is true for all enabling technologies, though recently, advances in Cyber-Physical Systems (CPS) are expected to be especially promising as they are the basis for advances in a variety of economic sectors. Such smart systems, in which sophisticated software/hardware is embedded in physical systems, are increasingly part of everyday life and the growth of CPS is likely to further accelerate. For Europe to benefit from this expansion, while avoiding the pitfalls that such complexity creates, there must be advances in the modelling and simulation (M&S) of CPS. The TAMS4CPS project activities, by fostering collaborative research with the US, will promote European M&S capabilities substantially. The European Commission-funded project TAMS4CPS which runs from February 2015 to January 2017 and which is conducted by project partners from Loughborough and

Newcastle Universities (UK) and Steinbeis-Europa-Zentrum (DE), together with leading researchers in the field at top US universities will thus create:

- A Strategic Research Agenda for Collaboration (SRAC), endorsed by researchers in the EU and US, to identify relevant research and development priorities in the field and to forge collaborative links between the best international researchers on both sides of the Atlantic.
- A set of openly available test cases for model developers to perform collaborative evaluation that can help to initiate



collaborative research through benchmarking and comparative assessments.

- A state of the art report on M&S for CPS to provide the context for the SRAC and to act as a baseline for future collaborative research activities and funding opportunities.

## The TAMS4CPS Approach

Taking a consultative approach, the project partners engage industry and academic researchers and M&S users in a series of workshops and web-based meetings to prioritise M&S research challenges and to create a constituency of future collaboration. All activities aim for the implementation of the SRAC findings and recommendations in a trans-national context.

The project directly addresses European priorities in CPS as the Strategic Research Agenda for Collaboration will feature the following five themes which are based on themes elaborated by ARTEMIS, the European Industry Association in Embedded & Cyber-Physical Systems:

- **Theme 1:** Architectures principles and models for safe secure Cyber-Physical Systems
- **Theme 2:** Systems design, modelling and virtual engineering for Cyber-Physical Systems
- **Theme 3:** Real time modelling for autonomous adaptive and cooperative Cyber-Physical Systems
- **Theme 4:** Model-Based Systems Engineering (MBSE) applied to computing platforms and energy management
- **Theme 5:** Integration of socio/legal/governance models within modelling frameworks

In 2015, three agenda-building events on themes 1 and 2 took place in the United States and Europe. Theme 3 is currently being addressed. Professionals in modelling and simulation for the above mentioned themes are welcome to join the project, become a member of the TAMS4CPS Community of Experts to share knowledge and be kept informed on

project progress.

As a basis for the discussions on research trends and priorities in M&S for CPS during the workshops, an overview on and a definition of M&S for CPS was elaborated, with relevant definitions as well as a distinction between EU and US understanding. This so-called definitional framework, including a comprehensive glossary, is available via the TAMS4CPS project website.



- **Federated EU/US testbeds:** The size and complexity of large CPS generally make any form of physical testing extremely expensive. At the same time, testing and prototyping of complex systems is a strategic priority in terms of the development of CPS and will thus provide considerable benefit.
- **Characterization and improvement**

## Project Outputs

During the agenda-generating workshops, possible dream projects and test cases are elaborated to sketch concrete possibilities for future trans-Atlantic cooperation. Dream projects within TAMS4CPS are a description of what the aims of a collaborative project might be, and the potential types of contributions from EU and US that make this a worthwhile collaborative endeavor. As regards potential test cases, participants firstly identify the properties of an ideal test case and then seek to identify real test cases that might meet these requirements. It should be noted that these issues identified within TAMS4CPS will not necessarily cover all areas of priority research, but focus on those for which collaboration may be mutually beneficial. Following, you will find the dream projects which have been identified so far:

**of entry and use of CPS:** Provision of data through which assurance and implementation of CPS can be understood and exploited.

- **Combining Formal Verification and Simulation Technology:** Combination of formal model checking (verification) with simulation; only viable within a specific domain such as transport management, or power distribution.
- **Common foundation for security metrics:** Creating a common foundation for developing metrics to evaluate the security of a system.
- **Hybrid dynamic system verification:** Verification of dynamic ensembles of hybrid systems operating in dynamic environments.
- **Integration and interoperability models and approaches:** Interoperability and integration of hybrid models in order to generate solutions that include multi-disciplines and multi-scales.

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- Characterize and Model Dynamic Human Interaction with CPS: Development of models that can enable more effective interaction through real-time modelling that supports behavioural aspects of CPS operation.
- Case studies for autonomous transportation in EU/US cities: Examining the process through which validation takes place as well as endeavouring to validate models.

### Next steps

So far, eight dream projects have been formulated. These are descriptions of potential research activities that participants in the workshops have identified as plausible and useful for collaboration between EU and US. Furthermore, nine potential test cases have been identified.

During the first half of 2016, further TAMS4CPS workshops will be held for Themes 3, 4 and 5. Also, the dream projects

and test cases which have been identified so far will be further elaborated and, in the case of the test cases, access and availability of required content will be established. All results will feed into the Strategic Research Agenda for Collaboration. In addition, funding mechanisms will be scrutinized on their suitability for enhanced trans-Atlantic research collaboration.

During the second half of 2016, a general workshop will take place to gather feedback on the project results and the draft SRAC, from both industry representatives and researchers. This event is open to all interested stakeholders and will be announced via the TAMS4CPS Community of Experts and the project website.

All project results obtained so far as well as additional resources can be downloaded from the project website at <http://www.tams4cps.eu/resources/>

## Join the TAMS4CPS Community of Experts!

ARE YOU AN EXPERT in modelling and simulation for CPS, interested in EU-US collaboration? If so, the TAMS4CPS consortium welcomes you to become a member of the TAMS4CPS community.

Join the TAMS4CPS Experts Group:  
[www.tams4cps.eu/project-details/expert-community](http://www.tams4cps.eu/project-details/expert-community)



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