DELIVERABLE D6.6 – WORK PACKAGE 6

ANNUAL DISSEMINATION AND EXPLOITATION REPORT

PERIOD 2

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Consortium Members:

University of Southampton	Critical Software Technologies	Alstom Transport	Systerel	Heinrich Heine Universität Düsseldorf

Document Overview
This document is designed to provide a details of the dissemination activites of the Advance consortium for the above stated reporting period. Below are lists of papers published related to Advance, Conferences and Seminars attended where Advance was discussed/promoted, and workshops/tutorials that have been run to further educate interested parties in the concepts being developed in Advance.

Press Releases/Newsletters		
Date	Publication	Consortium Member
April 2013	Advance Newsletter 1	All
Dec 2013	Advance Newsletter 2	All
General Dissemination Activities		

Web

The Advance website has been redesigned and updated following comments during the previous review. A snapshot of the new home page can be seen in Appendix A.

A You Tube channel has been created to allow the dissemination of tutorials and other discussion videos with regard to Event B, the RODIN tool and other elements associated with the Advance project: http://www.youtube.com/user/EventBTv

Demonstration Booths

University of Southampton had a demonstration booth for the Rodin toolset at the following events:

- DATE – Grenoble, France, March 2013
- 21st Safety-Critical Systems Symposium – Bristol, UK, February 2013 (Also attended by Critical Software)

Industrial Exploitation Projects

As part of on-going work with regard to the exploitation plan, Critical Software and the University of Southampton have been working on the exploitation of Event-B and the Rodin toolset through projects with the UK Ministry of Defence's Defence Science and Technology Laboratory (DSTL) and BAE Systems Submarines.

The University of Southampton have been working on a project funded by AWE which is supporting an AWE in-house hardware/software co-design method through a customisation for the Rodin toolset. The University of Southampton have also been supporting Thales on a pilot application of Event-B to a railway interlocking system. All of these projects exploit Event-B verification technology and UML-B modelling features developed by ADVANCE.

The company ClearSy (www.clearsy.com) has posted an interesting success story about using ProB for a railways reverse-engineering project, where they have made use of ProB's constraint solver in a new way. The article says "Data validation principles have been applied recently to a railways reverse-engineering project with great success. B and ProB have demonstrated again how efficient they are when used in combination. This problem was solved elegantly by using data validation principles: a B model representing the two graphs and their properties were elaborated, and ProB used for finding a solution." For details see: http://www.data-validation.fr/data-validation-reverse-engineering/

Workshops Organised

Members of the ADVANCE Consortium organised two workshops covering Event-B/Rodin and related methods:

- **Dagstuhl Seminar 13372 Integration of Tools for Rigorous Software Construction and Analysis, 8 – 13 September 2013.**

  Website: http://www.dagstuhl.de/de/programm/kalender/semhp/?semnr=13372.

  Organisors: Michael Leuschel (Heinrich-Heine-Universität Düsseldorf, DE), Uwe Glässer (Simon Fraser University – Burnaby, CA) Stefan Hallerstede (Aarhus University, DK) Elvinia Riccobene (University of Milan, IT).

The program spanned from theoretical and methodological foundations to practical applications, emphasizing system engineering methods and tools that are distinguished by their mathematical rigor and have proved to be industrially viable. A main goal of the seminar was to contribute to the integration of accurate state- and machine-based system development methods, clarifying their commonalities and differences to better understand how to combine related approaches for accomplishing the various modeling tasks of reliable high-quality hardware/software systems, such as experimental validation or mathematical verification.

- **Rodin User and Developer Workshop, Turku, June 10+11, 2013.**

   Website: http://wiki.event-b.org/index.php/Rodin_Workshop_2013.

   Organisers: Michael Butler, University of Southampton, Michael Leuschel, University of Düsseldorf, Laurent Voisin, Systerel, Stefan Hallerstede, Aarhus University, Thierry Lecomte, ClearSy, Alexander Romanovsky, University of Newcastle, Marina Walden, Åbo Akademi.

   The Rodin User and Developer workshop is a workshop for the Rodin community. The Rodin community includes several research institutions and companies who are not part of the ADVANCE consortium. There is strong interest in the results of ADVANCE in the Rodin community and workshop gave researchers working with Rodin an opportunity to exchange research experiences. Companies represented from outside ADVANCE included AWE (UK) and Thales (Germany).

Tutorial Presentations

ADVANCE Consortium memebers delivered two public turorials on ADVANCE related technologies:

- ProB Tutorial, by Jens Bendisposto, Sebastian Krings (University of Dusseldorf)
  Held at the Rodin User Workshop / iFM Conference in Turku, Finland June 10th, 2013

- UML-B Tutorial, by Colin Snook, (University of Southampton)
  Held at the Rodin User Workshop / iFM Conference in Turku, Finland June 10th, 2013

Dissemination and Collaboration Events

Members of the ADVANCE consortium participates in a number of dissemination and collaboration events related to ADVANCE topics providing opportunities for promoting the results and building links with related projects:

- Colin Snook, University of Southampton, participated in the T-AREA-SoS U.S. workshop held in the US in November 2012 where the ADVANCE case studies and tools were presented. **T-AREA-SoS (Trans-Atlantic Research and Education Agenda in System of Systems)** is a support action project funded by the European Commission with the primary purpose of formulating a research agenda for the system of systems area that spans US and European activities. www.tareasos.eu

- John Colley, University of Southampton, gave a presentation on STPA and Event-B at the **Marie Curie Critical STEP IAPP Workshop on Dependability and Certification**, on 2-+21 February 2013, hosted by Critical Software in Coimbra, Portugal. www.critical-step.eu

- The ADVANCE project was represented by Michael Leuschel, University of Dusseldorf, at a dissemination symposium on the theme of "Safety & Security". The meeting was held in Brussels on June 18th 2013 and was organised by the **North Rhine-Westphalia Innovation Alliance**" (www.innovationsallianz.nrw.de). A catalogue presenting research projects in the area of "Safety & Security" can be obtained from the website of the event.

- The ADVANCE project was represented by Michael Butler, University of Southampton, at the 1st **European Experts Workshop on Cyber-physical Systems** in Munich organised by the CyPhERS project which is developing a roadmap for Cyber-physical systems research in Europe. http://cyphers.eu/.

**Conference and Workshop Publications and Presentations**

Several publications on ADVANCE methods and tools were presented by members of the Consortium at various conferences and workshops during the second period as follows:

1. **Laurent Voisin and Minh-Thang Khuu (2013). Domain Specific Event-B Modeling, 4th Rodin User and Developer Workshop, Turku, June 2013.**
   The Rodin User and Developer workshop is a workshop devoted to the Rodin community. This presentation provided feedback to the community of the advances made in the WP1 case study about the benefits of the Theory plug-in.

2. **Laurent Voisin (2013). Presentation of the Rodin platform, Seminar #13372: Integration of Tools for Rigorous Software Construction and Analysis, Dagstuhl, September 2013.**
   The presentation gives a brief summary of the Rodin platform architecture, starting from its design objectives and going into details into the decomposition of tools and the proving interface.

3. **Sebastian Krings, Jens Bendisposto, Ivaylo Dobrikov and Michael Leuschel B Constrained Rodin User and Developer Workshop 2013, Turku, June 11th 2013**

4. **Michael Leuschel ProB: Solving Constraints on Large Data and Higher-Order Formal Models Dagstuhl Seminar Automated Reasoning on Conceptual Schemas May 19 – 24, 2013,** Dagstuhl Seminar 13211

5. ***Edmunds, Andrew (2013) Developments in Code Generation Tools for Event-B. In, 4th Rodin User and Developer Workshop.*** An update on code generation maintenance, and new features added, since the last workshop.

6. ***Butler, Michael and Maamria, Issam (2013). Practical Theory Extension in Event-B. In, Festschrift Symposium in Honour of He Jifeng on the Occasion of His 70th Birthday.***
   This Special Festschrift Symposium in Shangahi included presentations by leading scientists in formal methods (Hoare, Jones, Larsen, Neilsen, Roscoe, etc) with a large contingent of local researchers in attendance. Butler was invited to give a presentation on Event-B and the opportunity to promote the work on the theory plug-in WP3 of ADVANCE.

7. ***Dghaym, Dana, Butler, Michael and Salehi Fathabadi, Asieh (2013). Evaluation of graphical control flow management approaches for Event-B modelling. In, AVoCS 2013: 13th International Workshop on Automated Verification of Critical Systems, Guildford, UK.***
   AVoCS is a leading European workshop on verification of critical systems. This paper presented an evaluation of graphical control flow mechanisms based on UML, UML-B and Event Refinement Structures. This is based on work in WP2 on graphical modeling approaches that can be used to enhance Event-B.

8. **Sebastian Krings, Michael Leuschel. Inferring Physical Units in B Models. In Proceedings SEFM'2013, LNCS 8137, Springer, 2013.** SEFM is a conference that brings academia and industry together to discuss the application of formal methods to software engineering. Presents a technique that analyses the usage of physical units throughout a B machine, infers missing units and notifies the user of incorrectly handled units. The technique combines abstract interpretation with classical animation and model checking and has been integrated into the ProB validation tool, both for classical B and for Event-B.

9. ***Banach, Richard and Butler, Michael (2013). A Hybrid Event-B Study of Lane Centering. In, Complex Systems Design & Management (CSD&M) 2013.*** CSD&M is an international academic-industrial conference dedicated to all academic researchers and industrial actors working on complex industrial systems engineering. Hybrid Event-B is an extension of Event-B developed by Banach in the University of Manchester. This is a first step towards reasoning about continuous behavior using proof methods in Event-B showing how the approach is applicable to a hybrid case study from the automotive domain.

10. ***Banach, Richard and Butler, Michael (2013). Cruise Control in Hybrid Event-B. In, International Colloquium on Theoretical Aspects of Computing (ICTAC), Shanghai 2013.*** ICTAC is a leading conference on computer science theory with an emphasis on formal methods. This is another case study in application of Hybrid Event-B. Although Hybrid Event-B is not supported by Rodin, we have started preliminary working on prepresenting the approach by developing a hybrid theory using the Theory plug-in of WP3.

11. ***Yeganefard, Sanaz and Butler, Michael (2013). Problem Decomposition and Sub-Model Reconciliation of Control Systems in Event-B. In, IEEE International Workshop on Formal Methods Integration, 2013.*** The IEEE FMi workshop is a new workshop that was co-located with the IEEE conference on Information Reuse and Integration. This paper addressed the scalability of requirements analysis and formalization through decomposition. The approach is being used in WP5 which is developing methods for requirements tracability and safety analysis.

12. ***Satpathy, M., Ramesh, S., Snook, Colin, Singh, N.K. and Butler, Michael (2013). A Mixed Approach to Rigorous Development of Control Designs. In, IEEE Multi-Conference on Systems and Control (MSC 2013).*** The IEEE MSC is a leading conference on control systems engineering. This paper arose out of collaboration with researchers formerly in GM Research Lab Bangalore. The work uses the UML-B plug-in developed in WP2 to

13. ***Colley, John and Butler, Michael (2013) A Formal, Systematic Approach to STPA using Event-B Refinement and Proof. In: 21th Safety Critical System Symposium, Bristol, UK.*** The Safety Critical System Symposium is a leading event for industrialists working on safety-critical systems engineering. This paper presented work from WP5 on combining STPA safety analysis with Event-B analysis.

14. ***Renato Alexandre Silva.*** Lessons Learned/Sharing the Experience of Developing a Metro System Case Study. ***In: DS-Event-B-2012: Workshop on the experience of and advances in developing dependable systems in Event-B.*** The DS-Event-B workshop was co-located with ICFEM 2012, a leading international conference on formal methods with a mix of academic and industrial participants. This paper outlines the use of the Event-B decomposition approach developed in WP3 to a railway case study.

15. ***Edmunds, Andrew and Colley, John and Butler, Michael Building on the DEPLOY legacy: code generation and simulation. In: DS-Event-B-2012: Workshop on the experience of and advances in developing dependable systems in Event-B.*** This paper describes how the code can be generated from i-UMLB state-machine diagrams. State-machine diagrams can be used in simulations, and an approach is explored where pseudo-randomness is introduced into simulation code, as a means to control the exploration of executable paths/state-space.

Appendix A

ADVANCE Website
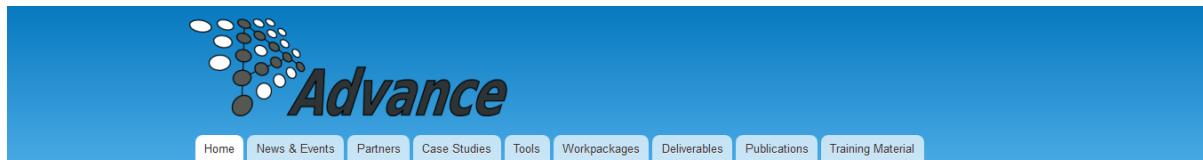
Advanced Design and Verification Environment for Cyber-physical System Engineering

FP7 Information and Communication Technologies (ICT) Programme

ADVANCE is an FP7 Information and Communication Technologies Project funded by the European Commission. The overall objective of ADVANCE is the development of a unified tool-based framework for automated formal verification and simulation-based validation of cyber-physical systems.

Unification is being achieved through the use of a common formal modelling language supported by methods and tools for simulation and formal verification. An integrated tool environment will provide support for construction, verification and simulation of models.

ADVANCE is building on an existing formal modelling language - Event-B - and its associated tools environment - Rodin - with strong support for formal verification. In ADVANCE, Rodin is being further strengthened and augmented with novel approaches to multi-simulation and testing.