AMASS

Architecture-driven, Multi-concern and Seamless Assurance and Certification of Cyber-Physical Systems

Exploitation Plans and Initial Market Megatrends Analysis (b)
D8.3

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Executive Summary

This document, deliverable D8.3 of the AMASS project, describes (a) an update of trends and market needs that the project intends to address and (b) the updated plans of individual partners. D8.3 is an update from deliverable D8.2 [1].

The market trend report in Section 2 has been prepared by collating results from a survey of the project partners' understanding and market information across various domains, particularly addressing the trends and changes in technology and market needs. Model-based technologies, formal methods, agile, and continuous integration are among the approaches that AMASS partners are considering as key needs of the market.

The AMASS initial exploitation strategy was heavily focused on the industrial partners' exploitation of their own technologies, through their introduction into commercial products or service offerings. The project involves different industry sectors and different parts of the supply chain within these industries, and individual partners have adjusted their exploitation plans to address this. This document includes updated versions of the initial plans, and a progress update on exploitation activities and challenges in the market.

The Exploitation Plans and Initial Market Megatrends Analysis will be updated further in deliverable D8.4 [2].

1. Introduction

AMASS will create and consolidate a *de-facto* European-wide assurance and certification open tool platform, ecosystem and self-sustainable community spanning the largest CPS vertical markets. Its aim is to lower certification costs in the context of rapidly changing market needs and product features developed to address these needs. This will be achieved by establishing a novel holistic and reuse-oriented approach for architecture-driven assurance (fully compatible with standards such as AUTOSAR and IMA), multi-concern assurance (compliance demonstration, impact analysis, and compositional assurance of security and safety aspects), and seamless interoperability between assurance/certification and engineering activities along with third-party activities (external assessments, supplier assurance, etc.).

This document is deliverable D8.3 (Exploitation Plans and Initial Market Megatrends Analysis (b)), released as part of AMASS WP8 (Exploitation, Dissemination and Standardization). This deliverable provides an update of overall market trend analysis and individual partner exploitation plans. The Plan should be seen as a "living document", in that it will be updated according to progress on technical development and the current status of the exploitation activities (T8.2) undertaken by the consortium.

Results from a survey on market trends are presented in Section 2. The overall exploitation plan remains unchanged since the original version produced as deliverable D8.2 [1]. Section 3 of this document contains an update of each project partner's exploitation activities up to m24, together with any updates on their exploitation plans, as outlined in D8.2. Section 4 presents the main conclusions of this report. Finally, Appendix A: Domain specific market trend analysis survey, includes the template used for the survey on market trends.

2. Updated domain specific market analysis

2.1 Market size and share

A 2013 report from a workshop on Cyber-Physical Systems[1] estimated the global Embedded Systems at $850 billion. The global Aerospace, Automotive, and Medical domains were estimated at $472 billion. Europe was estimated to produce 30% of the embedded systems, with the European share of the global Aerospace, Automotive, and Medical domains at $141 billion. The European markets have created many employment opportunities, the auto/aero/medical/embedded domains is a current growth area with a reported increase of 50,000 jobs per year globally. Figure 1 below shows the market share of the European Embedded systems markets.
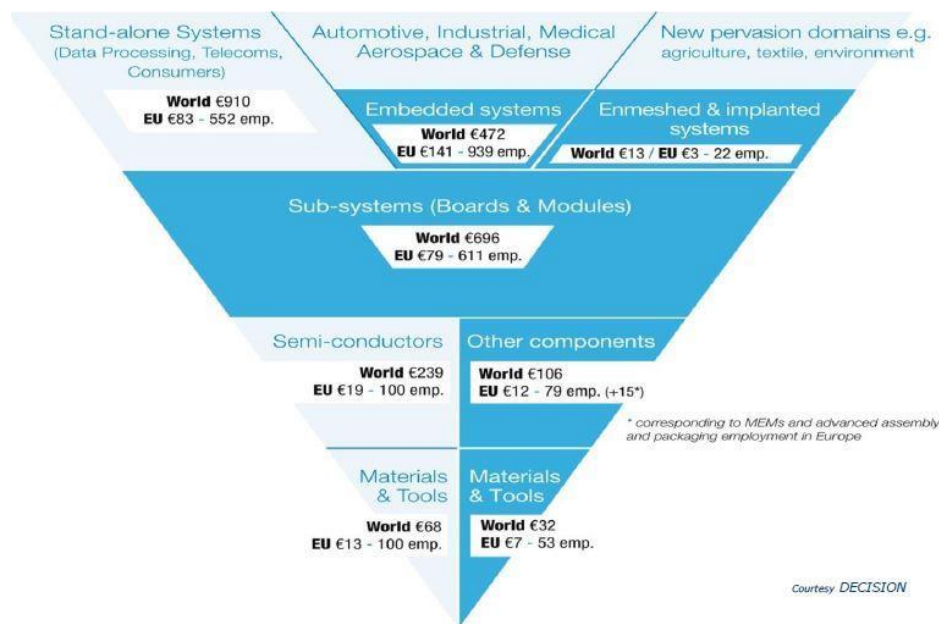
Figure 1. Embedded systems market size and European share

A summary of market research data is provided in Table 1. This data was collected from several market reports, predictions, and AMASS partners. The raw data shown in this table is available in references [3].

Table 1. Trends and expectations of the industrial markets addressed by AMASS

Market	Figures	Current trends	Expectations
Industrial Automation	• ~$200B revenue market • European share ~38% of the market. • 28.4% EU GDP.	• Smart factory concept deployed • Growing use of computers and Industrial Internet. • Market led by USA, but with European countries (e.g. Germany) and companies (e.g. ABB, Siemens) among the main players.	• Industry 4.0. • ~$250B revenues by 2018. • Significant growth of market for sub-systems (e.g. PLC) and applications (e.g. for automotive).
Automotive	• Europe: total turnover of €839B (6.9% EU GDP), 23% of worldwide car production; > 20M vehicles/year.	• ISO 26262 as the functional safety standard. • Recent issues with assurance including safety, security, reliability.	• From 800M to 1.6B vehicles worldwide. • Increasing complexity: hundreds of millions of SLOC and tens of internal and

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1   "Cyber-Physical Systems: Uplifting Europe's Innovation Capacity", K. Rouhana;

	• Automobiles: 10 million SLOC (source lines of code) and 1-10 networks. • 75-80% functions embedded.	• Smart Connected Cars: intelligent sensing to include functions to increase safety. • Connected vehicles: V2V, V2I. • AUTOSAR as the standard architecture for new vehicles.	external networks. • Almost every passenger vehicle sold in 2020 will have V2V systems, ultimately leading to autonomous driving.
Railway	• In many countries, ERTMS investments have brought considerable benefits, in terms of increased capacity, maintenance costs savings, multi-supplier opportunities, reliability or speed. As demonstrated by its worldwide success, ERTMS has emerged as "the" global signalling standard. • Continuous communication-based signalling system, such as ERTMS, reduces the headway between trains, enabling up to 40% more capacity on currently existing infrastructure.	• ERTMS deployment. ERTMS is becoming the reference signalling system in Europe with a "Corridor approach" – whereby investments are coordinated amongst different countries. • Together with railway stakeholders, the European Commission has established a list of six priority Corridors for the deployment of ERTMS. • A European ERTMS Deployment Plan has been defined, creating a legal obligation to equip ERTMS Corridors since July 2009.	• Whilst one of the key objectives of ERTMS is to achieve interoperability on the European railway network, the standard has also been designed and is fit for use by the railways worldwide. • One of the key advantages of ERTMS is that it "opens" the supply market (the product may be delivered by different suppliers) and that the ERTMS suppliers represent the largest part of the global signalling market. It is expected that ERTMS will gradually become the standard of choice for an ever-growing number of railway companies worldwide.
Aerospace	• Thousands of sensors per aircraft. • 7-12% of aircraft costs are related to CPS. • 60-70% of avionics development costs are related to verification. • 75-80% functions embedded.	• Introduction of new systems and features (e.g., unmanned aerial vehicles) has increased the need for new assurance approaches. • Compositional development and certification (IMA) as a standardised practice. • Use of large and complex networks.	• Tens of thousands of sensors. • Air traffic will double in the next 15 years. • Expected demand for over 30,000 new aircraft in the next 20 years.
Space	• More than $26B revenue during the next 10 years. • Minimum presence of CPS architectures in flight solutions. • New constellations market started with constellations over 600 satellites foreseen.	• Main challenges are related to the increase of performance / weight ratio, high reliability and product long life in challenging environments. • Certification and in-flight validation of reconfigurable HW. • Increase of the usage of non-Space COTS solutions. • Increase in the autonomous missions for science.	• In-flight reconfiguration to be extended for all domains. • Cost reduction of over 40% requested to maintain reliability figures for constellations. • Upgraded COTS to be used as main components for space solutions. • 2 orders of magnitude increase in data processing and data transmission needs by 2020.
Application Development Software	• $10B value worldwide. • 25% development time reduction and 40% time-to-market reduction	• Wide variety of tools used. • Tool qualification as a basic need. • Emergence of new tools for	• OSLC as standard tool interoperability mechanism, and development of further OSLC specifications.

thanks to information sharing.	supporting system assurance and certification activities. • Creation of open-source communities for building such tools. • Eclipse as the market leader.	• Wider use of open-source tools. • Market growth because of the increasing use of software and the need to deal with increasing system complexity.

Europe is a market leader for high complexity and mixed-criticality systems and controls in the Embedded automotive, industrial, medical, aerospace and health industries. These industries face a common need to produce higher reliability, dependability, mixed-criticality and production complexity in their products to maintain this competitive advantage. The main competitors to the European Embedded market are the USA and Asia.

2.2 Market "Megatrends" and Needs: Survey results

2.2.1 Time to market & competitiveness

In an increasingly competitive market, with an ever-increasing speed of innovation, partners must pursue easier, faster, and more efficient ways to build and assure safety and security of critical systems to remain competitive. A key part of this relies on *fast and reusable certification*.

Cost (price of product) pressures are increasing, with new products expected to exceed current ones in both features and quality, yet without price increase. The customer expectation is that new products are incrementally built based on prior product development, despite advances in modular and off-the-shelf components. Thus, the certification/safety process of systems still struggles as a result of "incremental certification" issues.

2.2.2 Reuse challenges

The trend and need is *to increase reuse-geared development and certification processes* as a major means to reduce costs. As noted above, the challenge with reuse is not necessarily with the reuse itself but with *reuse of certification and safety artefacts*, especially where artefacts are cross-domain. A safety artefact for aerospace might not be able to be applied directly "as is" in the railway or automotive domains, for example.

2.2.3 Open solutions & reuse

There is a trend to move from closed, proprietary systems to *more open CPS*. Open here includes: open source, open interfaces/API, and collaborative solutions from multiple partners integrated together.

Open solutions can help to provide incremental and off-the-shelf components for incremental developments. For many new technologies (cloud, big data, mapping software, Internet of Things (IoT), automotive, etc.) large actors and small start-up companies are choosing to collaborate, to share the cost of creating new platforms, in open source format, and thus to develop their products and solutions using these open source platforms.

2.2.4 Security

Open solutions, and particularly IoT, have created *enhanced security concerns*, stimulated by the increased communication in open networks with its associated risks of hacking, availability, and reliance on 3rd parties to support the infrastructure.

Combined safety and security engineering methods are needed and being developed. One challenge is when *safety and security are in conflict*. Safety is often achieved by simplicity, whereas security is often achieved by layers of complexity.

2.2.5 Rising complexity

Systems are becoming ever more complex, due to *increased customer demand for functionality*, *new capabilities, the expectation of increased automation, and the opportunities to introduce expert systems/intelligence within systems.*

The impact of that trend on safety-critical systems development makes it harder to ensure that software and systems are adequately tested, certified, and safe.

There is an increased *recognition of risks due to increasing complexity*: larger code bases, more cooperating systems, and distributed/multi-core systems are simply harder to develop robustly, and it is harder to justify the safety of these systems.

In the aerospace industry, as a way to understand when testing is sufficient, there is an increased emphasis on coverage analysis, especially at the integration-level. Data/control coupling coverage analysis is becoming more important, in addition to normal, structural, coverage analysis. This is due in part to complexity and in part to the increased operational testing emphasis, as required by ARP-4754A, which is now mandatory. This may propagate to other industrial domains.

Other examples where this trend in increased complexity is having a big impact include collaborative and autonomous vehicles and distributed control systems in "Industry 4.0", where both the level of control over testing and the number of ways for reaching a failure are growing dramatically.

2.2.6 New development practices

The software development process and practices are developing. New methodologies like agile approaches (common in many industries) are gradually making their own way into safety-critical software development. *Model-based development techniques, formal methods, object-orientation, and new simulation techniques are also seeing increased use* and are having an impact on the way we deal with reliable software in safety-critical systems.

In the aerospace industry, there has been a *progressive reduction of the emphasis on product-specific certification, in favour of process-specific certification*. The number of experts in favour of goal-based assurance and certification in contrast to other schemes is increasing.

2.2.7 Automation of labour intensive activities and intelligent control

Many *labour-intensive tasks are being progressively minimized through automation*. Manual activities, which may previously have been off-shored to lower labour cost countries, are now increasingly being performed by machines.

The increased automation of testing processes, for example, is a major trend. Companies are investing in automation solutions so that during the second and subsequent times that testing activities are performed, there is a very low cost to achieve results because of reduced need for repetition of manual effort. This allows re-use of testing and automatic generation of some safety/certification artefacts.

New technology *applications with autonomous vehicles and intelligent functionality* in aircraft, drones, etc., interactive robotics, autonomous transport systems, IoT, massive automation, connected vehicles, aircraft navigation/planning, displays, are all leading to a stronger interplay of safety and security engineering.

One challenge that this brings is the testing and certification of autonomous behaviours. This requires new ideas, tools, methods, and engineering solutions to efficiently tackle both safety- and security-related risks within systems.

2.2.8   Increasing product lifespans

In many industries, such as aerospace and railway, *the lifespan of products is long and increasing*: 30 years is typical and 30 to 50 years expected.

Given the rate at which technology is developing, tools, methods and documentation that are used for the original product need to be available throughout the product lifespan. This is so that incremental development and bug-fixes, for example, can be performed cost effectively.

2.2.9   Cross-domain and cross-country standardization

To handle increased product complexity with no extra effort, there are moves by the aerospace certification authorities, including the FAA, under "overarching properties" to further streamline the certification, and ideally to better *harmonise practices between different airworthiness authorities* - especially as there's now more commercial aviation development in Russia, China, and Japan.

2.2.10 Changes in certification and safety

There is an *increased focus on system-level safety risk management*, allowing for reduction in regulatory oversight when data exists showing that risks are low (but see the findings of the Haddon-Cave report[2] into the NIMROD loss, which may be at odds with this view). Meanwhile, civil standards are increasingly being applied to military systems too. More and more projects are starting under DO-178C rather than DO-178B, and starting to use the associated Object-Oriented (OO) and model-based supplements.

2.3   Market trend survey

The ten market trends listed in section 2.2 above were identified in D8.2 [1]. 14 months after this, a survey (Appendix A) was conducted by members of the AMASS consortium to provide opinions on each trend, relating to the market sector or sectors in which each member works.

The following questions were asked as part of the survey: "*How applicable is this trend to your organisation?*", "*Do you see a positive or negative direction for this trend, or no change?*", "*Please give an example and a brief description on how your company is adapting/preventing impact to this trend*".

Answers to the question "*How applicable is this trend to your organisation?*" were given based on a scale of 1–5 where 1 is *not applicable* and 5 is *highly applicable.* Answers to the question "*Do you see a positive or negative direction for this trend, or no change?*" were given as 1 for a negative trend, 0 for no change and 1 for a positive trend).

20 out of 28 partners completed the survey. Results were classified into the following categories based on the market sectors or sectors that each partner considered themselves as working in predominantly: aerospace (3 respondents), automotive (5 respondents), railway (2 respondents), space (2 respondents), energy (1 respondent), and multiple sectors (7 respondents, many/all of which from universities and research institutes).

A weighted average of trends across domains was calculated by, for each partner, multiplying values for the question "*Do you see a positive or negative direction for this trend, or no change?*" by a weight determined by the partner's answer for the question "*How applicable is this trend to your organisation?*". These values were summed and divided by the sum of the weights. The final value gives results on the scale -1 (*highly applicable* to all respondents, negative trend) to +1 (*highly applicable* to all respondents, positive trend), across partners working in all domains (Figure 2) or just partners working in the Auto, Aerospace and Multi domains (Figure 3).

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The positive trends are considered to represent a *level of concern* to the consortium, i.e. they might impact on the cost or influence on product or service direction.

Results from the survey show that:

- Across all domains:
  - All trends were assessed to have a positive direction overall.
  - Trend 6 "" and trend 7 "" present the greatest *level of concern*.
- In the Automotive domain:
  - Trend 10 "Changes in certification and safety" was assessed to have a negative direction.
  - Trend 4 "" and trend 6 "" present the greatest *level of concern*.
- In the Aerospace domain:
  - Trend 6 "" and trend 9 "" are mostly concerned.
- In Multi domains (partners working in multiple domains, including universities and research institutes):
  - Trend 3 "" and trend 7 "" present the greatest *level of concern*.
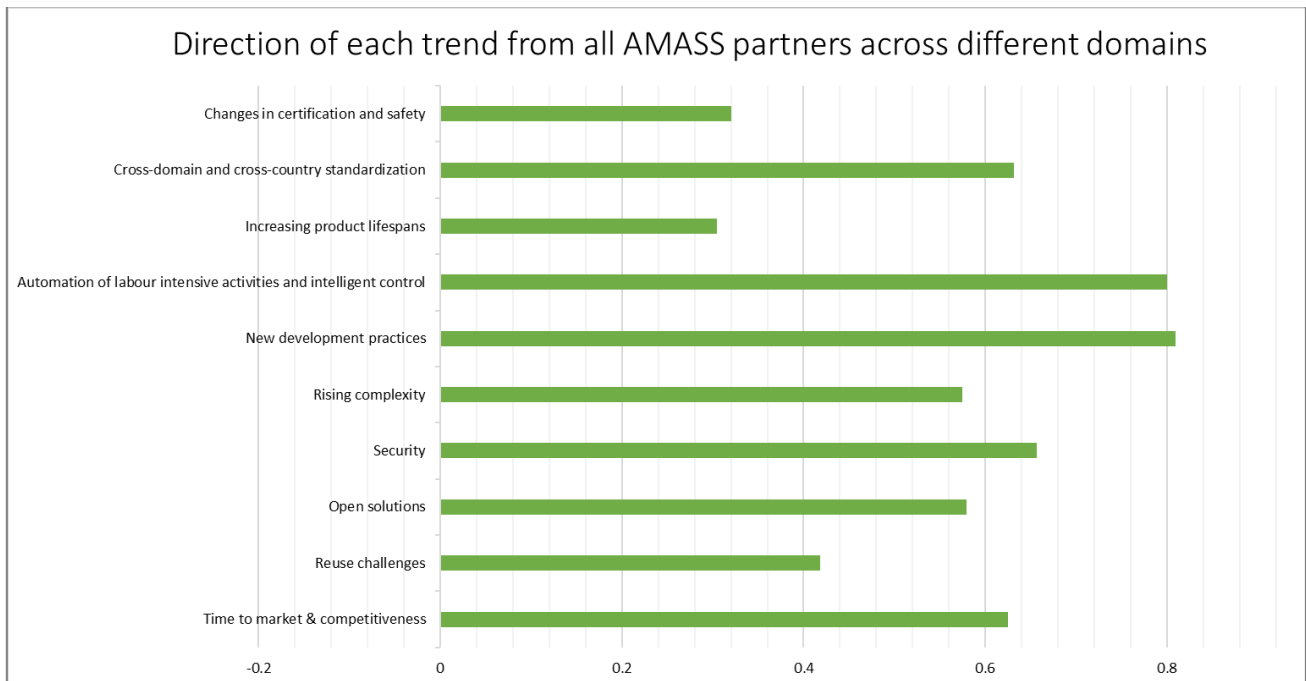

Figure 2. Direction of each trend from all AMASS partners across different domains, on the scale -1 (highly applicable to all respondents, negative trend) to +1 (highly applicable to all respondents, positive trend)

Direction of each trend from AMASS partners from Automotive, Aerospace and Multi domains

■ Multi ■ Auto ■ Aerospace

Trend	
Changes in certification and safety	
Cross-domain and cross-country standardization	
Increasing product lifespans	
Automation of labour intensive activities and intelligent control	
New development practices	
Rising complexity	
Security	
Open solutions	
Reuse challenges	
Time to market & competitiveness	

-0.2   0   0.2   0.4   0.6   0.8   1
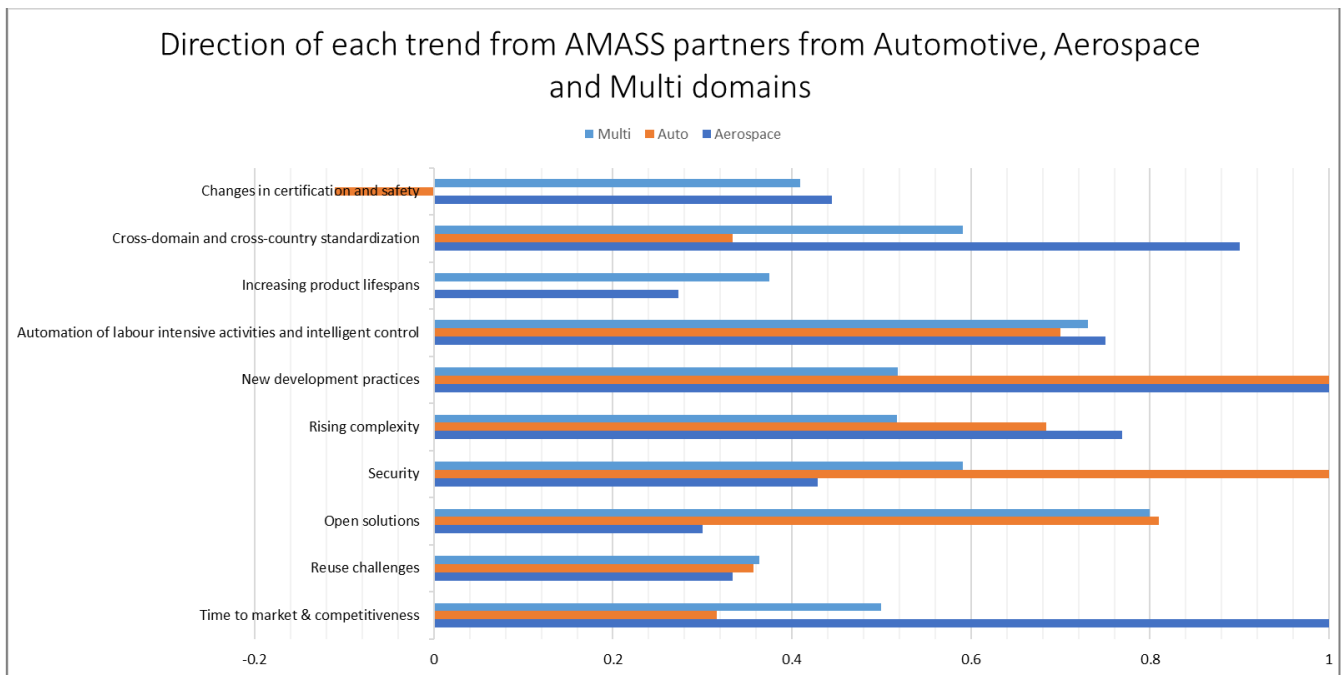
Figure 3. Direction of each trend from all AMASS partners from Automotive, Aerospace and Multi domains, on the scale -1 (highly applicable to all respondents, negative trend) to +1 (highly applicable to all respondents, positive trend)

Answers to the question "*Please give an example and a brief description on how your company is adapting/preventing impact to this trend*" were collated. This highlighted some of the following common approaches that AMASS partners are using to address market trends:

- Investing in research on metamodels, tools, methodologies to determine the best approach for our developments, such as **model-based techniques**, introduction of **formal methods**, etc.
- Working closely with industry to develop a **continuous integration**, e.g. more tightly integrated test environments to support the need for continuous integration and faster development cycles.
- Researching solutions to enable controlled **flexibility** regarding development processes.
- Adopting "**Agile**" methodology, where "Agile" increases both software quality and time-to-market. However, the development of safety critical CPS can hardly take advantage of agile methods due to the lack of support from safety standards.

3. Updated individual exploitation plan by individual partners

This section contains an updated exploitation plan, a progress update up to m24, and a list of challenges to market entry from each AMASS partner.

3.1 Tecnalia Research & Innovation (TEC)

3.1.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

TECNALIA is an applied research technological centre whose main goal has been clear from the outset: to transform knowledge into Gross Domestic Product (GDP), to improve people's quality of life, by generating business opportunities for companies.

TECNALIA aims at changing radically the ways of transforming knowledge into results. Our claim "Inspiring Business" means identifying and developing business opportunities through applied research. This is based on the four different types of activities we develop:

- Privately Funded Projects: TECNALIA is a strategic partner for the development of new products or processes, or for the improvement of existing ones. We design and develop flexible R&D&I projects adapted to the needs of each organisation, with a clear focus towards the generation of value and the market, promoting the competitive future of businesses and society at large.
- Technology Transfer: TECNALIA VENTURES is responsible for the comprehensive commercialization of the most relevant and state-of-the-art technology developed by TECNALIA itself, in the form of intellectual property, know-how or participation in technology-based companies. An essential bridge between R&D&I and a competitive business position.
- Technological Services: Over 50 years of experience providing technological services for the evaluation and diagnosis of materials, processes, and products. We have a highly-qualified technical staff with access to extensive laboratory facilities.
- Strategic Consultancy in Technology and Innovation: Consultancy in technology-based innovation strategies, pursuing business growth and diversification. Our technological know-how allows us helping our clients to identify and undertake new business ideas, detecting opportunities, and transforming them into successful results.

In this sense, the exploitation of the results coming from the AMASS project is oriented to the two first types of activities in the list above: Privately funded projects and Technology Transfer.

By participating in AMASS, TECNALIA extends its competence in applied software service engineering. More concretely, the AMASS results will be applied in the following ways to improve our business:

- Use and adjust project results (methods and tools) to improve existing products by TECNALIA and generate new ones, to be capable of developing safety-critical systems, especially for the automotive, aeronautics and energy sectors.
- Improve some of the products by TECNALIA in relation to the safety-assurance and certification of embedded systems. In this sense, results from AMASS will improve OpenCert[3], the modular & harmonized assurance tool platform hosted at Eclipse/Polarsys. The primary goal of this tool is to provide a set of methods and tools to certify the "conformance" of development activities/artefacts to standards (with special focus on safety and cybersecurity standards such as IEC 61508, ISO 26262, DO-178B or ISA/IEC 62443) or to internal company rules, without worrying about the confidence of the evidence. These methods and tools aim at reducing certification and re-certification effort and times.

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- • AMASS will help the creation of new systems based on the AMASS assurance/certification concepts. These systems can be tested internally with the modelling tools and quickly validated and verified to be ready for production of small-scale products for OEM's in the Basque Country, such as Irizar (Bus OEM) or Mercedes Benz (Vito EV model, developed in the Basque Country). Moreover, the technology behind the reconfigurable platforms will be very valuable to foster Tecnalia position in the field of software platforms, e.g. the OpenCert tool platform, improving the current solutions with input coming directly from industry.
- • TECNALIA already runs a significant business in both Product and Process certification, supported by the ESI@net[4] network. TECNALIA is a world reference in Software Process Evaluation based on models such as CMMI, ISO 15504-SPICE and ITmark in all continents. The results of AMASS, in coordination with OpenCert, will help our technology transfer activities in this domain by means of improved and new services/products regarding consultancy on assurance/certification concepts for E/E products.

3.1.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Technology transfer: AMASS results could be linked to the safety-critical community to provide a mature approach for safety/security assurance, to be applied in industrial projects for three different sectors:

- • Automotive and aeronautics, mostly the companies that are providers of electronic systems.
- • Energy, mainly related to power systems, such as RTUs or IDEs, and electric infrastructures.

In Spain, this will be done in particular across TECNALIA clients and some specific organizations such as sectorial national clusters.

Industry cooperation: participation in seminars/workgroups (LSIS, EADS workgroups, INCOSE, Certification Together community) will be a channel for a broad communication of AMASS results, and thus as a mean for sharing experience and data. TECNALIA will use this advantage on quick design and development of safety-critical systems, and the inclusion of security assurance as a proof for applying similar solutions in the context of the Automotive cluster located in the Basque Country.

The previous aspects refer to exploitation of the project results at an external level, that is, doing business with other companies and entities coming from different sectors. But additionally, we have the opportunity for internal exploitation, that is, applying the results related to methodologies and tools to improve the internal organisation development facilities for model-based development of embedded systems, and related validation & verification activities, which we are currently being performed in the Transport Business Unit of TECNALIA.

We also plan to reinforce our "cybersecurity and safety by design" offer, by working with Schneider Electric – Spain (AMASS partner), particularly in relation to the compliance with functional safety and cybersecurity standards applicable to power systems as well as in their safety-security co-assessment tool support.

3.1.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies and partnerships develop during and after the project?

Regarding the exploitation channels, TECNALIA will use the following ones to spread the AMASS project results at an international level:

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- Publication of AMASS results in prestigious international conferences and journals (such as IEEE ones).
- Use of the following Training and Consultancy Department of TECNALIA International Commercial Networks and Exploitation Channels:
    o TECNALIA delegations: Basque Country, Madrid, Barcelona, Sevilla. At the moment, TECNALIA delegations exist in Nuevo León (Mexico), Montpellier (France), Pontedera/Pisa (Italy), and Belgrade (Serbia).
    o Associated Innovation Centers: At the moment, Associated Innovation Centers exist in Cairo (Egypt), Bogota (Colombia), Sofia (Bulgaria), and Anglet (France).
    o Commercial alliances: TECNALIA is engaging in commercial alliances with locally active companies, in order to get quick access to market knowledge, increase sales of own products and services in the respective country through its partners, and start connected R&D projects with local clients, sometimes including the partner as well. The ESI@net in the area of ICT exists since 2001 and is composed of 35 partners from 20 different countries.
    o Participation in international networks: The valorisation methodologies TECNALIA uses to introduce its technological assets in international markets differ very little from the ones it is applying in its home market. The Cyber Security & Safety research group[5] is active in several relevant international organizations.
    o Inspiring Business Forum[6]: for the early distribution of high added-value technologies and associated business opportunities, TECNALIA has created an exclusive forum for interested companies where they get priority access to business opportunities, either detected by TECNALIA or coming from a network of international partners. The Inspiring Business Forum is in the process of being opened to companies from overseas, and TECNALIA is thinking of replicating the model with local partners in other regions of the world.
    o TECNALIA Ventures[7]: TECNALIA can count on its own Technology Transfer Office (TECNALIA Ventures) that supports the business units in all technology transfer issues, from licensing out to the creation of spin-off companies.
    o Out-licensing of technological assets (IP): The IP produced by TECNALIA business units is licensed-out internationally to interested companies, either directly through the business units themselves or using TECNALIA's internationally active Technology Transfer Office.

3.1.4   Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

The main outcome of the AMASS project will enhance the current safety-critical systems R&D by safety and security assurance and certification capabilities to our offering. The return is expected to be materialised onto new co-operations and collaborations and new areas where an integrated vision on safety and cybersecurity, proposed in AMASS, is needed.

It is expected to increase our consultancy and other supporting services related to safety/security assurance and testing in 1 to 2 years. We expect to increase this number thanks to the results of AMASS up to 3 services, summing up to 100,000€. This will enable TECNALIA to recover the investment in the project in 2021, after AMASS project termination.

The events, results and dissemination strategy, proposed in the project definition, will provide an increment in the social and networking activities of TECNALIA. This will provide an excellent value over the

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company research lines, towards the definition of new services for new customers, enhancing the offer in model-based development of safety-critical systems, safety assurance, and certification.

3.1.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

None yet.

3.1.6 Exploitation activity update up to m24

Up to March 2018 TECNALIA carried out several activities related to the exploitation of the results coming from AMASS. The most relevant ones are the following:

- Contact with Leet Security company: The rating agency Leet Security is an independent entity, formed for the sole purpose of developing and managing a labelling system to qualify reliably the levels of information security offered by ICT service providers. TECNALIA and Leet Security are in contact to analyse how OpenCert can support the labelling certification process and be a helpful solution to the final clients of Leet Security.
- Contact with Global Logic company: This company contacted TECNALIA because of its interest in the OpenCert platform. The platform was presented in detail to them and an economic offer was sent that included different services such as training and digitalisation of different standards.

3.1.7 Challenges to market entry

Compliance with security standards in the industrial sector is still at a very early stage of adoption. In fact, it is in the last few years that the first security standards have begun to appear in some sectors, such as IEC 621351 for power systems, or IEC 62443 for IACS (Industrial and Automation Control Systems).

TECNALIA has detected that companies that are suppliers of equipment for critical sectors – mainly energy and transport – are concerned about how to address the design and development of their products considering the security aspects from the very beginning. However, most of the industries do not still consider their products with a "security/safety by design" attitude. As the consideration of security standards for the industry sector is still in its infancy, the adoption of tools to manage compliance has a long way to go. The challenge will be to offer a tool that fulfils their specific requirements and needs, and to make it easy to use. A first approach to the critical infrastructure sector, in which the advantage of using this type of tool is observed, can facilitate its later adoption in other less advanced industries.

3.2   Honeywell (HON)

3.2.1   Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

Honeywell expectation is to lower the development costs as well as the costs of poor quality by deploying AMASS results in its projects, and via a formal verification integrated tool chain.

3.2.2   Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Aerospace market in general.

3.2.3   Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

The exploitation is planned as follows:

* Pilot <u>evaluation</u> of AMASS methods and tools in the development process of selected Honeywell projects (Control Systems, Display and Graphics, etc.).
* Pilot <u>deployment</u> of AMASS methods and tools, in the development process of selected Honeywell projects (Control Systems, Display and Graphics, etc.).

3.2.4   Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Short term (1-2 years): formal verification integrated tool chain should reach TRL 6 in 2016 and new low-maturity features will be added afterwards. The tools will be deployed in selected own pilot projects (Control Systems, Display and Graphics, etc.). Return on investment value is estimated to be about 2.02 just for one project in Control Systems.

Midterm (3-5 years): formal verification integrated tool chain and other AMASS results will be deployed in multiple Honeywell projects, and the savings will then be computed more precisely.

3.2.5   The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

The IPR is protected by consortium agreement. Non-Disclosure Agreements will be signed in case that we need to share confidential information with AMASS partners we cooperate with closely. In case of a new technology invention, a patent would be considered.

3.2.6   Exploitation activity update up to m24

Deployed requirement semantic analysis on Multi-modal Interaction Manager project.

Model checking of requirements written as C asserts using DIVINE LLVM model checker deployed to programs with Simulink models.

3.2.7 Challenges to market entry

Adoption of industrial requirement standard that has a single requirement form that is both human- and machine-readable, which allows automated formal verification of the requirements as well as automated test case generation, is difficult for legacy programs where changing the requirement standard in general would bring additional cost to the program. Therefore, we are focusing on the new programs.

3.3 Schneider Electric (TLV)

3.3.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

Schneider Electric expects to integrate new safety and security methodologies and tools to its Remote Terminal Units (RTU) devices, based on the standards, such as IEC 61508 and IEC 62443. The new AMASS tool would be integrated in the design and development RTU processes, including safety and security requirements in the workflow, improving the related verification and validation, and enabling the certification in these two aspects.

3.3.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Schneider Electric's exploitation plan for the project will be part of the global Smart Grid Strategy of the Company. The project results will have a direct impact in control devices (RTU) for the Smart Grid, providing solutions with new safety and security features to customers in the energy sector (Utilities).

Schneider Electric intends to exploit the project results with an international vision. The important presence of Schneider Electric in the global market will represent an excellent opportunity for exploiting the results of the project and to promote it.

3.3.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

Firstly, Schneider Electric will use the AMASS platform in the case study (CS1) to check its functionality for the RTU design and development process. Tecnalia and AIT, as safety and security experts, will participate in this case study.

After the project, the future use of AMASS platform in the internal procedures will be considered, based on the evaluation and case study results.

3.3.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

(1-2 years): methods and tools that are evaluated in RTU non-production environment.
(3-5 years): methods and tools that could be applied to RTU production environment.

3.3.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

If needed, NDA could be signed to share confidential information.

3.3.6 Exploitation activity update up to m24

Currently, Schneider Electric is validating the second prototype of AMASS and it is defining new functionalities for the third prototype. According to the results obtained for these first prototypes,

Schneider Electric could exploit the AMASS tools in two main levels. The first level is related to the RTU development processes and affects the safety and security analysis respect to some standards (IEC 61508 and IEC 62443). The use of AMASS tool will provide the gap analysis respect to the standard requirements. On the other hand, the second level is related to RTU product and affects the security and safety co-analysis, detecting vulnerabilities and checking requirements in order to increase the resilience of the RTU against cyberattacks and safety issues.

3.3.7 Challenges to market entry

The trend of the energy market is going to products more secure that comply with new safety and security requirements. New regulations for the energy sector are emerging in order to increase the protection of its critical infrastructures. Standards such as IEC 61508 and IEC 62443 are being considered by the industry as a guide to include safety and security aspects in their products. In this context, end users are demanding security certifications that imply high cost and effort. The sector is looking for new methods, techniques and tools that improve the safety and security aspects of products and also, reduce certification costs. The challenge now is to adapt these tools to the specific needs of this sector, taking into account its standards, requirements, architectures and functionalities.

3.4   ANSYS medini Technologies AG (KMT)

3.4.1   Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

The main business idea of KMT is to strengthen its position in the market for functional safety tool support. It is planned to extend the existing tool suite *medini analyze* with new features or new components that will be based on AMASS ideas. Focus here is on new seamless collaboration approaches, re-use of safety related information/components, and architectural patterns.

Besides the main focus on the product offerings, KMT seeks partnerships and collaborations that allow to broaden its scope towards other domains. The focus of KMT has been on the Automotive domain. However, in 2017 a major step towards the opening into other domains has been made. There has been introduced a profile mechanism that allows to select a "safety domain" like ISO 26262 or ARP4761 for a project in medina analyze. This profile influences the tool behaviour – so that e.g. some actions are only executable in certain contexts. It is planned to provide further domain profiles in the coming time.

3.4.2   Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

First step: Automotive OEM's, Tier suppliers and Semiconductors that deliver safety-related products.
Second step: OEM's, Tier Suppliers and Semiconductors in other domains (Industrial, Aerospace).

3.4.3   Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

Results of AMASS will be further developed to achieve the appropriate maturity level and then offered to the market. Either new tools will be added to the *medini* product line, or new components will be added to existing products. The business model for the tool will be a license model with the additional charge of yearly maintenance and service fees or a subscription model. Especially with the help of seamless integration, KMT will open its target market and will significantly extend its market share. Furthermore, the large participation of industrial partners with appropriate case studies and new target domains will strengthen KMT's potential to extend its current business.

Besides the above described tool business, the consulting branch of KMT will be strengthened by new topics especially in the area of certification. This topic is becoming more and more important in the Automotive domain and, with the expertise gained in the AMASS project, KMT will be able to further extend its current business in such domain.

In terms of concrete steps, KMT will conduct a number of activities that increases its reach on the market:
*   User conferences – this has the broadest audience of existing customers of medini. Typically, 2 times a year.
*   Seminars – organized on the major regions (China, Japan, Europe, US) for introduction of new topics in relation to the tool offerings
*   User days – per customer events
*   Internal trainings/events (Sales kick-off, FAE days) – to spread the knowledge to the internal team of ANSYS (sales and technical teams)
*   Webinars – various, at least once a month for new topics
*   White papers - various

- Technical papers and publications – on conferences, in journals

3.4.4   Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Commercialization will happen via tool licenses or tool subscriptions (lease).
It is expected that AMASS results help to remain at a strong growth rate for new medini analyze license sales. This long-term growth rate shall be between 10 and 20% per year. (The growth rate in 2017 has been 100%, but his is considered as short-term effect).

3.4.5   The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Software patents are not considered useful in Europe. Consortium agreement should be sufficient to protect knowledge. Source Code Copyright will be protected by giving source code to notary.

3.4.6   Exploitation activity update up to m24

The project work in AMASS is tightly coupled to the product planning activities for medini analyze. In summer 2017, a 3 years product roadmap has been planned and discussed and agreed within the ANSYS SBU. This product roadmap is the basis for our exploitation plan, that foresees the provision of new features of medini analyze that are based on AMASS.

Product management of medini analyze has been made aware of the results of AMASS to plan the productization of the project results.

In 2017, the events as described above have been conducted to make customers aware of long term product roadmaps: 2 user conferences, 7 seminars, various user days and webinars.

3.4.7   Challenges to market entry

Customers expecting more and more complete solutions, it is necessary to demonstrate the usefulness of the tools in the customer environment.

Entering other domains then Automotive is a challenge, since not only the tool needs to be present, but also the domain experts that can show and demonstrate the tool application to the customer. Such experts are difficult to find and hire. Therefore, the introduction of the product to the customers can take more time.

3.5   Mälardalen University (MDH)

3.5.1   Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

Academic achievements are counted in <u>publications, recruitments and development of new courses</u>. But in the long run also <u>new project grants and industrial collaborations</u> are inevitable prerequisites for successful academic research, thus the achievements of a good project are within all these areas.

MDH will primarily further <u>develop its competence</u> in the area. It is envisaged at least one promotion to associate professor, and a set of strategic recruitments of senior researchers and PhD-students to establish the knowledge field at the university. Through all of them a set of <u>journal and conference contributions</u> are expected.

The consortium itself represents also a base for future research activities in the area, and the partnership is expected to lead to <u>future collaborations</u>. The project is foreseen to support the partaking organisations, so <u>the growth and development of the partner organisations,</u> based on <u>successful project efforts</u>, is also a part of the benefit for the university, since also the collaboration opportunities will grow.

AMASS is also probably the largest European initiative in the area of Assurance and Certification of Cyber-Physical Systems, so the MDH active participation in AMASS is also expected to promote its <u>reputation</u>, and the contributions from MDH will promote its <u>authority</u> in the area.

3.5.2   Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

New research collaborations, for instance with automotive and other industry in different research programs, both nationally (SSF, KKS) and internationally (ECSEL, ITEA, Horizon).

Increased attraction of students via the development of new courses related to certification promoting the AMASS platform.

3.5.3   Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

The main outcome is a result of intense academic research work. To let it take place a strong project management is needed, which includes and emphasizes the efforts of the individual project workers. Models and methods could be patentable, partnership could be strengthened and mentorship of individuals could be an efficient tool for this.

There are support structures and experience of this kind of processes at MDH. There is also other public support available, as specific public funds and agencies for innovation (Västmanlands Forskings och Utvecklingsråd, ALMI företagspartner, VINNOVA). Patenting, covering both Sweden and a European market or worldwide as well, might cost about 20,000 €.

The main research issue that MDH would like to exploit would **be the connection of the three dimensions (Process, Product, Assurance Case) for variability management and impact analysis, the patterns and the model-transformations for argument fragment generation for Cross-Domain and Intra-Domain Reuse**, **and patterns for compliance checking**, which in the end will allow collaborating with commercial companies to benefit from the research. The methods may be patentable and might represent a base for a new spin-off company.

3.5.4   Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

The academic value of the results would be the promotion of the individuals, and the possibility to propose new projects. More specifically it is expected that at least 2 Postdoctoral Fellows, 1 PhD student, 3 MSs students, and 2 engineers will work on AMASS-related topics and will become members of the group during the project.

The commercial value is harder for us to estimate.

3.5.5   The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

For a commercialisation of the models, identification of ownership has to be done in the frame of the consortium agreement. Potential way of doing this is through establishing a spin-off company, consisting of the inventors. Another way of doing it is to let the existing business partners exploit the ideas.

For academic purposes, the most important way to protect IPR is to publish the new results. In that case collaboration agreements with specific business partners would be enough to secure the freedom to publish.

But patenting new methods could also be a way, and in the Swedish context the permanently employed researcher has the right to own the results privately, which makes the creation of a spin-off company easier.

3.5.6   Exploitation activity update up to m24

To prepare the exploitation of AMASS results, the following activities were conducted:
- Definition of a new course entitled: Quality assurance - Certification of safety-critical (software) systems to be offered for the first time during Spring 2019.
- New course related to AMASS results to be offered at MDH as part of the PROMPT initiative [8,9].
- Possible commercialization capability of some of the achieved MDH results within AMASS have been evaluated positively by Profengy (Västerås, Sweden). However, no additional effort has been spent yet to investigate further this possibility.

3.5.7   Challenges to market entry

From an industrial adoption perspective (transfer of MDH results to industry), possible challenges to MDH-market entry are as follows:
- The solution proposed within AMASS have the potential to be innovative, however, the theoretical background and its novelty might be hard to digest. Thus, practitioners might have difficulty to see the benefits in their mid-term future and might be reluctant to its adoption.

To face this challenge, a course targeting regular students as well as employees has been conceived and it is currently under development.

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3.6   Eclipse Foundation Europe (ECL)

3.6.1   Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

By supporting the AMASS partners to publish their results in open source, Eclipse Foundation Europe GmbH plans to achieve the following important goals:

- Improving its Open Source technology portfolio
- Growing the ecosystem, around open source tools for Embedded Systems, in PolarSys.

The benefit for the Eclipse Foundation is to recruit new members, and to provide more value to existing members thanks to a larger community.

3.6.2   Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Generally speaking, we target companies that design and develop embedded systems.

More specifically, we envision that large organizations will adopt the AMASS open platform, and leverage it in order to integrate assurance and certification features in their tool chains.

We also target small enterprises that assign more and more importance in the value chain and are now asked by their customers to cover more and more activities in the product lifecycle, including assurance and safety activities. For those small enterprises, the existence of an open source solution that can be used as is for small projects is a game changer as they get access to the same technologies as the larger companies, even with their limited resources.

3.6.3   Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

Recruiting new members for the Eclipse Foundation starts with building a community about useful and innovative open source technologies.

Concretely, the first step is to help the project partners publish their open source results, as soon as possible, in PolarSys. The second AMASS prototype is being published in the context of the CHESS and OpenCert PolarSys projects.

It means that once this prototype is available, we still have at least one year to develop the community, and to try to get enough adoption for the technology, not only from project partners but also from adopters of AMASS, so that they will likely become members of the Eclipse Foundation in order to influence the project itself.

3.6.4   Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

In terms of estimated value, the project helps retaining Eclipse Foundation members like CEA, Tecnalia, Infineon, Thales, ...

It also helps attract new members from the consortium. So far, MDH joined the Eclipse Foundation thanks

to the AMASS project, and we hope to have at least 2 or 3 more partners joining the Eclipse Foundation, as new members by the end of the project.

3.6.5   The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Assets created or published by the Eclipse Foundation are published under the Eclipse Public License v2.0, or possibly the Creative Commons by-sa 4.0 license for documentation.

3.6.6   Exploitation activity update up to m24

Our main exploitation activities are focused on the promotion of the Eclipse Foundation by demonstrating our specific approach of open innovation and exploitation of research through open source.

In the last two years of the project, we have promoted AMASS to potential new Eclipse and PolarSys members, as well as with existing members like Bosch, Thales Global Services. We usually integrate AMASS in presentations of our research activities, and of the PolarSys WG.

We also had a focus on AMAS during the following events:

- Research booth at EclipseCon France with the participation of Tecnalia
- ERTSS 2018

Finally, we focused on improving the OpenCert website hosted by PolarSys we will continue our work in this domain in order to demonstrate how AMASS technologies improve the coverage of the V model at PolarSys.

3.6.7   Challenges to market entry

We envision three main challenges to market entry for AMASS open source technologies:
- It takes time to create a vibrant open source community that ensures that the sustainability of the AMASS open source results will contribute to the growth of the PolarSys/Eclipse ecosystem.
- Open Source is an advantage to ease adoption as it allows "permission-less" evaluation and innovation, but open source adoption also requires mature technology to happen.
- AMASS addresses conservative industries where the owners of the quality assurance and certification process are sometimes reluctant to try new approaches.

In the last period of the project, we plan to specifically address these challenges.

3.7 Infineon (IFX)

3.7.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

- Strengthen the position in Advanced Driver Assistance Systems (ADAS), towards semi and fully autonomous driving.
- Key factor is the step from fail safe to fail operational systems.

3.7.2 Markets/Customers

Please list the markets or customers which you intend to exploit the results from AMASS.

- Focus on automotive

3.7.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

- Project results will become integral part of future design flow.

3.7.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

- Primary goal is to act as door opener for new applications (towards autonomous driving).

3.7.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

- AMASS results itself will probably be published
- Results integrated into our in-house design flow will only be available at company internal level
- No patents planned so far

3.7.6 Exploitation activity update up to m24

NA

3.7.7 Challenges to market entry

NA

3.8   AIT Austrian Institute of Technology GmbH (AIT)

3.8.1   Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

AIT expects to strengthen its position in the development of safety and security related engineering methods and tools, specifically, a workflow and tool automation platform for the engineering process for safety and security assurance of critical systems. The tools and the resulting expertise will be offered to partners outside of the project, in cooperative or contracted research. Additionally, AIT will exploit the knowledge and experience gained in AMASS in the context of ISO and IEC Standardization for functional safety and cybersecurity, thus promoting recommended use of co-engineering methodologies and tools.

3.8.2   Markets/Customers

Please list the markets or customers which you intend to exploit the results from AMASS.

OEMs and suppliers for connected and safety-critical systems, in domains like automotive, railway, and industrial automation and control.

3.8.3   Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

AIT thinks that, while the publically available AMASS platform is a good basis for further exploitation, all parts developed should be suitable as standalone applications, and able to cooperate with tools outside of AMASS, in order to restrict dependencies. To support the ongoing the development of tools after AMASS, open interfaces are considered valuable.

3.8.4   Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Short term (1-2 years): tools with TRL 6-7, that are evaluated in non-production environment.
Midterm (3-5 years): methods and tools that can be applied to production environment.

3.8.5   The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Combination of open and closed code, with clearly defined interfaces.

3.8.6   Exploitation activity update up to m24

The AMASS results regarding the workflow engine WEFACT, the standards compliant safety and security co-analysis process and the respective tool extensions in FMVEA and MORETO, and the AMT2.0 tool for Contract-Based Multiconcern Assurance by monitoring will be used as a basis for follow-up research projects. AIT's membership in several standardization groups for safety and cybersecurity offers the chance to influence standardization by bringing in experience from the AMASS project into these working groups.

3.8.7 Challenges to market entry

AIT's methods and tools portfolio wrt. safety and security co-engineering is slowly finding a broader market as the awareness about cybersecurity threats is increasing in industry. However, industrial practice is still mostly maintaining separate safety and security practices and teams, and flexibility to change corporate processes towards combined engineering methods is low due to associated cost for tools and training but also due to lack of acceptance in both safety and security communities.

3.9   Fondazione Bruno Kessler (FBK)

3.9.1   Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

FBK expects: 1) to strengthen the applicability of FBK's tools in the process of development and certification of embedded systems; 2) to increase the adoption of FKB's tools by industrial partners; 3) to identify industrial needs and develop novel methods to address them. FBK would benefit in terms of visibility and new partnerships based on the AMASS results.

3.9.2   Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

FBK develops analysis tools that are domain independent, but used in domains such as space, avionics, railways, automotive, health, automation control, and smart systems.

3.9.3   Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

The concrete exploitation plan of FBK comprises the following steps:
* enhancement of FBK tools with new functionalities related to the architecture-driven approach
* integration of FBK tools in the architecture-driven approach of AMASS
* publications about the research results obtained in AMASS
* industrial adoption of the assurance-driven approach using FBK tools
* increase the maturity level of the FBK tools

3.9.4   Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

FBK is a non-profit research organization and currently no commercial benefit is expected from the participation in AMASS.

3.9.5   The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Not yet planned actions for IPR protection. Research results will be published on open access publications; contributions to the AMASS platform will be released as open source; FBK tools will be released with specific licenses.

3.9.6   Exploitation activity update up to m24

At the current time, the following activities are in progress:
* enhancement of FBK tools with new functionalities related to the architecture-driven approach
* integration of FBK tools in the architecture-driven approach of AMASS
* increase the maturity level of the FBK tools

Regarding the publications about the research results obtained in AMASS, this activity is not started yet. Finally, no industrial adoption of the assurance-driven approach using FBK tools were found yet.

3.9.7 Challenges to market entry

Not applicable yet.

3.10 Intecs (INT)

3.10.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

Intecs will use the methodological results and the acquired knowledge for increasing its technical lead and competitive edge in the AMASS core domains, and for opening up domains where architecture-driven, multi-concern, and seamless assurance and certification are essential for the development of trusted and reliable CPS and systems of systems. Intecs will therefore expand and integrate its development and consultancy portfolio in relation with best practices and standards as improved within AMASS.

Intecs has already delivered the CHESS toolset as open source under the Eclipse Polarsys working group (see the CHESS Project at). The Polarsys group is a new open source industry collaboration created at the Eclipse Foundation, to focus on tools for safety critical and embedded system development.

The extensions developed for CHESS in AMASS will be delivered under Polarsys, as extensions to the existing CHESS Project. The open source distribution of the AMASS products, specifically addressing markets of interest to Intecs, is expected to increase the company visibility, competitiveness, and returns in terms of support, training, consultancy, and customization services.

Intecs is also interested to influence the evolution of the OMG SysML® and MARTE modelling standards, according to the AMASS results.

3.10.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Intecs designs and develops applications, tools, software, hardware components and products for Aerospace, Defence, Transportation, Telecommunication, and Smart Systems markets.

Intecs intends to promote the use of AMASS for the development, assurance and certification of critical systems in all these domains.

3.10.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps d you need to take? How will the technologies, partnerships develop during and after the project?

Participation in AMASS will feed directly the Intecs core competency and leadership position in embedded model-based development in the European embedded systems sector. We have a direct commercial interest in several areas, including development capability (projects with major clients including Finmeccanica in Italy), consultancy (we provide modelling consultancy to large clients in Italy), and tool offerings (we are a member of the Polarsys tool initiative).

Concrete exploitation plans for Intecs would be:
  a) Enhancement of the CHESS toolset offer with the AMASS architecture-driven, multi-concern assurance, and certification-related functions and methodology.
  b) Industrial adoption of CHESS by the end users of AMASS.
  c) Adoption of CHESS and AMASS results by the Intecs internal industrial divisions, in order to increase the respective capability in systems development.
  d) Enhancement of the maturity level of CHESS toolset from currently TRL 5, that is a technology validated in industrially-relevant environment, to TRL 7-8, possibly as a complete technology as successfully experimented in some operational environments.

3.10.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Short term (1-2 years): open source availability of the integrated toolset, with improved maturity, and visibility, no direct commercial value.

Midterm (3-5 years): methods and tools to be offered for adoption by industry, we estimate the growth related to the provision of training and consultancy services.

3.10.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

IPR generated by AMASS will be offered as open source, protected by the Eclipse Public License (EPL).

3.10.6 Exploitation activity update up to m24

The plan is confirmed.

Currently:
  a) Enhancement of the CHESS toolset are available on Eclipse, integrated with OpenCert
  b) Industrial adoption of CHESS by the end users of AMASS has started

3.10.7 Challenges to market entry

Industrial adoption of open source solutions requires some time, to ensure their maturation level is high enough. However, since commercial solutions are expensive, especially for SMEs, and their customization is poorly supported and expensive, we expect we can reach the market in the near future, supported by extensive dissemination and promotion.

3.11 Berner & Mattner (B&M)

3.11.1 Business Idea/Product & Services

What does your organization expect to achieve from AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

Main business idea of B&M is to strengthen its position in the market for software test and functional safety design tool support. It is planned to extend the existing tool TESTONA with new features or new components that will be based on AMASS ideas. Focus here is on new seamless collaboration approaches, re-use of safety related information/components and architectural patterns.

Besides the main focus on the product offerings, B&M seeks partnerships and collaborations that allow broadening its scope towards other domains. The current focus of B&M is on the Automotive domain.

3.11.2 Markets/Customers

Please list the markets or customers which you intend to exploit the results from AMASS.

First step: Automotive OEMs, Tier suppliers and Semiconductors that deliver safety related products.
Second step: OEMs, Tier Suppliers and Semiconductors in other domains (Industrial, Aerospace).

3.11.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps d you need to take? How will the technologies, partnerships develop during and after the project?

Results of AMASS will be further developed to achieve the appropriate maturity level and then offered to the market. Either new tools will be added to the B&M product portfolio or new components will be added to the existing products (TESTONA, MERAN, MODICA …). The business model for the tools will be a license model with the additional charge of yearly maintenance and service fees or a subscription model. Especially with the help of seamless integration B&M will open its target market and will significantly extend its market share. Furthermore, the highly participation of industrial partners with appropriate case studies and new target domains will strengthen B&Ms potential to extend its current business.
Besides the above described tool business, the consulting branch of B&M will be strengthened by new topics especially in the area of certification. This topic becomes more and more important in the Automotive domain and with the expertise gained in the AMASS project, B&M will be able to extend its current business here.

3.11.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Commercialization will happen via tool licenses or subscription models. Quantification not yet possible – need to have more detailed understanding of the product capabilities to come up with a sound price model for the licensing.

3.11.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Software patents are not considered useful in Europe. Consortium agreement should be sufficient to protect the knowledge.

Source Code Copyright will be protected by giving source code to notary.

3.11.6 Exploitation activity update up to m24

We have realized a prototypical approach combining several research topics we previously addressed:
- Contract based system specification
- Stepwise system refinement
- Template languages to express system behaviour

As a result, the prototypical tool SAVONA has been developed which features:
- System architecture modelling using SysML IBD
- Semi-formal contract specification using SSPL (System Specification Pattern Language)

SAVONA is used in further research activities such as the case studies dc-drive and velox cars to evaluate the methods proposed in the topics named above.

3.11.7 Challenges to market entry

Convincing customers to only slightly change their existing processes or use new tools supporting these is a huge challenge. Even if there are promising improvements over existing processes and technology, customers in the automotive domain tend to stick to existing and 'known to be good' tools. As a result, entering the market with a new tool requires lot of convincing and compatibility to existing tools besides the obvious fast ROI.

3.12 GMV Aerospace and Defence, S.A.U. (GMV)

3.12.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

By using the AMASS methodology and tools, GMV aims at reducing the development life-cycle key parameters (i.e., time and effort) and, at the same time, improving safety and qualification processes of space operational projects.

3.12.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Space domain (embedded critical software) / mainly for the European Space Agency (ESA).

3.12.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

Firstly, GMV will apply the AMASS methods and tools in R&D studies to check its applicability in the space domain. Subsequently, it is foreseen to use the AMASS framework in small operational projects.

3.12.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

1-2 years: GMV will assess the AMASS results in R&D studies in the space domain.
3-5 years: GMV will apply the AMASS framework in small operational projects.

3.12.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

If needed, NDA could be signed to share confidential information.
GMV does not develop any product. No patents will be generated.

3.12.6 Exploitation activity update up to m24

Investigation of how the AMASS Tool Platform can be used in operational projects: Integration of model-based techniques in the development process (requirements, design, safety) → Papyrus/CHESS.

3.12.7 Challenges to market entry

The AMASS Tool Platform should be mature enough (stable, error-free, etc.) to be able to use it in Space Operational Projects (reuse, model-based design including safety issues).

3.13 RINA (RIN)

3.13.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

RINA Services, as Notified Body no. 0474, expects to widen its experience in assessment of safety and compliance to various European standards in the railway domain, and in other sectors. Furthermore, RINA Services main activity in the project aims at developing a model of specific functions, as defined in the System Requirements Specification of European Rail Traffic Management Systems (ERTMS/ETCS), UNISIG SUBSET-026, for use in the laboratory test activities and the certification processes.

3.13.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Railway domain in general, especially in the field of ERTMS/ETCS laboratory tests and certification processes.

3.13.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

RINA Services aims at applying the methods and tools that are going to be created in AMASS, in particular in WP3, in the System Requirements Specification of ERTMS/ETCS, UNISIG SUBSET-026, as an example that could show the implementation in the railway ERTMS/ETCS domain of the architecture-driven approach developed in AMASS itself.

3.13.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

1-2 years: RINA will assess the AMASS results.
3-5 years: RINA will apply the AMASS results in the laboratory tests, and in the definition and reviewing of the ETCS on-board subsystem tests specifications.

3.13.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Not yet planned actions for IPR protection.

3.13.6 Exploitation activity update up to m24

RINA is currently developing the implementation of AMASS tool in its railway certification laboratory.

3.13.7 Challenges to market entry

From a certification company acting in the railway domain, the main challenge to market entry could be to be prepared for the certification of complex systems possibly developed by means of AMASS tool. The use

of formal method for the medialisation of complex safety and security critical systems and the relative framework standards is becoming more and more common in the railway sector. Consequently, there could be the need to adapt the certification processes to this trend.

3.14 Thales Alenia Space (TAS)

3.14.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

The main objective is to reduce the time of certification and re-certification of code and architectures, without repeating the whole process every time.

One of the most relevant improvements will be the on-board re-validation and re-certification of configurable FPGAs.

3.14.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

The main customer will be other parts of Thales, including TAS-E (España), and the advantage that this will cause in the offers TAS-E presents.

3.14.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

Plans depend on that are proved and accepted by the space industry and the space government divisions. Clear stating our requirements, constraints and our problems to the AMASS tool developers to support their development of tooling is the best approach.

3.14.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

With the AMASS tool developed and validated the number of acquired contracts will likely increase, with the consequent growth of the company, and with best profiting of the human resources, due to the longer time available in favour of other activities, instead of being involved in repetitive tasks, such as re-certification and re-validation.

3.14.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Patent or collaboration agreement.

3.14.6 Exploitation activity update up to m24

No relevant updates.

3.14.7 Challenges to market entry

The AMASS Tool Platform should be more confident to be certificated for Space products. It must debug the errors (must be error-free) principally including all security issues.

3.15 Universidad Carlos III de Madrid (UC3)

3.15.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

As an academic partner, UC3 will exploit its participation in AMASS for improving and extending its current activities on education, research, and technology transfer. In more specific terms, UC3 exploitation will focus on the following aspects:

- Education of a PhD student and a Postdoctoral Fellow
- Education of Bachelor's and Master's students through theses on AMASS-related topics
- Presentation of AMASS ideas and results in UC3 courses
- Use of AMASS methods and tools in the laboratory sessions of some UC3 course
- Publication of high-quality scientific papers from AMASS results
- Contribution to the AMASS results targeted at being released as open-source technologies (e.g., in Polarsys)
- Establishment of a community of AMASS results' potential users in UC3 industry network (Airbus, Chrysler, Daimler…)
- Participation in the activities related to AMASS Advisory Board
- Preparation of at least 2 scientific publications with researchers that are not part of the AMASS consortium
- Standardization of AMASS results through UC3 activity at INCOSE, OMG, and OSLC
- Acquisition of new knowledge and expertise in assurance and certification of CPS that could lead to the participation in new project proposals at European or national level
- Possibility of providing AMASS-based products and services based to local companies, via technology transfer contracts

Dealing with this set of aspects will ultimately allow UC3 to extend its competence on assurance and certification of critical systems, to establish new links with other organizations on this topic (which can lead to further collaboration in the future), and to gain recognition as a top academic institution in the area.

3.15.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Since UC3 is an academic institution, its main market and customers correspond to:

- Students, who can acquire AMASS-related knowledge through the presentation of project information and results to them, and through the work on thesis (PhD, MSc, and BSc) on topics related to the project.
- Research community, which can gain new knowledge and identify new research gaps to fill as a result of the publication of the AMASS results that UC3 produces. These results will be reported in scientific papers and presented at conferences and workshops. Members of the research community could further collaborate with UC3 in the future. This could result in a mutual benefit, via e.g. the exchange of knowledge and expertise and the joint preparation of research project proposals.
- Standardisation organisations, to which AMASS results could be transferred in the form of either proposals of new international standards, or recommendations, specifications, and modifications of existing ones.
- Companies, with which technology transfer contracts might be signed based on AMASS results. The

companies can belong to any application domain in which CPSs are used.

3.15.3　Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

UC3 will use different means for fulfilling its exploitation plans. The main ones will be (1) the use of AMASS information and results for students' training, (2) the publication and presentation of AMASS results at different research venues and industry-oriented ones, and (3) the participation in new project proposals that relate to AMASS and that could address AMASS-sibling areas not directly or sufficiently addressed in AMASS itself.

Once AMASS ends, UC3 will continue using the above means to exploit the project results.

3.15.4　Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

UC3 cannot provide an accurate estimated commercial value from the exploitation of AMASS results. It is an academic non-profit organization, and currently no commercial benefit is expected from the participation in AMASS.

Regarding growth, the UC3 research group involved in AMASS (Knowledge Reuse Group; Computer Science Department) expects that at least 1 Postdoctoral Fellow, 1 PhD student, 3 MSs students, and 6 BSc students will work on AMASS-related topics, and become members of the group during the project.

3.15.5　The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

No specific means are planned to be used at UC3 for IP protection. As a rule of thumb, the AMASS results that UC3 produces will be open. Open access will be provided to their publication, most AMASS deliverables to which UC3 contributes are public, and the implemented software will most likely be delivered to the AMASS open-source community. Authorship and copyrights are already handled in these results, with no extra action, e.g. authorship recognition and copyright management by the publisher for the publications.

3.15.6　Exploitation activity update up to m24

No relevant updates. Only minor ones are envisioned, e.g. about the final number of students that will be trained on AMASS-related aspects.

3.15.7　Challenges to market entry

From an educational and research perspectives, possible challenges to UC3-market entry are as follows:
- The problems addressed in AMASS are complex, thus students might have difficulty to understand them and be reluctant to work of AMASS-related aspects.
- AMASS is working on certain assurance and certification needs that are not major issues at this moment for many companies but will be in the future, e.g. compliance with engineering and assurance standards of different nature. Technology transfer might thus not happen in the near future.
- AMASS targets domain-independent results so that they can be applied for different system types:

road vehicles, energy systems, aircrafts, satellites…. However, possible new projects might focus on specific domains. Adaptation and extension of AMASS results in these new projects might not be straightforward.

3.16 Rapita Systems (RPT)

3.16.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

We plan that AMASS will provide Rapita with the following innovations:

1. RapiTest Framework features. Rapita is building a new product called "RapiTest Framework" that will provide our customers with the capability to reduce their test and certification costs. RapiTest Framework is designed to drive inefficiencies out of low-level testing in large projects, thereby reducing costs and eliminating unnecessary delays in the testing process. Several key features of RapiTest Framework are being developed during AMASS, including specific language support. This will benefit Rapita by enlarging the market size and applicability of the product. Our customers will benefit by reducing testing costs through use of RapiTest Framework.
2. Automated Qualification Data. Crucial to both RapiTest and our other products is the ability to quickly and automatically produce qualification documentation and tests that our customers can use directly. Through AMASS, Rapita is developing a new way of creating qualification data for DO-178C. This will eventually allow Rapita to reduce the cost of producing qualification data for different software versions.
3. Tool integrations: our products will benefit from tool integrations with a number of related tools, including DOORS (requirements traceability), Mx-Suite (system-level test), and possibly others.
4. On-target seamless integration. Our work in AMASS includes building new ways of integrating verification software within our customers' systems. A new product feature will enable faster and easier integration, reducing costs of adopting tooling.

3.16.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

The target market is avionics suppliers providing DO-178C, assurance level A-C software systems, primarily Tier1 suppliers. Certification and qualification of systems and the tools used to produce them is vital in this market. RapiTest Framework is designed to reduce the manual effort for certification and test of large projects, thereby reducing costs and eliminating delays in the verification process. Within this market, both "new project" and "legacy systems" are relevant opportunities, both in Europe and exporting to the US market.

3.16.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

- Rapita will add new AMASS-supported features to RapiTest Framework, bringing them to market as fast as they are available. The RapiTest roadmap of features extends well beyond its status today, with much R&D still required.
- As a new product, a fast release cycle is required, allowing us to support our customers' certification/testing needs. Therefore, bringing the automatic qualification kit generation into a commercial state will be an important step in achieving impact. Rapita has rolled out the first qualification data for RapiTest using the new qualification framework, which will then be evaluated and improved as necessary.
- The marketing of the product will be accelerated, including promotion of its qualification data and ease of integration.
- Support for tool integration with products like Mx-Suite and DOORS will open opportunities for

partnership and joint exploitation opportunities.

- Rapita also plans to create a new service offering, based around own tools, and providing testing services for our customers.

3.16.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

- Rapita will primarily benefit from the results of AMASS by generating more licence sales of RapiTest Framework and the qualification kit.
- The market opportunity is growing as software systems get more complex and harder to certify. Therefore, innovations to reduce our customers cost of test/certification have high value. For example, if RapiTest can reduce the cost of testing by 30% then for a large avionics project, where the cost of test is many millions, then this represents both a significant saving for the customer and significant revenue in licences and services for Rapita.
- RapiTest is expected to be licensed to large suppliers over the next few years; and along with value-add services such as integration and tool qualification, the company is expecting a return on investment within 2 years after termination of AMASS project, with revenue growth of 30%/year for the subsequent 3-5 years.

3.16.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

There are a number of different innovations in RapiTest Framework, which may need different types of protection. In general, the proprietary source code will be confidential and the knowledge and skills needed to replicate the product are hard to reproduce. Patents may be investigated for specific components if necessary.

3.16.6 Exploitation activity update up to m24

Several features of RapiTest Framework have been developed by AMASS (including C++ support) – this has successfully been used on a large subcontracted verification project.

The automated qualification framework has been used for several versions of RapiTest Framework qualification data, saving significant effort and a faster time to market for it. Feedback from customers has been excellent.

Integration with Mx-Suite has developed and trialled with a few customers.

3.16.7 Challenges to market entry

Cautious market. Market entry of RapiTest Framework has been positive, however the conservative aerospace industry takes time to fully adopt technology – stepwise evaluation of the technology precedes wide rollout.

Legacy support. Legacy test support for long-lifecycle programmes means that additional work is required to support old and legacy tests and code.

Uncertainty about model-based design. Model-based design is still in infancy, but it is changing the shape of the verification processes. Until a clear path with testing model-based engineering methods is defined, there is reluctance to make decisions about other areas of verification.

3.17 The REUSE company (TRC)

3.17.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

The REUSE Company expects to exploit AMASS results in different aspects:

- R&D Acceleration: Improve its tools and open/interconnect them with existing tools, and methodologies within the engineering ecosystem.
- Stronger market position: raise awareness of TRC as a tool vendor in companies working with systems engineering methodologies about TRC offers to improve their products and processes. This mutual knowledge can be turned into partnerships with other companies, or generate a new customer for TRC. Thus, improving TRC position in the market.
- Standardization: Participate in the standardization (definition of the standards) around Knowledge Engineering activities, which are the core of TRC business.
- Synergies: generate synergies, both technical and commercial, with other tool implementers within the AMASS consortium.

3.17.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.
- Quality Assessment Market for:
    - Requirements
    - Models
    - Etc.
- Industrial domains:
    - Aerospace
    - Automotive
    - Railway
    - Healthcare

3.17.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

With the envisioned improvements, TRC plans to consolidate its current customer base in the aerospace industry and make progress in others, such as automotive and railway. This will be done by offering them new capabilities to manage and create new evidences for certification processes.

These ideas will be included in our commercial products and they will represent the basis of the upcoming TRC tools releases.

Finally, we aim to gain either technical or commercial synergies with the other partners in the consortium.

3.17.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

The estimated growth for:

- Period 1-2 years: no new revenues from AMASS-derived products

- Period 3-5 years: starting with 5% in the 3rd year and ending in 10% at the end of the 5th year

3.17.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

The IPR is protected by consortium agreement.

Non-Disclosure Agreements will be signed in case that we need to share confidential information with AMASS partners that we cooperate with closely.

We plan to protect our new features IPR by means of patent application.

3.17.6 Exploitation activity update up to m24

Focus on the interaction with partners inside the consortium interested in using our technology to their use case. Several iterations will improve the understanding of the work products produced by the industry in their development process, and the industry can reach a better understanding of our tool features and methodology, this will allow them to think of new ways of improving the quality of their work products.

A referment of the seamless integration of TRC tools in the AMASS platform will be developed.

3.17.7 Challenges to market entry

Not applicable yet.

3.18 OHB Sweden AB (OHB)

3.18.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

The development of critical on-board software applications such as Attitude and Orbit Control Systems (AOCS) is continuously becoming more complex as space missions become more autonomous. At the same time, it is expected that the pressure on budget and schedule will continue to increase such that the demand for efficient software development, still ensuring dependability and safety, will increase.

Within the AMASS projects, OHB expects to improve the engineering process of developing safety-critical systems for Space. This means making the engineering process more cost-effective without affecting quality. This will be crucial for future development of AOCS software in the telecom satellite programmes.

3.18.2 Markets/Customers

Please list the markets or customers which you intend to exploit the results from AMASS.

- ESA ARTES 33 program (Electra primary)
- Space market in general

3.18.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

Exploitation Plan:
- Evaluation of tools and methods provided by the AMASS framework, with the aim to create seamless integrated tool-chain to semi-automated evidence management and quality assurance activities. Additionally, identification of methods to support identification of reusable components and generation of reuse-files.
- Dry run of the selected tools and methods within the Electra project.
- Compare result of using AMASS framework to results from original project to measure the effect on cost and quality.

3.18.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Short term 1-2 years: Seamless integrated tool chain and methods for identification of reusable components is considered successful and the software engineering process is updated to describe these improvements. The engineering process is applied in selected OHB Sweden projects.

Long term 3-5 years: OHB Sweden has the objective of reducing the cost of developing safety critical systems, but without affecting its quality, and therefore establishing itself in a stronger position on the Space market.

3.18.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

The IPR is protected by consortium agreement. Non-Disclosure Agreements will be signed in case that we

need to share confidential information with AMASS partners that we cooperate with closely. In case of a new technology invention, the patent would be filled.

3.18.6 Exploitation activity update up to m24

NA

3.18.7 Challenges to market entry

NA

3.19 Masaryk University (UOM)

3.19.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

Partnership with Honeywell International, co-operation on integration of tool for system verification and requirements engineering into industrial tool chain. Industrial relevant benchmarks. Extended integration into AMASS-based tool chain, hence, partnerships with other AMASS partners.

3.19.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Academic and Research.

3.19.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

Joint effort on tool integration, maintenance and tool support will persist once AMASS project terminates, and so the cooperation.

3.19.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Although it is hard to value such things financial, the open source tool supports the university, its research and reputation.

3.19.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Our tool is open source, and we do not propose particular protection is required.

3.19.6 Exploitation activity update up to m24

Partnership with Honeywell International, Participation of students in AMASS activities (improved knowledge of software engineering processes, topics for PhD students), Tool-provider (some of our software tools have already been integrated).

3.19.7 Challenges to market entry

As a university we do not aim at free economical market, we aim at academic and research community, the challenge lies in generalisation of AMASS procedures and extraction of ideas that could be sold to research community in an appropriate form (publications).

3.20 Kompetenzzentrum – Das virtuelle Fahrzeug Forschungsgesellschaft mbH (VIF)

3.20.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

ViF expects to strengthen its Position in the Development of safety- and security-related Engineering Methods for model-based System, Safety, and Security Engineering, and for Safety and Security Co-Analysis based on Failure Mode Effects Analysis.

3.20.2 Markets/Customers

Please list the markets or customers which you intend to exploit the results from AMASS.

OEMs and suppliers of safety- and security-critical systems in the automotive domain.

3.20.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

- Publishing and presenting results in both research and industry-oriented venues.
- Be active in preparing new project proposals, where AMASS results are used.
- Integrate results and knowledge, as generated by the project, in follow-up research projects and costumer projects.
- Cooperation and interchange of results with other research projects.

3.20.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

Short term (1-2 years): Use of the AMASS results in R&D studies and projects in the automotive domain. Midterm (3-5 years): Use of the AMASS results in costumer projects in the automotive domain.

3.20.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Collaboration Agreements.

3.20.6 Exploitation activity update up to m24

The AMASS results regarding safety/security co-engineering process will be used as a basis for follow-up research projects.

3.20.7 Challenges to market entry

VIF is part of the international ISO standardization group for Cybersecurity for Road Vehicle and it will take some years to have a first version of the standard available – in the meantime it is challenging to handle

cybersecurity and the interaction of Cybersecurity and Functional Safety in the automotive domain in a harmonized way.

3.21 Alliance pour les technologies de l'Informatique (A4T)

3.21.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

A4T intends to strengthen its co-engineering methodology and tool solution in Safety and Security, and to combine other concerns such as availability or performance. Moreover, A4T intends to develop possible partnerships with AMASS partners in relation with best practices and standards as proposed within AMASS project.

3.21.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

A4T is planning to target Safety and Security co-engineering tool market, by acquiring new costumers and augmenting market share in different domains (Automotive, Aerospace, Defence and Transportation).

3.21.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

The concrete exploitation plan for A4T during the AMASS project would be the enhancement of Safety Architect tool with safety and security co-analysis solution and the integration of the Safety Architect tool with AMASS platform tools, such as CHESS and OpenCert. Thanks to the seamless integration proposed by AMASS project, A4T plan to extend its market. Consequently, the implemented solution will be further developed after the project in order to support future needs of commercial users. The business model for the tool and the bridge with other tools is a license model with the additional charge of maintenance and service fees.

3.21.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

In short term (1-2 years): Enhancement of Safety Architect tool with co-engineering solutions and develop possible collaboration with AMASS partners.

In long term (3-5 years): increase Safety Architect licence sales and get new customers in multi-concern assessment with co-engineering tool.

3.21.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

The IPR generated by AMASS is protected by the consortium agreement and may be licensed to other partners.

3.21.6 Exploitation activity update up to m24

The exploitation plan of AMASS project is to enhance the Safety Architect tool for Safety and Security co-analysis, and to interface Safety Architect with AMASS platform. This plan is complied with the tool

roadmap and the development of new features has started.

3.21.7 Challenges to market entry

The introduction of tool-based solutions, such as Safety and Security co-analysis, to customers can take some time. The challenge is to demonstrate the applicability of the tools in the customer environment with domain experts. A4T addresses this challenge by offering extensive tool supports and demonstrations.

3.22 Commisariat a L'energie Atomique et aux Energies Alternatives (CEA)

3.22.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

CEA LIST is a public research institute focused on the development of software and hardware technologies for complex systems in various domains (transport, energy, robotics, etc.).

In AMASS, CEA LIST focuses on two, out of its areas of expertise:

1. "Safety and Security by Design", covering system modelling, architecture design and analysis, including issues on safety, security and risk assessment, with regards to performance criteria.
2. "Safety and Security Verification", covering code analysis and code properties checking, in order to identify vulnerabilities in critical code via the production of correction evidences.

For CEA, the AMASS project represents an opportunity to increase the level of maturity and confidence in its offer on safety- and security-oriented design and verification tools, which are respectively Papyrus/Sophia and Frama-C. The expertise of CEA, already established in the field of critical industrial systems, will thus result strengthened. CEA aims at allowing non-experts of these issues to appropriate norms, standards, and reference practices.

The gained expertise in the project will help enforcing CEA involvement in standardization actions within the Object Management Group (OMG) organization, and extending its role in the Eclipse and Polarsys communities with its open-source strategy, by increasing the distribution of its tooling.

CEA has an important industrial transfer activity, and expects to strengthen its existing collaboration with A4T and increase the number of collaborations with industry actors and SME's, thanks to the AMASS project results.

Finally, CEA expects to improve its educational offer, on safety and security by design, for master and PhD students, as well as to propose new training services for companies.

3.22.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

- Transfer activity in favour of industries from various domains (railway, automotive, avionics, internet-of-things, manufacturing, etc.), by developing safety- and security-critical systems.
- Education activity, by proposing new courses and trainings on safety and security co-engineering for Universities, Engineering Schools, and Companies.

3.22.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

By working on the railway use case, CEA expects to develop a tight collaboration with ClearSy, by achieving a suitable tooling platform and methodology for the railway domain, from model to code together with Papyrus and Frama-C tools.

CEA has interest in developing collaboration with Tecnalia for developing a seamless integration between Papyrus and OpenCert platforms.

CEA will further take advantage from the fact that Papyrus is a building block of the AMASS Core platform to develop interfaces to cooperate with external tools, as proposed in the AMASS platform, and with other tools connected via OSLC/transformation mechanisms.

In order to increase the visibility of AMASS platform tooling and methodological results, CEA LIST will conduct dissemination activities in national and international conferences, exhibitions, and symposiums. Demonstrations at CEA internal and external industrial events will be a vehicle for advertising and building new industrial collaborations.

3.22.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

In 1-2 years, AMASS project will increase and demonstrate the maturity of CEA safety and security platform both on the design phase (Papyrus/Sophia) and verification phase (Frama-C).

In 3-5 years, through its industrial transfer activity and thanks to AMASS results, CEA expects to develop new direct collaborations with industrial partners in the railway domain, and to increase its number of collaborations in automotive and avionics domains.

Moreover, CEA expects to develop a partnership with Tecnalia partner on Safety and Security by design, by providing complementary and joint research, development, and consultancy services.

3.22.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

The IPR generated by AMASS is protected by consortium agreement. Non-Disclosure Agreements will be signed in case that we need to share confidential information with AMASS.

Papyrus modelling tool and Frama-C are released as open source. Specific add-ons to these tooling (e.g., for tackling safety, security aspects) will be released with specific licenses to interested partners.

3.22.6 Exploitation activity update up to m24

The integration of Papyrus tool and Opencert tool is intended to be adapted for exploitation in different industrial projects in the upcoming years.

The AMASS results regarding safety/security co-engineering process will be used as a basis for follow-up research projects.

3.22.7 Challenges to market entry

Compliance with security standards is still not a major issue for industrial sector while they are showing interested to comply with.

To use the AMASS results, the challenge will be to first teach the industrial how to include safety and security aspects in their products.

The technology and tools developed in AMASS ae numerous and can be very complex. The second challenge will be to adapt the framework to the specific needs of the industrial and make it easy to use.

3.23 Clearsy SAS (CLS)

3.23.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

The results from AMASS are expected to reduce the development effort and time-to-market for safety critical systems development. ClearSy develops for the railways (signalling systems). They will naturally improve our competitiveness on this market and we forecast a growth of our activity as a direct outcome of the project.

3.23.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

The results from AMASS are expected to contribute to the market of safety critical systems for the Railways (signalling systems). Potential customers are train manufacturers (Alstom, Bombardier, Siemens) and metro/main lines operating organisations (RATP, SNCF, Metro, etc.)

3.23.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

The results from AMASS are expected to improve our existing development cycle, by strengthening it locally (improved level of confidence of several technical/assurance aspects).

Experiments will be conducted a posteriori on past developments. Based on feedback collected, AMASS technologies are intended to be applied on on-going projects. Some technologies adjustments are expected to ease their integration into existing development flow.

3.23.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

The results from AMASS are expected to:
- provide a growth of 500k€ per year during their deployment (1-2 years)
- provide a growth of 1M€ per year during their exploitation (3-5 years)

3.23.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

As a SME, ClearSy rarely protects its assets with patents (some of our products are copied and we need to run faster than our competitors). The results of AMASS will be seamlessly integrated to our existing assets.

No specific collaboration is yet planned.

3.23.6 Exploitation activity update up to m24

Internal dissemination activities have been conducted. We have been studying internally how to apply the results of AMASS in some past projects.

3.23.7 Challenges to market entry

Not applicable yet.

3.24 Alten Sverige Aktiebolag (ALT)

3.24.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

The expectation from ALTEN on the project is to provide methods and tools for safety product development. Today the work is a very complex work from proving heavy load on all stakeholders of the work. The assurance procedure is also from a software perspective outdated with negative impact on the software product quality. Modern ways of working for software development are difficult to map to development of functional safe product.

The expectation is to see improvements affecting both methods and tools that manage "reuse" of components in a safety scenario.

Alten expects to update the software production line "Flord" with methods and tools that are able to handle the impact/dependability analysis, the relation of a specific change in the software and the consequently side effect.

The future Alten tool is the LBFarkle development. This tool will analyse the software and then generate a model. By using in parallel and incremental during development, the tool will be able to identify unforeseen impact.

The business goal is to reduce the actual design work of safety software development to be in line with the AMASS project goals. The specific extra overhead should define success not add extra work for the developer when adding a new feature in one existing software code. As a side effect, Alten also understands that the improved quality the tool will provide is valuable for any complex embedded software system.

3.24.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Alten is a global provider of technology and services for all markets. The major domains are Aerospace and Automotive. The result of AMASS is expected to be used when developing future customer products in the embedded market with functional safety requirements. The customer expectations of Alten are strongly focused on the skills and competence of Alten individual engineers. Alten success depends on its employees' ability to deliver customer satisfaction.

Alten examples for customers are Airbus, Volvo, Renault, Volkswagen, BMW, Ericsson, ALSTOM, Safran and Finmeccanica. The results from AMASS will make it possible to ensure that Alten is able to protect and possibly expand its market share on product development on market related to safety-assurance.

3.24.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

To understand the future market demand and potential of the competition is the rule of business success. The AMASS project will provide a strong package of methods and tools. The idea of AMASS is a very specific with a good understanding of the goals in relation to the State of Art.

The estimated market expectation on reliable and safe CPS is major. In near future, embedded product will have a major impact, including human interaction. To develop safe CPS with shorter TTM and with a lower cost for development, it will be mandatory important to those who want to compete. The Alten

scenario is in the context to be defined from a baseline of the requirements of relevant daily work. The idea is to fill the gap with new open source tools and adapt the methods. Furthermore, own tools will be improved with new technology from the project. Alten perspective in the AMASS project context is that Alten is a technology integrator. It is needed a high level of collaboration with the academic partners to insure valuable state of art knowledge of technology. It is also needed a high level of collaboration to understand the OEM roadmap, what is needed and how to reach the estimated goals. The project will also provide partnership of strategic nature.

Especially, Alten is focusing on Aerospace to address the exploitation plan.

The post project plans are to use the results from the project in relation to the above explained show case.

3.24.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

The estimated growth of Alten business due the AMASS project is based on new customers and already existing customers. The estimated increased growth due AMASS will major. The figures are always hard to define, but as Alten major business (the estimation is about 800 MEUR for 2016) is related on best performance in this market. Not all of this turnover will be affected on a short term; the estimation is that about 1MEUR will be affected and the growth there will be +10%. The conclusion is that AMASS will definitely have a significant long-term impact on the turnover. The estimation on the growth for the long term is that it will have an increase worth 10MEUR.

3.24.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

There are no plans to protect Alten IPR in the project. The LBFarkle tool to be developed will be protected as knowledge IPR and not a commercial product. Furthermore, the virtual IPR of gained goodwill both during the project and by using the results post the project, is not to be neglected.

In case the AMASS project decides to define a project common IPR (via open source or standard), Alten will support it.

3.24.6 Exploitation activity update up to m24

Alten provides dissemination activities to spread AMASS results and progress:
* Alten Innovation: The purpose of Alten Innovation is "To inspire and spread knowledge of innovative technological developments inside and outside ALTEN". The goal with this event is an easy to access, through many shorter events rather few larger ones.
* Alten TechDays: six times a year, half-day workshop on ongoing research activities.
* Training for employees on AMASS M&T (three sessions)
* Public information: Electronic Tidningen (A Swedish domain magazine with 40 000 signed readers), Title: "Cost efficient M&T for functional safety"
  Internal workshop AMASS: Case Study 3: "AltenCar"

3.24.7 Challenges to market entry

Not applicable yet.

3.25 Lange Aviation (LAN)

3.25.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

LAN expects to optimize the development life cycle of CPS and to reduce effort by using AMASS tools and methods. This will strengthen its position in order to achieve certification for own aviation products (costs, time to market).

3.25.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Aviation / Avionics.

3.25.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

LAN will analyse how the AMASS tool platform can help reducing effort in its own R&D department. If successful, the design and development process will be adapted to be supported by AMASS tools.

3.25.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

1-2 years: usage of first AMASS methodology and tools with sufficient maturity in our development process for avionic products.

3-5 years: usage of AMASS framework as a central tool platform in R&D.

3.25.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Usage of additional Non-Disclosure Agreements (NDA) if we need to cooperate with any partner more closely. LAN does not expect to invent patent-related results during the AMASS project.

3.25.6 Exploitation activity update up to m24

LAN intends to use automotive components, such as Infineon microcontrollers, inside the aircrafts we develop. We analysed how Commercial of the Shelf automotive components can be used in a cross-domain scenario for aviation, what artefacts may be reused for certification purpose and how AMASS Tools can support.

3.25.7 Challenges to market entry

AMASS tools must be easy to use in order to achieve high user acceptance.

3.26 Thales Italia SpA (THI)

3.26.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

Hardware and Software of all radio-navigation systems produced by THI are intrinsically safety-critical due to their key role in positioning techniques and in air traffic management (ATM) procedures. Methods and tools provided by AMASS will therefore increasingly improve, for the new THI products belonging to ATM family, all the involved processes: specification, design, implementation, validation, etc. This will boost the efficiency of the quality processes, will reduce costs and efforts, and will increase THI capabilities to face the challenges associated to the next-generation applications of radio-navigation beacons.

3.26.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.
- The ATM market, in the sector of landing, navigation, and surveillance systems
- The Air Forces market (landing and navigation systems)
- The Far East ATM market
- The Italian avionics market
- The Air Navigation Service Providers (ANSPs).

3.26.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

For THI the first step will consist in using the AMASS tools to complete a case study within AMASS, comparing the achievements with the results obtained, for similar developments, by using the previous-generation approach.

As a function of such achievements, the integration of AMASS tools and methods, into Thales development processes, will be considered.

3.26.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

THI invests about 5% of its turnover in R&D: AMASS will concur to keep stable the level of such investments, despite an ATM-market decline of 10-15% in the last 3 years.
For the next 5 years a market increase of about 5% per year is envisaged: the achievements, in terms of efficiency and technical competence, originated by AMASS, are expected to increase THI capabilities to face the challenges associated to such growth.

3.26.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

No disclosure of IP is planned and, in any case, IPR are protected by the Consortium Agreement.

Additional NDA will be signed in case confidential information needs to be shared with AMASS partners.

No patents, associated to THI activities in AMASS, are expected.

3.26.6 Exploitation activity update up to m24

Within our CS we exploited the tools provided by the AMASS platform to finalize or to address three main objectives:

- modelization of the software standard (for CNS/ATM systems) ED-109 objectives (to get evidences of the fulfilment of such objectives)
- verification and validation of the software modules (of the navaids beacon sub-component under development) interactions, to verify that the architecture is consistent (activity started in January 2018, through P1 tools)
- production of a Safety Analysis (FTA) of the sub-component under development (the activity will be addressed through the use of P1 or P2 tools)

The first objective covers *Compliance* and *Evidence Management*.

The second objective covers *System Component Specification* and *System Architecture Modelling for Assurance.*

The third objective covers *V&V-based Assurance Impact Assessment* and/or *Contract-Based Assurance Composition*.

3.26.7 Challenges to market entry

The approach to the market presents two main issues, each posing two conflicting aspects. The importance of safety requirements for ATM systems is increasing but the cost and the effort for a complete certification is becoming quite significant.

Consequently, the industry is equipping itself with methods, techniques and tools (to support the safety processes) which also imply high costs, and plenty of time to implement and stabilize such processes.

New tools and methods, even if advanced and provided with additional functionalities, require therefore some time and some pressure to replace settled tools and methods.

One of the challenges of our participation to AMASS is the possibility to compare the results achievable through its tools and the capabilities offered by tools already adopted by other company departments.

3.27 RISE Research Institutes of Sweden (SPS)

3.27.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

RISE is a research institute with the mission to generate value and sustainable development for business and society, by offering knowledge and help throughout the innovation chain. We do this by participating in publicly funded as well as contracted research with industry partners. We also perform product testing in our extensive testing facilities, and certification in many areas, including safety for the automotive and industrial automation domains.

In AMASS, RISE expects to strengthen its expertise in assurance and certification, especially regarding co-engineering and co-assessment of multiple concerns, and management of cybersecurity issues in safety-critical products. The expertise will be disseminated to industrial partners outside the AMASS project, in future collaborative research projects or other venues and partnerships, consistent with our role as innovation partner. The gained knowledge is also expected to represent useful input to the safety and cybersecurity standardization activities that we participate in, and as a base for improving and expanding our services in testing, certification, and training. Finally, we expect the participation in AMASS to lead to future collaborations with other consortium partners.

3.27.2 Markets/Customers

Please list the markets or customers where you intend to exploit the results from AMASS.

Our principal partners are OEMs, suppliers, and system integrators of safety-critical control systems, mainly within the automotive and industrial automation domains.

3.27.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps do you need to take? How will the technologies, partnerships develop during and after the project?

RISE will use different means to exploit the results, both during and after the project.

- Publishing and presenting results in both research and industry-oriented venues.
- Be active in preparing new project proposals, where AMASS results are used.
- Continuously integrate results and knowledge generated from the project in our testing, certification, and training services.
- Cooperation and interchange of results with other research projects RISE is concurrently involved in, such as national projects HoliSec (cybersecurity in the automotive domain), iTransit, and Chronos.

3.27.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

The commercial value for RISE is difficult to quantify as we are a research institute and not a for-profit business. The main expected result is to improve our dependable systems expertise and our services, enabling us to become a stronger innovation partner, and fulfil the goal of generating value to business and society. Short-term, these goals include providing the results to partners outside AMASS and bring results to new research projects. Long term, this also includes growth of the dependable systems research group, and of our testing, training and certification offerings.

3.27.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

We currently do not foresee that any IPR requiring protection will be generated because, as a general rule, research results will be published publicly. The consortium and grant agreement regulates many of the IPR issues among partners. If a need for IPR protection should arise, collaboration agreements with specific partners may be needed.

3.27.6 Exploitation activity update up to m24

RISE is currently looking for follow-up research projects related to the interplay between safety and security since unsolved questions remain in this area, and AMASS results will be very useful in this further work. For instance, we plan to use some of the knowledge and results from AMASS in the project ECSEL SECREDAS (Cyber Security for Cross Domain Reliable Dependable Automated Systems) than will begin in April 2018.

3.27.7 Challenges to market entry

There is still no consensus on how to handle cybersecurity for many types of CPS, i.e. for the automotive domain a suitable cybersecurity standard is still not in place, even though work is ongoing to fill this gap.

3.28 Comentor AB (COM)

3.28.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

COM delivers expert services within safety-critical embedded systems. We combine long experience from the automotive industry with a strong cross competence between software and systems engineering.

COM expects to strengthen its expertise, especially in co-engineering and co-assessment of multiple concerns as well as management of cybersecurity issues in safety-critical products. This expertise will be disseminated to our customers.

3.28.2 Markets/Customers

Please list the markets or customers which you intend to exploit the results from AMASS.

COM's principal customers are OEM's, suppliers, and system integrators of safety-critical embedded systems, mainly within the automotive and industrial automation domains.

3.28.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps d you need to take? How will the technologies, partnerships develop during and after the project?

COM will use different means to exploit the results, both during and after the project:
- Publishing and presenting results in both research and industry-oriented venues.
- Continuously integrating results and knowledge, as generated by the project, in our expertise services.
- Participation in regional and international safety and security networks.

3.28.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

COM expects a growth in services related to safety and security, and as a first step to expand the business from mainly safety expert services to also include more security and multiple concern services.

3.28.5 The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

Comentor mainly anticipates that product results will be publicly available. COM has not yet identified a need to protect specific IPR.

3.28.6 Exploitation activity update up to m24

Comentor makes use of the findings and knowledge found in our participation in the AMASS project when working with Automotive OEMs and Automotive suppliers. Currently the topic of Functional Safety and Cyber Security is very much in vogue. Work with building up de facto processes for this is ongoing in lack of established standards.

Participation in ICES Security Competence Group, Associated Partner in VICTA cyber security, and

participation in regional ISO work.

3.28.7 Challenges to market entry

The challenges now are mainly to create a thorough understanding for cyber security problems and what can and shall be done to them. Many speak about cyber security, but few people have a deeper understanding of the implications in the Automotive domain.

3.29 Alstom Transport SA (ALS)

3.29.1 Business Idea/Product & Services

What does your organization expect to achieve with AMASS? How will this benefit your organization? Examples might include: new products, new services, joint/partnerships, strengthening position in market.

The results from the AMASS project are expected to have a beneficial impact on Alstom activities regarding two main aspects.

First, the Alstom Case Study will help improve the existing development and validation process of the Automatic Train Control (ATC) system of the Urbalis 400 Communication-Based Train Control solution. Indeed, by introducing the use of formal methods in this process, which are exhaustive and unfalsifiable mathematically-based techniques, the level of confidence in the safety demonstration can be increased. When developing a new baseline (product evolution), the impact analysis will be made easier with the use of formal development and it will ensure the early validation of safety related requirements of the system.

Secondly, the AMASS tools and platform are expected to help create an assurance project guidance that will facilitate the safety demonstration of the ATC.

These two aspects combined will improve Alstom's competitiveness on the market as the company will be able to provide safer systems with shorter delays.

3.29.2 Markets/Customers

Please list the markets or customers which you intend to exploit the results from AMASS.

The results from AMASS are expected to be directly exploitable in the Urbalis 400 ATC product. Therefore, all potential customers for the Urbalis 400 CBTC solution are targeted. This solution is already in service on 39 metro lines and has been ordered for a total of 76 lines throughout the world today, but this number is still expected to grow in the following months. The results from AMASS could then be expended to other product lines in order to broaden the spectrum of potential customers.

3.29.3 Participant Exploitation Plan

How can you turn your ideas into reality? What steps d you need to take? How will the technologies, partnerships develop during and after the project?

After implementing the full workflow of the Alstom Case Study, the results will be analysed in order to provide an estimation of the costs reduction regarding the development and validation of new ATC baselines. Should these results be positive, the goal will be to integrate the AMASS tools and methods in all ATC development activities and systematize their use.

3.29.4 Commercial value

Please give estimated commercial values or estimated growth in 1-2 years and 3-5 years.

The main commercial value of the AMASS project for Alstom will stem from the early validation and verification of the safety requirements of the system. The use of formal development implies that safety properties are proven to be satisfied at each step (refinement) of the design process. It is therefore highly unlikely that safety related issues should be detected after the product development is finished. In case of a product evolution (that is to say a new baseline of the product), the use of formal methods ensures that the impact analysis does not have any gaps. This ensures a reduction of the costs related to the correction of the product after the end of the development that is estimated at about 30% of the global costs today.

3.29.5   The means by which IPR will be protected

How would you intend to protect IPR generated by AMASS? I.e., patent, collaboration agreement or else.

In order to protect IPR generated by the AMASS project, Alstom will sign Non-disclosure Agreements when sharing confidential information is required.

3.29.6   Exploitation activity update up to m24

We are still conducting the Alstom Case Study which will be considered as a proof of concept for the integration of the AMASS project results in new projects.

3.29.7   Challenges to market entry

In order to be able to use the AMASS project results, the main challenge will be to ensure a high acceptance among users of the new validation process.

4. Conclusions

Market trends identified in D8.2 [1] are all growing in a positive trend, which represents a *level of concern* to the consortium, i.e. they might impact on the cost or influence on product or service direction. "New development practices" and "Automation of labour intensive activities and intelligent control" are on top of the list of these trends.

Although there are many concerns, AMASS partners are able to minimise the impact or utilise their expertise, by using or developing model-based techniques, formal methods, continuous integration, controlled flexibility and "Agile" methodology. Many examples of how each partner deals with the *concerns* are in the individual exploitation plan and update. These plans and updates have shown that the AMASS partners are able to maximise the impact of the research funding, i.e. to create more products or services and teaching courses.

Abbreviations and Definitions

API	Application Programming Interface
ADAS	Advanced Driver Assistance Systems
AOCS	Attitude and Orbit Control Systems
ARP	Aerospace Recommended Practice
ARTEMIS	ARTEMIS Industry Association is the association for actors in Embedded Intelligent Systems within Europe
ATC	Automatic Train Control
ATM	Air Traffic Management
AUTOSAR	AUTomotive Open System ARchitecture
CA	Consortium Agreement
CMMI	Capability Maturity Model Integration
COTS	Commercial Off-The-Shelf
CPS	Cyber-Physical Systems
E/E	Electrical/Electronic
EC	European Commission
ECSEL	Electronic Components and Systems for European Leadership
EPL	Eclipse Public License
ERTMS/ETCS	European Rail Traffic Management Systems / XXXX
ESA	European Space Agency
FAA	Federal Aviation Administration
FPGA	Field Programmable Gate Array
GDP	Gross domestic product
HW	Hardware
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMA	Integrated Modular Avionics
INCOSE	International Council on Systems Engineering
IoT	Internet Of Things
IP	Intellectual property
IPR	Intellectual property rights
ISO	International Organization for Standardization
JU	Joint Undertaking
LSIS	Laboratoire des Sciences de l'Information et des Systèmes
MARTE	Modeling and Analysis of Real Time and Embedded systems
NDA	Non-Disclosure Agreement
OEM	Original Equipment Manufacturer
OMG	Object Management Group
OO	Object Oriented
OSLC	Open Services for Lifecycle Collaboration
PLC	Programmable Logic Controller
ROI	Return of Investment
RTU	Remote Terminal Unit
SLOC	Source lines of code

SME	Small and Medium-sized Enterprise
SysML	Systems Modelling Language
TRL	Technology Readiness Level
TTM	Time to Market
V2I	Vehicle to Infrastructure
V2V	Vehicle-to-Vehicle
WP	Work Package

References

[1]   AMASS project: D8.2 - Exploitation Plans and Initial Market Megatrends Analysis (a). November 2016.

[2]   AMASS project: D8.4 - Exploitation Results and Final Market Megatrends Analysis. 2018.

[3]   Gartner: Application Development Software, 2012

ECSEL: Multiannual Strategic Plan, 2015

"Cyber-Physical Systems: Uplifting Europe's Innovation Capacity", K. Rouhana

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RnR Market Research: Smart Factory Market, 2014

CyPhERS project: Integrated CPS Research Agenda and Recommendations for Action, 2015

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ARTEMIS: Press Release Cyber-Physical Systems, 2015

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Shea & Company: Software Development Tools Competitive Landscape and Market Trends, May 2015

Gov2020: Cyber-physical systems, 2014

Appendix A: Domain specific market trend analysis survey

The template of the market trend analysis survey is shown in the following pages.

[AMASS]D8.3 Domain specific market trend analysis
*Required

1. **Email address** *

   _____

Basic information

2. **Which industry your company is working in? If multiple industries, please submit a separate form for each.**
   Mark only one oval.

   ⬭ Automotive

   ⬭ Railway

   ⬭ Space

   ⬭ Aerospace

   ⬭ Other: _____

Time to market & competitiveness

In an increasingly competitive market, with an ever-increasing speed of innovation, partners must pursue easier, faster, and more efficient ways to build and assure safety and security of critical systems to remain competitive. A key part of this relies on fast and reusable certification.

3. **How applicable is this trend to your organisation?** *
   Mark only one oval.

	1	2	3	4	5	
Not applicable	⬭	⬭	⬭	⬭	⬭	Highly applicable

4. **Do you see a positive or negative direction for this trend? Or no change?** *
   Mark only one oval.

	1	2	3	
Negative	⬭	⬭	⬭	Positive

5. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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6. **Any other comments on this trend?**

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Reuse challenges

The trend and need is to increase reuse-geared development and certification process as a major means to reduce costs. As noted above, the challenge with reuse is not necessarily with the reuse itself but with reuse of certification and safety artefacts, especially where artefacts are cross-domain. A safety artefact for aerospace might not be able to be applied directly "as is" in the railway or automotive domains for example.

7. **How applicable is this trend to your organisation?** *

Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

8. **Do you see a positive or negative direction for this trend? Or no change?** *

Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

9. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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10. **Any other comments on this trend?**

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Open solutions

There is a trend to move from closed, proprietary systems to more open CPS. Open here includes: open source, open interfaces/API, and collaborative solutions from multiple partners integrated together.

11. **How applicable is this trend to your organisation?** *
Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

12. **Do you see a positive or negative direction for this trend? Or no change?** *
Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

13. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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14. **Any other comments on this trend?**

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Security

Combined safety and security engineering methods are needed and being developed. One challenge is when safety and security are in conflict. Safety is often achieved by simplicity, whereas security is often achieved by layers of complexity.

15. **How applicable is this trend to your organisation?** *
Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

16. **Do you see a positive or negative direction for this trend? Or no change?** *
Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

17. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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18. **Any other comments on this trend?**

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Rising complexity

There is an increased recognition of risks due to the increasing complexity: larger code bases, more cooperating systems, and distributed/multi-core systems are simply harder to get right, and to justify their safety too.

19. **How applicable is this trend to your organisation?** *

Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

20. **Do you see a positive or negative direction for this trend? Or no change?** *

Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

21. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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22. **Any other comments on this trend?**

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New development practices

The software development process and practices are developing. New methodologies like Agile (common in many industries) are gradually making their own way into safety-critical software development. Model-based development techniques, formal methods, object-orientation, and new simulation techniques are also increasing and are having an impact on the way we deal with reliable software in safety-critical systems.

23. **How applicable is this trend to your organisation?** *

Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

24. **Do you see a positive or negative direction for this trend? Or no change?** *

Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

25. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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26. **Any other comments on this trend?**

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Automation of labour intensive activities and intelligent control

The software development process and practices are developing. New methodologies like Agile (common in many industries) are gradually making their own way into safety-critical software development. Model-based development techniques, formal methods, object-orientation, and new simulation techniques are also increasing and are having an impact on the way we deal with reliable software in safety-critical systems.

27. **How applicable is this trend to your organisation?** *
Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

28. **Do you see a positive or negative direction for this trend? Or no change?** *
Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

29. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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30. **Any other comments on this trend?**

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Increasing product lifespans

Given the rate at which technology is developing, tools, methods and documentation that are used for the original product need to be available throughout the product lifespan. This is so that incremental development and bug-fixes, for example, can be performed cost effectively.

31. **How applicable is this trend to your organisation?** *
Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

32. **Do you see a positive or negative direction for this trend? Or no change?** *
Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

33. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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34. **Any other comments on this trend?**

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Cross-domain and cross-country standardization

To handle increased product complexity, with no extra effort, there are moves by, for example, the aerospace certification authorities, including the FAA, under "overarching properties" to further streamline the certification, and ideally to better harmonise practices between different airworthiness authorities - especially as there's now more commercial aviation development in Russia, China, and Japan. Similar harmonization and strategic moves may be taking place in other domains.

35. **How applicable is this trend to your organisation?** *
   Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

36. **Do you see a positive or negative direction for this trend? Or no change?** *
   Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

37. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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38. **Any other comments on this trend?**

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Changes in certification and safety

There is an increased focus on system-level safety risk management, allowing for reduction in regulatory oversight when data exist showing that risks are low. Meanwhile, civil standards are increasingly being applied to military systems too.

39. **How applicable is this trend to your organisation?** *
   Mark only one oval.

	1	2	3	4	5	
Not applicable	◯	◯	◯	◯	◯	Highly applicable

40. **Do you see a positive or negative direction for this trend? Or no change?** *
   Mark only one oval.

	1	2	3	
Negative	◯	◯	◯	Positive

41. **Please give an example and a brief description on how your company is adapting/preventing impact to this trend.** *

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42. **Any other comments on this trend?**

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