

OSCCAR: FUTURE OCCUPANT SAFETY FOR CRASHES IN CARS



Draft Exploitation Plan

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1 EXECUTIVE SUMMARY

The draft plan for exploitation activities summarizes the first draft strategy related to the dissemination and exploitation of the project results after one-year project run time. A preliminary draft plan for the exploitation and dissemination of results was already part of the project proposal [1] and is described in section 3.7. As defined by the EC (European Commission) this preliminary plan needs to be updated during the implementation of the project, which in a first step, is done with this deliverable.

The report at hand is a compilation of basic processes regarding approval and reporting of exploitation activities within OSCCAR project. The purpose of this report is to outline basic exploitation activities that beneficiaries plan to carry out during the project with the purpose of allowing dissemination and use of the foreground at the end of the project in support of an optimal exploitation.

The document details each project partner's plans for exploiting OSCCAR results in their field of work. Besides their plans and measures for exploitation the partners describe their markets, market opportunities and competitors as well as their position in the academic environment, research and educational opportunities, as far as relevant (see section 3.7). The document also contains a list of exploitable foreground (see Annex A) that has been specified by OSCCAR partners and has already been added to the related list [4] on OSCCAR SharePoint.

The draft exploitation plan will evolve and become more precise and substantial during the lifespan of the project and will then reflect the exploitation of the generated results. The initial plans delivered in this document will be updated based on technical project progress and resulting new exploitable foreground. Exploitation and dissemination activities (patents, publications, exploitable foreground) for exploiting results are updated continuously. Concrete action on exploitation of results will be described in the follow-up document (D6.5 Final exploitation plan).

Keywords: dissemination, result transfer, industrialization/commercialization, target audience, market opportunities exploitation.

2 OBJECTIVES

In this section the overall goals of OSCCAR project and specific objectives regarding exploitation and dissemination are detailed.

The overall objectives of OSCCAR project are

- Understanding future accident scenarios involving passenger cars
- Demonstration of new advance occupant protection principles and concepts
- Contribution to the development of diverse, omnidirectional biofidelic and robust HBMs
- Establishment of an integrate, virtual framework [1]

The following two goals of OSCCAR project are directly linked to exploitation and dissemination:

- **Contribution to the standardization of virtual testing procedures**

Objectives in this respect are to provide recommendations for future virtual crash test guidelines to demonstrate possible regulation options for legal entities (such as the European Commission) and testing organizations (such as The European New Car Assessment Programme). Harmonized injury criteria and validation procedures with respect to HBM's pre-crash and in-crash biofidelity will be defined.

- **Development of an exploitation strategy towards large scale implementation of virtual testing methods**

The benefits of widely harmonized and standardized virtual methods for complex testing will be demonstrated. This enables the development and homologation of advanced protection systems using HBMs, thereby leading to safety improvements for all occupants. Furthermore, dissemination of results to the European and international research community as well as regulatory and consumer test organizations in an open access format, i.e. publication of guidelines, input for future standards and ready-to-use download material, will be done.

To reach these goals workpackage 6 Project communication, dissemination and exploitation will support by focusing on an efficient communication within the consortium and external of OSCCAR and by preparing dissemination activities and executing exploitation and dissemination actions.


This report refers to Task 6.2 Exploitation of results. The objectives of task 6.2 according to the description of action in the Grant Agreement No 768947 [1] within OSCCAR project are

- Adapt exploitation of project results to partners individual interests
- Analysing of the project outcomes (see the objectives above) with regard to their future exploitation possibility along the different exploitation paths:
 - Enhance best practice by spreading results
 - Commercialisation: creation of new products or enhancement of existing ones
 - Sustainability: keep project results visible and available for access
- Exploitable foreground

The main goal of exploitation activities within OSCCAR project is to make OSCCAR a successful and sustainable project. An adequate exploitation strategy is very important for the whole project as already described in the proposal [1]. All dissemination activities are a beneficial support to the related exploitation activities on individual partner level.

3 DESCRIPTION OF WORK

OSCCAR Draft Exploitation Plan at hand describes – at an early project stage – the overarching exploitation plans of all partners in the consortium. It takes the different approaches for industrial and academic research partners into consideration. Interaction and communication with all consortium partners and interaction with all workpackages are necessary to successfully disseminate the results of the project. To get a first overview on exploitation activities on partner level, all partners were asked to provide input for this report by detailing their planned exploitation activities within OSCCAR project. For this purpose, a template was created and all partners were asked to fill it in, see Figure 1.



Partner Exploitation Input for D6.3

Exploitation of OSCCAR foreground - partner level

Partner Name:

Relevant Market (industrial partners) Relevant position in the academic environment (academic/research partners) <ul style="list-style-type: none"> • .. • .. • ..
Market Opportunities (industrial partners) Research and educational opportunities (academic/research partners) <ul style="list-style-type: none"> • .. • .. • ..
Competitor description (if applicable) <ul style="list-style-type: none"> • .. • .. • ..
Plans and measures for exploitation <ul style="list-style-type: none"> • .. • .. • ..
Target audience <ul style="list-style-type: none"> • .. • .. • ..

Figure 1 Template for exploitation of OSCCAR foreground on partner level

To make sure to present an overall picture of exploitation and dissemination at this stage of the project, all partners were also asked to update all lists regarding exploitation and dissemination. These lists are described in section 3.4.

To steer exploitation and dissemination activities formal processes regarding exploitation and dissemination such as approval and reporting processes, and according responsibilities were implemented and are detailed in the following chapters. Legal issues like Intellectual Property Rights (IPR), the use of background and foreground and their regulation within the consortium are explained in section 3.6.

Subsequently the report also describes a credible longer-term path to deliver OSCCAR results and exploitable foreground to the market. The plan is proportional to the scale and ambition of the project and contains measures to be implemented both during and – to a major degree – after the project.

To ensure effective exploitation and dissemination of OSCCAR results the definition of both terms between industrial and academic research partners has to be clear as they are following different strategies. The following terms have been defined:

Dissemination

- The transfer of project results and achievements to target audiences with the objective to maximise the impact of the project.
- Every form of dissemination is aimed at preparing and supporting further exploitation of the project results. Dissemination channels which are directed to stakeholders, expert audiences and potential customers, such as website, newsletter and press releases have top priority as they will have a direct influence on the overall impact of the OSCCAR project.

Exploitation

- Utilization of the project results in form of an activity, which is part of the core business of the respective partner.

For example: While publishing a scientific paper is a measure of exploitation for a research centre like VIF, it constitutes a measure of dissemination for example for an industrial research partner such as Volvo or VW.

3.1 Reporting and Context

There are four deliverables dedicated to OSCCAR exploitation and dissemination strategy.

Deliverable	Title	Date
D6.1	Short description of the setup of the dissemination tools	M6
D6.2	Dissemination plan	M9
D6.3	Draft Exploitation Plan	M12
D6.5	Final Exploitation Plan	M36

Table 1 Planned exploitation documents of results and achievements

The Draft Exploitation Plan D6.3 will be continuously adapted and yield the Final Exploitation plan D6.5 to best adapt to both project results / achievements.

3.2 OSCCAR Stakeholders

OSCCAR stakeholder will substantially promote OSCCAR project and its goals and support dissemination and exploitation activities. The core of OSCCAR stakeholders in the field of automotive safety are the members of the consortium itself. The OSCCAR consortium comprises all key stakeholders needed to develop, demonstrate and market the planned technologies. The large and balanced international consortium includes OEMs, Tier1 suppliers, simulation software supplier, research and development companies, regulatory and standardization bodies, as well as universities.

Summarised, the wider OSCCAR Stakeholders consist of:

- Customers, consumers and users
- International research community in the area of vehicle safety and beyond
- Professionals & students
- (Public) Authorities
- Regulatory and standardization bodies
- Automotive industry
- OEMs, supplier and software vendors
- European Commission
- Collaboration platforms
- International partnerships
- Public audience including authorities and consumer rating agencies

In section 3.8. each partner has described its specific target groups in detail.

3.3 Approval Process for Exploitation

The general approval process for exploitation and dissemination activities is described in the OSCCAR Project Handbook [2], chapter 8 *Rules for dissemination and exploitation*. According to the Grant Agreement [1] each participant must use its own foreground (or ensure that it is used) and disseminate it as swiftly as possible. All partners are invited to perform dissemination and exploitation activities. It is necessary that these activities include the OSCCAR acknowledgement: “OSCCAR has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 768947”, as well as the EU emblem. All activities must be reported in detail in the lists described in section 3.4.

3.4 Reporting of Exploitation Activities

According to the Grant Agreement [1] “...each beneficiary must - as soon as possible - ‘disseminate’ its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium)”. It is also important to note that “Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.” [1].

Exploitation activities have to be reported via a database on OSCCAR Sharepoint. Each partner needs to report exploitable foreground [4] and IP protection measures pursued such as patents or trademarks [5]. The lists need to be maintained continuously to show the impact of OSCCAR and to ensure proper handling of the rules stated in the consortium agreement [8] and feed the lists needed for the project reporting.

Similarly planned and done dissemination activities [7] (articles, press information, conferences, workshops, lectures, trainings, social media, etc.) are reported continuously in a list on OSCCAR Sharepoint.

Publications as an important part of exploitation activities have to be reported on OSCCAR Sharepoint [6] as well. The general approval process for publications is described in the OSCCAR Project Management Handbook [2].

3.5 Steering/Responsibilities for Exploitation Activities

First, it has been clearly agreed among the OSCCAR partners that all project partners have to take care about exploitation by using existing communication channels for individual communication of the OSCCAR project on relevant platforms (i.e. conferences, publications, events, etc.) as well as exploitation on OEM/Tier supplier/scientific/service provider level.

Industrial research partners focus on market / economic interests including key results / technologies of the project. Scientific partners focus on mainly scientific and educational interests such as scientific papers, conference contributions, education & trainings, follow up research, etc.

The project coordinator takes care for preparative exploitation activities, giving support to all partners in the consortium in this respect. Also, activities like presenting the overall project, e.g. at EU TRA fair or “advertising” papers like the ATZ paper are important tasks of the project coordinator. Major changes in the dissemination and exploitation strategy need to be approved by the General Assembly.

The OSCCAR Executive Board (consisting of the WP leaders, project coordinator) keeps track of dissemination and exploitation activities. To keep the Executive Board up to date dissemination and exploitation are key topics in the monthly web meetings.

3.6 Intellectual Property Rights Management (IPR)

All partners agreed upon main guidelines concerning IPR management and responsible bodies, which subsequently have been detailed in the OSCCAR Consortium Agreement [8].

- Access rights to background and results for implementation, for exploitation purposes and for affiliates;
- Background, and specific limitations and/or conditions for implementation (if any) and for exploitation;
- Results, (joint) ownership and transfer of results;
- Publications, procedures for dissemination of results and research data and open access [8].

Regarding exploitation activities the Grant Agreement [1] defined: *Each beneficiary must – up to four years after the period set out in Article 3 – take measures aiming to ensure exploitation of its results (either directly or indirectly), in particular through transfer or licensing by:*

- *Using them in further research activities,*

- *Developing, creating or marketing a product or process,*
- *Creating and providing service, or*
- *Using them in standardization activities [1]*

3.7 Exploitation Plan

In this section the exploitation of project results as well as the draft exploitation plans of the OSCCAR consortium are described. Details on the impact and future plans for exploitation of OSCCAR project are shown. Already gained exploitable foreground can be found in Annex A. Due to its early stage of the project, the progress on exploitation is in its beginnings.

A draft plan for the exploitation of project results, a roadmap toward full implementation in 2021, OSCCAR position in this respect and the subsequent steps, was developed and included in the Description of Action (DoA) [1], see Figure 2.

As exploitation and dissemination are an integral part of the European research and innovation funding, certain obligations already arise at the project proposal stage. It is specified that project proposals shall include a draft plan for the exploitation and dissemination of results. *“Under Horizon 2020, an exploitation and dissemination plan needs to incorporate detailed exploitation and dissemination strategies, clearly defining how research results will be implemented and how they will impact on the market, on future developments and policy making”* [10]. The main aspects of this first draft plan included in the Description of Work of OSCCAR project for the exploitation and dissemination of results is shown in the following.

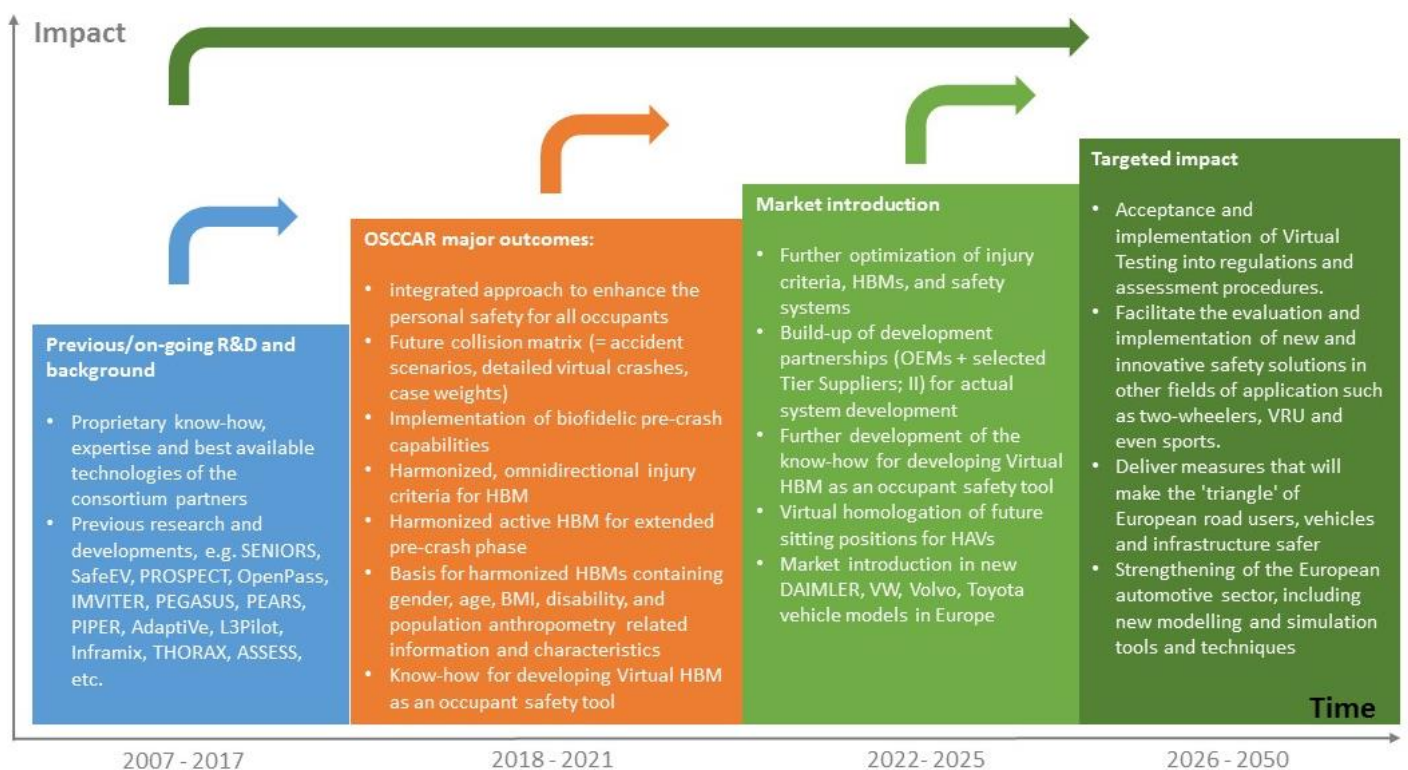


Figure 2 OSCCAR long term exploitation and impact plan [1]

Figure 2 shows that OSCCAR (during the project period 2018-2021) will deliver an integrated approach to enhance the personal safety for future occupants involved in future vehicle accidents.

OSCCAR will contribute to HBM development also considering the population heterogeneity (age, gender, anthropometry, BMI, disability).

Long term market rollout is enabled by the consortium consisting of four leading automobile manufacturers (Daimler AG, Toyota Motor Europe MV, Volvo Personvagnar AB and Volkswagen AG), three Tier 1 suppliers (Autoliv Development AB, Robert Bosch GmbH and ZF Friedrichshafen AG) paired with three dedicated software suppliers (ESI Group, Siemens Industry Software NV, Siemens Industry Software and Services B.V.) and complemented with leading European universities, research and engineering organisations as well as one university and one research center from China (Applus Idiada, Chalmers Tekniska Hoegskola AB, Rheinisch-Westfälische Technische Hochschule Aachen, Ludwig-Maximilians-Universität München, Universität de Strasbourg, Universitaet Stuttgart, Technische Universität Graz, Bundesanstalt für Straßenwesen, Kompetenzzentrum – Das Virtuelle Fahrzeug, Tsinghua University, China Automotive Technology and Research Center). Since the OSCCAR consortium comprises all key stakeholders needed to develop, demonstrate and market the technology in the automotivesector, there is a legitimate interest in bringing the technologies to mass production.

The OSCCAR project results will also have impact in boosting the competitiveness of the European automotive industry and thus eventually creating new high-value jobs within the sector. Addressing vehicle safety will create jobs at universities and institutes developing the new competences needed for the research as well as industrial work.

The innovation safety technologies components, systems, control systems and testing equipment are important pillars of the exploitation plan and the way to achieve maximum impact. It is the full intention that they will also be applied or implemented by other OEMs. The foreseen routes to deliver the innovations to the market by the various types of partners are presented in Figure 3.

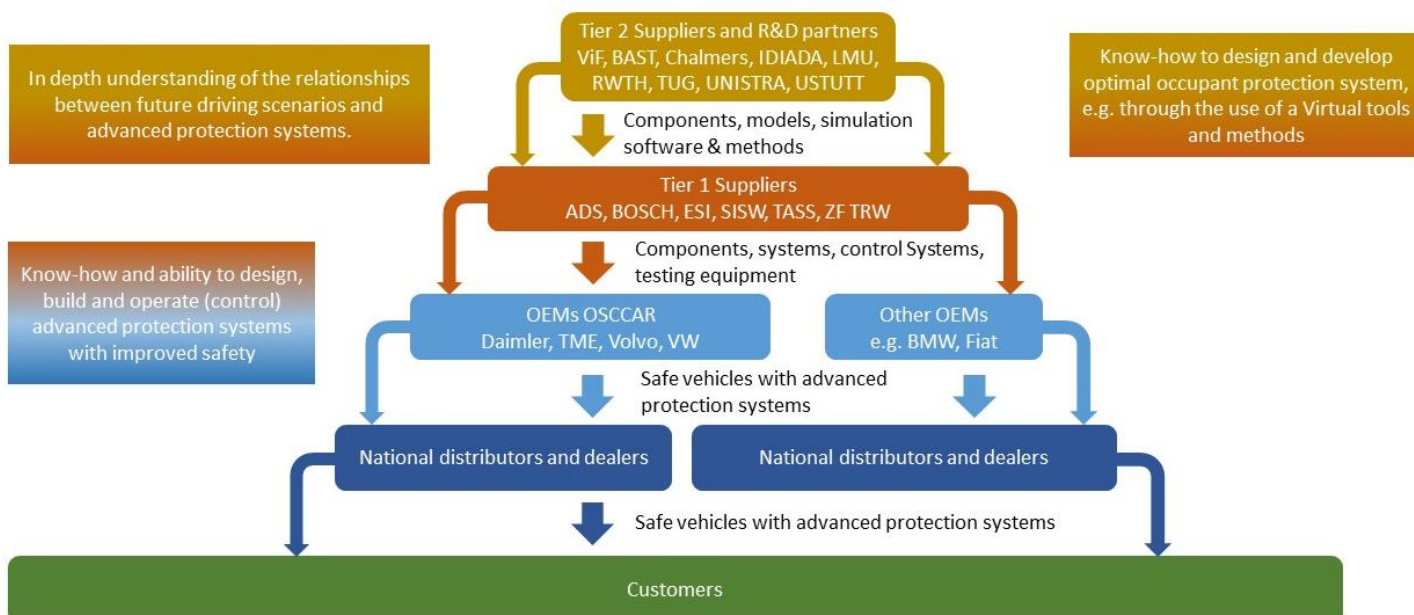


Figure 3 Supply chain in the automotive sector

The supply chain describes the OSCCAR stakeholders (see also section 3.2). Core of the stakeholders are the members of the consortium itself. It is important to use the organizations of the partners involved in the project for dissemination of the project results. In addition, it is especially

important in large enterprises to raise the awareness also in other divisions or departments. This way partners can bring in their own communication channels and become multipliers of OSCCAR.

3.8 Partner-specific routes to Exploitation

Each partner has vital interest to exploit OSCCAR results and achievements on individual level. Thus, the current section provides a comprehensive description of individual exploitation plans for all OSCCAR partners. It takes into consideration their generally different focus of exploitation addressing different “markets”.

Therefore, besides their plans and measures for exploitation, a) industrial research partners describe their relevant markets, market opportunities and competitors, and b) academic / research partners describe their relevant position in the academic environment, research and educational opportunities. All partners clarify the target audience (potential users and stakeholder) of their exploitation activities on partner level.

3.8.1 KOMPETENZZENTRUM - DAS VIRTUELLE FAHRZEUG, FORSCHUNGSGESELLSCHAFT MBH (ViF)

VIRTUAL VEHICLE Research Center (ViF) has positioned itself as an independent, international platform for research and development in the automotive industry. It addresses the gap between academic research and the needs of industrial R&D departments.

Cutting-edge research and technology development is essential, and simulation is a key opening completely new possibilities. VIRTUAL VEHICLE provides a close linkage of numerical simulation and experimental validation and offers comprehensive system simulation up to the complete vehicle. Its project landscape ranges from thorough investigation of individual technologies up to combining various individual aspects to create a comprehensive vehicle perspective.

Relevant position in the academic environment

ViF aims at establishing an integrated and systematic approach in order to exploit the full optimization potential in all areas of vehicle development together with numerous national and international scientific and industrial partners. VIRTUAL VEHICLE is currently working in close collaboration with over 80 industrial partners and, in addition to our principle scientific partner, Graz University of Technology, more than 40 international university research institutes. As the main shareholder the Graz University of Technology (TUG) connects ViF to more than 20 institutes.

ViF has many years of experience in developing passive and active safety simulation methods for, amongst others, ATDs, HBMs, VRUs, restraint systems, full vehicle structures and component testing, test bench development and integrated simulation and effectiveness assessment.

VIRTUAL VEHICLE Research Center is funded within the COMET – Competence Centers for Excellent Technologies. The COMET K2 program provides the basis for funded research activities.

Research and educational opportunities

ViF is embedded in Graz University of Technology and hence, is involved in teaching activities, student projects, Bachelor and Master theses. The university offers special courses on vehicle safety, applied simulation, crash testing, virtual product development, etc. Several employees at ViF are engaged in teaching activities at Graz University of Technology fostering the dissemination of OSCCAR research and the development of results to students and possible future researchers in upcoming European projects.

Plans and measures for exploitation

Virtual Vehicle strategic interest lies amongst others in virtual approval and acceptability, one key aspect of OSCCAR. ViF is strongly interested to extend its expertise in active human body modelling. It is strongly involved in developing a standardized test procedure for occupant kinematic assessment during the pre-crash phase for new seating position and model independent controller development and the implementation for active HBM applications. It will also extend its expertise on continuous occupant assessment and co-simulation know-how and on effectiveness simulation and assessment. Key research areas, within OSCCAR and also the COMET program are virtual approval, validation and acceptability of numerical models, in this case of numerical simulation including HBMs, are.

Exploitation of results aims mainly at promoting the project outcomes by means of presentations at related events, and publications to scientific journals, as well as on-line and paper magazines.

Target audience

- OSCCAR consortium
- International vehicle safety community and beyond
- International partnerships
- Researcher and Experts
- OEMs, supplier and software vendors

3.8.2 AUTOLIV DEVELOPMENT AB (ADS)

Autoliv is the worldwide leader in automotive safety, with sales to all major car manufacturers. Autoliv products save over 30,000 lives each year. Autoliv develops, manufacture and market protective systems, such as airbags, seatbelts, steering wheels and pedestrian protection systems for the vehicles of today and tomorrow. Autolive current portfolio provides a foundation for vehicles with higher autonomy. Autoliv solutions for autonomous driving are a natural evolution of our safety products, positioning Autoliv at the forefront of innovation. Autoliv participates in research collaborations that include universities and research institutes with the aim to improve traffic safety.

Relevant Market

- Autoliv's advanced omnidirectional human body models simulate real human bodies containing bones, muscles and organs. Autoliv can depict the characteristics of a diverse population of differing age, sex, weight and height. This allows us to study injury mechanisms on a very detailed level, which is necessary for such areas as upcoming new restraint systems for automated driving.
- New ways of evaluating crashes can be achieved with virtual methods and human body models. New types of impact conditions together with biofidelic human body models could demonstrate a need for new and improved occupant restraints.

Market Opportunities

- Only virtual assessment may be viable to asses new complex load cases in the future vehicles. Virtual assessment might be specifically suitable for autonomous driving vehicles with new interior architectures allowing for new sitting positions.
- Virtual testing and evaluation of new complex crash configurations has the potential to show the benefits of and the need for new occupant restraint systems.

Competitor description

- Automotive safety suppliers

Plans and measures for exploitation

- Predicted autonomous driving future crash configurations
- Improved human body models
- Virtual assessment methods
- Improved generic autonomous driving interior safety protection principles

Target audience

- New car assessment programme (NCAP) and legalisation/regulators
- Automotive industry

3.8.3 BUNDESANSTALT FÜR STRAßENWESEN (BAST)

BAST is a research institute in the department of the Federal Ministry of Transport and Digital Infrastructure Germany. Each year around 300 own research projects are conducted, and more than 300 research projects carried out by external scientists are supervised. Furthermore, BAST is actively participating in numerous national and international committees (e.g. GSPR, [EU MDR General Safety and Performance Requirements], Euro NCAP [The European New Car Assessment Programme]).

Relevant position in the academic environment

One of BAST's main objectives is the reduction of fatalities on German roads. Therefore, research is focussed on the improvement of regulations, safety protocols and testing equipment.

Research and educational opportunities

- Development of combined testing procedures for the safety assessment of future vehicles using ATD- and HBM-models
- Development of testing methodologies for HAV
- Identification of deficiencies and open questions for future projects

Plans and measures for exploitation

- Publications in journals and at conferences (e.g. IRCOBI, ESV)
- Application of results in future internal and cooperative research projects
- Consultation of the Federal Ministry of Transport and Digital Infrastructure and contribution to regulatory groups (e.g. GRSP) and consumer testing programs (e.g. Euro NCAP)
- Internal dissemination

Target audience

- German government (Federal Ministry of Transport)
- European Commission
- Regulatory and standardization bodies
- Euro NCAP
- International research community in the area of vehicle safety

3.8.4 ROBERT BOSCH GMBH (BOSCH)

Relevant Market

- Occupant safety architecture for future automated vehicles – gathering, processing and fusion of multiple data sources for crash decision making.
- Occupant safety in future crash scenarios in combination with a new vehicle interior, e.g. including new seating positions, new sitting postures, new interior use cases.
- Identify relevant pre-crash functions to increase occupant safety.
- Advanced assessment methodologies, i.e. via advanced human body models, in particular models that capture the pre-crash phase in a realistic format.

Market Opportunities

- Successful market entry for new safety systems electronics for HAVs and carry over to L2 and L3 vehicles [9].
- Use synergies with products concerning planning, sensing and perception in HAVs.
- Provide advanced occupant safety architectures for future automated vehicles allowing for a new interior with safe seating positions and postures through optimized occupant safety using improved and validated human body models.

Competitor description

- Tier 1 supplier of safety systems electronics, e.g. electronic control units for restraint system deployment covering the pre-crash and crash phase.
- Tier 1 supplier of sensor systems, e.g. advanced driver assistance units and future AD sensor kits, covering forward looking sensors like radar, LIDAR, camera technology.

Plans and measures for exploitation

- Bosch-internal dissemination of future challenges and opportunities for enhancement of existing products but also for creating new products.
- Bosch-internal rising of awareness of challenges of mixed traffic automated driving.
- Bosch-internal dissemination of AV (automated vehicles) future accident scenarios and adequate simulation methodologies in order to represent the traffic situation of the future, in particular focussing on mixed traffic scenarios.
- Understand the requirements, requests and needs of the automated vehicle industry (OEMs) in building safe automated vehicles for mixed traffic situations.
- Understand the requirements, requests and needs of the restraint system suppliers in creating innovative restraint solutions for novel interiors so that OEMs can make safe automated vehicles for mixed traffic situations.
- Requirement elicitation in order to develop new and better pre-crash and in-crash safety systems for AD (automated driving).
- Use requirements to generate advanced occupant safety architectures for future automated vehicles allowing for a new interior with safe seating positions and postures, i.e. control strategies for pre-crash activation of components within vehicle interior as well as optimized triggering of in-crash restraint systems.

Target audience

- Bosch-internal development departments business unit Chassis Systems Control (responsible for integrated safety, e.g. active and passive safety, automated driving functions from SAE level L1 to L5)
- Bosch-internal strategic and product marketing
- Our potential customers: OEM
- OSCCAR consortium and partners
- International vehicle safety community and beyond
- Our international research networks
- End users: Increase public acceptance of automated vehicles (AVs) optimized safety systems.

3.8.5 CHALMERS TEKNISKA HOEGSKOLA AB (CHALMERS)

Relevant position in the academic environment

- Academic partner
- Accident data analysis
- Evaluation data for evaluation of human body models
- Development and validation of human body models

Research and educational opportunities

- Identification of future crash scenarios
- Projection of local results on a target region
- Initiates collaboration with world leading research units
- Provides background material for seminars and lectures held at MSC level and PhD-level courses given at Chalmers and when giving guest lectures
- Facilitates that we can carry out advanced MSc projects

Plans and measures for exploitation

- Apply methods in future projects
- Dissemination in scientific journal publications and conference proceedings
- Education/training in MSc-courses/thesis and PhD-education programs

Target audience

- International research community
- Scientific community
- Vehicle industry

3.8.6 DAIMLER AG (DAIMLER)

Daimler AG with its businesses Mercedes-Benz Cars, Daimler Trucks, Daimler Financial Services, Mercedes-Benz Vans and Daimler Buses, is a globally leading producer of premium passenger cars and the largest manufacturer of commercial vehicles in the world. Daimler sells its products in nearly

all the countries of the world and has production facilities on five continents. As an automotive pioneer, Daimler and its employees willingly accept an obligation to act responsibly towards society and the environment and to shape the future of safe and sustainable mobility with ground-breaking technologies and high-quality products.

Relevant Market

The research & development areas and the world-wide market of these brands and products form the basis and framework for the Daimler internal dissemination and exploitation of the OSCCAR results. The main technical dimension is given with a general and extensive implementation of numerical methods and tools within a digital development process in all product lines:

- Virtual Testing and application of human body models
 - Daimler already has implemented numerical human body models to its (safety) development process as a supplemental evaluation tool. All findings and further harmonisation in this area will directly be discussed for use and internal exploitation.
 - Virtual testing will be an indispensable part within the consolidation and evaluation of new interior concepts and related occupant protection system development for future AV (automated vehicles).
- Open source approach for effectiveness assessment:
 - *OpenPASS* working group :input to OSCCAR: based on requirements regarding relevant scenarios, the open source project provides the models and components to simulate highway traffic with collisions to OSCCAR.
 - OSCCAR input to *OpenPASS* working group : methodology harmonization and alignment across relevant stakeholders how to base predictions regarding future relevant crash configurations on real-world data and how to integrate active and passive safety simulation approaches.

Market Opportunities

For Daimler numerical methods and further implementation and acceptance of virtual testing (by other stakeholders > consumer information & rulemaking) are an integral element of the car development process and will especially allow us to realise safe autonomous vehicles with new interior concepts and offer new use cases to our customers.

Competitor description

- OEM / car maker
- Provider of mobility solutions

Plans and measures for exploitation

- HBM and virtual testing: direct implementation and application within vehicle development process.
- Open source approach for effectiveness assessment: use different open source tools and create demonstrator; create reference implementation in openPASS of “OSCCAR approach” & documentation in OSCCAR D1.2 and D1.3.
- Sharing and transfer of best practice guidelines within the world-wide R&D structures of Daimler.
- Promote and further harmonize the use of HBM and virtual testing via external communities and international collaboration activities.

Target audience

- End-user – providing high-quality, inspiring and safe products for sustainable mobility solutions
- Consumer information programs
- worldwide authorities & rulemaking
- International HBM and biomechanics research community

Collaboration platforms (e.g. TUC [Thums User Community], PDB [Partnership for Dummy-Technology and Biomechanics])

3.8.7 ESI GROUP (ESI)**Relevant Market**

- Simulation software for automotive safety
- Modelling tools for active human body models

Market Opportunities

- Simulation of occupants in new scenarios for autonomous vehicle safety

Competitor description

- Vendors of simulation software for automotive safety engineering

Plans and measures for exploitation

- Integration of developed muscle model and VPS/SimulationX co-simulation technologies in respective product releases

Target audience

- VPS (Virtual Performance Solution) safety products users in automotive OEMs and their suppliers

3.8.8 APPLUS IDIADA (IDIADA)**Relevant position in the academic environment**

- Future accident scenarios and new safety systems related to occupant configurations
- Protocols and regulations according to the new occupant seating positions
- Virtual assessment to evaluate the upcoming complex scenarios
- Enhancement of the HBM research and development

Research and educational opportunities

- Future testing methodologies for HAV
- Protection principles for new complex scenarios
- HBM and virtual testing assessment

Plans and measures for exploitation

- Scientific publications and congress' presentations
- Input for future research projects

- Improvement of the testing procedures
- Internal dissemination

Target audience

- OEMs and Tiers
- Applus IDIADA (both technical and marketing departments)
- European consortiums
- International vehicle safety community
- End users

3.8.9 LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN (LMU)

Relevant position in the academic environment

- Automotive safety
- Improvement and validation of human body models
- Evaluation of road user's protection
- Computational modelling of biological materials
- Anthropometric research for future accident scenarios
- Virtual assessment of safety technologies in future accident scenarios

Research and educational opportunities

- Development of advanced HBMs for road user safety evaluation
- Virtual testing methods for crash design (in autonomous driving)
- Input for future car safety concepts by evaluating safety systems via HBM simulations
- Provide data for seating positions and postures in autonomous driving

Plans and measures for exploitation

- Dissemination by presentations on scientific congresses or publications in scientific journals
- Education of students/researchers at LMU (student thesis, lectures, workshops)
- Dissemination of enhanced tools (e.g. HBMs) and methods to evaluate road user's protection
- Contribute to ideas for future research projects

Target audience

- International vehicle safety communities
- Scientific community (peer-researchers and experts in this field)
- OEMs & Tiers
- European consortiums (OSCCAR and future)
- Public authorities and regulators

3.8.10 RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (RWTH)

Relevant position in the academic environment

- Occupant safety in future crash scenarios in combination with new seating positions and sitting postures relevant in e.g. highly automated or autonomous cars
- Pre-crash measures to increase occupant safety
- Impact of different driving scenarios (highly automated and/or autonomous) on sitting postures and preferred seating positions
- Utilisation of Human Body Models (HBM) in occupant simulation to enhance injury prediction

Research and educational opportunities

- Initiates collaboration with world leading research institutions
- Provides background material for seminars and lectures given at RWTH
- Aachen University at MSC level
- Enables ika to offer sophisticated master theses to students

Plans and measures for exploitation

- Education in bachelor and master program Mechanical Engineering and Automotive Engineering and Transport at RWTH Aachen University (bachelor and master theses, one dissertation, lectures)
- Publications in the field of automotive engineering, especially novel safety principles for new seating positions and sitting postures relevant in e.g. highly automated or autonomous cars evaluated in crash simulations and testing

Target audience

- Public
- Students
- Professionals

3.8.11 SIEMENS INDUSTRY SOFTWARE NV (SISW)

Relevant Market

- Simulation software for development (semi-)autonomous vehicles and their controllers and sensors

Market Opportunities

- Development of workflows and processes together with validation of Siemens Simcenter software for pre-crash simulation of (semi-) autonomous vehicles.

Competitor description

- Vendors of simulation software for vehicle, ADAS (Advanced Driver Assistance Systems) controllers and sensor development

Plans and measures for exploitation

- Improvement, validation and publication of the use of Siemens Simcenter software for pre-crash simulation.

Target audience

- Vehicle OEMs and suppliers of ADAS controllers and sensors.

3.8.12 SIEMENS INDUSTRY SOFTWARE AND SERVICES B.V. (TASS)

Siemens Industry Software and Services B.V. (formerly Tass International) supports the global automotive industry in the creation of safer and smarter vehicles and is known for its unique development methodology, offering a set of advanced simulation software tools, tailor made engineering solutions and state-of-the-art testing and certification facilities and services, with the aim to improve Integrated Safety systems of vehicles and boost the development of Highly Automated and Connected Driving. Siemens Industry Software and Services helps to develop better products, increased speed-to-market and more robust and cost-effective development processes.

Siemens Industry Software and Services is a leading organisation and has a history of more than 25 years, employing 200 people in 11 countries worldwide and operates several laboratories, under which a unique facility for testing and validation of Intelligent Transportation Systems and Cooperative Driving technologies. Its software brands Simcenter Madymo™, Simcenter PreScan™ and Simcenter Tyre™ are familiar names to the OEMs and to suppliers in the automotive industry.

Relevant Market

- Simcenter Madymo, has created a worldwide standard for analysing and optimizing vehicle safety designs and consists of a unique combination of MB, FE and CFD technology. Focusing on occupants as well as vulnerable road users, Siemens Industry Software and Services offer an extensive database of crash dummy and human body models together with advanced solutions for seat belt and airbag simulation.
- The validated and biofidelic set of human models predict passive, active and reactive responses before and during the vehicle crash. Designed for the active role, the suite of models consist of Active Human which is capable of human response prediction for a broad range of loading conditions for which no physical crash test dummy exists. It is validated for frontal, lateral, rear, oblique and vertical loading conditions and based on real-world data.

Market Opportunities

- Autonomous Drive (AD) - new seating configurations are going to necessitate modifications and adjustments to how OEM's keep occupants safe;
- The market expects more diversity requirements in terms of occupant population i.e., age, size, gender, etc. and requires bespoke solutions. This also offers an opportunity in being able to supply parameterized solutions which can be adapted to individual cases. Scalability of HBM being an example of such a requirement;
- People require higher levels of comfort in automated vehicles - OEMs are considering new seating positions and new restraint systems consistent with the newly proposed seating positions;
- Growing need for fast iterative modelling and re-positioning of simulation models

Competitor description

- Simcenter Madymo is a multi-physics solver with a focus on multibody (MB) with the AHM built on the same technology and focus on pre-crash and in-crash human body kinematics and is designed to simulate human muscle response.
- Other solvers and human body models (HBM) are based on finite element (FE) technology and besides human body kinematics focus on in-crash tissue-based injury mechanism analysis.
- These products are not competitive but serve different purposes:
 - Simcenter Madymo for example is highly suitable for concept (early in the design phase) analyses, especially there where in the design process required design changes are still relatively cheap.
 - MB is highly suitable for multiple long duration pre-crash events and FE is highly suitable for detailed in-crash simulations as for example for structural analysis.
 - MB is typically useful for large scale design explorations and stochastic approaches

Plans and measures for exploitation

- Improve occupant safety by providing the most advanced software solutions to the vehicle designers and safety engineers to measure pre-crash and in-crash human body kinematics.
- Being integral in increasing the awareness and understanding of future accident scenarios involving new seating positions and occupant restraint systems through the use of advanced simulation techniques involving human body models.
- Validate AHM against OSCCAR data .
- Create methodologies for generating data and validating the Active Human model for use in accurate prediction of human body kinematics.
- Work with governing bodies regulatory compliance agencies to gain a wider acceptance of virtual testing methodologies and standards.
- Help in the training of future generations of safety engineers by fostering relationships with universities, engineering schools and research institutes

Target audience

- Car designers and safety engineers
- Automotive industry suppliers and research institutes involved in occupant safety designs
- Governing bodies and regulatory compliance agencies
- Certification and homologation companies
- Universities, engineering schools and education authorities involved in training future generations of safety engineers
- Engineering companies

3.8.13 TOYOTA MOTOR EUROPE NV (TME)

Relevant Market

- Future accident scenarios and relevant new safety technologies
- Enhanced and validated human body models

- Integrated and virtual assessments

Market Opportunities

- Enhance further car safety and enable HAVs by contributing to the development of new safety assessments through simulations
- Enhance THUMS models to fulfil OSCCAR HBM requirements

Competitor description

- OEMs
- HBM providers

Plans and measures for exploitation

- Internal (EU and Japan) dissemination of OSCCAR main results
- Contribution to ACEA effort developing virtual assessment methodology
- Scientific papers: Residual problem analysis, THUMS simulation demonstrators

Target audience

- Toyota R&D for development and evaluation of vehicle performances
- Regulatory and assessment bodies
- European Council for Automotive R&D (EUCAR) / European Automobile Manufacturers' Association (ACEA)

3.8.14 TECHNISCHE UNIVERSITAET GRAZ (TUG)

Relevant position in the academic environment

- Automotive safety
- Improvement and validation of human body models
- Evaluation of road user's protection
- Virtual assessment of safety technologies in future accident scenarios (different driving scenarios (highly automated and/or autonomous))
- Occupant safety in future crash scenarios
- Accidentology: advanced accident investigation, requirements

Research and educational opportunities

- Development of advanced HBMs for road user safety evaluation
- Virtual testing methods for crash design (in autonomous driving)

Plans and measures for exploitation

- Dissemination on scientific congresses or publications in scientific journals
- Education of students/researchers (student thesis, lectures, etc.)

Target audience

- Public authorities and bodies
- International vehicle safety communities

- Scientific community

3.8.15 UNIVERSITE DE STRASBOURG (UNISTRA)

Relevant position in the academic environment

- Automotive safety
- Human body models
- Motorcyclist protection
- Defence

Research and educational opportunities

- Autonomous driving
- Virtual testing

Plans and measures for exploitation

- Development of demonstrators
- Monitoring parameters in standard bodies or consumer test context

Target audience

- Automotive industry
- Standard bodies

3.8.16 UNIVERSITAET STUTTGART (USTUTT)

Relevant position in the academic environment

- High performance computing
- Simulation Science
- Accident research / automotive safety
- Digital human body models

Research and educational opportunities

- Autonomous driving
- Active human body models for all road users
- Virtual testing and visualisation

Plans and measures for exploitation

- Development of demonstrators
- Providing controller concepts for active human body models
- Virtual testing measures

Target audience

- Automotive industry
- Ergonomics

- Health industry

3.8.17 VOLVO PERSONVAGNAR AB (VOLVO)

Relevant Market

With the overall target to accommodate future car development, addressing the occupant desire of future transportation needs, the OSCCAR project will provide relevant research in the following areas related to occupant protection:

- future accident scenarios, and development of methodology to include in safety evaluation of future products
- contribute to understanding possible new seating configurations and sitting postures and how to address them in occupant protection evaluation – specifically through use of human body models
- refinements of human body models and development of associated methodology for occupant protection assessment
- development of integrated, virtual assessment framework for complex scenarios

Market Opportunities

Input to future passenger car developments. Advanced occupant protection evaluation methods are essential and a prerequisite for developments of HAV.

Plans and measures for exploitation

With the overall target to benefit end-customers by enhanced protection, and reducing injury risks, exploitation include:

- New safety systems
- Enhanced methods and tools for occupant protection evaluation
- Publications and presentations at conferences
- In-house learnings
- Sharing with other stakeholder, e.g. authorities, institutes having a wider safety impact

Target audience

- End-customer; providing enhanced products and safety offer
- Authorities
- Test institutes and consumer information programmes
- International safety communities
- Peer-researchers, influencing further research activities and harmonized methods and tools

3.8.18 VOLKSWAGEN AG (VW)

Relevant Market

- Autonomous and electric vehicle occupant safety
- Advanced Human Body Models for occupant safety evaluation

- Integral safety systems and interior concepts for new autonomous vehicle seating positions and postures

Market Opportunities

- Provide autonomous vehicles (AVs) offering new safe seating positions and postures
- Increased AV sales through optimized occupant safety using improved and validated human body models (HBMs)
- Increase public acceptance of AVs through optimized safety systems

Competitor description

- Other passenger car OEMs

Plans and measures for exploitation

- Application of new integral safety systems for AV concepts cars
- Corporate-wide dissemination of improved generic AV safety systems
- Corporate-wide dissemination of improved occupant HBMs and corresponding application procedures of virtual methods
- Corporate-wide dissemination of AV future accident scenarios

Target audience

- Volkswagen corporation passenger car brands (VW, Audi, Porsche, SEAT, Skoda, VW-Commercial Vehicles, Bentley)
- Volkswagen corporate technical development safety system departments
- Volkswagen corporate vehicle safety simulation departments

3.8.19 ZF FRIEDRICHSHAFEN AG (ZF)

Relevant Market

- Integrated safety systems for automated and non-automated vehicles
- Including the 3 domains see.think.act, i.e. sensor systems, control units with software, as well as actuators for active and passive safety systems
- OSCCAR results will improve the toolchain for developing and customizing integrated safety solutions for the passenger car market as well as commercial people transport vehicles (e.g. RoboTaxis or PeopleMover)
- ZF will mainly focus its research activities in OSCCAR on the pre-crash domain to investigate HBM (human body model) / AHBM (active human body model) readiness for developing pre-crash intervention systems for improved occupant safety
- Support legal authorities and NCAP organization for updating, developing and introducing relevant safety regulations for automated vehicles

Market Opportunities

- OSCCAR results will increase awareness and understanding of future accident scenarios and AD (automated driving) vehicle interior use cases, which will be an important input to identify and create adequate occupant safety solutions

- Development and optimization of integrated safety system architectures to address the new crash scenarios and interior use cases
- Development and market introduction of improved and new safety systems for pre-crash and in-crash application, including sensors, algorithms, and actuators

Competitor description

- Main competitors for integrated safety technology are other global tier 1 suppliers with individually different portfolio
- Two competitors are also partnering in OSCCAR, i.e. Autoliv and Bosch

Plans and measures for exploitation

- ZF internal dissemination of OSCCAR results and tools
- Introduction of relevant AHBM / HBM tools into the core and application engineering projects
- Improve and extend standard engineering process and tools to reflect best practice usage for AHBM / HBM in product development
- Marketing / publication of OSCCAR project and results on scientific conferences and events, e.g. OSCCAR poster at the ESV conference
- Support marketing of new safety products & systems for our global customers in traditional OEMs and New Automotive Customers (NAC) with adequate HBM / AHBM simulation results
- Accelerate time-to-market and increase field safety robustness for new occupant safety products and systems, including sensor systems, control units with software, as well as actuators for active and passive safety systems

Target audience

- Internal functions R&D, core engineering and application engineering
- Current and future customers from traditional OEMs and NAC (National Automotive Consulting)
- Public audience including authorities and consumer rating agencies
- Global scope, i.e. developed market, bridge countries and emerging markets

3.8.20 TSINGHUA UNIVERSITY (TSINGH)

Relevant position in the academic environment

- Adaptive occupant restraint tailored for diverse seating positions and sitting postures in emerging traffic scenarios
- Influence of active human response in occupant safety
- Development of advanced human body models (HBM) for improved injury prediction in motor vehicle collisions (MVCs)

Research and educational opportunities

- Safety development of highly automated vehicles
- Virtual testing using highly biofidelic human models
- Advanced occupant protection principles and evaluation methods

Plans and measures for exploitation

- Education in bachelor and master program mechanical engineering and automotive engineering at Tsinghua University
- Publications in the field of automotive engineering, transportation, applied biomechanics

Target audience

- Public
- Professionals
- Students

3.8.21 CHINA AUTOMOTIVE TECHNOLOGY AND RESEARCH CENTER (CATARC)

Relevant position in the academic environment

- Future accident scenarios and early warning means
- Chinese occupant ride behaviour under smart car interior scene
- Forms and severity of injury to future traffic accident occupants

Plans and measures for exploitation

- Road traffic accident data collection and analysis
- CIDAS Database
- Regulations and technical standards

Target audience

- Automobile industry
- Professionals
- Public

4 CONCLUSION & NEXT STEPS

This section draws conclusions and lessons learned from this deliverable and outlines next steps until the submission of the final OSCCAR exploitation strategy.

The deliverable has described the draft plan for exploitation of OSCCAR results. It has presented the objectives and procedures and gathered preliminary exploitation plans on individual partner level for all OSCCAR partners, which will be updated in the course of the project. Depending on their field of business, OSCCAR partners are planning their exploitation activities accordingly.

In brief, OSCCAR partners plan the following exploitation activities:

Dissemination & Exploitation

- Dissemination of AV (automated vehicle) future accident scenarios
- Internal dissemination
- Internal dissemination of future challenges and opportunities
- Support marketing of new safety products and systems
- Publications

Development

- Develop new and better pre-crash and in-crash safety systems
- Development of demonstrators
- Generate advanced occupant safety architectures
- Integration of developed muscle model in human body models
- Virtual testing measures

Improvement of processes and methods

- Improve and extend standard engineering process and tools
- Improve HBM, virtual assessment methods and dissemination of them
- Improved knowledge of autonomous driving interior safety protection principles for future autonomous driving interiors
- Improvement and validation of internal software for pre-crash simulation
- Improvement of testing procedures
- Enhance methods and tools for occupant protection evaluation

Education

- Education of students/researcher
- Supporting PhD, bachelor and master programs

Using results

- Implementation of results
- Results/Input for future research products
- Sharing results with stakeholders to have a wider safety impact

Market requirements

- Accelerate time-to market and increase field safety robustness for new occupant safety products and systems
- Understand requirements, requests and needs of the automated vehicle industry; restraint system suppliers

These activities focusing on OSCCAR results clearly will support both overall EC (European Commission) goals, incl. modularity, reusability, cost reduction etc., as well as overall OSCCAR goals, aiming at comprehensively delivering OSCCAR results to the market.

The next steps will start with actively involving all partners in developing the final exploitation strategy to ensure successful exploitation of the project results. As already mentioned, all partners have committed to contributing in exploitation activities to achieve OSCCAR objectives. The current version of the exploitation plan contains gaps that will be filled in the coming months. It can be expected that most partners will be more prepared to contribute to developing the exploitation strategy and plan towards the end of the project. At this time the concepts and guidelines are more mature.

To encourage all partners to think in more detail and strategic about exploitation this topic will be made to a fixed point at the upcoming face to face meetings. An exploitation workshop where partners can reflect their own input and of the other partners will take place. Questions to be discussed within the consortium will be: What are appropriate exploitation activities and how can we scale them up? Main focus will be to discuss and analyse their approaches and to develop more mature and in-depth approaches to all aspects related to exploitation. Results from these workshops will be validated and discussed in the monthly web meetings and written down in D6.5. This will then be used as a check point to see if the objectives were met. If required, corrective actions will be suggested and discussed in the Executive Board.

One of the lessons learned is that it is crucial to open up the discussion on exploitation with partners early in the project. It takes time to develop a profound understanding of the full spectrum of exploitation and to formulate a take on it. It is therefore important to encourage partners to start thinking about their stance as early as possible.

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A. OSCCAR EXPLOITABLE FOREGROUND

In this section the declared Exploitable Foreground (knowledge / Intellectual Property produced within the project) OSCCAR partners as of June 2019 is shown.

Related research area/ WP	WP3: HBM improvement
Exploitable Foreground, OSCCAR output	<ul style="list-style-type: none"> • VPS/SimulationX coupling • Extended Muscle model in VPS
When	June 2021
By Whom	ESI GROUP
Where	Worldwide
Exploitable product(s) or method(s)	VPS and SimulationX
Sector(s) of application	Primarily Automotive
Timetable for commercial use	2022-2025
Patents or other IPR exploitation (license)	N.A.
Owner and other beneficiaries involved	ESI GROUP
Planned use and dissemination measures	2022 Software releases VPS users seminars
Dedicated investments	50 kEuros
Purpose	Industrialisation
IPR exploitable measures taken or intended	sale of software licenses
Further research	possible adaptation of existing human body models
Potential/expected impact	<ul style="list-style-type: none"> • secure VPS license business • sell additional and new licenses for new applications

Related research area/ WP	WP3: HBM improvement
Exploitable Foreground, OSCCAR output	Material card skin in VPS and LSDyna
By Whom	LMU and ESI Group
Where	Worldwide
Exploitable method(s) product(s) or	HBM, virtual testing
Sector(s) of application	Automotive, human modelling
Owner and other beneficiaries involved	LMU, ESI Group

Related research area/ WP	WP3: HBM improvement
Exploitable Foreground, OSCCAR output	Subcutaneous fat thickness assessment based on supine CT scans (n=120)
When	June 2019
By Whom	LMU
Where	Worldwide
Exploitable method(s) product(s) or	Data base for improvement of HBM geometry
Sector(s) of application	Automotive, human modelling
Owner and other beneficiaries involved	LMU

B. ABBREVIATIONS AND DEFINITIONS

Term	Definition
ACEA	European Automobile Manufacturers' Association
AD	Automated Driving
ADAS	Advanced Driver Assistance Systems
AHBM	Active Human Body Model
AV	Automated Vehicles
EC	European Commission
EUCAR	European Council for Automotive R&D
Euro NCAP	The European New Car Assessment Programme
GSPR	General Safety and Performance Requirements
HAV	Highly automated vehicles
HBM	Human Body Model
NAC	National Automotive Consulting
PDB	Partnership for Dummy-Technology and Biomechanics
TUC	Thums User Community
VPS	Virtual Private Performance SolutionServer