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BIO-ADVANCE: FINAL REPORT

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Contents

Acknowledgment

I would like to express my deepest gratitude to the Marie Curie fellowship program of the European Commission. The fellowship allowed me to develop a research project that was challenging and enjoyable at the same time. These two years have constituted an incredible opportunity of growing as a researcher while continuing learning. The always present help of my colleagues at the University of Zaragoza, the day-to-day work with the other researchers of TESSA and the generous help of the Government of Aragon have been essential in the development of this research program. During the life of the project, we contacted many public and private institutions asking for their support and cooperation and the answer was very positive in almost all cases. The cooperation of the members of the Oversight Committee has been a tremendous push to all our activities as the members were committed truly to the project.

To all of them, my most sincere THANK YOU.

Dr. Francisco J. Lopez-Valdes, experienced researcher of BIO-ADVANCE

Executive Summary

This report expands on the information submitted to the European Commission through the ECAS online reporting system. The first section contains a summary of the project, to be followed by a section describing the details of the several research tasks that were proposed within BIO-ADVANCE. The task description points out the deviations from the initial plan and how they were addressed and corrected. The report continues providing additional information on the transfer of knowledge and training activities carried out within the project, that surpassed greatly the initial expectations. Detailed information of the different dissemination activities follows, classifying these activities according to the intended target audience. Transfer of knowledge, training and dissemination are of the utmost importance in the Marie Curie actions and that is why we have decided to provide more information on those activities than the limited one required in the ECAS system. The report finishes reviewing the milestones and summarizing the main results achieved during the project.

1. Introduction: BIO-ADVANCE

The Research Executive Agency (REA) representing the European Commission and the University of Zaragoza (UNIZAR)agreed to co-fund the project titled Advancing traffic safety through the investigation of human tolerance to impact (BIO-ADVANCE), under the Support for training and career development of researchers (Marie Curie) program (FP7-PEOPLE-2011-IIF, Grant Agreement Number 299298).

The main objective of BIO-ADVANCE was to develop and implement a research program involving Post Mortem Human Subjects (PMHS) tests at the University of Zaragoza, while investigating on the 6-degree-of-freedom (dof) kinematics of the human spine in pure frontal and oblique impacts. As stated in part B, the best proof of the success of the research was to complete a number of experiments with PMHS before the end of the project. More specifically, the project was set to perform PMHS tests to understand the kinematics of the human spine under seatbelt loading and to establish the necessary infrastructure (including procedures and protocols to ensure the utmost respect for Ethics) so that such research could be carried out at the facilities of the University of Zaragoza.

First activities within BIO-ADVANCE consisted of establishing links to other institutions in Spain that could provide support in obtaining Post Mortem donors suitable of being acceptable for the research to be performed at the University of Zaragoza. Instead of creating a new body donor program, researchers at TESSA (the crash test facility of the University of Zaragoza) joined existing programs in Spain. This programs had been already assessed by the corresponding authorities and showed a long-time record of successfully implementing body donation programs management and handling. To ensure the protection of the donor's rights at all times, donors (or next-of-kin) were explicitly asked about their understanding and willingness to participate in research on injury prevention such as the one to be performed at TESSA. In addition, TESSA established its own Oversight Committee that met in September 2013 that provided its unanimous agreement to TESSA's protocol for the procurement and handling of donated bodies. The Oversight Committee was formed by a variety of people including Government and University representatives, industry representatives, experts on Ethics and coordinators of donor programs from other institutions in Spain. Last, the procedure established in BIO-ADVANCE was also submitted to the assessment of the CEICA *(Comité Étic para Investigación Clínica de Aragón)*, the Clinical Research Ethics Assessment Commission of Aragon, whose assessment is valid in the whole country. CEICA provided a positive assessment (from the

Ethical point of view) of the activities to be performed in BIO-ADVANCE in March 2014.

In parallel, TESSA's facilities needed to be updated to make them capable of performing PMHS testing. A state-of-the-art preparation room was built so that body preparation and post-test injury assessment could be done at TESSA. The preparation room can host eight frozen and four refrigerated specimens. A research agreement was signed with the Hospital MAZ (Zaragoza) and the hospital provided instrumentation and equipment (including a portable X-ray machine) to the preparation room. In addition to the preparation room, a 10-camera VICON system was acquired and installed in the sled room to capture the 3D motion of the sled occupants during the impact. The generous contribution of the IAF *(Instituto Aragonés de Fomento)*, the Infrastructure Institute of the Regional Aragonian Government, made possible to undertake these renovations. With this capabilities, TESSA became the only crash test laboratory capable of performing PMHS test and to record the 3D kinematics of occupant surrogates during a high-speed impact.

As an essential part of the Marie Curie IIF program, a successful collaboration was established with the Center for Applied Biomechanics of the University of Virginia (UVA), the institution from which the incoming researcher graduated. It would have been not possible to complete the tasks proposed in BIO-ADVANCE without the guidance and assistance of the researchers from UVA. The research methodology used in BIO-ADVANCE matched the one from UVA, making possible to exchange research results and to grow the body of knowledge about the behavior of the human body during the impact. This cooperation is shown by the multiple publications co-authored by TESSA and UVA researchers in the period 2012-2014.

In the BIO-ADVANCE proposal, it was mentioned the intention of involving the industry in the research program so that the society at large could benefit from the results obtained in the project. Through the participation in the Oversight Committee of the project, one of the leading automotive restraint manufacturers worldwide has cooperated with the research carried out within BIO-ADVANCE. The project has benefited from using state-of-the-art technologies (including the most advanced existing dummy, the THOR, and innovative restraint systems that are expected to be in the market in the near future). The cooperation with this company has allowed the project to surpass the research objectives proposed initially, as the outcome from the project will inform the design of these restraint systems, increasing the impact of the project. As a result, TESSA has prepared and submitted a proposal for an Initial Training Network to the call H2020-MSCA-ITN-2014 in cooperation with the company. Also, TESSA has become part of consortia applying for funding to several Horizon 2020 calls, focusing its activities in performing PMHS testing.

The following lines summarize the research contents developed within BIO-ADVANCE:

–Establishing agreements with the existing donor programs of the University of Castille-La Mancha (UCLM) and the company Scientific Anatomy.

–Creating its own protocol for the handling of human tissue.

–Training of TESSA personnel to ensure the right handling of human tissue, including

Ethics and personal protective procedures.

–Building a preproom dedicated to the preparation of the bodies and to the assessment of the experiment outcome.

–Upgrading the available instrumentation, including a 3D motion capture system.

–Performing 19 dummy tests using the THOR with three different types of restraints (seat belts). One of the restraints was a prototype concept, not in production yet.

–Performing four PMHS tests to assess the performance of three different seat belts.

–Publishing four papers in indexed journals.

–Participating in five international conferences on automotive safety.

–Dissemination activities: collaboration in national and international radio shows, several interviews in local and national newspapers, participation in national TV shows, collaborating in research and industry meetings in Zaragoza, participating in encounters with Engineering students to explain the research carried out within BIO-ADVANCE, explanation of project activities to associations of tissue donors, promoting the Marie Curie actions by meeting with prospective candidates, etc...

All these contents are described in detail in the following pages.

In summary, the initially proposed objectives for BIO-ADVANCE have been achieved successfully during the duration of the project. As for the research planned, even though some of the contents were updated during the evolution of the project, the outcome of the research performed in the project has achieved a larger impact due to the closer cooperation with industry. For further information about the outcome of BIO-ADVANCE, please contact Dr. Francisco J. Lopez-Valdes at fjlv@unizar.es

2. Work progress

The main goal of BIO-ADVANCE is **to develop and implement a research program involving Post Mortem Human Subjects (PMHS) testing at the University of Zaragoza (UNIZAR) while investigating on the 6-degree-of-freedom (dof)kinematics of the human spine in pure frontal and oblique impacts**.

The focus of the activities performed during the first year of BIO-ADVANCE was to create the necessary infrastructure at the University of Zaragoza so that the PMHS tests can be performed. This infrastructure encompassed from the actual construction of a surgical room to prepare the bodies before the tests, to establish the procedures for the procurement of the tissue or the training of the personnel.

The second year focused on the establishment of the body donor program at the University of Zaragoza, the training of the personnel involved in the testing, the development of the methodology to be used in the tests and the actual execution of the tests.

At the end of BIO-ADVANCE, it can be reported that the main goal of BIO-ADVANCEd was achieved successfully as four PMHS tests were completed before the end of the project. In other words, the research team managed to implement all the necessary procedures to establish the first crash laboratory with capabilities of performing full-scale sled tests in Spain.

2.1 Task 1- Characterization of spinal injuries in MVC (m1-m2)

This first task focused on the epidemiological analysis of spinal and head injuries caused by Motor Vehicle Crashes (MVC). At the time of writing the mid-term report, this task had not started due to different problems with the access to the data. Even if corrective actions were taken, the interest of the study shifted towards a more practical approach.

The collaboration between the University of Virginia and the University of Zaragoza focused in the analysis of previous experimental work done by the experienced researcher during his time at the University of Virginia. Instead of analyzing epidemiological data (as it had been originally proposed), the experienced researcher and his colleagues from the

University of Virginia worked on a mathematical model that characterizes the bending motion of the human spine. This work was included in a peer-reviewed publication submitted to the Conference IRCOBI. The paper was accepted for publication and presentation at the annual congress that will happen in Berlin (September 10-12, 2014). The title of the paper is *Characterization fo the In-Vitro Dynamic Behavior of the Human Thoracic Spine in Flexion* and it was co-authored by Sabrina Lau, Patrick Riley and Richard Kent, all of them at the University of Virginia.

2.2 Task 2- Participation in the tissue donation program. Development of the ethical plan (m1-m2)

The midterm report explained the constitution of the Oversight Committee and provided information about the members of the committee and its function. The first meeting of the Oversight Committee was held at TESSA on September 18, 2013. The minutes of the meeting are included in appendix A. The assessment of the Ethics procedures that were proposed to the Oversight Committee was favorable unanimously. The questionnaire used in the assessment and the answers provided by the members of the Oversight Committee can be consulted in Deliverable D2.3 *Ethics protocol to be used in BIO-ADVANCE*.

As explained in the same deliverable, the University of Zaragoza decided not to appoint an University-wide Internal Review Board to assess the compliance of research projects with Ethical principles (even if this had been the position of the University at the time of BIO-ADVANCE start), but instead to submit all university research susceptible to involve any Ethical issue to the regional committe for the assessment of clinical trials. This is a government institution called *Comité Ético para la Investigación Clínica de Aragón (CEICA)* and details about its competences and scope were given in Deliverable D2.3. It suffices to say that it is an external committee whose assessment is necessary and valid in the whole country.

BIO-ADVANCE received a favorable assessment from CEICA on February 19, 2014. Even if this assessment was not strictly necessary, it conferred a much stronger status to the project and it paved the way so that subsequent TESSA projects involving PMHS could be submitted to the same committee.

Following the final outcome of the CEICA assessment, the procedures to start receiving donors at the facilities of TESSA started. The coordination of these procedures were arranged by the representatives of the body donor program of the School of Medicine of the University of Castilla La Mancha and of the company Scientific Anatomy, and the experienced researcher. Both institutions were asked to collect the donor forms that were sent to them by TESSA. The donor forms clearly stated that either the donor or the next-of-kin approved the use of the body for research in injury prevention and most specifically for the prevention of motor-vehicle induced injuries. The duly-signed forms are in TESSA archives together with medical reports from the donors.

The cooperation with both institutions have resolved very satisfactorily and up to date there are seven donors in TESSA facilities (four that have been already exposed to the experiments and are awaiting on the autopsy study) and two more waiting to be moved in early September.

The basic anthropometry and cause of death of the donors is shown in table 2.1.

ID	Gender	Age	Weight (kg)	Stature (cm)	Cause of death
M-0001	Male	59	85	178	Cirrhosis
F-0002	Female	42	62	165	Cirrhosis
M-0003	Male	39	65	170	Cardiac arrest
M-0004	Male	67	90	176	Digestive hemorrhage
M-0005	Male	74	90	180	Cardiopulmonary stop
M-0006	Male	90	70	165	Cardiopulmonary stop
M-0007	Male	74	80	175	Cardiopulmonary stop

Table 2.1: PMHS anthropometry and general information.

2.3 Task 3- Adaptation of crash facilities of University of Zaragoza to PMHS testing (m2-m7)

As reported in the midterm report, the remodeling of the facilities had been delayed due to the process of obtaining the necessary legal permits and all the issues normally associated with the construction business. Despite of it, the preparation room and the storing freezers and coolers were finished and fully functional by the end of September 2013. See fig. 2.1 for a descriptive picture of the preparation room.

It consists of two working positions for full body preparations and room for storing 8 bodies at $-15°C$ and 4 bodies at $+5°C$ (for conservation purposes, during the implementation of the experiments).

The design of the preproom and the acquisition of the necessary surgical equipment was supervised by medical personnel of the Hospital MAZ (Zaragoza). A collaborative agreement was signed between the University of Zaragoza and the Hospital MAZ so that the members of the Neurosurgery department would collaborate actively with the researchers at TESSA. This collaboration has resulted in a very active implication of the medical doctors at MAZ, that have supported effortlessly the research developed at TESSA.

As result of this cooperation, Hospital MAZ has lent to the laboratory TESSA the use of a portable X-ray equipment that can be used during the preparation of the subjects as well as for intermediate assessment of injuries during the test. One of the researchers

Figure 2.1: Interior of the preparation room showing the two working positions and the donor storage area

at TESSA using the portable X-ray equipment during one of the experiments is shown in fig. 2.2.

2.4 Task 4- Development of methodology for the handling of human tissue (m3-m4)

At the time of submitting the mid-term report, the effort of drafting a protocol for the handling of biological tissue had not been finished despite of the initial planning of having it ready before month 5 of the project. Reasons for the delay were that it was not feasible to finalize the report before the actual construction of the preproom and before the practical arrangements for receiving donors were completely set.

Thus, the protocol was finally completed before the end of the project and the experienced acquired during the execution of the first PMHS was incorporated into the final version.

The final text is titled *Protocol for the handling of biological material* and it has been submitted to the Commission as Deliverable 4.1.

It has to be pointed out that the protocol to be followed at the University of Zaragoza is based largely on the protocol used at the Center for Applied Biomechanics of the University

Figure 2.2: Researcher of TESSA using the portable X-ray arc during one of the experiments

of Virginia, adapted to the particularities of the Spanish laboratory.

2.5 Task 5- Execution of PMHS sled tests (m4-m17)

2.5.1 Anthropomorphic Test Device (ATD) tests: cooperation with Autoliv

The summit of the BIO-ADVANCE project was the execution of PMHS tests at the facilities of the University of Zaragoza. It was the core of the whole proposal and the best way of showing whether the initial goals proposed for the project had been achieved.

The midterm report had described that during the organization of the first round of tests with the Hybrid III dummy as described in Annex B, the conversations with the University of Virginia and the company Autoliv (whose director of research programs is a member of the Oversight Committee) resulted in a change of the initial research plan so that the experiments planned within BIO-ADVANCE could have a much bigger impact by providing results that could be directly used in the development of advanced restraint systems.

Even if this fact constituted a deviation from the original proposed plan, it was decided

that the benefit of providing results that were directly applicable by the European industry balanced a non-substantial change in the focus of the project. On one hand, instead of using the Hybrid III dummy, which is considered obsolete by many despite of being used still in regulatory tests, TESSA borrowed the updated THOR dummy from Autoliv. It should be mentioned that the updated THOR dummy is the result of another European funded project of the 7^{th} Framework Program (THORAX). On the other, instead of using non-representative restraint systems in the experiments, Autoliv proportioned state-of-the-art seatbelts that were either recently introduced in the market or going to be introduced in the near future. It is unquestionable the value added by these two modifications to the results of the project, even if the originally proposed test matrix needed to be updated.

Thus, dummy tests were completed before the end of 2013 and the results were submitted in a joint publication of researchers from Autoliv and the University of Zaragoza to the annual conference of the Association for the Advancement of the Automotive Medicine. The paper was accepted for publication, with the additional implication of being automatically accepted for an special issue of the indexed journal Traffic Injury Prevention. The goal of the paper was to compare the response of the THOR dummy under the action of two different restraint systems. It received very positive feedback from the Scientific Committee in charge of assessing the contributions to the conference. As a token, fig. 2.3 shows high-speed video frames illustrating the differences observed in the kinematics of the dummy that can be attributed to the use of one restraint system or another. These differences may play a very significant role depending on the type of occupant that is using the restraing (young vs. older, man vs. woman).

The successful initial contact between Autoliv and the University of Zaragoza has resulted in a continuous cooperation of the two entities. As a consequence, the institutions have submitted two joint proposals for consideration of the European Commission: one European Industrial Doctorate under the Innovative Training Networks (ITN) Marie Skłodowska-Curie actions, and one to the topic MG-3.4-2014 (in conjunction with other partners). The participation of the University of Zaragoza in these proposals was facilitated by the possibility of running PMHS tests at TESSA. In other words, BIO-ADVANCE has contributed to enhance the cooperation of the University of Zaragoza with the industrial sector in Europe.

In addition to these strategic benefits, Autoliv has lent the use of an old Hybrid III dummy to the University of Zaragoza for its internal projects. The gracious donation will enable the University to participate in other research initiatives, increasing its capabilities.

2.5.2 Benchmarking of advanced Human Body Models (HBM)

An important part of the cooperation described in section 2.5.1 was based on the existing need of obtaining experimental data that could assist in the benchmarking and validation of the results obtained by several existing advanced (computational) human body models. The future of the field of automotive safety relies on the biofidelity of these models, as

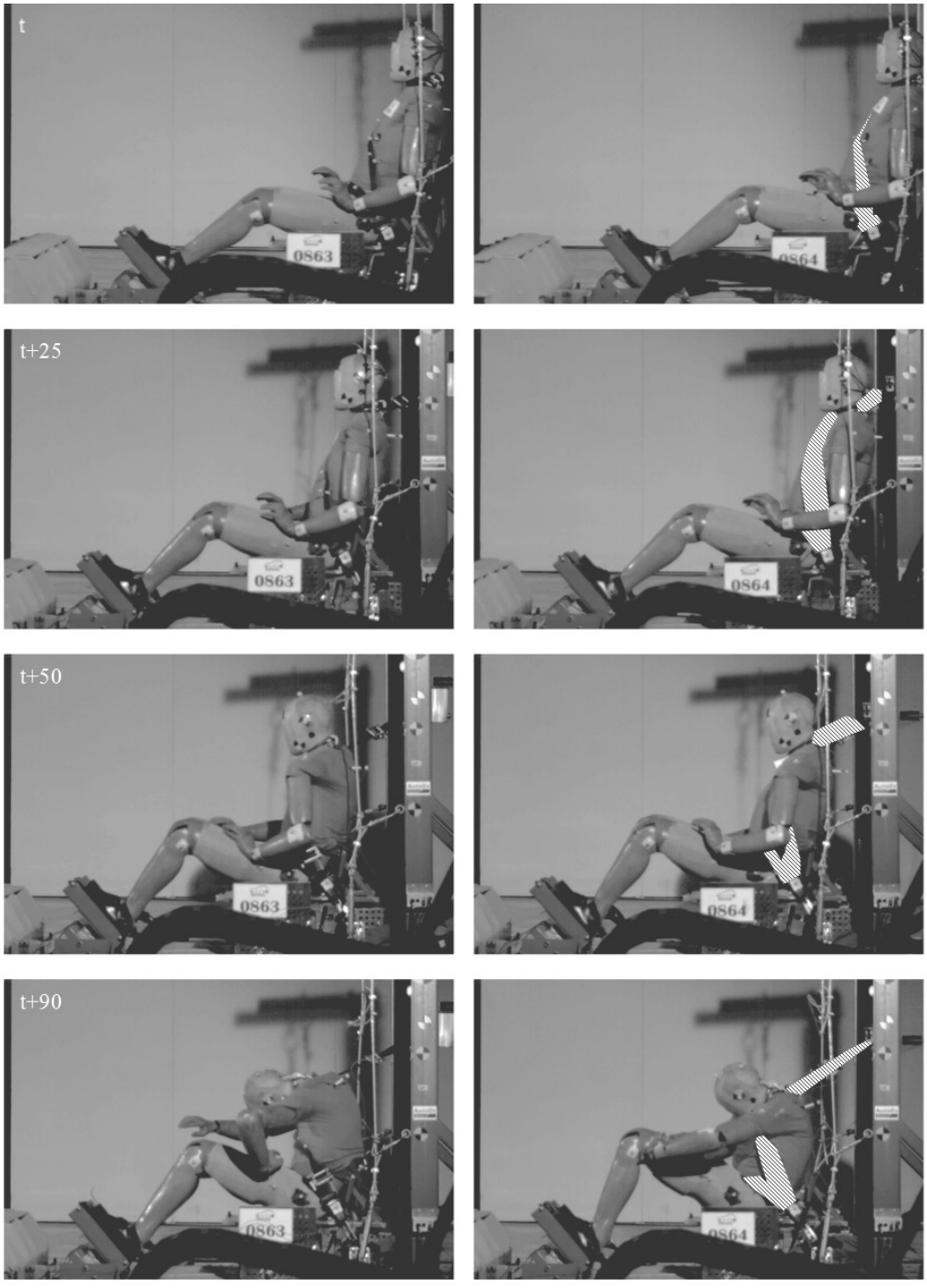

Figure 2.3: Kinematics of the THOR dummy under the action of two different restraint systems

much investment has been put into them for the last two decades.

Thus, TESSA contacted the *Global Human Body Model Consortium (GHBMC)* [1] and signed a cooperative agreement to use the model of the GHBMC in its research. The goal is to compare the results predicted by this advanced HBM to those observed in the experiments.

2.5.3 PMHS tests

All the work carried out within BIO-ADVANCEd conducted to the final result of performing four complete PMHS tests in the project.

After several round of discussions, the following test matrix was agreed to maximize the information that could be used by the researchers of Autoliv and of the University of Zaragoza in their respective research:

No.	PMHS	Speed (km/h)	Restraint system
1	M-0001	35	Inflatable belt
2	F-0002	35	Inflatable belt
3	M-0003	35	Prototype
4	M-0004	35	Reference

Table 2.2: Test matrix of PMHS experiments.

The reference restraint system consisted of a force-limitted pretensioned belt that is available in the market. As for the so-called protoype belt, it is not possible to provide information about this restraint as it is a concept design still under assessment and development.

The instrumentation included in the tests was:

–Arrays of optical markers in: head; left scapula; right acromion; first(T1) and eighth (T8) thoracic vertebrae; second lumbar (L2) vertebra; pelvis; fourth rib (bilateral); eighth rib (bilateral) and sternum body. The location of some of these arrays of markers in a CT-scan sagittal capture is shown in fig. 2.4.

[1]The GHBMC is a consortium of seven automakers and one supplier to consolidate their individual research and development activities in human body modeling into a single global effort to advance crash safety technology. The companies involved in this effort are: Chrysler Group LLC, General Motors Holding LLc, Honda R&D Co.,Hyunday Motor Co., Nissan Motor Corp. Ltd., PSA Peugeot–Citroen, Renault s.a.s, Takata Corp. It counts also with the participation of the National Highway Traffic Safety Administration of the United States and PDB.

–Individual optical markers at: head (3 markers); ulna epicondyles (bilateral); styloid processes (bilateral); greater trochanter (bilateral); femur lateral epicondyles (bilateral) and lateral malleoli.

–Tri-axial accelerometers at: head, T1, T8, L2 and pelvis.

–Tri-axial angular rate sensors at: head and T1.

–Uni-axial accelerometers at sternum.

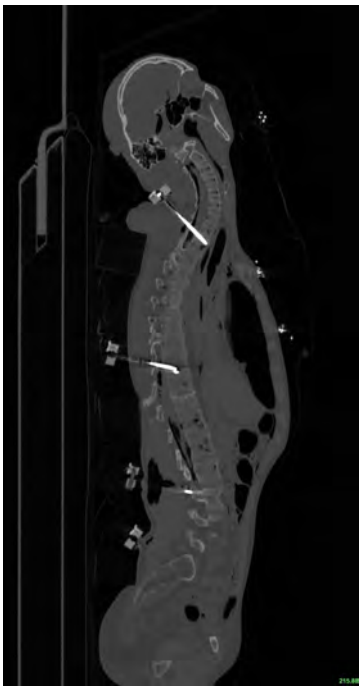

Figure 2.4: Sagittal CT-scan capture showing the location of the optical markers arrays in the spine and pelvis.

On top of these subject-attached sensors, other instrumentation was incorporated into the test fixture: four seatbelt tension gages were used to measure the action of the belt on the occupants, three load cells to measure the reaction of the foot rest and seat assembly on the subject and two linear accelerometers to measure the acceleration pulse of the sled buck.

Due to the provisions included in the Ethical protocol of the laboratory, it is not possible to show pictures of the tests.

2.6 Task 6- Analysis of PMHS data

The analysis of the data obtained from the PMHS is still ongoing at the time of writing this report, as the cumulative delays in the project did not allow the completion of the

analyses within the project time.

The results will be submitted to the journal Traffic Injury Prevention for publication before the end of 2014. The funding collaboration of the European Commission will be acknowledged as done in previous publications.

3. Training and transfer-of-knowledge activities

3.1 Cooperation with the Center for Applied Biomechanics of the University of Virginia

One major aspect of the Marie Curie International Incoming Fellowship is to strengthen the transfer of knowledge between institutions, establishing long-lasting research relationships that can benefit the hosting institution and the experienced researcher.

As described within Part B, cooperation was established with the University of Virginia and the University of Zaragoza benefited largely from this cooperation. It would be impossible to summarize all the instances in which the researchers from the University of Virginia assisted the experienced researcher and the team at the University of Zaragoza. Nevertheless, the following lines provide information about some of these shared activities.

1. **Visit of Dr. Richard Kent (University of Virginia) to the University of Zaragoza (Zaragoza, October 2012)**
   Dr. Richard Kent, professor from the University of Virginia visited the University facilities in October 2012. During his stay in Zaragoza, Prof. Kent imparted the seminar titled "From head to toe: the latest on injury biomechanics" to the researchers of the Institute for Engineering Research. Prof. Kent also visited the crash test facility of the University, providing advice about how to adapt the current facility to the particularities of PMHS testing (fig. 3.1)

2. **Visit of the experienced researcher to the University of Virginia (Charlottesville, April 2013)**
   Dr. Francisco J. Lopez-Valdes visited the Center for Applied Biomechanics of the University of Virginia in April 2013. Among other ideas and proposals for collaboration, it was set up a framework for collaboration involving The Children's Hospital of Philadelphia, the University of Virginia and the University of Zaragoza to investigate pediatric injuries associated to rollover crashes.

3. **Publication of two journal papers co-authored by researchers of the University**

Figure 3.1: Seminar imparted by Dr. Richard Kent from the University of Virginia

of Zaragoza and the University of Virginia:

- *Lopez-Valdes FJ, Riley PO, Lessley DJ, Arbogast KB, Seacrist T, Balasubramanian S, Maltese M, Kent R. (2014) The six degree-of-freedom motion of the human head, spine and pelvis in a frontal impact. Traffic Injury Prevention 15:3, 294-301*
  This publication corresponds to the analysis of the kinematics of the head, several vertebrae and the pelvis of restrained PMHS in high-speed frontal impacts. The method chosen to analyze the rotation of the rigid bodies was to determine the finite helical axis of the motion, that provides an approximation to the actual motion of the bone in a simplified manner. The same method was used in BIO-ADVANCE to report the results from the tests. As the test fixture is the same used in the tests included in the publication, it would be possible to compare between the results obtained in BIO-ADVANCE and previous tests performed at the Center for Applied Biomechanics of the University of Virginia.
- *Lopez-Valdes FJ, Forman JL, Ash JH, Kent R, Alba JJ, Segui-Gomez M. Assessment of a head support system to prevent pediatric out-of-position: an observational study. Ann Adv Automot Med. Volume 57, 2013, 297-310.*
  This paper is not directly related to the research done in BIO-ADVANCE, but it was part of previous research done by the experienced researcher while he was at the University of Virginia. It was considered to be a good opportunity to expand the focus of the collaboration between both Universities, and the shared publication was prepared, submitted and accepted. The methodology and results obtained in this

paper open the door for future studies that are of interest for both institutions.

4. **Presentation of co-authored papers in international conferences:**

   –*Lopez Valdes FJ, Lau SH, Riley P, Kent RW. Characterization fo the In-Vitro Dynamic Behavior of the Human Thoracic Spine in Flexion. IRCOBI Conference, September 2014. Berlin, Germany. In press.*
   At the time of the submission of this report, the paper has been accepted and it will be presented at the IRCOBI Conference in September 2014.

   –*Lopez-Valdes FJ, Kent RW. Can pediatric trajectories be predicted in a high-speed frontal impact? 2014 JSAE Annual Congress (Spring) Paper No. 20145269. Society of Automotive Engineers of Japan, Inc. Pacifico Yokohama (Japan).*
   The paper relates to the research completed by the experienced researcher while he was at the University of Virginia and it was presented at the Spring meeting of the Japanese SAE Congress in Yokohama (Japan) on May 22nd, 2014.

3.2 Participation of the advanced researcher in conferences

1. **Attendance to IRCOBI Conference (Dublin, September 2012).**
   Since 1973, the International Research Council on Biomechanics of Injury (IRCOBI) has organized an international conference annually. The IRCOBI conference is the premier forum for researchers in the field of injury biomechanics. Researchers in the field of biomechanics, crash mechanics, crash reconstrcution, sports injury, tissue modeling, epidemiology and other related fields get together every year to share the latest advancements in the field of injury biomechanics.

   The experienced researcher attended the 2012 edition of the conference, taking the opportunity of contacting other researchers from different European institutions and letting them know about BIO-ADVANCE. As fruit of these initial conversations, researchers from UNIZAR were invited to visit Chalmers Technical University to look for common research interests and future cooperation.

2. **Attendance to IRCOBI Conference (Goteborg, September 2013).**
   In 2013, the experienced researcher attended the IRCOBI Conference and presented the study "Preventing pediatric out-of-position: impact assessment of a head support system "co-authored by the principal investigator of BIO-ADVANCE, Dr. Alba, and a junior research in training, Mr. Juste-Lorente. This paper served to initiate Mr. Juste-Lorente in the analysis of experimental data and constituted part of his undergraduate thesis.

3. **Attendance to AAAM Conference (Quebec City, October 2013).**
   The Association for the Advancement of the Automotive Medicine (AAAM) publishes the papers presented in the conference in the Annals of Advanced Automotive

Medicine yearly. This publication is indexed in PubMed. The experienced researcher attended the conference and gave a presentation co-authored by several former colleagues of the University of Virginia. The paper title was "Assessment of a head support system to prevent pediatric out-of-position: an observational study ".

4. **Attendance to JSAE Conference (Yokohama, May 2014).**
   In May 2014, the experienced researcher presented the study "Can pediatric trajectories be predicted in a high-speed frontal impact "at the Spring edition of the 2014 Japanase Society of Automotive Engineers Annual Congress in Yokohama, Japan. Again this work was co-authored by Dr. Richard Kent, former advisor of the experienced researcher at the University of Virginia.

3.3 Training received by the experienced researcher at UNIZAR

As part of the training provided by the Universtity of Zaragoza, the experienced researcher participated in the following courses that were related to the activities to be performed within BIO-ADVANCE:

1. **Setup and training for the use of the 3d motion capture system VICON**
   The training took place at the facilities of the University of Zaragoza during October 7,8,9 and 10, 2013.

2. **Management of chemical products**
   The training provided information about how to manage different chemicals susceptible to be used in the laboratory. The session was held at the University of Zaragoza on June 6, 2014.

3. **Management of biological hazards**
   The training focused on the existing policies at the University of Zaragoza to manage and dispose of potentially hazardous biological materials, including tissue and instrumentation. It was important for the establishment of the laboratory as complying with these procedures satisfied the current regional law. Training occurred at the University of Zaragoza on June 6, 2014.

3.4 Training provided by the experienced researcher to the personnel at UNIZAR

As included in BIO-ADVANCE Part B, the experienced researcher presented the "Protocol for the handling of biological material "to UNIZAR's personnel involved in the PMHS

tests. The initial training occurred on 23 and 24 April 2014. During the training session, the attendees had enough time to ask questions and to clarify all the points related to their personal protection and to the handling of biological material. After the presentation, there was a practical session focusing on how to put on the Personal Protective Equipment necessary to work with human tissue according to the protocol of the laboratory. UNIZAR's personnel participating in this training were: Dr. Alba, Mr. Juste-Lorente, Mr. Merino and Ms. Altubo.

It should be mentioned that the personnel was not in contact with tissue before receiving this initial training.

4. Dissemination

As stated in Part B of BIO-ADVANCE the main goal of the dissemination of the project activities was to raise awareness of the burden that motor vehicle related injuries impose on the society and to explain the importance of investigating on human tolerance to injury.

During the life of BIO-ADVANCE, several dissemination activities were planned and carried out. Some of them addressed the broader general public through the media with the focus of providing the rationale for the research to be done in the project. Others were addressed to smaller groups of people that were involved in research or industrial activities that could benefit from the results obtained in the project. Last, there is the dissemination of research contents to the scientific and technical community.

The following sections provide a list of these dissemination activities.

4.1 Dissemination activities in the media

The activities in the media targeting the broader public are listed below. It is worth mentioning that these dissemination actions caused a positive reaction to the research to be carried out at TESSA in the public. As proof, there were several people using TESSA's website to consult about donating their bodies specifically for the BIO-ADVANCE research program.

- Magazine "Crónica": *Cadáver al volante para salvar 60 vidas* [Cadaver at the wheel to save 60 lives]. 05/06/2012
- Magazine "Autobild": *¿Pruebas con cadáveres?* [Tests with cadavers?]. 05/18/2012
- Daily "El Correo": *España realizará pruebas de choque con cadáveres para desarrollar sistemas de seguridad* [Spain will perform crash tests using cadavers to develop restraint systems]. 09/23/2012
- Magazine "Tráfico y Seguridad Vial": *Cadáveres para salvar vidas*. [Cadavers to save lives]. N 215, 2012.
- Radio station "Intereconomia"radio interview. 01/22/2013

–Daily "El Periódico": *Cadáveres que salvan vidas*. [Cadavers that save lives]. 05/06/2013

–Online magazine "Acelera": *Un cadáver es el mejor modelo que tenemos de un ser humano* [Cadavers are the best surrogates for human beings]. June 2013. See http://issuu.com/acelera.com/docs/2013-junio

–Daily "El Heraldo de Aragón": *La Universidad de Zaragoza apuesta por la biomecánica para prevenir lesiones por impacto* [The University of Zaragoza bets on biomechanics to prevent impact-related injuries]. 07/05/2013

–TV magazine "CUATRO ": *Usan cadáveres como dummies en pruebas de impacto* [Cadavers that replace dummies in crash tests]. 10/22/2013 See http://www.cuatro.com/noticias/sociedad/Usar-cadaveres-munecospruebas- impactos 2 1688430123.html

–Daily "El Correo": *Muertos que salvan vidas* [Cadavers that save lifes]. 11/03/2013

–Radio station "PRI"(Public Radio International, Minneapolis, USA): Europe takes a cue from US and decides to use cadavers to make cars safer. 02/10/2014. See http://www.pri.org/stories/2014-02-10/europe-takes-cue-us-and-decides-use-cadavers-make-cars-safer

–Daily "La Tribuna de Albacete ": *Cuerpos para mejorar la seguridad en vehículos* [Bodies to improve vehicle safety]. 06/20/2014

Records from these dissemination activities are compiled in the document titled "BIO-ADVANCE: COMPILATION OF DISSEMINATION ACTIVITIES IN THE MEDIA"attached to the Final Report.

4.2 Dissemination to other research groups and relevant companies and institutions

In parallel to the dissemination activities targeting the broader public, there were several presentations of BIO-ADVANCE to smaller groups that were related to the research being done within the project to some extent. These presentations allowed to spread BIO-ADVANCE activities among the scientific and industrial communities.

As result of these contacts, several research activities have been planned in cooperation with some of the companies and institutions, securing the continuation of the research started within BIO-ADVANCE.

Presentations of BIO-ADVANCE activities to the scientific community

–Institution: Institute for Engineering Research (I3A).
Title: From Head to Toe: the latest on human tolerance to Injury. Shared with Dr. Richard Kent (University of Virginia).

Figure 4.1: Inauguration act of TESSA, with the attendance of the Spanish Road Safety Authority, representatives of the Spanish Ministry of Industry and the Regional Industry Commisioner

Date: 09/11/2012.

–Institution: Surgery and Trauma department, Miguel Servet Hospital
Date: 10/19/2012

–Institution: Centro Zaragoza.
Title: Impact Biomechanics
Date: 01/17/2013

–Institution: Master of Bioengineering of the University of Zaragoza.
Title: Road accident deaths: are they accidental?
Date: 05/06/2013

–Institution: Master of Mechanical Systems of the University of Zaragoza.
Title: Road accident deaths: are they accidental?
Date: 05/13/2013

–Institution: Chalmers University of Technology.
Title: Cooperation between UNIZAR and Chalmers in the framework of the BIO-ADVANCE project.
Presentation given to several Chalmers? researchers involved in occupant protection and traffic safety.
Date: 06/19/2013.

–Institution: Autoliv.
Title: Potential collaboration between UNIZAR and Autoliv in the framework of the BIO-ADVANCE project.
Presentation given to the department of Biomechanics and Restraints of Autoliv Research, Inc.
Date: 06/20/2013

–Institution: Showcase ARAHEALTH
Title: Studies on the human tolerance to external loads
Presentation given to member companies of the ARAHEALTH group. Showcase organized by I3A.
Date: 06/21/2013

–Institution: Japan Automobile Research Institute (JARI)
Title: BIO-ADVANCE: Summary of the project.
Presentation given to Dr. Ejima-san and Mr. Antona-san at TESSA when they visited the lab to learn about BIO-ADVANCE activities.
Date: 09/16/2013

–Institution: Visit of the Spanish Road Safety Authority, the Spanish Ministry of Industry and the Regional Industry Commisioner
Title: TESSA: Impact biomechanics
Presentation given to representatives of the National and Regional governments about the importance of research on impact biomechanics to prevent motor vehicle related injuries.
Date: 10/21/2013

–Institution: Honda Research
Title: Research activities at TESSA-I3A
Presentation given to Dr. Motozawa-san, representative of Honda Research. Dr. Motozawa-san visited TESSA to learn about the PMHS testing program being developed in BIO-ADVANCE.
Date: 03/17-18/2014

–Institution: TAKATA
Title: TESSA research on biomechanics
Presentation given to junior and senior engineers of the Echigawa TAKATA plant, Kyoto (Japan)
Date: 05/21/2014

–Institution: *Foro Biomecánica y Calidad de Vida* [Forum: Biomechanics and Life Quality]
Title: Are crash/accident related injuries accidental?
Presentation given to general public. Seminar organized by the I3A, the Aragonian Confederation of Industry and the SAMCA chair for Technological Development
Date: 11/30/2013

–Institution: Spanish Association of Trauma and Orthopedic Surgery (INVESCOT)
Title: TESSA: Research on impact biomechanics
Presentation given to attendees of the 10th National Congress of INVESCOT describing TESSA's capabilities in the study of trauma biomechanics
Date: 01/31/2014

–Institution: Japan Automobile Research Institute (JARI)
Title: It is not only about age: concurrent biomechanical factors influencing injury tolerance
Prsentation given at the JSAE Pre-Conference workshop "Diversity of traffic injury in declining birth rate and a growing proportion of elderly people" in Tokyo University
Date: 05/20/2014

–Institution: International Federation of Motorcycling (FIM)
Title: Review of biomechanics research at TESSA
Presentation given to the members of the board of the FIM
Date: 06/17/2014

4.3 Dissemination of Marie Curie actions to junior researchers

The Institute for Engineering Research (I3A) jointly with the European Projects Office of the University of Zaragoza organized a seminar to encourage junior researchers to apply to Marie Curie Actions. In an event shared with personnel from the European Projects office of the University of Zaragoza and three other Marie Curie fellows, the incoming fellow of BIO-ADVANCE explained his experience in the preparation and proposal phase of a Marie Curie action. The event took place on 05/06/2013.

4.4 Dissemination in scientific journals and technical conferences

Although some of these publications have been already listed in other sections of this report, the complete list of journal publications and contributions to conferences is included here.

4.4.1 Peer-reviewed journal publications with impact factor

1. Lopez-Valdes FJ, Juste Lorente, O, Pipkorn B, Garcia I, Sunnevang C, Dahlgren M, Alba J. (2014) A comparison of the performance of two advanced restraint systems in frontal impacts. Traffic Injury Prevention. In press.

2. Lopez-Valdes FJ, Riley PO, Lessley DJ, Arbogast KB, Seacrist T, Balasubramanian S, Maltese M, Kent R. (2014) The Six Degrees of Freedom Motion of the Human Head, Spine, and Pelvis in a Frontal Impact, Traffic Injury Prevention, 15:3, 294-301, DOI: 10.1080/15389588.2013.817668

3. Lopez-Valdes FJ, Seacrist T, Arbogast K, Balasubramanian S, Maltese M, Tanji H, Higuchi K, Kent, R. A methodology to estimate the kinematics of pediatric occupants in frontal impacts. Traffic Injury Prevention. 2012. Vol. 13(4):393-401. DOI: 10.1080/15389588.2012.660664.

4. Kent R, Lopez-Valdes FJ, Lamp J, Lau S, Parent D, Kerrigan J, Lessley D, Salzar R. Biomechanical response targets for physical and computational models of the pediatric trunk. Traffic Injury Prevention. 2012. Vol. 13(5):499-506.

4.4.2 Peer-reviewed journal publications without impact factor

1. Lopez-Valdes FJ, Forman JL, Ash JH, Kent R, Alba JJ, Segui-Gomez M. Assessment of a head support system to prevent pediatric out-of-position: an observational study. Ann Adv Automot Med. Volume 57, 2013, 297-310.

4.4.3 Peer-reviewed conference papers

1. Lopez Valdes FJ, Lau SH, Riley P, Kent RW. Characterization fo the In-Vitro Dynamic Behavior of the Human Thoracic Spine in Flexion. IRCOBI Conference, September 2014. Berlin, Germany. In press.

2. Juste Lorente O, Alba JJ, Lopez-Valdes FJ. A comparison of the performance of child restraint systems between a variant of the ECE-R44 bench and a vehicle seat. IRCOBI Conference, September 2014. Berlin, Germany. In press

3. Lopez-Valdes FJ, Juste Lorente O, Alba JJ. Preventing pediatric out-of-position: impact assessment of a head support system. IRCOBI Conference, September 2013. Goteborg, Sweden.

4.4.4 Non-peer-reviewed conference papers

1. Lopez-Valdes FJ, Kent RW. Can pediatric trajectories be predicted in a high-speed frontal impact? 2014 JSAE Annual Congress (Spring) Paper No. 20145269. Society of Automotive Engineers of Japan, Inc. Pacifico Yokohama (Japan).

5. Review of milestones achieved during the project (m1-m24)

All proposed deliverables for BIO-ADVANCE were achieved by the end of the project. As explained in the sections above, some of the originally planned activities had to be adapted to the existing circumstances (delays in the construction work to adapt the facility, delays in the arrival of test equipment as VICON, a period with less donated bodies than expected originally, etc). All these problems were managed promptly and effectively, resulting in the successful completion of all milestones as described in the table below:

No.	Milestone	Month	Status	Comments
1	Signed collaborative agreement with ECIP	2	Completed	As explained during the first reporting period, ECIP stopped its activities as a research group in 2012. Due to this circumstance, links were established with different institutions that could act as providers of subjects. A collaborative agreement was signed with the School of Medicine of the University of Castilla la Mancha and with the company Scientific Anatomy. The collaboration has resulted very successful and TESSA has received 9 donors from March 2014 up to the moment of submitting this report

2	Protocol for the handling of biological tissue approved	4	Completed	The completion of the protocol occurred during the development of the tasks of the project as there were aspects that were impossible to foresee before being exposed to them. Also, the protocol was developed according to the recommendations of the University of Zaragoza and regional authorities in terms of handling human tissue and disposing of the remains. The protocol was ready by the end of the project and reflects the particularities of TESSA, although it is largely based on the protocol of the Center for Applied Biomechanics of the University of Virginia
3	Remodeling of crash facility finished	7	Completed	The construction work finished by the end of September 2013, slightly later than expected according to the Midterm Report of BIO-ADVANCE.
4	Test fixture built	7	Completed	The test fixture (including relevant instrumentation) was available thanks to the collaboration with Autoliv Research, Inc. The use of this particular test fixture will assure potential data sharing and collaboration with the University of Virginia, as this fixture is an exact replica of that used in the Gold Standard tests.

5	3D motion capture system working	9	Completed	The approval for the acquisition of the system was finally signed in July 2013 and the system arrived to TESSA in October 2013, with a significant delay from the planned arrival. Despite of it, TESSA's researchers set up the system and it was up and running in October 2013. The late arrival of the system and some technical problems derived from its use introduced further delays in the completion of the PMHS tests. These problems were finally overcome and the system was used both in the dummy and in the PMHS sled tests planned in BIO-ADVANCE. This system was funded through the collaboration with the Regional Government of Aragon and will be unique in Spain.
6	PMHS test completed	24	Completed	The experiments were completed later than planned due to the difficulties associated to securing donated bodies suitable for the project and to the training of the personnel. Regardless of these difficulties, four fully-instrumented PMHS tests were completed before the end of the project. The publication showing the results obtained in under preparation and will be submitted to a journal before the end of 2014.

6. Summary of the most significant results obtained in the project (m1-m24)

It is difficult to summarize two complete years of work in just a few bullet points, but the list below attempts to provide an overview of all the activities covered during the life of BIO-ADVANCE:

- Appointment of the Oversight Committee including 15 members from relevant national and international stakeholders.
- Drafting of a document specifying the duties and procedures to be followed by the members of the Oversight Committee in their assessment of UNIZAR's activities in BIO-ADVANCE.
- First meeting of the Oversight Commitee of BIO-ADVANCE with the result of the unanimous approval of the procedures for the procurement and handling of biological materials
- Satisfactory assessment of the *Comité Ético para la Investigación Clínica de Aragón* (CEICA) and establishment of a procedure so that this commission can review and assess TESSA's projects in the future.
- Deliverable 2.1 "Protocol for the procurement of human tissue"completed.
- Deliverable 2.3 "Ethics protocol at TESSA"completed.
- Deliverable 4.1 "Protocol for the handling of biological material"completed.
- Collaborative agreement signed with the University of Castilla- La Mancha for the procurement of human tissue.
- Collaborative agreement signed with the Regional Government of Aragon and Hospital MAZ for the development of a common research program focused on PMHS testing to prevent injuries in motor vehicle crashes.

- Securing of nine donors that are valid for sled testing following the aforementioned procedures.
- Securing funding for the construction of an autopsy room (prep room) and the acquisition of instrumentation to upgrade UNIZAR's facilities (including a 10-camera motion capture system, with capabilities of recording motion at 1000 Hz).
- Securing the use of the Hybrid III dummy for future internal studies (thanks to Autoliv's cooperation)
- Agreement with the GHBMC so that researchers at TESSA can use the HBM in dissertations and internal research.
- Publication of four journal papers, two of them written in collaboration with researchers of the University of Virginia.
- Three presentations given at conferences, two of them in collaboration with researchers of the University of Virginia.
- Three visits from companies.
- Four visits from public and private organizations.
- 12 appearances in the news (press, TV or radio).
- Training of the personnel of the University of Zaragoza in PMHS testing.
- 19 sled tests with the THOR dummy successfully completed.
- Four sled tests with PMHS successfully completed.
- Participation in three recent European-wide proposals (Marie Skłodowska-Curie actions, RIA, tender) thanks to the acquired capabilities in PMHS testing.

The research team at the University of Zaragoza assesses positively the outcome of the project, as it has served to the main goal originally planned: to establish and implement the necessary procedures so that the crash test facility of the University of Zaragoza was capable of running fully instrumented PMHS sled tests. Thanks to BIO-ADVANCE, TESSA has become one among few laboratories worlwide.

Appendix

Appendix A. Minutes of the Oversight Committee meeting

BIO-ADVANCE: 1st Oversight Committee Meeting Minutes

Attendees:

Members of the Oversight Committee:

Mr. Jacobo Antona
Dr. José Aso Escario
Dr. Ignacio Garcés
Dr. Luis Miguel García Vinuesa
Dr. Antonio Herrera
Dr. Ricardo Insausti
Dr. Jesus Monclús González
Dr. Maria Seguí Gómez
Mr. Jose Enrique Román

Observers:

Mr. Juan Luis de Miguel
Mr. Rafael Sánchez
Mr. Daniel Urquizu

TESSA staff:

Dr. Juan J. Alba López
Mr. Oscar Juste Lorente
Mrs. Raquel Martín Casas
Mr. José Merino
Mrs. Elena Portero
Dr. Francisco J. López-Valdés

Regrets:

Mr. Arturo Aliaga
Dr. Rogelio Altisent
Dr. Ola Bostrom
Dr. David McManus
Mr. David Ward

1. ATTENDEES INTRODUCTION

Juan J. Alba López opened the meeting introducing the members of the TESSA team to the attendees. This was followed by a round table introduction of each of the attendees who explained why they had been approached to become members of the

Committee and provided information about their background and current professional activities.

2. VISIT TO THE FACILITIES

The members of the Oversight Committee participated in a tour of the facilities in which they visited the universal form launcher (pedestrian machine), the acceleration sled and the prep room for the preparation of the human subjects. The visit included watching one sled test of a child restraint system so that the attendees could ask questions about the procedures, crash test dummies, etc.

3. PRESENTATION OF TESSA AND BIO-ADVANCE

Ignacio Garcés, director of the Institute of Engineering Research (I3A), introduced the institute to the members of the Oversight Committee, describing the research activities done within the different divisions of the institute.

TESSA is one of the research groups that belong to the institute and is led by Juan J. Alba López. After Dr. Garcés' explanation, Dr. Alba presented the development of TESSA and its main research activities, including European research projects. BIO-ADVANCE is one of these projects and Dr. Alba gave the floor to Francisco J. López - Valdés to explain the research activities to be done within BIO-ADVANCE as well as the role of the Oversight Committee within the project.

The reason for creating an Oversight Committee within BIO-ADVANCE was the need of having an external committee that could assess the Ethics of the procedures that were proposed in BIO-ADVANCE in the absence of such committee within the University of Zaragoza. This need for an external assessment was one of the points raised by the European Commission during the evaluation of the project.

It was explained that the invitations to become part of the Oversight Committee were extended to people from different backgrounds and professions so that the society as a whole could be represented in the committee. Some members of the committee are public servants serving at different Administrations (including traffic safety and industry), some come from industry, others are medical doctors with experience in research using cadaveric material, and others are experts on Forensic Science and Ethics and traffic safety research foundations.

Although the research goal of the project had been already approved by the European Commission, it is expected that the Oversight Committee can serve more as a strategic committee instead of just assessing the Ethics of the procedures. But within BIO-ADVANCE, it was required that the Committee had this specific Ethics focus. Dr. López-Valdés explained that at the end of the BIO-ADVANCE project some of the members of the committee will be asked to serve in this strategic committee.

The general procedure to obtain and to handle the bodies of the donors within BIO-ADVANCE (see presentation attached: BIO-ADVANCE_goals and ethics.pdf) was presented in detail.

The first part of the presentation focused on the key importance of using human cadavers to understand the tolerance of the human body to external loads and to develop biofidelic models (such as crash test dummies or computer models) that could assist in the understanding of the first point (tolerance of the human body to external loads). Dr. López-Valdés provided a few examples about the existing differences between current dummies and human beings.

Next, the presentation explained the diverse background of the members included in the Oversight Committee. It was emphasized the necessity of having industry participating actively in the activities of TESSA: if the research done using cadavers does not help industry to improve the protection of the users, then TESSA's researchers do not think that the research can be considered ethical. Thus, it is of the utmost importance to ensure the transfer between the generation of knowledge in the research and the applications of that research in the real world.

It was read out loud the Ethics commitment signed by all the researchers at TESSA that is based in a model proposed by the National Highway Traffic Safety Administration (NHTSA) of the United States of America. Anyone performing work on human tissue at TESSA needs to sign that form and to abide by the ethical principles contained in it.

Tissue to be used within BIO-ADVANCE can be obtained from four different sources. Before accepting a donor to be used in BIO-ADVANCE it is required that the donor (or the family) has donated voluntarily the body for research purposes and, if it is going to be used in an impact related study, an additional consent is required from the next of kin (in the form of a singed document stating that they are aware of the goals of the

research). Should the body be used in a biomechanics application that is closer to Orthopedics instead of Impact Biomechanics, then this additional consent is not required: it is assumed that these studies are within what a regular donor understands that can be done with his/her donated body after death.

This procedure brought up some discussion about the necessity of having this additional consent from the family in case of impact studies. Dr. Herrera pointed out that the additional consent was not necessary from any point of view, including Ethics. Dr. Seguí-Gomez concurred with this affirmation, reminding that at the University of Navarra, the Institutional Review Board had found that no additional informed consent was needed once the donor had donated his body for research. Dr. López-Valdés explained that, although from the Ethics perspective no additional consent was required, previous experiences in Germany made it advisable to avoid scandal especially in the media. Dr. Herrera explained that the problem in Germany was of different nature since cadavers that had not been donated were used in research without informing the next of kin. Dr. Insausti pointed out that everything should be carried out with complete transparency and always respecting the dignity of the donors. He had the experience of informing the next of kin about the intention of using the donated bodies of their relatives in impact studies and the feedback had been always positive. He mentioned the success of the tissue donor program (especially the blood donor one) in Spain and that it was based in a complete transparent procedure. Dr. Alba intervened to point out that even if BIO-ADVANCE had been openly presented to the media, all the reactions had been very positive. Same situation happened when the DGT published an article about using cadavers in research on occupant protection, as commented by Dr. Seguí-Gomez.

Dr. Aso reminded that there were two aspects to be considered: the ethical and the legal one. As for the Ethics, it was required to respect the principles of:

i. avoiding unnecessary cruelty,
ii. providing a benefit to the society (to reduce the number of injuries),
iii. respecting the will of the deceased manifested by himself or his family,
iv. and justice (i.e. that there is not money benefit involved in the process of donating and accepting the donation of the body).

As for the legal part, if the donor has given his consent to be used in research, then there is no legal problem. Dr. Aso remarks that the term autopsy should not be used to refer to the post test examination as it is a legal term associated to the act of certifying the death of the person. Expanding on this issue of using the right terminology, it was reminded that we should avoid the terms “impacting cadavers” or “smashing cadavers” as it can transmit to the neophyte a wrong and negative impression of the research being done. Instead, it was proposed to use terms such as “injury prevention studies” or “impact biomechanics studies”.

It was explained that at the end of the meeting, each of the members of the Committee was going to be required to fill in a questionnaire in which they could state their ideas about the different levels of informed consent so that a donor can be used in programs such as BIO-ADVANCE.

During the meeting, the Vice-president for Research of the University reminded the responsibility of the University to the community and more specifically the need of publishing any result obtained from experimenting with human subjects. This responsibility was acknowledged and subscribed by the researchers at TESSA.

Mr. Román asked if the cadavers were treated anonymously and it was confirmed that at no point the researchers will know personal information to identify the cadaver.

It was also pointed out that the members of the Oversight Committee did not represent officially their institutions and they were to provide advice to the best of their abilities as their solely personal opinion.

It was confirmed that the minutes of the meeting and the relevant presentations would be distributed among the members of the Committee that could not attend the meeting and they were going to be asked to fill the questionnaire as well.

The meeting finished with the members filling in the questionnaires and it was adjourned at 2.15 pm.