Publishable summary report of the TelliBox project

Grant agreement number:	217856
Project acronym:	TelliBox
Project title:	Intelligent MegaSwapBoxes for Advanced Intermodal Freight Transport
Start date of the project:	01.04.2008
Project type:	SP1 – Cooperation Collaborative Project, Small or medium-scale research project
Date of preparation of Annex I:	14.02.2008
Period covered:	01.04.2008-31.03.2011
Responsible organisation:	Project Coordinator and Scientific Lead: RWTH Aachen University, IMA/ZLW & IfU (Prof. Dr. rer. nat Sabina Jeschke)
Tel.:	0049 241 809 911 49
Fax:	0049 241 809 911 22
E-mail:	max.klingender@ima-zlw-ifu.rwth-aachen.de
Project website:	www.TelliBox.eu

Executive summary

TelliBox – Intelligent MegaSwapBoxes for Advanced Intermodal Freight Transport has been an EU funded project within the Seventh Framework Programme led by the RWTH Aachen University, IMA/ZLW & IfU (Prof. Dr. rer. nat. Sabina Jeschke). The project has dealt with the development of an all-purpose loading unit, the MegaSwapBox, which is applicable for intermodal transport of road, rail, inland- and short sea shipping and an adapted chassis. The MegaSwapBox combines the advantages of containers and semitrailers and is based both on a technical and efficiency feasibility analysis and on a proof of concept via a concrete prototype and a demonstration phase. The overall aim of the project has been to counteract the trend towards increasing freight transport by making better use of the different modes on their own and in combination with each other (co-modality), offered in an integrated, safer, greener, smarter and competitive product compared to established loading units. Main distinctive characteristics of the developed MegaSwapBox are:

- stackability,
- inside height of 3 meters,
- length of 45 feet,
- cargo capacity of pallet wide 100 meter^3,
- openable on 3 sites,
- top-handable and
- pilfer and theft-proof.

Research, innovation and the creation of a seamless oriented transport concept are crucial for the further development of intermodal transport systems. Modal share and intermodal transport are encouraged within the actual Framework Programme of the European Commission through the improvement of the efficiency of interfaces between modes, the maximisation of cargo capacity and the optimisation of logistics services and transportation flows within European and global supply chains.

TelliBox gives concrete answers to all those issues through a custom-oriented intermodal transport approach and by encouraging dialogue between industrial and scientific partners, gathered on a neutral European intermodal platform. Within the demonstration phase it has been proofed that the TelliBox prototypes (MegaSwapBox and adapted cahssis) are seamlessly applicable to the different transport modes road, rail, inland- and short sea shipping. Foundation for the success of the project has been the interdisciplinary consortium with partners from science, industry/manufacturers, freight forwarders and consultants/associations accompanied by an advisory board of lead customers.

1 Summary Description of the Project Context and Objectives

TelliBox – Intelligent MegaSwapBoxes for Advanced Intermodal Freight Transport has been an EU funded project within the transport theme of the Seventh Framework Programme, led by the RWTH Aachen University, IMA/ZLW & IfU (Prof. Dr. rer. nat. Sabina Jeschke), that has aimed at developing an intermodal loading unit, the MegaSwapBox, to meet the current challenges of international freight transport (cf. Figure 1). Within the last few years innovations and developments for intermodal transport have been made, but there are still a number of economical, technical and operational obstacles to overcome so as to provide a beneficial usage of intermodal systems for various freight transports. Moreover the trend towards more freight transport by road needs to be altered for a more sustainable greener transport. The improvement of integration and compatibility between modes provides the necessary scope for a sustainable transport system. The road transport system is nearly overloaded and currently does not offer enough potential for technological enhancement to face the future increase of traffic performance. Thus, the balancing of the modes of transport i.e. intermodal transport represents a crucial solution within the scope of European transport policies.

Figure 1: TelliBox at final event in Duisburg

The aim has been to develop a new intermodal loading unit that faces the current and future transportation challenges and is usable for common applications of intermodal freight transport. In addition, this MegaSwapBox should benefit from the advantages of preferred loading units for the individual transport modes, such as mega-trailers, swap bodies and containers. To work out a new intermodal loading unit that is both cost effective and sustainable a design process that integrates all relevant stakeholders of intermodal transport and regards usability, profitability and technical aspects has been necessary.

The European-wide need of balancing transport modes has been taken into account by combining the suitability for employment in rail, road, short sea and inland shipping. The lack of standardization concerning intermodal loading units hinders the connectivity of modes and generates costs e.g. by requiring special transhipment technologies.

The MegaSwapBox contributes to the improvement of interfaces between transport modes and enhance logistic services while achieving high safety requirements (cf. Figure 2). For an optimal combination of the advantages of containers, swap bodies and mega-trailers the development has focused at an inside height of 3 meters and enables loading of cargo through three doors (both sides and the rear portal). Lockable hard covered sides are constitutive elements of the MegaSwapBox in order to remove the disadvantages of curtain sides commonly used in today's swap bodies. A 100 meter³ cargo capacity guarantees the competitiveness of the box when faced with mega-trailers. In order to offer a maximum optimisation of loading and unloading processes a liftable top is considered. Additional requirement to fulfil has been an internal width of 2.48 meters to ensure a pallet wide storage space.

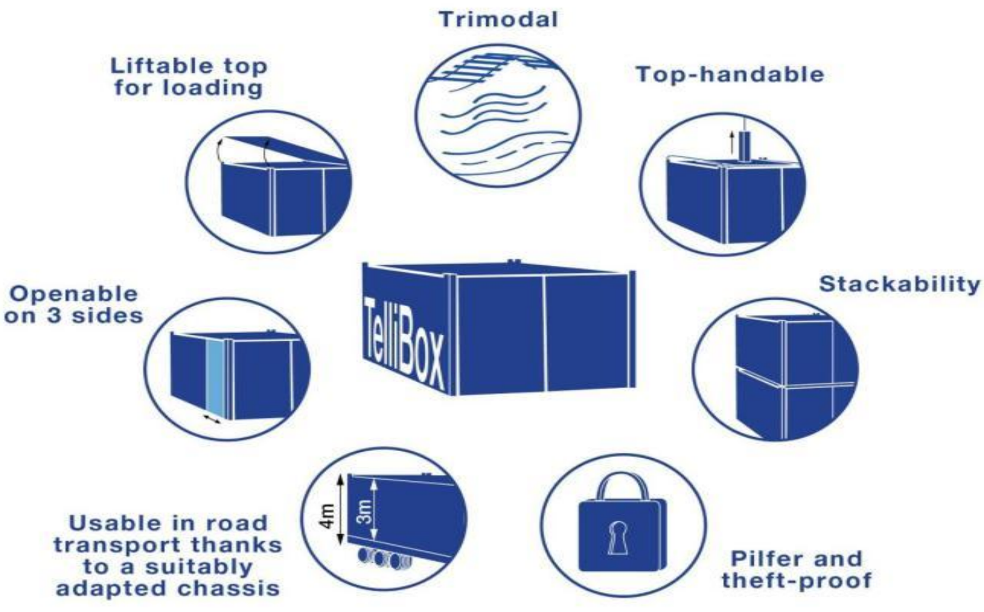

Figure 2: Challenges of TelliBox

The developed loading unit offers a liftable roof, three openable sides, can be craned from the top, presents an inner height of 3 meters without exceeding the permitted overall height of 4 meters (MegaSwapBox and chassis) during road transport, is stackable (allowable stacking weight 38,600 kilograms), has solid sidewalls and therefore offers a high loading theft protection. It can be used trimodal on road and rail, on inland waterways and during short sea shipping in Europe and possesses a high loading theft protection and TIR certification.

The achieved internal height of 3 meters demands the development of an adaptable chassis for road transport to comply with current regulations. The chassis is also usable for standard containers. The operability of this MegaSwapBox on rail is ensured by currently existing standard low platform wagons. Project consortium’s ambition has also been the certification of the prototypes by CSC and UIC after having been tested on a multimodal test route from the Netherlands via Poland to Great Britain to ensure their usability. The composition of the consortium and the enthusiastic participation of all partners have ensured a global and comprehensive view of transport stakeholders needs and interests. Thus, the project’s success have been guaranteed by including among its members representatives of all parties concerned e.g. freight forwarders (Ewals Cargo Care B.V., Wincanton GmbH and CTL Logistics S.A.), manufacturers (Wecon GmbH, Wesob Sp.z.o.o. and HRD Trailer Engineering) and scientists/associations (RWTH Aachen University, University of Zilina, European Intermodal Association and Intermodal Concepts & Management AG). The extensive demonstration phase with test runs of the prototypes of MegaSwapBox and adapted chassis across Europe has proofed the concept of the project TelliBox prototype.

2 Work Performed and main S&T Results Achieved

2.1 Project Methodology

The project TelliBox has been subdivided into dedicated work phases for an efficient work flow and to ensure the successful development of the MegaSwapBox (cf. Figure 3). In the first phase, the analysis phase, the consortium has defined a solution space by comparing existing solutions and innovations in order to devise a requirement specification. The exploration of technical attractiveness and feasibility with proven scientific methodologies within the second phase has aimed to highlight best possible solutions and their combinations, which than had been subject to an elaborated design, including material tests, in work phase three. The most favourable solution has been selected by means of profitability and usability analysis. Its design has been transferred to the construction phase in order to build the prototype of the MegaSwapBox and the chassis. Finally, in the demonstration phase, these prototypes has been tested on a defined intermodal corridor from Poland, via Germany and the Netherlands, to the United Kingdom using rail, inland and short sea shipping as well as road transport. To guarantee an optimal solution, the constructed prototypehas been subject to an optimisation loop which has led to minor improvements of the MegaSwapBox and the adapted chassis.

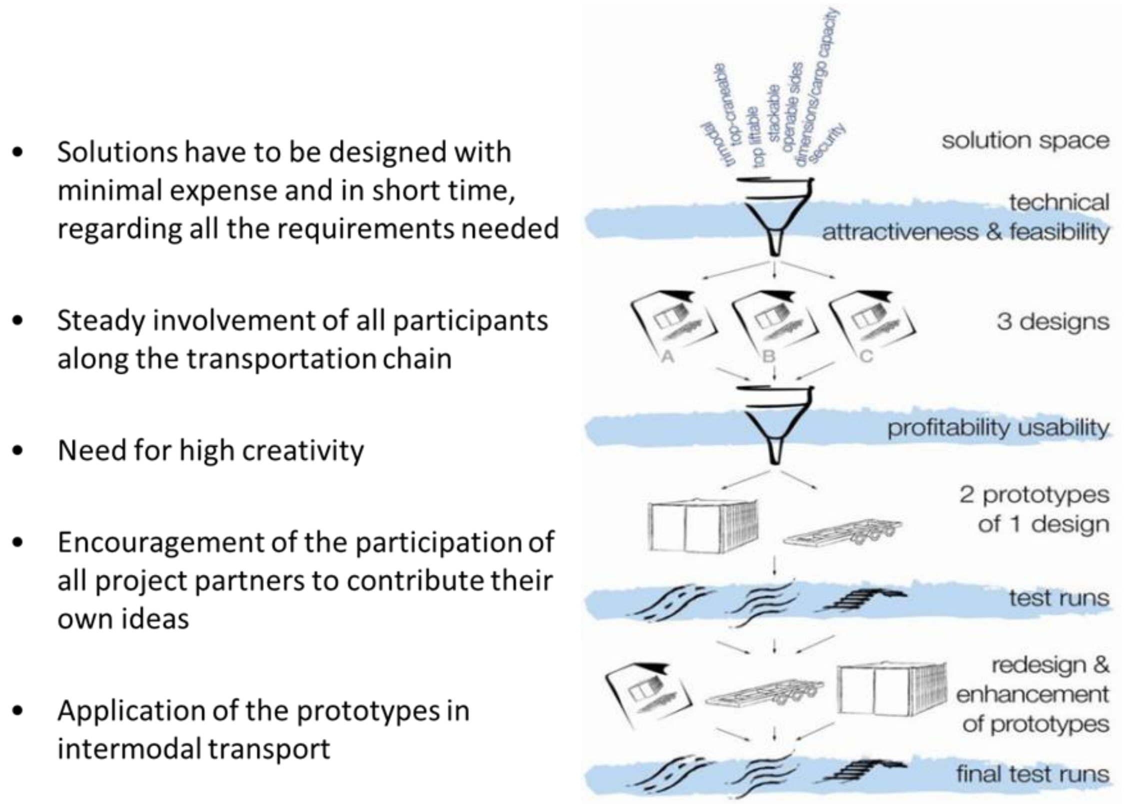

Figure 3: Methodology of the TelliBox project

Simultaneously to the whole project process, intermediate results and final achievements has been published and disseminated in the transport sector (cf. Table 3), following specific exploitation strategies. As a European research project, TelliBox has generated an applicable and custom-oriented intermodal transport solution by encouraging dialogue between industrial and scientific partners.

Within the next chapters significant results of the work phases analysis, design and decision, elaboration, evaluation, construction and demonstration are presented in detail. The in-depth documentation can be found on the project webpage www.tellibox.eu in various deliverables. Thus, the respective deliverables and responsible partners are indicated in the following chapters.

2.2 Analysis Phase

2.2.1 As-is-Analysis

Subject to the as-is-analysis (Deliverable 1) has been a summary of all intermodal loading units and related technologies available on the market; their design, handling, weaknesses and strengths. Following that report, headed by the University of Zilina, the demands to the new box have been defined on the report on requirement specification, describing all its parts and functionalities from a construction point of view e.g. internal, external height, observing legal standards and bearing in mind the surveyed opinion of all stakeholders involved.

There are several intermodal systems in the intermodal transport market and each of them uses different UTI (Unité de Transport Intermodal). Individual UTIs (containers, swap bodies, semi-trailers, etc.) have their advantages and disadvantages related to their design, technology, transportation and handling. The as-is-analysis in its first part has compared the individual most frequently used UTIs from the design, handling and other parameters point of view. The result of this analysis is a comparison matrix (cf. Table 1) in which weaknesses and strengths of the individual UTIs are presented and they are compared to the proposed MegaSwapBox. Furthermore the advantages and disadvantages of the individual UTIs are compared to the MegaSwapBox.

An important part of the as-is-analysis has been the questionnaire distributed to major European transport forwarders and manufacturers. The questionnaire has been distributed by the project consortium members to almost 60 companies. Number of responses that could be used for analysis has been 32, great majority of them from Germany (19), followed by Slovakia (7), 2 from the Czech Republic and by 1 from France, Hungary, Slovenia and UK.

Table 1: Comparision Matrix

	ISO 1A container	HC 45' container (UNIT 45)	Swap body (series A)	Semi-trailer (Jumbo)	MegaSwapBox
Transport modes	trimodal (road, rail, waterway)	trimodal (road, rail, waterway)	bimodal (road, rail)	monomodal (road)	trimodal (road, rail, waterway – inland and short sea)
Advantages	+ availability, + the most used UTI, + good interoperability, + high stability, + safety of cargo, + stackability.	+ increased capacity against ISO 1A containers, + high stability, + safety of cargo, + stackability	+ good interoperability (road – rail) + possible horizontal handling (without external equipment) + good loading/ unloading process	+ good loading area utilisation with europallets + availability, + no need of terminals, + easy loading/unloading process, + flexibility	+ high cargo volume, + stackable, + m internal height, + liftable top, + easy loading/unloading process,
Disadvantages	- Insufficient use of loading area with europallets, - lower volume, lower internal height, - loading of goods only from back, - only vertical handling	- loading of goods only from back, - only vertical handling - exceeded loading gauge (on standard wagons)	- only box SB are stackable - Safety of cargo (not in case of box SB) - not applicable for shipping - not optimised handling process	- only road transport - not stackable, - impossible vertical handling - other disadvantages related with road transport	- adapted lower road chassis - railway wagons with low platform on C45 lines (available)

Outputs from this questionnaire show satisfaction or dissatisfaction with existing situation with intermodal transport in Europe. At the same time opinions of the respondents are good bases for the further solution as they expressed their opinions of new UTI (MegaSwapBox) thus giving good input for requirement specifications and value of individual features. The newly proposed high-capacity UTI named MegaSwapBox is expected to link as much as possible the advantages of the individual UTIs and eliminate their disadvantages (cf. Figure 4).

Large containers ISO 1 are the most used type of UTI, but they have some disadvantages, while the most serious one is the internal dimension of the container. When loaded by europallets the loading area of the container is not sufficiently used because the internal width of the container does not allow loading two europallets side by side. From this reason in the last years there is a trend to utilise so called pallet wide containers that means containers with extended internal dimensions.

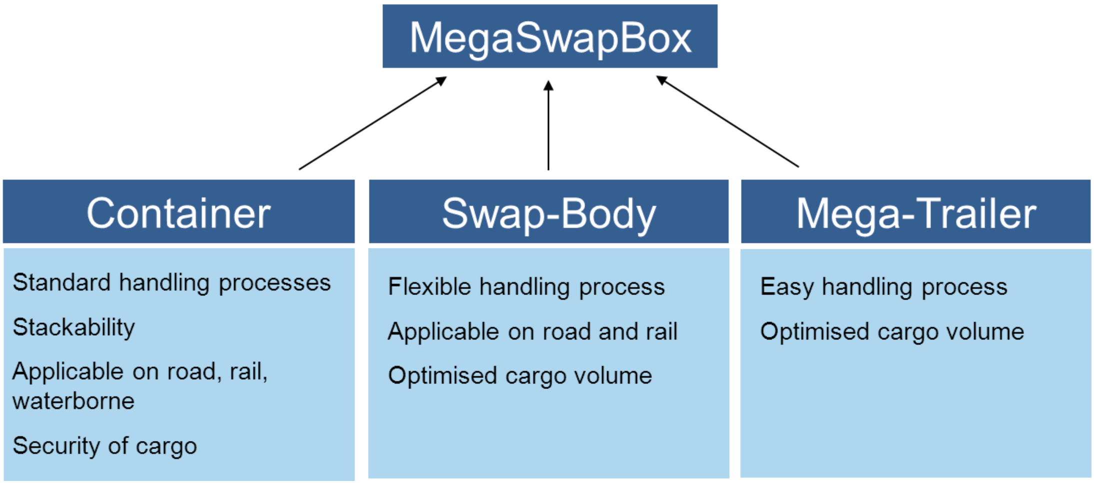

Figure 4: Composition of the new MegaSwapBox

Swap bodies eliminate some disadvantages of ISO containers: dimensions of loading area are educed from dimensions of europallet, by which more effective use of loading area has been achieved. In terminal points of transportation the swap body can be taken off and on a vehicle without use of handling facility.

Semi-trailers are primarily used in road transport. Only few of them can be used in intermodal transport and none of them for transports on waterways. Compared to containers and swap bodies they prove to be more flexible especially in using of their cargo area. In road haulage semi-trailers are preferred because of their flexibility not only in terms of manoeuvrability but also concerning the coupling and uncoupling process. When a semi-trailer is transported on railway its disadvantage is its high dead-weight.

The project *TelliBox* has come about as a result of increasing demands from politics and society to counteract the trend towards increasing freight transport by road. That is why in the beginning of the project an as-is-analysis has to be elaborated. For development of new efficient and competitive intermodal transport system it is necessary to recognise the actual constraints as well as advantages of existing intermodal transport units and means of intermodal transport.

2.2.2 Requirement Specification

The development of a requirements specification is one of the basic tasks for a successful and sustainable project progress and has been carried out by the entire consortium, led by the University of Zilina. The basic requirements have already been set in the project proposal and are also in brief reviewed in the as-is analysis of the project, where the main features of the system are summarised and compared to other principal systems of intermodal transport in detail.

The trade-off among requirements is a classical technical problem of any new design. A huge number of aspects should be considered. The parameters set in the project proposal are ambitious and are going to constructive limits for the MegaSwapBox.

The requirements on the MegaSwapBox are mutually dependent. For example, one priority is the internal height of 3 meters in combination with a construction that also allows stackability of the MegaSwapBox. But at the same time there is a strict limit for the permissible overall external height of the combination of 4 meters on road transports which creates difficulties for solutions. The requirement to have both sides to be openable and equipped with doors involves greater demand on the stiffness of MegaSwapBox structure/frame and the need for stiffer beams. This also implies a larger height of bottom or upper frames in case only common designs and materials are used for the MegaSwapBox.

An important part of the task of establishing the requirements has been gathering the answers from the survey in the major companies active in transport, manufactures and other transport services. Their opinion has also been a base for prioritisation of the requirements and for the classification in *must* and *should* criteria.

Last but not least, a source of information has been a dedicated workshop of the project consortium partners on the basic requirements specifications. The participants have been divided into three groups (Road, Rail and Shipping) and during the professional discussion the ideas and comments have been written and summarised on boards (cf. Figure 5).

Figure 5: Requirement workshop

Not only within this requirements specifications workshop, but also virtually at every meeting the discussion has been about the MegaSwapBox features and how these features could be achieved. The requirements are marked *must* and *should*. *Must* requirements are fundamental for the new system, while *should* are the requirements fulfilling of which would enhance the properties of the new TelliBox system.

The requirements have been clustered into the categories dimensions (external and internal length, width and height), weight (gross weight and tare weight as well as payload), handling (spreader and grab-lifting as well as top craning), operational aspects (openable, stackability etc.), costs and recycling. They are documented in detail in Deliverable 2.

2.2.3 Definition of Solution Space

Aim of this phase has been to analyse various solution possibilities of the components for the MegaSwapBox and its chassis and to establish the solution space which represents the most important possible combinations of these solutions for the subsequent project phase. Within this part a collection of materials has been introduced and their characteristics that may be of interest for the components of the MegaSwapBox and the chassis have been described. Furthermore, these solutions have been discussed with regard to their advantages and disadvantages. One result of this analysis is that some of the components (cf. Figure 6) of the MegaSwapBox such as the roof or the front wall can be realised by existing, proven techniques and materials to satisfy the requirements of the project TelliBox. The other components such as the floor have to be devised in detail based on totally new concepts of design and materials to fulfil the requirements.

The solution space according to the TelliBox chassis consists of five different solutions in general. These are conventionally shaped chassis, flat bed trailers (in use already but only by special permit) as well as special concepts exclusively for TelliBox transport. Besides these general concepts, further detailed development can consist of a variety of materials and constructive solutions.

Concerning the chassis different solutions are presented considering the requirements of Directive 96/53/EC. Because of the current debate in the EU on adapting the regulations on weight and dimensions, some solution schemes for the chassis have been added surpassing Directive 96/53/EC. The result of the current discussion about the chassis is that under current legal framework the solution has to be developed with a conventional chassis. This solution strongly depends on developments outside the project consortium such as the fifth wheel height of the tractor.

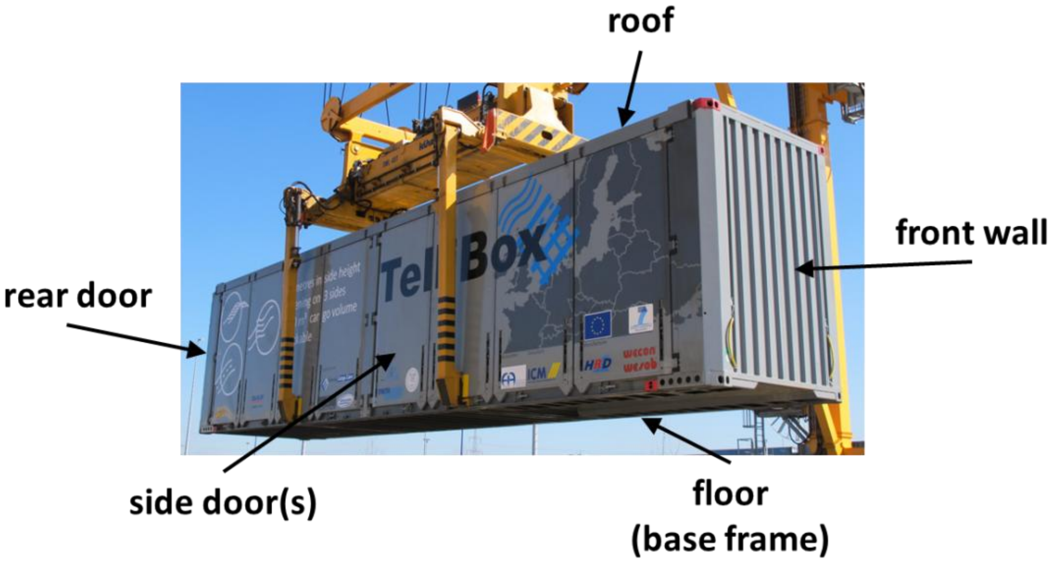

Figure 6: General components of the MegaSwapBox

The morphological analysis has been employed in a workshop to come up with new ideas and to be able to *think different* (cf. Figure 7). This creativity technique makes it possible to combine the features of a product and produce particular solutions that would not have been discovered otherwise. Each specific combination of the values can be guided by a certain criteria, like costs, weight, etc. Thus, within the morphological box the most interesting extreme combination possibilities have been established by selecting certain criteria for the MegaSwapBox.

This solution space has acted as a frame when deciding how to design the MegaSwapBox and the chassis but it remains open to new alternative ideas. The aim of the solution space has been the reduction of the vast variety of solution possibilities to a manageable amount (seven) which then has constituted the basis for the following work phase.

Within the approach by morphological analysis all theoretically possible solutions for individual components have been listed and combined in diverse variants. The developed solution space identifies solution variants that can be taken into consideration for later analysis in the decision phase of the project.. Furthermore, the solution space provides identification of cross-influences in different specific requirements such as a *light* and a *cheap* design.

Morphological Analysis		
Roof		
Roof Construction	Permanent Roof	
Material Roof	Steel	
Lift Mechanic	Rack Toothed Jack	
Liftable Roof Range		
Liftable Side	Right	
Front Wall		
Front Wall	Creased Wall	
Material Front Wall	Steel	
Rear Doors		
Rear Doors	Portal Door, Inner turnable Rod	
Material Rear Doors	Steel	
Side Wall		
Side Wall	Sliding Curtain Wall	Tilt Side Wall

Figure 7: Morphological analysis (extract) for the solution space

Accomplished first milestone of the project has been the presentation of the solution space, which established seven solution possibilities of the components for the MegaSwapBox and its chassis and possible combinations for the subsequent project phase. In summary it can be mentioned that Deliverable 3 concludes the first work phase of the project TelliBox by identifying the main scientific focus for the next project phases. Certain materials and component designs are pointed out that need special attention. Furthermore, the solution space reduces the number of possible solutions to a manageable amount which then constitutes the basis for the value-benefit analysis and the development of the sensitivity model. This task has been supervised by the RWTH Aachen University, IMA/ZLW & IfU.

2.3 Design and Decision Phase

During the second work phase the consortium has been concentrated on elaborating the seven designs developed and presented in the solution space. Main objective has been an analysis on technical attractiveness that consists of the value-benefit relation of the ideas together with the sensitivity model according to the theory of Frederic Vester (*The Art of Interconnected Thinking.Ideas and Tools for a new way of dealing with complexity*, 2002). A preliminary feasibility study has been carried out concentrating results on the structural analysis with CAD and FEM tools and a detailed study of the kinematical structures. Furthermore, a material analysis has been performed to choose the most suitable option for each solution. The reduction of the former solution space down to only three solutions has been the most important outcome of this phase, when the second milestone of the project has been achieved with the presentation of the selected solutions.

Within the design phase the selected solutions during the decision phase have been constructively implemented. The single components of the MegaSwapBox and chassis have been designed including calculations and simulations for strength and flexural rigidity. Within the second part of the design phase after the optimization loop the prototypes have been improved through a series of evaluation and modification.

2.3.1 Feasibility Study

Within Deliverable 4 the most commonly used container terminologies are introduced. The aim of this deliverable has been to identify the possibilities to construct a new MegaSwapBox. Thus, the Wecon GmbH has been responsible for this task. This report is not intended to be a comprehensive evaluation that identifies precisely at what cost such a MegaSwap-Box can be built, rather it is only a preliminary feasibility assessment of the bottom frame for the new MegaSwapBox.

As basis currently used components for the roof, side walls, rear doors, front doors and the bottom frame have been briefly described. The aim has been to point out the advantages and disadvantages of each solution and chose the most applicable component for the new MegaswapBox. In addition, an overview of the materials used in the construction of the bottom frame for containers and swap bodies has been given and it highlights requirements and considerations needed for establishing the new transport unit.

The report describes the structural analysis method used for the feasibility study - CAD and FEM programmes. The advantages of using structural analysis method when designing new products have also been analysed. Different design methods for containers constructions which are currently used have been discussed. Each single design method has been analysed and reasons are given why it is not applicable for the construction of the new MegaswapBox. Deflection, the main problem by container construction is briefly described as well as methods of reducing the deflections. Starting with the bottom frame, different 3D models have been developed to study statically the calculations of the deflections, tensions and reaction forces which occur when new bottom frame is loaded. Finally the bottom frame design has been optimised and a pre-design of the bottom frame is presented in the report (cf. Figure 8).

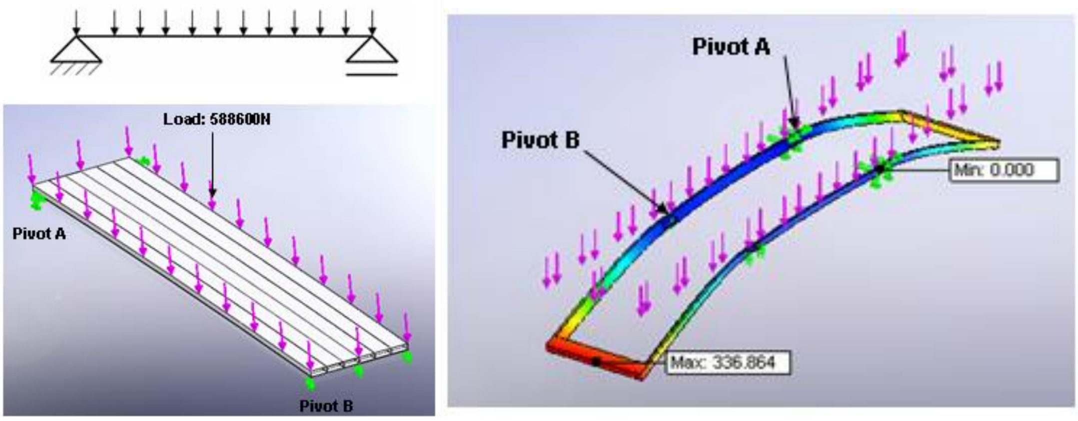

Figure 8: Tentative bottom frame design calculation during storage (left) and grappler handling (right)

The TelliBox consortium has investigated ways of modifying some currently used innovative loading unit construction methods like the Arcus 100, a volume optimized swap body or a shoebox design, were a stiff lid brings in constructive stability. These modification methods however have not brought the desired result as they contradict the targeted requirements. For example the shoebox design means having a reduced loading width from the sides. The Arcus 100 container construction method could be applicable but it means the new MegaswapBox cannot be stacked. The investigations have revealed that a pre-bent bottom frame could benefit the construction. This method is used to construct bridges (arch bridge), but it is not widely used to construct containers or swap-bodies.

For the kinematical structures of the side doors *coiling up*, *pushing together* and *folding* have been evaluated as the best concepts for the MegaSwapBox (cf. Figure 9). Best results for the roof has provided by the concept with lifting worm gears with rack and pinion as well as the concept with a straight-line parallel guiding mechanism.

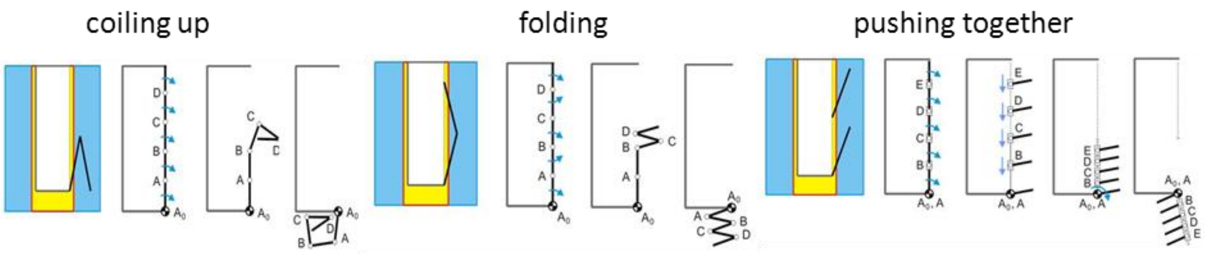

Figure 9: Kinematical structures for the side planes

The solution proposals for the TelliBox chassis have been researched in detail. The different possibilities for designing a suitable chassis are presented and discussed in terms of technical feasibility as well as legal constraints. Finally, an overview has been provided of the assessment rate for the different solution proposals. The assessment of chassis proposals has shown that the conventional shaped container chassis is the most favourable. As bottle necks for the design the technical feasibility analysis has revealed the availability of low coupling.

2.3.2 Material Analysis

Aim of this deliverable has been the analysis of suitable materials for the design of the components of the MegaSwapBox. Due to the high structural demands on the MegaSwapBox a detailed materials selection has to be done. A brief introduction of basic groups of structural materials resulted in significant reduction of number of applicable materials. The selected applicable structural materials have been divided into two groups: metals and composites. This report has been created mainly by the University of Zilina.

From metal materials the steels and aluminium alloys have been selected as the most suitable material for MegaSwapBox design. The steels and aluminium alloys are generally one of the most versatile materials in today's society. Steels can be produced with a wide range of properties and are used in millions of applications. Aluminium alloys have a unique combination of properties and the major incentive for employing aluminium is its weight saving compared to steel.

According to chemical composition structural steels can be divided into two groups, namely carbon steels and alloy steels. Carbon steels are further divided to low carbon steels, medium and high carbon steels. Alloy steels are divided to low alloy structural steels, micro alloy steels, and special high strength steels. High strength low alloy steel for welded structures and low carbon steel for welded structures have been selected for the MegaSwapBox production. These steels provide good weldability and high strength stability at lower and higher temperatures that are important material properties for container design.

Aluminium alloys can be divided into two major groups namely wrought and cast aluminium alloys. Only the wrought aluminium alloys are suitable for container production due to low mechanical properties of cast aluminium alloys. The wrought aluminium alloys are further divided to heat treated and non-heat treated alloys. The suitable aluminium alloys for MegaSwapBox production are mainly aluminium alloys from the 5xxx and 6xxx series but aluminium alloys from the 2xxx and 7xxx series can be also applied. The 2xxx and 7xxx series alloys have considerably higher tensile strengths than the 5xxx or 6xxx series alloys, but the 5xxx or 6xxx series alloys have better weldability. They can be supplied in the form of sheet, plate, or as extruded profiles.

Composite materials are composed from matrix phase and dispersed phase. The matrix material can be metallic, ceramic, or polymeric origin. The metal matrix composites are not suitable for MegaSwapBox design because they are predominantly used for production of small proportion parts in automotive field. Ceramic matrix composites are also not suitable for MegaSwapBox design because of high brittleness. The polymer matrix composites have low specific weight, high mechanical properties and are used for production of high proportion parts. Epoxy resin is polymer matrix with highest mechanical properties. According to the reinforcement material the glass fibre reinforced polymer composites, Kevlar (aramid) fibre reinforced polymer composites, and carbon fibre reinforced polymer composites can be produced. The glass fibres and Kevlar fibres have low elastic modulus whereas the carbon fibres have high elastic modulus. Therefore the carbon fibre reinforced epoxy resin composite is the most suitable composite material for MegaSwapBox design.

Detailed materials analyses have revealed that the commonly used metallic structural materials are sufficient for each of parts except of the bottom frame. For the bottom frame special materials or unconventional design have to be applied. The results of materials analysis and their recommendation for MegaSwapBox design can be summarized as follows:

- bottom frame: combination of standard structural steel (S355), high-strength structural steel (S550, S690, S890, S960 or RQT501, RQT601, RQT701, RQT901) and eventually special beams from pultruded carbon fibre profiles,
- pillars: profiles from structural steel,
- beams: profiles from structural steel or high-strength structural steel and
- rear door, side doors, roof and front wall: frames from steel or aluminium profiles, panels from corrugated steel sheet or aluminium honeycomb plate eventually.

2.3.3 Technical Attractiveness

To define possible integral solutions for the construction phase, different solution proposals for every component of the MegaSwapBox have been estimated by their technical attractiveness. For the estimation a value benefit analysis and a sensitivity analysis have been carried out in workshops. The participants of these workshops have been divided in two groups, customers and suppliers. The combining of those two analysis methods yields to the technical attractiveness. This work phase has been headed by the RWTH Aachen University.

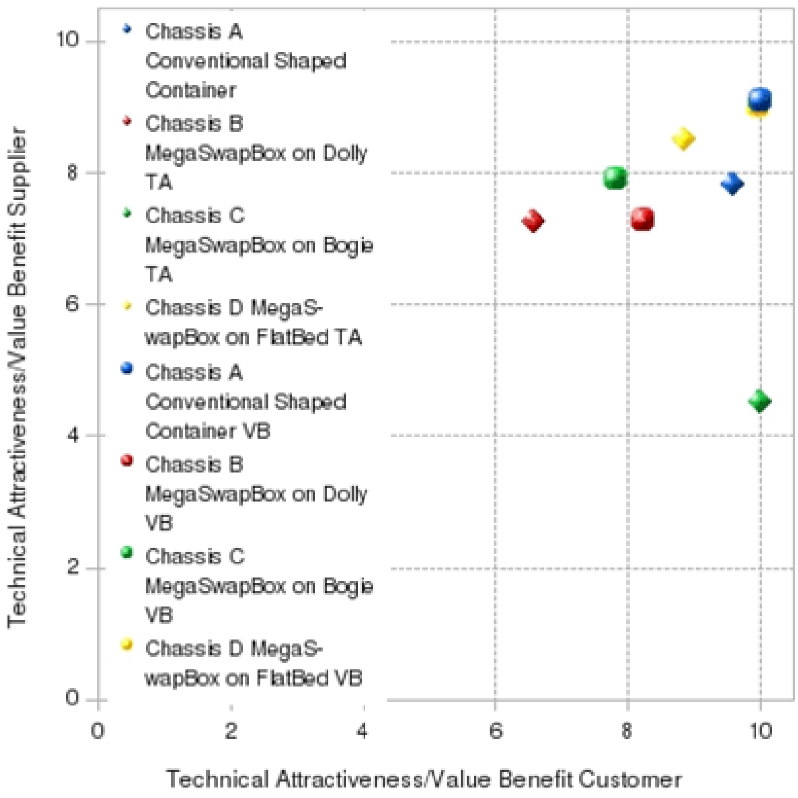

Figure 10: Technical attractiveness of chassis solutions

The technical attractiveness of the concept with a framework design as the structure of body has provided the highest value of all investigated proposals. The pre-bent floor construction has seemed to be the most attractive and potent proposal for the design phase. The roof should be designed as a tilt roof in order to maximise the technical attractiveness of the total design. According to the technical attractiveness the front wall should be designed as a creased wall and the rear door as a portal door. The side walls should be conceived as lifting side walls. The preferred lifting mechanism of the roof has been a rack toothed jack. Regarding the chassis the technical attractiveness recommends that the design should be a MegaSwapBox on conventional chassis.

The estimation and evaluation of the technical attractiveness has been undertaken only component-wise (cf. Figure 10). Thus it has also been possible to re-check the findings of the technical attractiveness analysis during the construction phase of the loading unit.

2.3.4 Target Specification

Deliverable 7 (performed mainly by the RWTH Aachen University) describes the conclusion of the decision phase. Main goal of this phase has been to determine three different concepts for the MegaSwapBox and solution proposals for the related chassis (cf. Table 2).

The target specification describes the necessary technologies for the construction of each solution, previous calculations as a basis for the elaboration phase, and the selected materials for the components. This report has been the basis for further work in the elaboration phase.

The first concept is made up of the following elements: a fixed roof with 45ft steel corner castings only, a portal door with external hinges, folding side walls for both sides of the unit; a pre-bent floor, a creased steel front wall and the rack toothed jack as the lifting mechanism.

The second concept differs as follows: the position of the corner castings stay spaced at 45ft. but are built into a two-piece roof, the portal door would be built of a sandwich structure, the side wall is a guided folding door, opening to the rear side of the MegaSwapBox, the floor of this variation is a pre-bent steel sheet but separated into three parts, the front wall uses a sandwich structure, too, instead of the creased steel wall.

The third concept includes both 40ft. and 45ft. corner castings, the side wall is provided with a coiling up system that folds half of the door to the front side and the other half to the rear side of the unit, the roof lifting mechanism is a straight-line parallel guiding system that determines the design of the front wall.

Table 2: Three selected solutions for later development

	Roof	Door	Side wall	Floor	Front wall	Lifting mechanism
1	Fixed roof only 45ft. corner castings	Portal door external hinges	Folding side wall (both sides)	Prebent floor	Creased wall	Rack toothed Jack
2	Fixed roof separated 45ft. corner castings	Sandwich portal door	Guided folding door (rear)	Prebent floor separated in 3 parts	Sandwich flat wall	Rack toothed Jack
3	Fixed roof 40ft. +45ft. corner castings	Portal door	Coiling up (both sides)	Prebent floor	(depends on mechanism)	Straight-line parellel guiding

The assessment of chassis proposals has shown that the conventional shaped container chassis is the most favourable. As bottle necks for the design the technical feasibility analysis reveals the availability of low coupling i.e. low fifth wheel height.

2.4 Elaboration Phase

Aim of this work phase has been to design and calculate in detail the MegaSwapBox and the adapted chassis. In addition simulations have been performed to guarantee the robustness of the concepts. Important aspects of usability of the later prototypes have been examined support by the regular consultations with the Advisory Board of the project and the opinion of operators has been considered. Thus, the key players of this work phase have been the manufacturers (Wecon GmbH, Wesob Sp.z.o.o. and HRD Trailer Engineering) and the RWTH Aachen University, supported by Ewals Cargo Care B.V. The concepts have been compared to each other with regard to economic and usability aspects as well as technical feasibility. To evaluate the profitability, different calculations of economic efficiency have been carried out using traditional static profitability analysis, such as Return on Investment (ROI) and traditional dynamic profitability methods like the Net Present Value (NPV). After determination of the profitability, the feasibility and the usability, the solutions have been compared to each other. The identification of the overall best three designs regarding its profitability, feasibility and usability marks the transition to the next work phase.

The aim of Deliverable 8 has been to identify three possible solutions and a suitable chassis for the construction of the TelliBox. This study is only a preliminary feasibility assessment of the three solutions which the TelliBox consortium has worked out.

The pre-bent bottom frame FEM results showed only the bottom frame as the basic element for the load bearing of the MegaSwapBox design will not help to reach the maximum required deflections. Some parts of the body construction must play a big role in reducing the deflections. In different meetings held by the TelliBox consortium, different designs (Airtech, EC Box, Fala, Shoe Box and the WingEBox) have been presented to identify a solution that offers the maximum deflections and at the same time fulfils the requirements set. Statically FEM calculations for the designs and the different working principles of each design have been performed to compare and find out similarities and differences between the designs.

From the former seven designs, the consortium chose three designs (Airtech, EC-Box and 3D-Box) for more detailed analysis (cf. Figure 11).

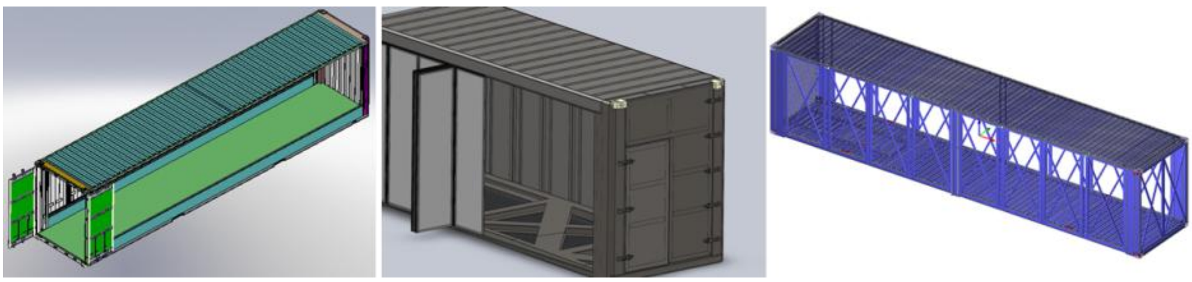

Figure 11: Concepts for MegaSwapBox: Airtech, EC-Box and 3D-Box (left to right)

Statical FEM calculations, components and materials analysation for the three designs have been carried out according to the CSC requirements. Prototypes of the Airtech and 3D-Box designs have been constructed to give a clear picture of the concepts.

Within the design phase the selected solutions realised during the decision phase are constructively implemented. The single components of the MegaSwapBox and chassis are designed including calculations and simulations for strength and flexural rigidity. Within the second part of the design phase the prototype has been optimised through a series of evaluation and modification.

Technical drawings to present the working principle of each component have been made. Feedback slopes during the workshops and feedback given by the advisory board helped the designers to optimise the solutions.

At the end of this task, a final workshop has been performed to choose the solutions to be built. In this workshop the consortium measured each solution according to the fulfilment of the requirements and practical use with the function of two sample solutions.

In order to ensure concepts that can achieve the CSC/UIC certification the designer have been in contact with the “Germanischer Lloyd” to discuss each concept. Three concepts for the MegaSwapBox have been designed in detail:

- Concept 1: The EC-Box which bases of a very stiff bottom
- Concept 2: AirTech-Box which bases on a pneumatically liftable bottom plate
- Concept 3: 3D-Box which bases on side doors which supports the stiffness of the MegaSwapBox.

The design phase has revealed that the construction of the needed chassis depends on the chosen variant. For the chosen variants a chassis has been designed which supports the stiffness of the MegaSwapBox in order to achieve all technical requirements.

A frame structure is provided with outer beams in order to achieve maximum torsion stiffness. The transportable MegaSwapBox should lie across the complete chassis length on the frame, to ensure an uncomplicated loading and unloading.

The chassis is operated according to current knowledge as a standard container chassis. Brakes, suspension and lighting system will be equipped with commercially available components. The final FEM calculations have shown that the chassis has the necessary strength for support the MegaSwapBox by opening and closing of the side doors (cf. Figure 12).

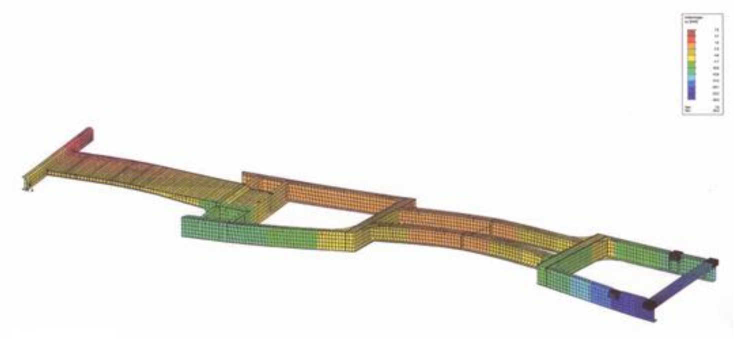

Figure 12: FEM calculations for chassis

2.5 Evaluation Phase

The objective of the evaluation phase has been to evaluate the developed concepts in terms of their economic and operational value prior any prototype has been built. The result is the selection of the best concept for constructive implementation in the construction phase. After optimising the prototypes based on the first tests, the evaluations has been adapted in a second, shorter evaluation phase.

2.5.1 Profitability of Concepts

The results from the profitability analyses are documented in Deliverable 10. Within the NOWS workshops, an estimation of the value orientated cost-effectiveness has been conducted for three alternative designs of the TelliBox as well as the final design of the MegaSwapBox. Participants of the workshops have been members of the project consortia of TelliBox. The cost-effectiveness has been evaluated for each design compared to currently used swap-bodies. The Life Cycle Cost Analysis (LCC) also regarded the three TelliBox solutions and the LCC workshop has been conducted with representatives from each TelliBox concept team. The Return of Investment (ROI) and Net Present Value (NPV) have been determined for each of the three TelliBox solutions. As baseline for the calculation, due to not yet completely definable assets, a “modified mega-trailer” has been used. The comparison with swap-bodies and mega-trailer shows in addition the profitability compared to current solutions.

Generally it could be shown that the benefits for each design strongly dominate the costs independent of the risk attitude of the decision maker. This means that even when all costs of any type and with any probability are aggregated and compared with only direct benefits with a high probability, the benefits still exceed the arising costs.

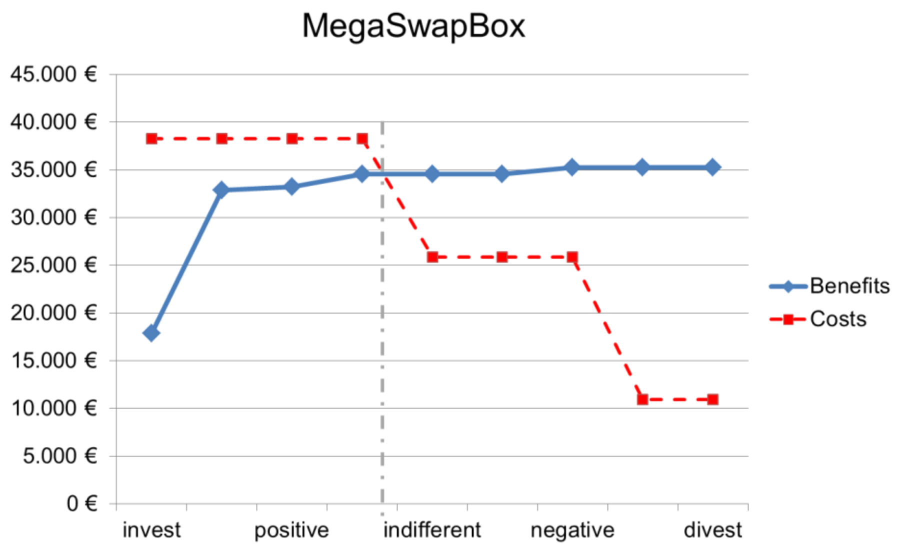

Figure 13: Profitability of MegaSwapBox

After evaluating the results of the NOWS-method and the ROI & NPV, it can be stated that an investment for any TelliBox concept can be recommended. However, the evaluation of the results almost gives no preference for any design variant of the TelliBox as with NOWS for any scenario only a tendency can be given. The tendency of NOWS is also for LCC, ROI & NPV the same: first EC-Box, second 3D-Box and third AirTech-Box. The final design of the MegaSwapBox has been evaluated, too (cf. Figure 13). The intersection point of the cost and benefit curve for the MegaSwapBox provides a profitability indicator with a slightly positive trend. The profitability evaluation has been performed by the RWTH Aachen University with the support of the entire consortium.

2.5.2 Report On Usability

The aim of Deliverable 11 has been to investigate the usability of the MegaSwapBox on rail, water and road, including handling at the terminal. Therefore the freight forwarders of the consortium (Ewals Cargo Care B.V., Wincanton GmbH and CTL Logistics S.A.) have been mainly responsible for this task. Interviews have been conducted with various parties involved in the MegaSwapBox handling along the transport chain, in order to determine the current situation and to present the different concepts to prospective beneficiaries, who are part of the advisory board among others. Following different workshops within the consortium and discussions with different stakeholders of the intermodal transport chain, the consortium has jointly decided to concentrate further activities on the so-called 3D-Box which is accessible from both sides as well as the rear portal and provides the required liftable roof.

In comparison, the EC-Box would be accessible from one side only and from the back with lifted roof. This solution would be acceptable as a second option. The Airtech-Box is considered to be very innovative, but one of its drawbacks is its potential susceptibility to mechanical failures of the lifting device, depending on external energy supply and it would have a considerably high dead weight.

The three different concepts have been presented to the members of the advisory board and the different designs have been discussed deeply.

- It has been basically agreed, that there are no objections concerning the loading and unloading from the rear and only from one side (left side).
- In case of minor problems in the different factories, each member has been prepared to adjust their logistics in the factory accordingly.

It has been demanded that the container has to be adapted to the processes of the customers, not the other way round.

2.5.3 Most Suitable Solution

This report describes and chooses the most suitable solution for the MegaSwapBox based on the findings of Deliverable 10 and 11. Within a decision workshop with the whole consortium an objective and fair consensus about the best concept for the MegaSwapBox and chassis to build as prototypes has been found. All partners have committed themselves to support this solution to guarantee an efficient and mutual further development process (cf. Figure 14).

Figure 14: TelliBox Partners at the decision workshop

Since the results of the profitability analysis claim that all solutions are economical, it became more important to obtain the most usable solution. As a result the AirTech-Box is the most expensive solution and seems to be the most unfavourable in use. The EC-Box is favourable on the monetary aspect, but the 3D-Box on usability aspects. Due to the higher relevance of the usability and the similarity of the profitability the 3D-Box is the favourable solution and has been chosen by the consortium for the further approach of the project.

2.6 Construction Phase

In this work phase a prototype of the MegaSwapBox and one of the adapted chassis have been built up by the manufacturers (Wecon GmbH, Wesob Sp.z.o.o. and HRD Trailer Engineering) which have passed all relevant testing conditions for the application in commercial intermodal transport (cf. Figure 15).

Figure 15: Prototyping of MegaSwapBox and chassis

The MegaSwapBox has been certified according to the directives on high volume containers, on rail road registration, on cargo control and on customs (CSC; DIN EN 283, DIN EN 12642-2 Code XL, TIR). Furthermore, different tests of handling and compatibility between chassis, truck and MegaSwapBox had been successfully carried out.

In order to keep the requested tolerances during construction, welding and assembling jigs for all assembly groups and their sub-assemblies (front wall, rear wall, lateral and rear doors, roof, middle post), as well as for the total assembly has been designed and produced. The procedure of segment manufacturing has been applied for the assembly. Sub-assemblies have been produced from single elements and from these the next higher assembly groups up to the complete assembly of the five main assembly groups. Each sub-assembly or single part has been measured and, if necessary, modified before and after the welded assembly.

Most of the mechanical components have had to be manufactured in single piece production by cutting, turning and drilling. Only for the locking system of the rear door, the standard corner fittings, the sealing profile and the plywood floor standard components could be employed. The certification society DEKRA and its partner organization Germanischer Lloyd have accompanied the production in all its steps. They have checked the internal quality system, the adherence to the requested technical rules and norms, the material selection, the welding qualification of the assembly staff. After the assembly of the MegaSwapBox it has been tested for all its functions. The result has been that the dimensions of the connection between center post and roof has not been sufficiently designed. The interaction of the three components MegaSwapBox, chassis and truck including driving has been tested. It has been found that the tailoring of the connection between chassis goose and box has to be optimized. The MegaSwapBox has been certified by the DEKRA management: The single components and the MegaSwapBox as a whole has been structurally loaded (push, pull, gravity forces) according to the guidelines of DIN ISO 492-4; DIN EN 12642-2 XL; DIN EN 283 and CSC. By this successful proof of the structural strength of the MegaSwapBox the codification for rail traffic as well as the issue of the CSC test mark and the certification of cargo securing has been achieved (cf. Figure 16).

Figure 16: Certofication at DEKRA proofing ground

After certification the MegaSwapBox has been conventionally treated, i.e. sandblasted, primed and covered with a final coating. For this treatment, all mechanical components, such as flooring and locking elements, has been detached, dismantled and separately treated resp. covered as described above.

2.7 Demonstration Phase

The prototype has been tested under real conditions for all transportation modes (road, rail, inland and short sea shipping), as well as for handling processes in terminals within extensive test runs. The test runs have been carried out on routes which a freight forwarder usually uses for the transport of goods. Therewith this phase demonstrates the realization of the developed solution and its applicability in intermodal transport. In addition, tests concerning the loading and unloading of freight have been performed. Through this test run, an evaluation of the quality of the prototype that considers both technical and operational aspects has been done. The freight forwarders (Ewals Cargo Care B.V., Wincanton GmbH and CTL Logistics S.A.) have been supported by the RWTH Aachen University in executing this task.

The test cases for the demonstration phase have been worked out in several workshops with all involved consortium members, manufacturers as well as freight forwarders. As methodology for the test case definition a risk assessment has been executed. Several fault trees have been analysed and based on this initial test cases have been defined (cf. Figure 17).

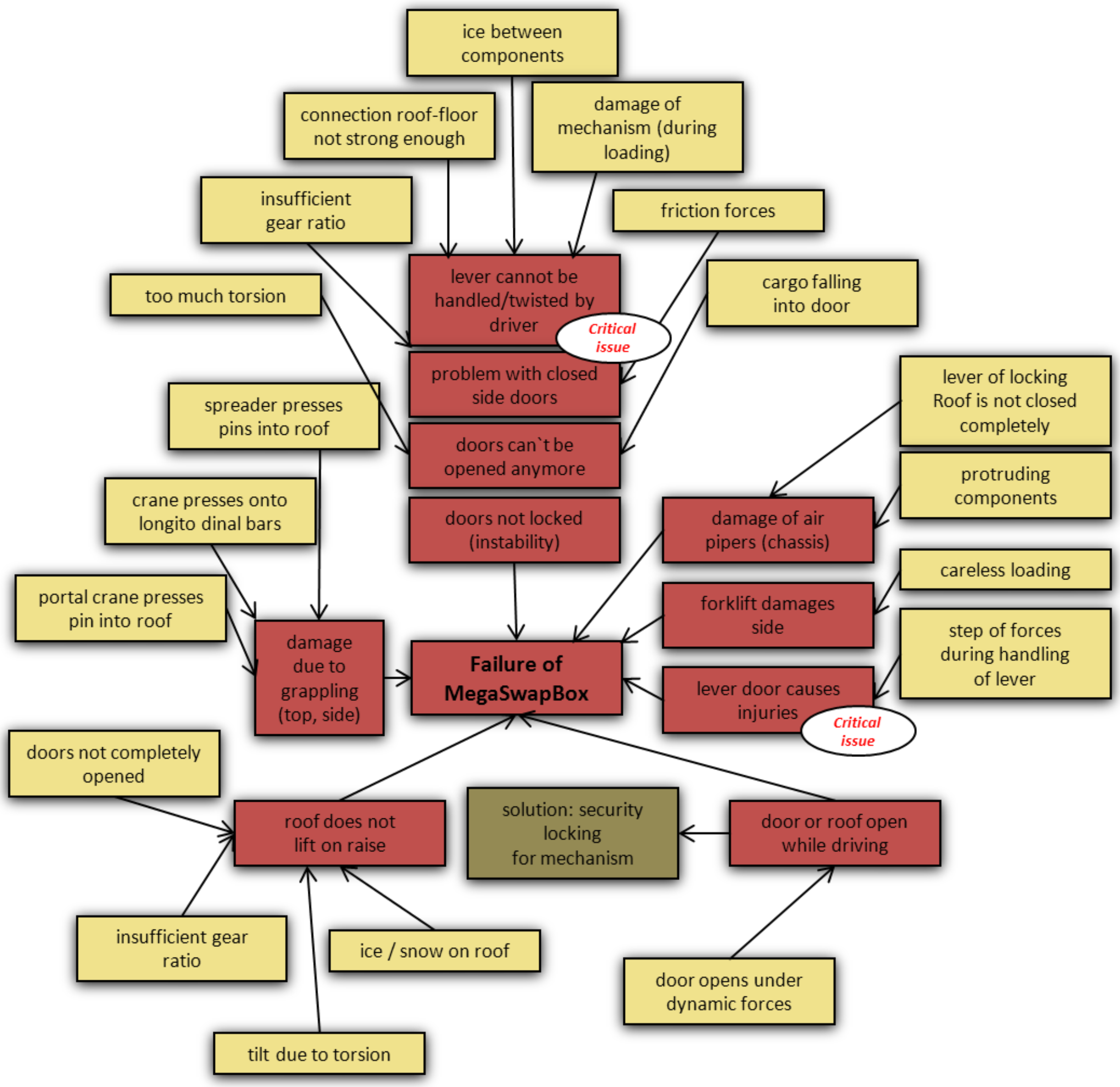

Figure 17: Fault tree analysis of the MegaSwapBox

For these initial test cases facilities and destinations along a real-world supply chain of an automotive manufacturer have been identified. The final routes for the demonstration consist of over 5,000 km of road transport, of railway transport and shipping on inland water ways as well as on roll-on/roll-off (RORO) ferries (cf. Figure 18) from Eindhoven (Netherlands) to Ellesmere Port (United Kingdom). The duration of the test runs has been more than two months.

In parallel with the planning of the exact test schedule first integration tests with the MegaSwapBox, the adapted chassis and the truck have been carried out. The truck used during the test runs has been made available with courtesy of DAF Trucks N.V. The truck, equipped with a very low fifth wheel/coupling height, has been in a prototype stadium. Thus, prior to the long-haul runs and especially the RORO passage junction tests of this new combination have been performed to ensure proper and save manoeuvring behaviour. Another important task has been the preparation for a standardized documentation process. For all test cases and all responsible staff identical test protocols have been implemented and filled in during the individual tests. The entire evaluation of the test runs is documented in Deliverable 17 and 19.

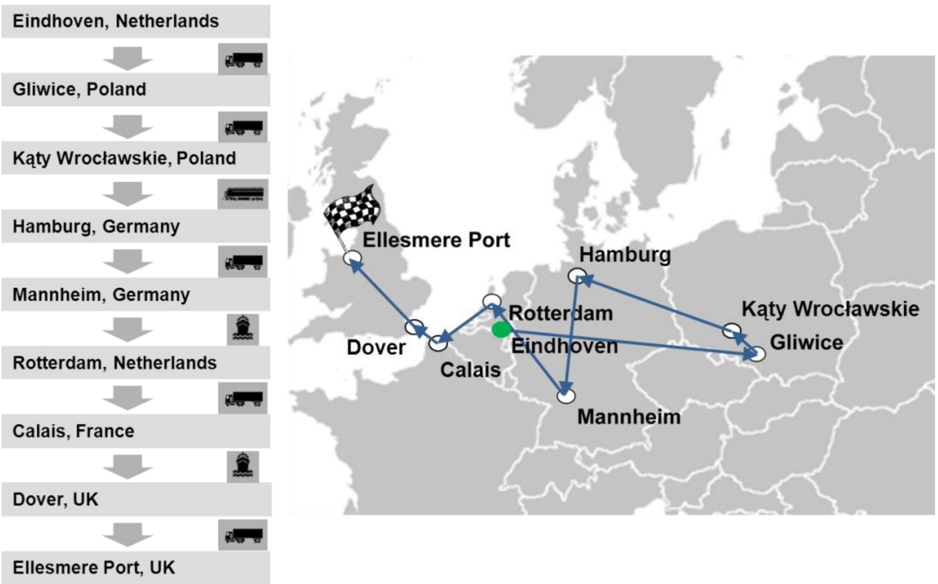

Figure 18: Route of test runs

The test runs itself have been performed with the assistance of the consortium members CTL, Wincanton, Wecon, HRD, Ewals Cargo Care and the RWTH Aachen University. In addition, a professional test driver of DAF Trucks N.V. accompanied the test runs on road. The test runs consist of the following individual steps and have been performed in August and September 2010 (cf. Figure 19):

- Eindhoven (NL) (Road transport): On the proving ground of a Dutch truck manufacturer clearance tests with the tractor/trailer unit combined with the MegaSwapBox have been performed. In addition, the driving dynamics of the entire combination have been evaluated.
- Eindhoven (NL) – Gliwice (PL) (Road transport): To perform the unloading and loading tests, the new loading unit has been transported to a forwarder in Gliwice. Moreover, the transport of the MegaSwapBox on road has been tested. In Gliwice at the compound of Müller Lila Logistik stacked racks with a total height of three meters have been loaded and unloaded without any problems.
- Gliwice (PL) – Katy Wroclawskie (PL) (Road transport): To accomplish the craning from truck onto terminal facilities and onto a railway wagon the loading unit has been transported by road to the terminal in Katy Wroclawskie where the loading unit has been transhipped onto a Megafret railway wagon.
- Katy Wroclawskie (PL) – Hamburg (GER) (Rail transport): The subsequent forwarding has been carried out by a partner on rail to Hamburg.
- Mannheim (GER) – Rotterdam (NL) (Inland waterway): For the next test case – transport on inland-water barges– the loading unit has been transferred to Mannheim (Germany) on road. At the terminal in Mannheim, the transhipment onto the barge has been carried out so that from Mannheim, a test run on an inland waterway (Rhine) to Rotterdam (NL) could be executed.
- Rotterdam (NL) – Ellesmere Port (GB) (Road and short-sea transport): Arrived in Rotterdam, the loading unit has been transported on road to Calais (France) to succeed the ferry trip to Dover. From Dover (UK), the test run continued on road to Ellesmere Port (UK), where a test loading and unloading has been performed at an automotive company. At the compound of Vauxhall racks with a total height of three meters have been loaded and unloaded (both with a height of one point five meters) without any problems. Subsequently, the loading unit has been transported via Dover and Calais back to Eindhoven.

Figure 19: Demonstration phase of TelliBox

As a major result it can be stated that the modes road, rail, short sea and inland shipping could be used successfully. In addition all test cases have been passed without any objections. It could be shown that the MegaSwapBox can be loaded and unloaded with goods of three meters height and be transported on road without any restrictions. The transhipment from road to rail and the following transport on rail have been performed without problems likewise the transport on the inland waterway from Mannheim to Rotterdam and the ferry trip on a vessel to England. The road transport to Ellesmere Port and the succeeding loading/unloading at the loading and unloading facility have been executed successfully. As a result of the demonstration phase the evaluation of the test runs are documented and recommendations for optimising the system are developed within Deliverable 17 and 19 as well as in a vast variety of test protocols (cf. Figure 20). In the course of the test runs it could be proven that the terminals as well as the transport carriers vessel and rail did not have to be changed concerning the technical features.

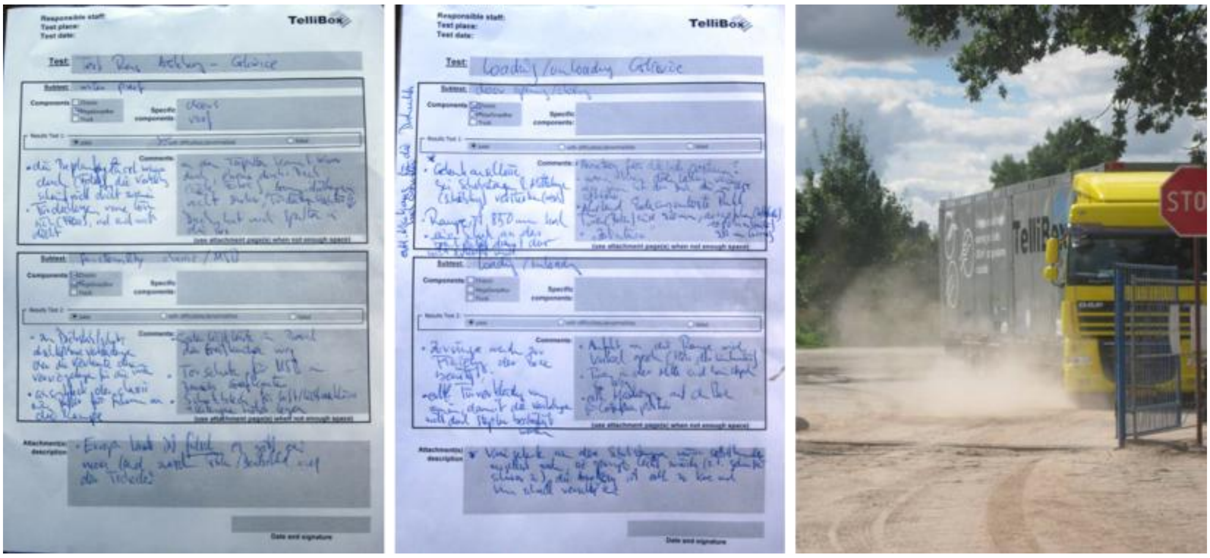

Figure 20: Test protocols

The knowledge achieved by these test runs, test loadings, meetings with the Advisory Board and the consortium as well as by the production process has been taken into account for the optimization loop. The optimizations are as follows:

- inner lining on the lateral doors, to achieve two improvements: a) better theft protection and b) reduction of handling damages by installation of a pallet deflector for loading and unloading procedures,
- elongated holes in the pallet deflector and in the lateral doors facilitate additional cargo securing by tension belts,
- support for locking bars mounted at the rear post,
- the floor locking drive is protected by a flap which is lockable by a padlock; additionally, a customs seal can be fixed on this flap,
- above the grappler edges there have been fixed additional deflector plates,
- at the roof the position of the grappler edges is marked with yellow colour,
- modification of the locking bolt fixing system, formerly welded construction, now sliding guide with locking screw,
- modification of the centre post push piece connection for an easier exchange of the gas-pressure spring,
- fixation of a support for operation tools at the inner rear door,
- door fixation for joining the door wings which are positioned at the centre post and
- referring to a serial production the assembly groups, whose inner parts are also exposed to the weather, have been redesigned to make cataphoretic painting of the inner profile surfaces possible.

These optimizations have been realized directly at the prototypes. In case it has been impossible to modify the prototype within the project duration, construction drawings for future constructive changes of the findings have been amended.

The improvements which were realized have been tested during the second test runs. These test runs have been performed in February 2011. The MegaSwapBox has passed two weeks of extensive railway transit between Mannheim and Rotterdam to evaluate the endurance of all components.

3 Potential Impact of the Project, Dissemination and Exploitation of Results

3.1 Impact of the Project TelliBox

The aim of the European Commission is to optimize the performance of multimodal logistic chains and thus making use of inherently more resource-efficient modes of transport. The project TelliBox has addressed the European strategic and policy challenges of improving a more environmentally-friendly, more secure and safety concious transport system, increasing and encouraging modal share as well as strengthening the competitiveness within the transport sector by providing an innovative and intermodal MegaSwapBox. The developed prototype of the MegaSwapBox has proven its principle availability for road, rail and waterborne transport and its easy handling and transhipment in extensive test runs.

Another important positive impact of the project TelliBox can be the increase of safety on roads and their relief. Accidents are related to the traffic intensity like the amount of vehicles on road. In many fatal accidents on motorways trucks are involved. Thus, by shifting freight transportation from semi-trailers to an intermodal solution using the MegaSwapBox the intensity of traffic flows and the risks for accidents can be reduced, especially in long-haul transport.

Furthermore a reduced number of semitrailers on road disburden road connections. Especially in the transalpine connecting motorways are affected by traffic jams. Tunnels are even more bottlenecks. Megapolis areas are affected by traffic jams daily. Lots of citizens spend a lot of their daily time within traffic jams. Disburdened motorways will enhance the quality of their life as well as their safety.

Additionally, the MegaSwapBox provides more security of the cargo on all transport modes as the opening sides are not equipped with Curtains but with solid side-doors. Thereby the risks of pilferage of the cargo can be reduced. This is important, especially for cross-border freight transport according to the eastern enlargement as curtain-sided swap-bodies are often not accepted in some eastern countries.

The opportunity of launching a stackable MegaSwapBox reduces the storage space in terminals, as commonly used semi-trailer and swap-bodies are not stackable. According to the CSC certification of the prototype of the MegaSwapBox the allowable stacking weight for 1.4 g is up to 38,600 kg. Thus, the storage capacity of swap-bodies in terminals can be at least doubled.

To benefit from the advantages of the TelliBox concept and to maximize the potential impact further efforts are needed. It has to be stated that the provision of all advantages of the TelliBox at this moment are accompanied by e.g. higher manufacturing efforts and a higher tare weight. Supply chain processes are consumer driven. Especially the modularisation has not been focussed within the TelliBox project as the automotive and white goods industries have been considered as key customers. In addition, during the test runs a prototype truck with a low fifth wheel/coupling height has been used.

Besides the technical achievements and impacts of TelliBox the applied project management methodology – with tailor-made methods for the active integration of all partners – has been proved to be best-practice for small or medium-scale collaborative research projects within the EU Framework Programme. The Ministry of Innovation, Science and Research of North Rhine-Westphalia (Germany) has conferred the FRP.NRW Award to the RWTH Aachen University, IMA/ZLW & IfU to honour a brilliant example of project-coordination under the Seventh Framework Programme. The prize has been awarded for the first time to recognise the outstanding performance of coordinators and their management teams. This award is so far unparalleled in Europe and has been presented by the EU Commissioner for Research, Innovation and Science, Máire Geoghegan Quinn.

3.2 Dissemination and Exploitation Activities

During the first year of the project European Intermodal Association (EIA), in charge of dissemination activities, has continuously promoted TelliBox into the freight transport sector. A press release of the kick off meeting has been released in April 2008 and sent to EIA network and to the press.

The dissemination of the results has been developed in cooperation with all partners. A website (www.tellibox.eu), serving as a platform for the dissemination of project results and also as an entry point for parties interested to be updated about project evolution, has been set up and constantly been updated. Diverse PR materials for the project such as leaflets, one-pagers, banner and a poster have been developed. Articles about TelliBox have been published in transport journals such as DVZ and Bulletin des Transport et de la Logistique (France). A text on the MegaSwapBox appeared in May 2010 on the website of the Danube Project Centre of Belgrade: this institution showed a keen interest in promoting the result of the project and considered a key factor in developing intermodality on the Danube and in the Balkan region. Another large article appeared in the special 'Kombi Beilage' of DVZ (May

2011) which has been distributed among the largest EU transport & logistics fair in Munich (May 10th to 13th). Moreover a promotional movie has been realized, which demonstrates the characteristics of TelliBox throughout the test run on an intermodal corridor from Poland to the United Kingdom. The movie contains an introduction by the Project Officer and several interventions from consortium partners. In addition, the project has been promoted in several scientific conferences (cf. Table 3).

Table 3: List of publications

No.	Title	Main author	Publisher / Place of presentation	Year of publication / presentation
1	Value oriented cost-effectiveness estimation of an innovative intermodal loading unit.	Jursch, Sebastian; Bischoff, Sabine; Hauck, Eckart; Flachskampf, Paul; Henning, Klaus; Jeschke, Sabina	International Journal of Trade, Economics, and Finance (IJTEF). Heft Vol.1, No.3/ 2010	2010
2	Ladungsträgereinheit für den intermodalen Verkehr	Jursch, Sebastian; Hauck, Eckart, Jeschke, Sabina	International Journal of Trade, Economics, and Finance (IJTEF). Heft Vol.1, No.3/ 2010	2010
3	Interdisziplinäre Produktentwicklung durch gezielten Erfahrungsaustausch.	Jursch, Sebastian; Jalocha, Sylwia	Wissensmanagement – Das Magazin für Führungskräfte. Heft 08/2010/ 2010	2010
4	Design and Application of a New Workshop Concept on the Development of an Innovative Transport Unit – A New Way of Knowledge Sharing	Jursch, Sebastian; Ramakers, Richard; Jeschke, Sabina; Henning, Klaus	The International Journal of Engineering and Industrial Management. Heft 2nd Issue/ 2011	2011
5	Economic Evaluation of “Intelligent MegaSwapBoxes” for Advanced Intermodal Freight Transport through Value Orientated Cost-effectiveness Estimation.	Jursch, Sebastian; Bischoff, Sabine; Hauck, Eckart; Flachskampf, Paul; Henning, Klaus; Jeschke, Sabina	2010 International Conference on Information and Financial Engineering (ICIFE 2010)	2010
6	Design and Application of a new Workshop Concept on the Development of an Innovative Transport Unit - A new way of Knowledge Sharing	Jursch, Sebastian; Hauck, Eckart; Ramakers, Richard; Jeschke, Sabina; Henning, Klaus	Proceedings of the 11th European Conference on Knowledge Management	2010
7	An efficient development process by the example of an innovative transport unit	Jursch, Sebastian; Jalocha, Sylwia; Hauck, Eckart; Jeschke, Sabina; Henning, Klaus	Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)	2010
8	Presentation	Selders, Ulrich; Jursch, Sebastian	BVL Logistics Forum Duisburg	17.03.2011
9	Presentation	Jursch, Sebastian	Logistik Forum Nürnberg	09.11.2011

Furthermore different dissemination activities have been done, such as a stand on a fair as well as participation and promotion on intermodal events. At the International Transport Forum in Leipzig and the ITS World Congress in Busan, South Korea, high-level meetings took place, where the PR material of TelliBox has been personally handed over to the German and South-Korean Ministers for Transport. During the European transport exhibition the “Intermodal Europe 2010” fair in Amsterdam TelliBox has had a dedicated space inside the stand of the EIA. EIA staff presented during those four days the project to the visitors and invitees of the stand. TelliBox project description and website address has been added in the special Amsterdam edition flyer made by the European Intermodal Association and spread to the EIA network before and after the fair. A conference for the presentation of the key features of the projects and of the two platforms has been held during the inaugural day of the exhibition. Furthermore TelliBox had a dedicated space at the Green Port conference in Stockholm, the Inform Intermodal Europe in London and at the Global Freight in St. Petersburg.

Target groups of the project have been individuated and invited for presenting the project and discuss future implementation into the transport sector of the loading unit in order to prepare the market launch of the TelliBox. At the end, a final event took place that consisted in a live public presentation and demonstration of the MegaSwapBox (cf. Figure 21).

Figure 21: Impressions from the final event

Even after the project ended, EIA will promote TelliBox e.g. EIA assisted within the EGCI (proposal P&G) to present TelliBox in Brussels (May 30-June 3) at a public event. During the ‘Italian Intermodal Day’ organized by EIA the leaflet of TelliBox has been personally handed over to the Vice-President of the EU Commission and Commissioner in charge of Transport, Mr A. Tajani. At the ‘EIA Intermodal Reception’ in Brussels the project officer of TelliBox together with other heads on unit of the EU Commission and transport operators have been invited. TelliBox had a dedicated space inside the stand of the EIA (Hall B6, Stand 101) during the world's biggest transport exhibition the “Transport and Logistics” fair in Munich.

Given the number of participants to the fair, around 48,000, the visibility of TelliBox has been consistently broadened.

4 TelliBox – the Consortium at a Glance

The final goal of the TelliBox project has been achieved through collaborations within a very strong consortium based on a team with outstanding scientific, engineering and manufacturing qualifications (cf. Figure 22). The consortium consists of ten European leading companies and academic institutions: CTL Logistics SA (CTL), European Intermodal Association (EIA), Ewals Cargo Care B.V. (ECC), HRD Trailer-Engineering GmbH (HRD), Intermodal Concepts & Management AG (ICM), RWTH Aachen University (Coordinator of the project), University of Zilina (UNIZA), Wecon GmbH (WEC), Wesob Sp.z.o.o. (WES) and Wincanton GmbH (WIN). Together they represent a consortium with excellence in plating technologies and knowledge stretching from basic research to the design and marketing of products.

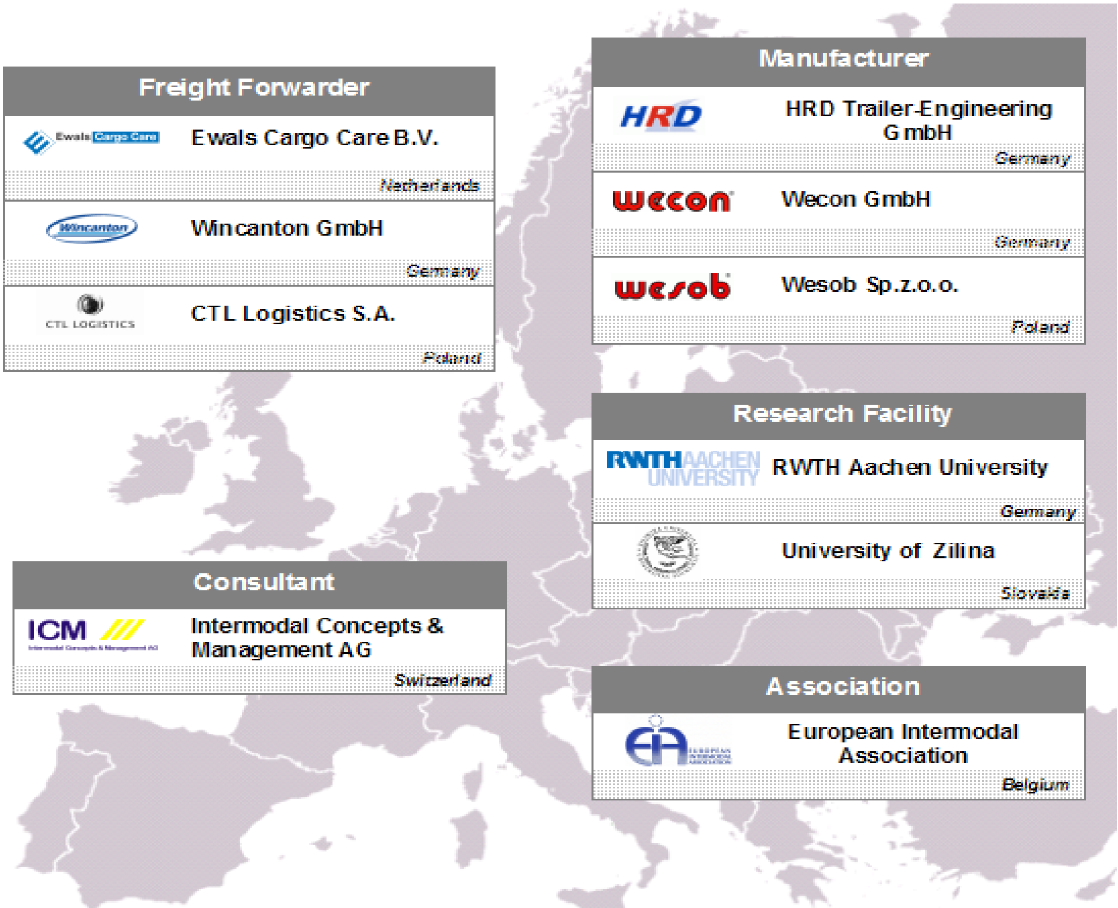

Figure 22: TelliBox Consortium

The total volume of the project has been roughly 4.37 Million Euro, part of which has been granted by the EC under the Seventh Framework Programme. For more information about the TelliBox project please visit the project's website www.tellibox.eu or contact:

RWTH Aachen University, IMA/ZLW & IfU

Dennewartstraße 27

D-52068 Aachen

Phone: +49 241 80 911 49

E-mail: info@tellibox.eu

www.tellibox.eu