FINAL REPORT

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Periodic Report: **Final**

Project Coordinator: **GMVIS SKYSOFT, S.A.**
TEL: **+351 21 382 93 66**
FAX: **+351 21 386 64 93**
E-MAIL: **marta.quintiaes@gmv.com / jose.neves@gmv.com**

	NAME / COMPANY	DATE	SIGNATURE
Document Author	Marta Quintiães / GMV	06/03/2012	MQuintiães
Technical Approval	Marta Quintiães / GMV	06/03/2012	MQuintiães
Head of Division Approval	José Neves / GMV	06/03/2012	
Project Management Authorisation	Marta Quintiães / GMV	06/03/2012	MQuintiães

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1.INTRODUCTION

1.1. PURPOSE

This document is the Final Report for the Weights and Manufacturing Costs (WEMACS) project being developed under the Clean Sky Joint Technology Initiative (JTI) and it cover the period from month 1 to the final month of the project.

The focal purpose of this document is to report the project objectives and achievements, and the use and dissemination of foreground.

1.2. DEFINITIONS

1.2.1. ACRONYMS

The following table provides a list of acronyms used in this document and in need of a definition to aid the reader in understanding the overall context.

ACRONYM	DEFINTION
AIAA	American Institute of Aeronautics and Astronautics
ASM	Aerospace Sciences Meeting
CFI	Customer Furnished Item
CFRP	Carbon Fiber-Reinforced Plastic
CI	Configuration Item
CM	Configuration Management
COST	COST estimation Module
CPU	Central Processing Unit
CS	Clean Sky
CSJU	Clean Sky Joint Undertaking
CVS	Concurrent Version System
DoW	Description of Work
DRR	Document Review Record
FWM	Fuselage Weight estimation Module
GMV	GMVIS SKYSOFT, S.A.
HMI	Human-Machine Interface
HW	Hardware
IPR	Intellectual Property Right
JU	Joint Undertaking
JTI	Joint Technology Initiative
KEW	KE-works
MDO	Multidisciplinary Design and Optimization
MLW	Maximum Landing Weight
MOM	Minutes of Meeting
MTOW	Maximum Take-Off Weight
MZFW	Maximum Zero-Fuel Weight
N.A.	Not Applicable
RAM	Random-access Memory

ACRONYM	DEFINTION
SAE	Society of Automotive Engineers
SPR	Software Problem Report
SPW	Spin.Works
SW	Software
TN	Technical Note
TUD	Delft University of Technology
WEMACS	Detailed WEigths and MAnufacturing CostS
WBS	Work Breakdown Structure
WP	Work Package
WWM	Wings, tail and pylons Weight estimation Module
XML	Extensible Markup Language

Table 1-1: Acronyms

1.2.2. CONCEPTS

The following table provides a list of terms and concepts used in this document and in need of a definition to aid the reader in understanding the overall context.

TERM / CONCEPT	DEFINITION
GMV's Collaborative Website	GMV defined and created a collaboration website exclusively dedicated to the AERODESIGN & WEMACS projects to easily exchange information and distribute documentation. The website is hosted on a specific server physically located in GMV's Lisbon premises.
WEMACS Consortium	The WEMACS Consortium consists of the following four companies with expertise in the aeronautical and software development areas: • GMV (coordinator), Portugal • Spin.Works, Portugal • Ke-works, Netherlands • TU Delft, Netherlands
Dissemination	Means the disclosure of foreground by any appropriate means other than that resulting from the formalities for protecting it, and including the publication of foreground in any medium.
Foreground	Means the results, including information, whether or not they can be protected, which are generated under the project. Such results include rights related to copyright; design rights; patent rights; plant variety rights; or similar forms of protection.
Software	Means sequences of instructions to carry out a process in, or convertible into, a form executable by a computer and fixed in any tangible medium of expression.
Use	Means the direct or indirect utilisation of foreground in further research activities other than those covered by the project or for developing, creating and marketing a product or process, or for creating and providing a service.

Table 1-2: Concepts

2.REFERENCES

2.1. APPLICABLE DOCUMENTS

Applicable documents are defined as being documents which are needed to complete the contents of this document. They are referenced in this document in the form [AD.X].

REF.	TITLE	CODE	ISSUE / REVISION	DATE
[AD.1]	WEMACS Grant Agreement	CS-GA-2009-255877	-	23/12/2009
[AD.2]	WEMACS DoW	JTI-CS-2009-1-GRA-01-001	V2.2	27/11/2009
[AD.3]	Clean Sky Joint Undertaking Call for Proposals	SP1-JTI-CLEAN SKY-2009-1	-	15/06/2009

Table 2-1: Applicable Documents

2.2. REFERENCE DOCUMENTS

Reference documents are defined as being documents that are not applicable but rather improve the readers understanding of the overall context or for other reasons deemed important. They are referenced in this document in the form [RD.X].

REF.	TITLE	CODE	ISSUE / REVISION	DATE
[RD.1]	Alenia's Presentation	-	-	26/05/2010
[RD.2]	Quality Management Plan	CS-GRA-PLN-GMV-W-002	1-A	18/08/2010
[RD.3]	Software Requirements Document	CS-GRA-REQ-SPW-W-001	1-A	18/08/2010
[RD.4]	Methodology Tool Design Document	CS-GRA-SDD-SPW-W-001	1-A	25/10/2010
[RD.5]	Test Cases Document	CS-GRA-PLN-SPW-W-005	1-A	17/01/2011
[RD.6]	"737 – Airplane Characteristics for Airport Planning", Boeing Commercial Airplanes	D6-58325-6	-	Oct 2005
[RD.7]	"Type Certificate Datasheet no. FA2", UK CAA	-	FA2 Issue 15	Mar 2002
[RD.8]	Jan Roskam, "Airplane Design Part V: Component Weight Estimation", DARcorporation	-	-	1985

Table 2-2: Reference Documents

3.PUBLISHABLE SUMMARY

3.1. EXECUTIVE SUMMARY

The main objective of this project was the development of a software application - WEMACS - capable of obtaining detailed weights and manufacturing costs of various structural components of an aircraft, to support the Clean Sky Green Regional Aircraft development process in the preliminary design phase, and enable achieving the pollution and noise reduction targets for the regional aircraft entering the market in the coming decades.

Starting from a first level weight breakdown and based on conventional technologies given as input by the user along with other relevant data, the WEMACS software application provides a detailed weight breakdown for the fuselage, wing, horizontal and vertical stabilizing surfaces and pylons. The tool was designed to consider new materials, technologies and design solutions for the weight estimation, while estimating the cost for each of the components.

To promote flexibility and reusability in other projects as well as to allow future evolutions/expansion and updates, the WEMACS tool was designed and developed in a highly modular fashion. Each module is independent from others and with clearly defined, easily reconfigurable interfaces.

The modular approach and transparent interfaces also means that WEMACS architecture is easily integrated, as a whole or partially, into more complex aircraft design tools, namely in Multidisciplinary Design and Optimization (MDO) environments.

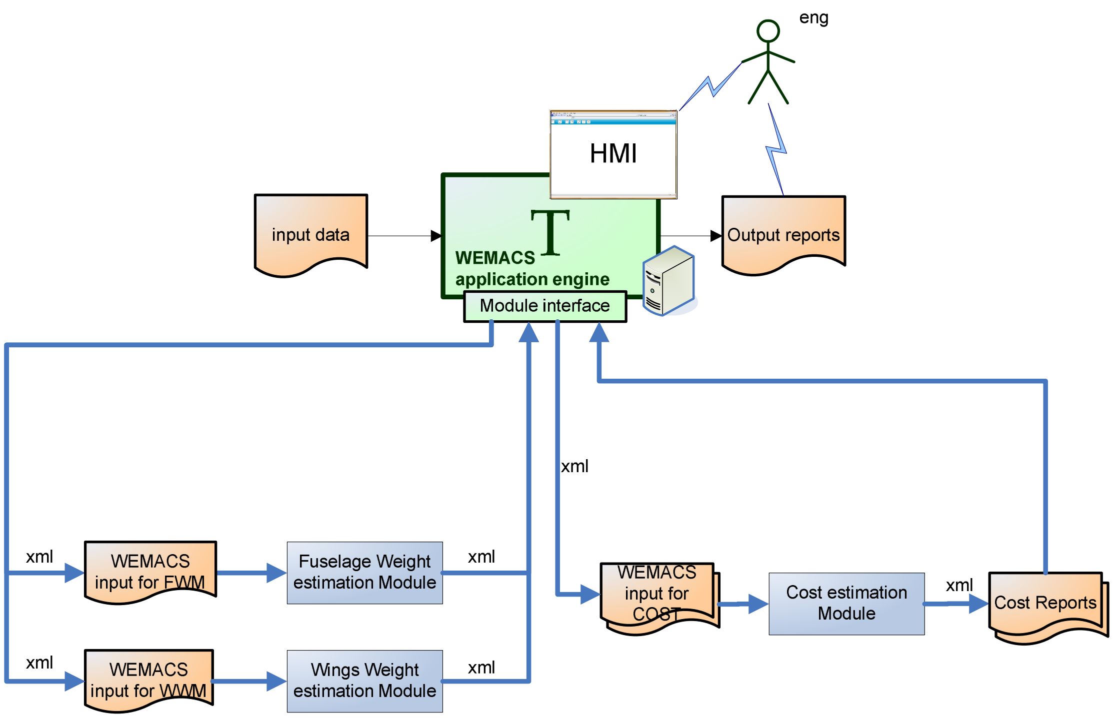


Figure 3-1: WEMACS software application architecture

The consortium is composed by GMV Portugal (GMV), acting as coordinator, and Spin.Works (SPW) from Portugal, KE-Works (KEW) and University of Delft (TUD) from Netherlands.

3.2. PROJECT CONTEXT AND OBJECTIVES

From a technical perspective, the most relevant deliverables of this project are D2.1 – Software Requirements Document, D3.1 – Methodology Tool Design Document, D5.1 – Test Cases Document, D5.2 – Integration and Verification Report and two Software Packages, containing the WEMACS tool. Although not an official deliverable, the coordinator, responsible for the tool HMI, has prepared and submitted also a User Manual. The purpose of this document was to present the WEMACS application to the user and to provide the WEMACS user a comprehensive guide to the application's features and describe the best way to use them. All deliverables were submitted to the Topic Technical Manager, which in this case is Alenia Aeronautica, and duly approved.

WEMACS software application, starting from a first level weight breakdown based on conventional technologies given as input by the user along with other relevant data (e.g. concerning geometries, design variables, etc.), is capable of obtaining a detailed weight for each structural item while also providing also detailed information about costs.

By default, a detailed weight breakdown is estimated based on conventional technologies. This detailed conventional weight breakdown may be then updated by the user through the tuning of weight technology coefficients in accordance with the following potential changes to the project (see Figure 3-2):

- New materials (i.e. change from Aluminium to CFRP; change from Aluminium to Aluminium-Lithium etc.);
- New technologies (i.e. new manufacturing processes);
- New design solutions (i.e. one piece frames, different frame and/or stringer spacing, one piece barrels, fuselage panels layout, wings with/without centre box etc.).

This design philosophy allows for quick and easy trade-off analyses.

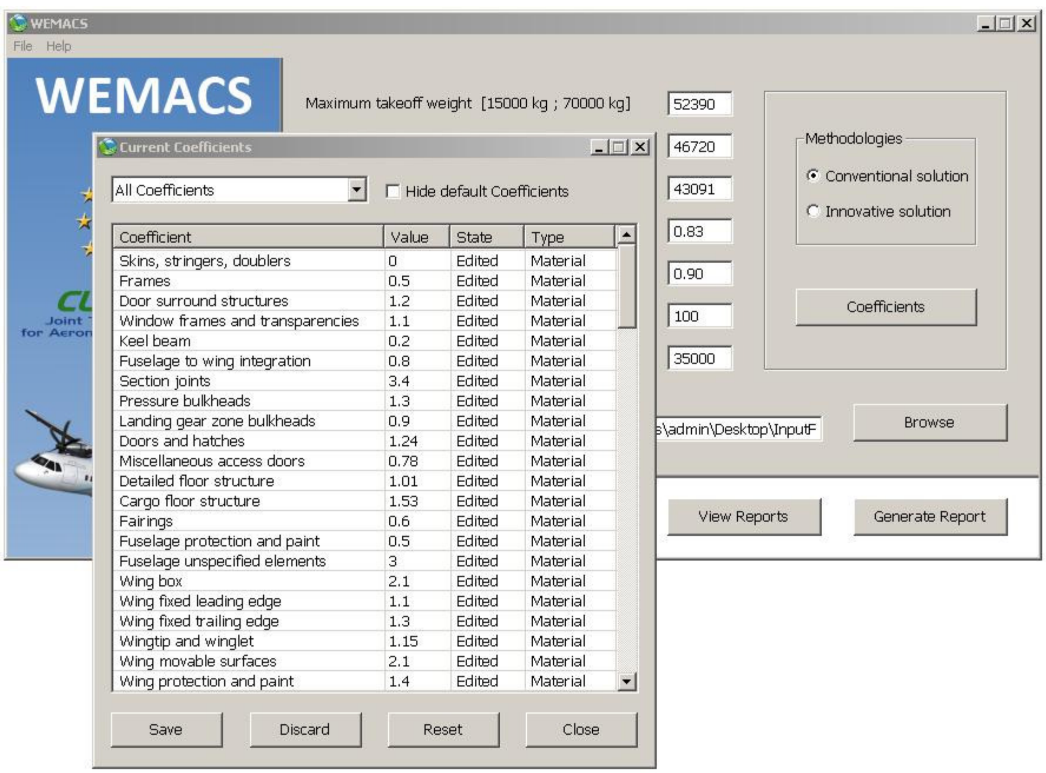


Figure 3-2: WEMACS application – 'Current Coeficients' window

WEMACS software application also estimates the costs associated to the conventional and innovative solutions.

WEMACS users have yet the possibility to create new input files from within the application, reducing the time needed to explore changes in aircraft design and even novel aircraft configurations. Coupled with well defined interfaces and the ability to run in batch mode, WEMACS becomes a tool easily integrated into wider aircraft design frameworks.

The detail of the main structural items is provided with the following breakdown (as required in the tender):

- **Fuselage**:
  - skins, stringers and doublers;
  - frames;
  - door surround structures;
  - window frames and transparencies;
  - keel beam;
  - fuselage to wing integration;
  - Sections joints;
  - pressure bulkheads;
  - landing gear bulkheads;
  - doors and hatches;
  - miscellaneous access doors;
  - detailed floor structure;
  - cargo floor structure;
  - fairings;
  - protection and external paint;
  - other miscellaneous elements;

- **Wing**:
  - wing box;
  - fixed leading edge;
  - fixed trailing edge;
  - wingtip and winglet;
  - movable surfaces;
  - protection and external paint;
  - other miscellaneous elements;

- **Horizontal and Vertical Tail**:
  - the same level of breakdown as is performed for the wing;

- **Pylons**:
  - structure, fairings, attachments, fittings;

Furthermore, for each of the items above, the specific installation weight is also estimated.

WEMACS software application is valid for projects within the following validity range defined in Table 3-1.

PARAMETER	VALIDITY RANGE
Maximum Take-Off Weight	15.000 – 70.000 (kg)
Number of Passengers	40 – 150 pax
Range	900 – 3000 (nm)
Mach Number	0.45 – 0.83
Maximum Flight Altitude	20000 – 40000 (ft)

Table 3-1: WEMACS software application validity range

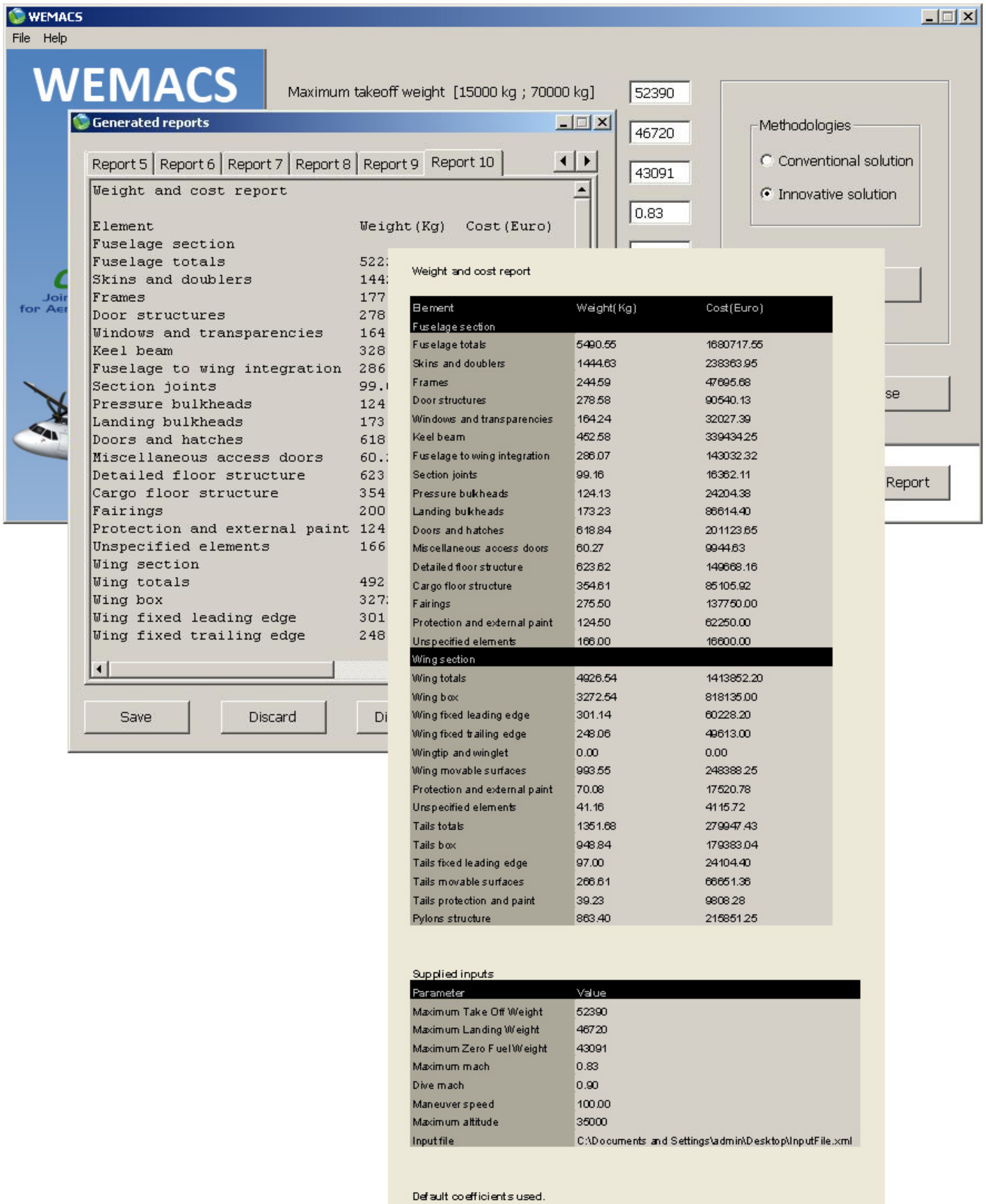


Figure 3-3: WEMACS – example of the application reports

3.3. S&T RESULTS/FOREGROUNDS

WP5 of the WEMACS project was dedicated to the verification and validation of the software application that was developed in the previous work-package. Several system verification tests (focused on functionality, interfaces, resource and performance) were performed. In this section, more focus on the system validation test and results will be given.

The main purpose of the system validation test is to validate the detailed weight breakdown as estimated by the Fuselage Weight estimation Module (FWM) and the Wings, tail and pylons Weight estimation Module (WWM) when running WEMACS with the inputs referring to the Boeing 737-200. One can only validate the detailed weight estimations, by comparison, given that the available data (retrieved from literature) is limited in scope for the purpose of performing a detailed validation of the costs breakdown estimations as provided by WEMACS.

3.3.1. VALIDATION RESULTS

This section aims at presenting the system validation tests that were performed in the WEMACS software application. The objective was to use the available (Boeing 737-200) aircraft data to feed-in and run the application, to compare it with the WEMACS application output reports, while establishing that reasonable deviations in the results were obtained.

The test presented below is part of the Integration and Validation Report (D5.2) of the WEMACS project.

3.3.1.1. WEMACS Tool Validation Test

This validation test is referenced as WEMACS-IVR-TC500 in the Integration and Validation Report. To perform this test, the user is required to run the WEMACS application in HMI mode with correct inputs and to verify the output produced.

3.3.1.1.1 Description

The user shall run the WEMACS application with the HMI inputs specified in Table 3-2 and compare the application output reports with the expected output data as specified in Table 3-3; and then establish a mean deviation between the application results and the data from literature for an intermediate aircraft structural breakdown (i.e, for fuselage, wings and horizontal and vertical tail). The test will be considered successful if the procedure is concluded without any error message, while returning the complete breakdown for the detailed weight estimations as specified in Table 6-2, Table 6-4 and Table 6-6 defined in [RD.3] and result deviations are shown to be reasonable.

Table 3-2 presents the inputs list that is required to start the WEMACS application in order to execute the test WEMACS-IVR-TC500 presented above. The data refers to Boeing 737-200 and was collected from [RD.6] and [RD.7] and compiled in *InputFile737200.xml* (shown for completeness in Appendix A.1) according to the application schema as defined in [RD.4].

BOEING 737-200				
TYPE	**PARAMETER**	**VALUE**	**UNIT**	**REFERENCE**
value	MTOW	52390	[kg]	[RD.6] and [RD.7]
value	MLW	46720	[kg]	[RD.6] and [RD.7]
value	MZFW	43091	[kg]	[RD.6] and [RD.7]
value	Max Mach number	0.83	[-]	[RD.6] and [RD.7]
value	Dive Mach number	0.90	[-]	estimated
value	Manoeuvre Speed	100.0	[m/s]	estimated
value	Max Flight Altitude	35000	[ft]	[RD.6] and [RD.7]
file	Input file	Appendix A.1	N.A.	-

Table 3-2: WEMACS inputs (Boeing 737-200) used in WEMACS-IVR-TC500

Table 3-3 presents the weight breakdown that was found in the literature. The data refers to Boeing 737-200 and was collected from [RD.8]

TYPE	PARAMETER	VALUE	UNIT	REFERENCE
Weight	Wing	4814	[kg]	[RD.8]
Weight	Horizontal and Vertical tail	1233	[kg]	[RD.8]
Weight	Fuselage	5503	[kg]	[RD.8]

Table 3-3: Boeing 737-200 Weight breakdown

3.3.1.1.2 Test Case Procedure

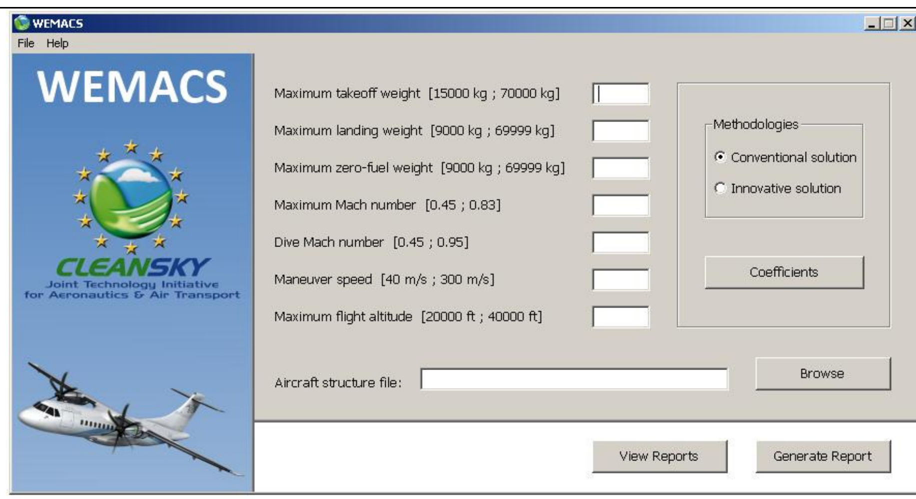
Table 3-4 presents the procedure for the test execution, step-by-step, as well as the verifications to be made.

STEP DESCRIPTION	TEST VERIFICATION
Launch wemacs.exe	Check that the WEMACS HMI launches.
Fill out the HMI inputs with the data presented in Table 3-2 and select: • 'Create conventional solution' for the solution type.	N.A.
Click the "Generate Report" button.	Check that the tool begins to perform the calculations to generate the report. Confirm that the tool notifies the user that the report has been successfully generated.
Click the "View Reports" button.	Check that the reports dialog box appears.
Verify generated report.	Confirm that the weights and costs from the report are displayed according to the breakdown specified in Tables 6-2, 6-4 and 6-6 in [RD.3].
Analyse the estimated total weight for the Wing.	Check that the estimated weight deviation from the literature value is reasonable.
Analyse the estimated total weight for the Horizontal and Vertical tail.	Check that the estimated weight deviation from the literature value is reasonable.
Analyse the estimated total weight for the Fuselage.	Check that the estimated weight deviation from the literature value is reasonable.

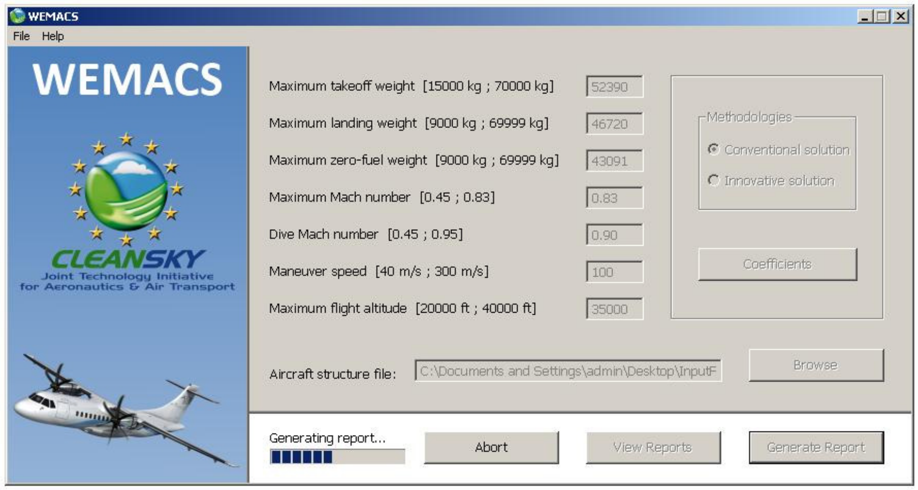
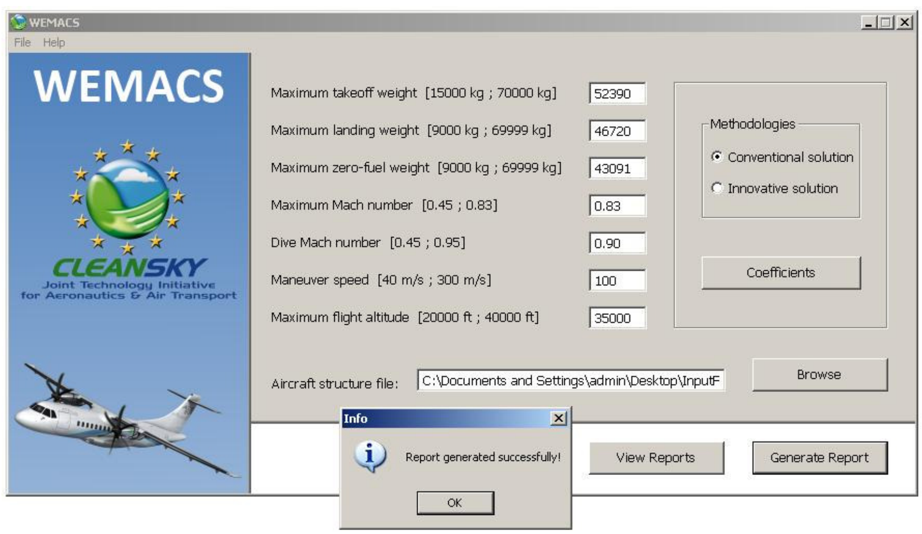
Table 3-4: WEMACS-TCD-TC500 Test Case Procedure [RD.5]

3.3.1.1.3 Test Results

The application was successfully subject to the test described in WEMACS-TCD-TC500 [RD.5].
The following table describes the outcome of each of the steps of the test procedure.

STEP DESCRIPTION	wemacs.exe was launched.
TEST VERIFICATION	Check that the WEMACS HMI launches.
TEST RESULT	 **Figure 3-4: Validation test: WEMACS HMI**

CONCLUSION	WEMACS HMI was successfully presented to the user.

STEP DESCRIPTION	The HMI inputs were filled in accordingly and report generation was demanded.
TEST VERIFICATION	Check that the tool begins to perform the calculations to generate the report. Confirm that the tool notifies the user that the report has been successfully generated.
TEST RESULT	 **Figure 3-5: Validation test: WEMACS generating a report**  **Figure 3-6: Validation test: WEMACS notification of sucessful report generation**
CONCLUSION	WEMACS began to perform the required calculations after user request displaying a progress bar, given the valid inputs. WEMACS notified the user after generating the requested report.

STEP DESCRIPTION	“View Reports” button was clicked.
TEST VERIFICATION	Check that reports dialog box appears.

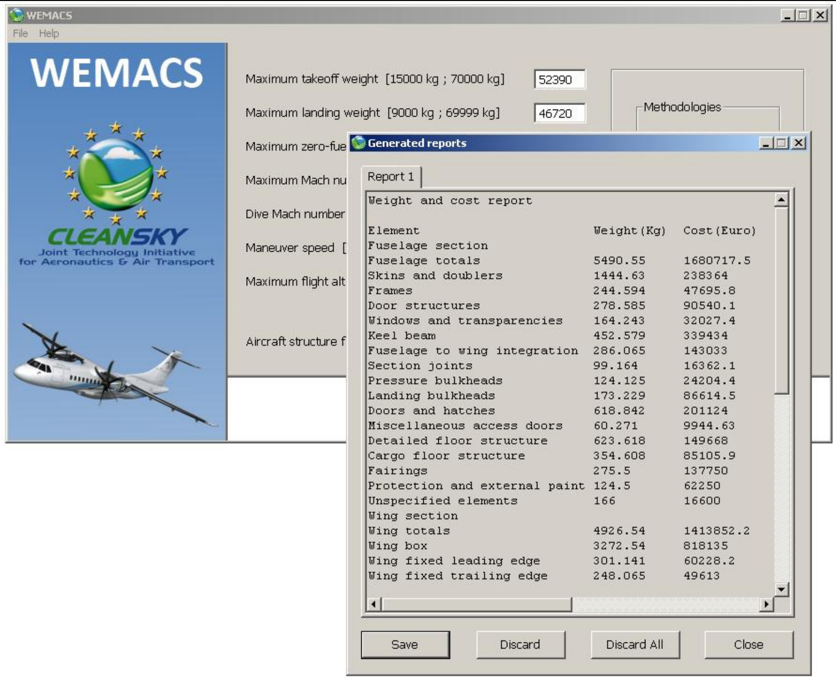
<table>
<tr><td>TEST RESULT</td><td>


Figure 3-7: Validation test: WEMACS reports dialog box
</td></tr>
<tr><td>CONCLUSION</td><td>WEMACS displayed the required reports dialog box, presenting the report in a separator with a corresponding number.</td></tr>
</table>

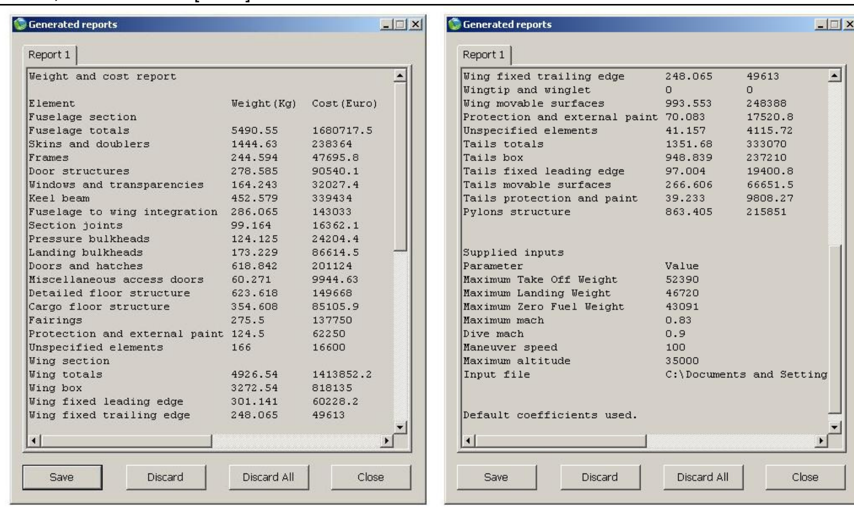
<table>
<tr><td>STEP DESCRIPTION</td><td>The generated report was verified.</td></tr>
<tr><td>TEST VERIFICATION</td><td>Confirm that the weights and costs from the report are displayed according to the breakdown specified in Tables: 6-2, 6-4 and 6-6 in [RD.3].</td></tr>
<tr><td>TEST RESULT</td><td>


Figure 3-8: Validation test: WEMACS report breakdown
</td></tr>
<tr><td>CONCLUSION</td><td>WEMACS report was presented according to the specified breakdown, also displaying HMI inputs and whether default coefficients were changed.</td></tr>
</table>

STEP DESCRIPTION	The estimated total weight for the Wing was analyzed.
TEST VERIFICATION	Check that the estimated weight deviation from the literature value is reasonable.

TEST RESULT	Wing weight as estimated by WEMACS: 4926.54 kg Wing weight according to [RD.8]: 4814 kg WEMACS estimation error: +2.34%
CONCLUSION	The estimation error presented by WEMACS in the estimation of the Wing for 737-200 is acceptable.

STEP DESCRIPTION	The estimated total weight for the Tail group was analyzed.
TEST VERIFICATION	Check that the estimated weight deviation from the literature value is reasonable.
TEST RESULT	Tail group weight as estimated by WEMACS: 1351.68 kg Tail group weight according to [RD.8]: 1233 kg WEMACS estimation error: +9.63%
CONCLUSION	The estimation error presented by WEMACS in the estimation of the Tail group for 737-200 is acceptable.

STEP DESCRIPTION	The estimated total weight for the Fuselage was analyzed.
TEST VERIFICATION	Check that the estimated weight deviation from the literature value is reasonable.
TEST RESULT	Fuselage weight as estimated by WEMACS: 5490.55 kg Fuselage weight according to [RD.8]: 5503 kg WEMACS estimation error: -0.02%
CONCLUSION	The estimation error presented by WEMACS in the estimation of the Fuselage for 737-200 is acceptable.

Table 3-5: WEMACS-IVR-TC500 Test Case Results

3.4. DISSEMINATION ACTIVITIES

The WEMACS Consortium has developed several dissemination activities under the scope of the WP7 (Dissemination and Exploitation). The main objectives of such activities are: to ensure a systematic dissemination of the project outcomes among the aeronautical community (public dissemination) and to facilitate the collaboration and information exchange between partners (internal dissemination).

The dissemination activities are under the responsibility of each consortium member and therefore, in the following sections, each partner reports on the activities they carried out for the dissemination of the WEMACS project results, activities that are compatible with the any protection of intellectual property rights, confidentiality obligations and legitimate interests of the owner(s) of the foreground.

3.4.1. GMV DISSEMINATION ACTIVITIES

GMV's dissemination activities for the WEMACS project entailed and covered a few common practices as described herein.

3.4.1.1. Conferences

3.4.1.1.1 Clean Sky National Information Day

The *Portuguese Ministry of Science, Technology and Higher Education* held in cooperation with the *Clean Sky JU* and event in Lisbon on the 8th February, 2011. The event was dedicated to presentations on the progress of the Clean Sky programme, with a particular focus on the activities and experiences of the Portuguese participants. As a key player, GMV was invited to and provided a presentation depicting their participation in the WEMACS project highlighting some of the most important positive aspects attained amongst other things.

The realization of this event was publicized on the official Clean Sky website under the News & Events page (http://www.cleansky.eu/index.php?arbo_id=77&set_language=en).

3.4.1.1.2 National Security & Defence Congress

The I Portuguese National Security & Defence congress organized in conjunction by *AFCEA Portugal* and the magazine «*Segurança e Defesa*» was held in the *Centro de Congressos de Lisboa* on the 24th & 25th of June, 2010. During the event, GMV provided a presentation entitled "*Criação de Centros de Excelência nos sectores da Aeronáutica, Segurança e Defesa, em Portugal*" whereby GMV's participation in the WEMACS project is briefly covered. The respective presentation is found under in the following site under the section dedicated to *Mesa A*.

Webpage: http://www.segurancaedefesa.org/comunicacoes/2

3.4.1.2. Press Releases

3.4.1.2.1 Semana Informática

It is common practice for articles associated with GMV to be included some of the editions of the magazine «*Semana Informática*». Therefore, a set of articles stating GMV's participation in the WEMACS project was respectively publicized such as, the article entitled "*GMV vence contratos de Segurança Marítima e Aviónica Modular*" (Semana nº 965 de 5 a 11 de Março de 2010).

3.4.1.2.2 Ciência Hoje

«*Ciência Hoje*» is a journal that publicizes fundamental information concerning the development of scientific and technological activities in Portugal as well as abroad. Naturally, an article entitled "*Novas tecnologias para voos mais confortáveis e ecológicos*" was publicized on the 19th of August, 2010 by Anajara Amarante and referenced under the following webpage whereby it mentions GMV's participation in the Clean Sky programme and namely in the WEMACS project.

Webpage: http://www.cienciahoje.pt/index.php?oid=44613&op=all

3.4.1.2.3 TSF Radio Station

The Portuguese radio station TSF announced in January of 2010 that GMV, as part of a Consortium, had been awarded the coordination of the WEMACS project.

3.4.1.3. Websites

Websites are fundamental sources of information capable of effectively reaching a sizeable and multicultural audience. GMV took advantage of the approach in different ways, as explained below, to communicate corresponding project information.

3.4.1.3.1 Blogs

On occasions, the internet takes on a life of its own. As such, it is expected that certain articles / news may appear on particular websites such as blogs relaying applicable information that was not communicated by GMV. The following are a couple of blogs found whereby information regarding GMV's participation in the WEMACS project has been publicized:

Webpage: http://godmasterdownload.blogspot.com/2010_08_26_archive.html
Webpage: http://desastresaereosnews.blogspot.com/2010/08/novas-tecnologias-para-voos-mais.html

3.4.1.3.2 GMV

It is common practice for GMV to use its own website (http://www.gmv.com.pt) to convey important information to the general public including events and news deemed more relevant and explicit to the company.

GMV publicizes imperative information as an integral part of the news section concerning projects for which the group plays a participative role as sole implementer or a consortium contributor. The following figure provides a snapshot example of the present day layout whereby one can easily locate the news highlights on the right-hand side of the page.

Figure 3-9: GMV's Website Snapshot

Apart from the news highlights depicted on the home page, GMV has a dedicated webpage that relays, amongst other things, the articles released to the press according to the release dates. Two such articles through which GMV's participation in the WEMACS project is portrayed are as follows:

Webpage: http://www.gmv.com/company/communication/news_2010.html
Webpage: http://www.gmv.com.pt/empresa_GMV/comunicacion/notas_2010.html

In addition, the site provides further details such as key projects on a per market basis under each respective section of the website that can be accessed by simply clicking on one of the related links exposed on the upper-left hand side of the page (see Figure 3-9).

3.4.1.4. Internal News Magazine

GMV circulates amongst all employees the monthly issues of its internal news magazine whereby it portrays the group's worldwide involvement in a myriad of markets, through the innovative and technological projects developed, and vital social events. A relevant project deemed news worthy is highlighted in the magazine by essentially offering the audience an overview of the project describing its nature, purpose, client(s), consortium (if applicable), and in general how it will help shape the future.

Thus, as predicted, GMV's participation in the Cleank Sky programme and namely in the WEMACS project was revealed on issue Nº44 dated April 2010 which is actually available to the public and viewable under the subsequent web-link:

Web-link: http://www.gmv.com.pt/empresa_GMV/comunicacion/boletin_corporativo/revista_44.pdf

3.4.2. KE-WORKS DISSEMINATION ACTIVITIES

KE-works has planned during the project the following dissemination initiatives:

1. Corporate Website news item
2. Workshops and Network Event
3. Commercial Presentations
4. Publications and White papers

3.4.2.1. Achievements

KE-works made an effort of dissemination to publish a news item on the granting of the offer on its corporate website (refer to Figure 3-10), as planned, which is actually available to the public and viewable under the subsequent web-link: http://www.ke-works.com/index.php/news/71-european-research-projects-granted

Figure 3-10: News item on the website on the start of the WEMACS project

Moreover it publicly presented the involvement in the WEMACS project on the YES!Delft network event 2010, a professional event of the incubator YES!Delft that KE-works is involved in. This event was attended by about 800 visitors, including investors, customers, potential customers, students and policy makers (national and European). We had a conference booth in which we displayed our recent developments including involvement in research networks such as the Clean Sky - Green Regional Aircraft.

Figure 3-11: KE-works talking with Dutch minister of Finance, Jan-Kees de Jager, during the network event 2010

Next to this public event KE-works mentioned the involvement into the WEMACS project on several occasions during private talks with customers, in presentation with customers and other research partners.

3.4.3. SPIN.WORKS DISSEMINATION ACTIVITIES

The following sub-sections report on the activities carried out by Spin.Works' to effectively communicate with parties, outside the consortium, to create awareness on this project and to disseminate the project results by current means (website, publications and participation in conferences/workshops).

3.4.3.1. WebSite Publications

As it is common practice at Spin.Works, a page dedicated to the WEMACS project was published in the company website (refer to Figure 3-12), which is actually available to the public and viewable under the company website: http://www.spinworks.pt/wemacs.

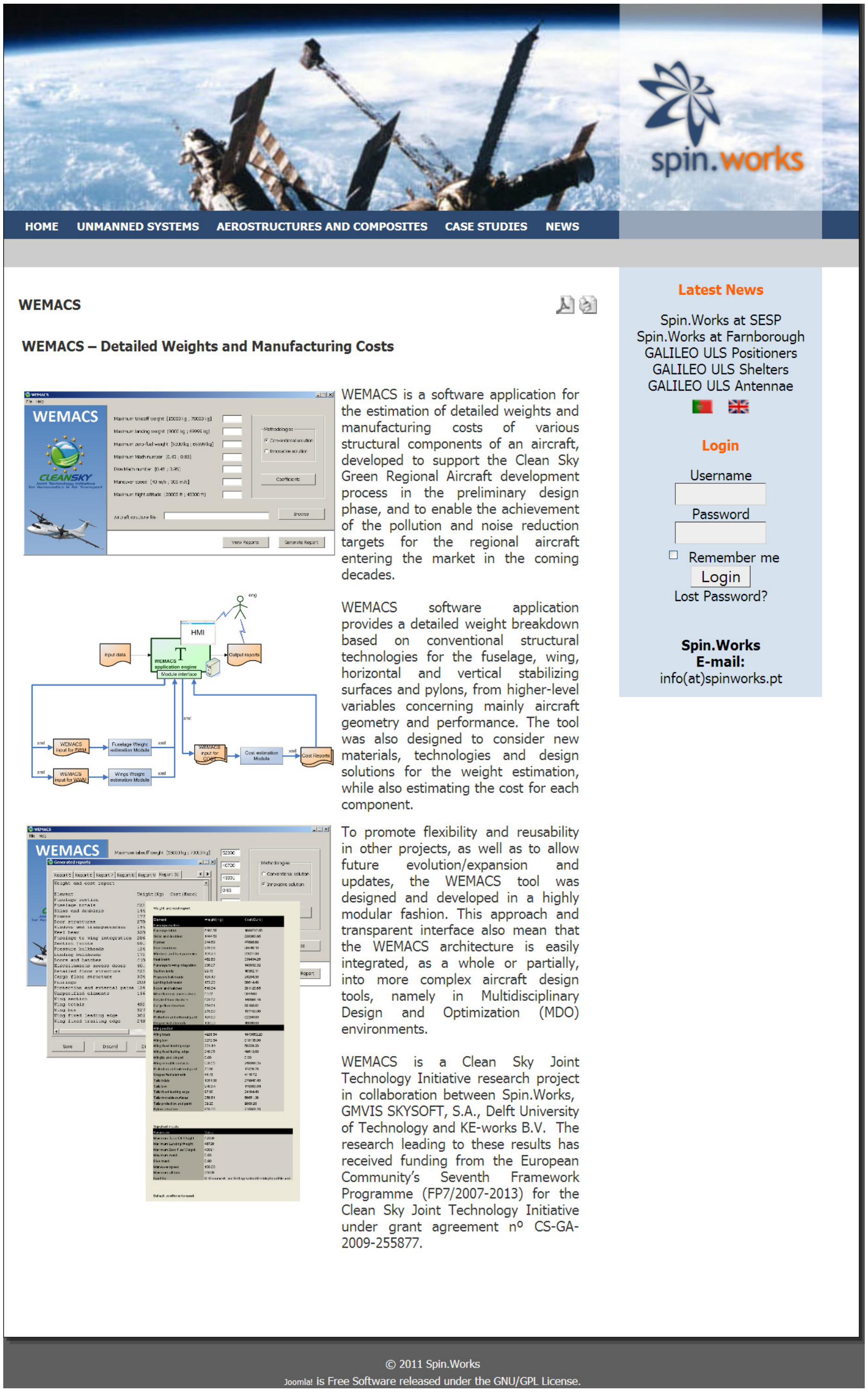


Figure 3-12: WEMACS project webpage on Spin.Works's website

3.4.3.2. Pesentations to third parties

As it is common practice at Spin.Works, when promoting the company to customers and other research partners, the involvement into current projects, namely into the WEMACS project, was mentioned on several occasions during private talks and company presentations.

3.4.4. TU DELFT DISSEMINATION ACTIVITIES

The following sub-sections reports on TU Delft's activities to effectively communicate with parties, outside the consortium, to create awareness on this project and to disseminate the project results by current means (website, publications in technical journals and participation in conferences/workshops).

3.4.4.1. Website Pulications

TU Delft disseminated the findings and the projects results on the TU Delft webpage. Each group within TU Delft has a website on their research activities and findings (see as an example Figure 3-13). TU Delft published its results also on the website of the group of Systems Engineering and Aircraft Design.

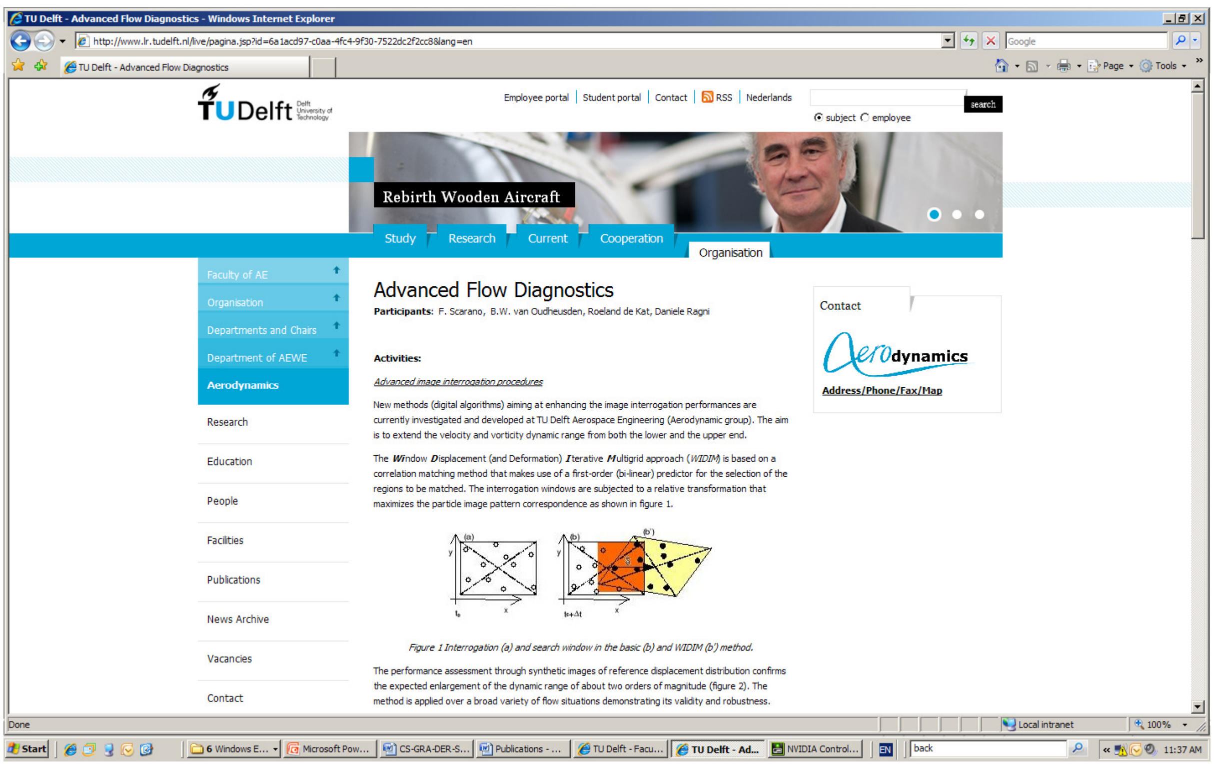


Figure 3-13: Print screen of TU Delft website presenting research

3.4.4.2. Technical Publications

TU Delft proposed to write at least one publication for an international technical journal such as AIAA's Journal of Aircraft. In this article the weight estimation methods that were implemented for all lifting surfaces will be presented.

3.4.4.3. Conferences and Workshops

To disseminate the weight estimation methods, TU Delft has submitted a paper to the bi-annual SAE AeroTech Congress and Exhibition. This paper has been submitted in the category of Systems Engineering and Design. Upon acceptation a full paper was written and presented at the congress in October 2011. In addition, a second paper will be written, tailored to the AIAA Aerospace Sciences Meeting (ASM) in January 2012.

4.USE AND DISSEMINATION OF FOREGROUND

The Consortium does not foresee the exploitation of the WEMACS tool beyond the scope of the Clean Sky JTI. Nevertheless, CleanSky JTI and Alenia Aeronautica will be given a period of 6 months after the work is completed during which the consortium will provide engineering support (i.e., feedback to technical questions and small scale modifications to the software) with the objective to create linkage to other CleanSky subprojects related to aircraft design, and potentiate the use of the WEMACS tool.

However, the project results, i.e., the WEMACS tool will be used by the members of the Consortium in further research activities in the fields of aircraft preliminary design and estimation models for weight & cost.

5.APPENDIX A

This appendix contains the input/output files exchanged within the application that are relevant to the test analyses covered in this document.

A.1 VALID USER INPUT FILE BASED ON B737-200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END OF DOCUMENT