FP7-REGPOT-2010-1 Grant agreement no.: *264084*

Final report

of CEDESA project

Prepared by: **Brno University of Technology (BUT)**

Document control data			
Report:	Final, 48M	Document Code:	LU63-2014-CEA.PR
Revision:	IR		
Date of issue:	1-October-2014		
Author's name:	R. Hlinenska, J. Juracka	Status:	Approved
WP Leader's name:	Jaroslav Juracka	Status:	Approved
Coordinator:	Jaroslav Juracka	Status:	Approved
Release status:	Confidential		

Start Date of CEDESA: 1 September 2010 Duration: 48 Months

The overall aim of the ***CEDESA*** project is to upgrade the existing research capacity in aerodynamics and aircraft structures at the Institute of Aerospace Engineering, Brno University of Technology (IAE-BUT) to the highest European level and create a Centre of Excellence for the Design of Efficient and Safe Aircraft. IAE-BUT is a very promising major European research organisation as demonstrated by its participation in four FP6-AEROSPACE and one FP7 Aeronautics R&D project. The Centre of Excellence will be developed through a range of activities derived from IAE-BUT s SWOT analysis.

The activities will increase IAE-BUT s competitiveness and visibility in the most advanced topics of aerodynamics and aircraft structures:

1. Aerodynamic Shape Optimization;
2. Aircraft Parameters Identification;
3. Analysis of Structure Dynamics Behaviour during Extreme Situations; and
4. Composite Structure Behaviour under Static and Fatigue Loading.

Essential for the ***CEDESA*** are twinning partnerships with 4 specialist research organisations: European Aeronautic Defence and Space Company Innovation Works (EADS), Swedish Defence Research Agency (FOI), Deutsches Zentrum für Luft- und Raumfahrt (DLR) and Materials Engineering Research Laboratory Ltd (MERL). IAE-BUT will increase its human potential by hiring 6 experienced researchers and 1 research manager.

It will also organise extensive know-how exchanges with the twinning partners. IAE-BUT will increase its technology potential by upgrading its computer equipment and structural testing facilities to enable more advanced CFD/FEM modelling and physical testing. It will increase its visibility by organising international workshops and conferences with support from Technical University Braunschweig, University of Limerick and University of Glasgow. Finally, to ensure its research quality, IAE-BUT will be evaluated by a team of international, independent experts nominated by the Commission.

Contents

ABBREVIATIONS **4**

1 INTRODUCTION **5**

2 PROJECT OBJECTIVES OF THE PERIOD **5**
1.1 General preview of the project 5
1.2 Detailed list of objectives 6
1.3 Summary 7

2. WORK PROGRESS AND ACHIEVEMENTS DURING THE PERIOD **7**
2.1 WP1 - Know-How and Experience Exchange 7
2.1.1 Indicators 7
2.1.2 Use of resources 11
2.1.3 More information 12
2.2 WP2 - Recruitment by IAE-BUT 12
2.2.1 Indicators 12
2.2.2 Use of resources 14
2.3 WP3 - Development and Upgrade of Research Equipment 14
2.3.1 Indicators 14
2.3.2 Use of resources 17
2.4 WP4 - Workshop and Conference Organization 18
2.4.1 Indicators 18
2.4.2 Use of resources 24
2.5 WP5 - Dissemination and Promotional Activities 25
2.5.1 Indicators 25
2.5.2 Use of resources 29
2.6 WP6 - Evaluation Facility 30
2.6.1 Indicators 30
2.6.2 Use of resources 30

3 PROJECT MANAGEMENT DURING THE PERIOD **31**
3.1 Consortium management tasks and achievements 31
3.2 Changes in the consortium 31
3.3 List of project meetings, dates and venues 31
3.4 Project planning and status 31
3.4.1 PM effort consumed 31
3.4.2 Deliverables progress 32
3.4.3 Milestones progress 33
3.5 Impact of possible deviations from the planned milestones and deliverables 33
3.6 Changes to the legal status of any of the beneficiaries 33
3.7 Financial review 34

4 CONCLUSION **34**

Abbreviations

BUT	Brno University of Technology
DoW	Description of Work, Annex I to CEDESA Grant agreement no.: 264084
DLR	Deutsches Zentrum für Luft- und Raumfahrt
EADS	European Aeronautic Defence and Space Company
FOI	Swedish Defence Research Agency
IAE-BUT	Institute of Aerospace Engineering – Brno University of Technology
MERL	Element Hitchin (formerly Materials Engineering Research Laboratory (MERL) Ltd)
PM	Person Month
WP	Work Package

1 Introduction

The major purpose of the document is to provide brief information about project objectives, work progress and achievements and project management. The period of the project is from 1.9.2010 to 31.8.2014.

2 Project objectives of the period

1.1 General preview of the project

The table 1 presents an approximation of the project's progress.

Work Package	Content	Project target	Changed by Amendment I	Done in Period I.	**Done in Period II.**	Summa
WP1 Know-How and Experience Exchange **Progress 87 %**	Milestones	1		1	-	1
	Deliverables	3		2	1	3
	Targets of twinning	58 PM	76 PM	38 PM	28 PM	66 PM
WP2 Recruitment by IAE-BUT **Progress 100 %**	Milestones	2		1	1	2
	Deliverables	3		2	1	3
	Targets of recruitment	8+1	6+1	6	1	7
WP3 Development and Upgrade of Research Equipment **Progress 100 %**	Milestones	2		2	-	2
	Deliverables	2		1	1	2
	Targets of procurement	4	5	4	1	5
WP4 Workshop and Conference Organization **Progress 152 %**	Milestones	2		0,9[1]	1,1	2
	Deliverables	4		2	2	4
	Targets of events	17	19	9,9	19,1	29
WP5 Dissemination and Promotional Activities **Progress 100 %**	Milestones	2		2	-	2
	Deliverables	6		4	2	6
	Targets of actions	17		13	4	17
WP6, WP7 Evaluation Facility, Project Management **Progress 100 %**	Milestones	4		0	4	4
	Deliverables	9		4	5	9
	Targets of expert team	1		0	1	1

Table 1 – Fulfilment of WPs

[1] The conferenced was fully prepared, but held in October – more details in section 2.4

1.2 Detailed list of objectives

The list of objectives originates from Action plan of the DoW and it is supplemented by the current status of the tasks. It gives a better explanation to the table 1 and shows detailed targets planned in specific WPs.

WP	Indicator	Project target	Done in Period I.	Done in Period II.	**Total**
WP1	3. individual IAE-BUT researcher visits to EADS	25 PM	16 PM	10 PM	**26 PM**
	4. individual IAE-BUT researcher visits to FOI	24 PM	10 PM	14 PM	**24 PM**
	3. individual IAE-BUT researcher visits to DLR	14 PM	4 PM	4 PM	**8 PM**
	2. individual IAE-BUT researcher visits to MERL	13 PM	7 PM	1 PM	**8 PM**
	Mid-Term Report with description of know-how gained in Aerodynamics and Aircraft Structures.	1	1	-	**1**
	Final Report with description of know-how gained in Aerodynamics and Aircraft Structures.	1	0	1	**1**
WP2	Recruitment strategy for attracting experienced researchers & research manager	1	1	-	**1**
	Recruitment of experienced researchers	6	5	1	**6**
	Recruitment of research manager	1	1	-	**1**
	Mid-Term Report describing recruitment activities	1	1	-	**1**
	Final Report describing recruitment activities	1	0	1	**1**
WP3	Procurement of computer cluster	1	1	-	**1**
	Procurement of fatigue actuators	2	2	-	**2**
	Procurement of personal workstations	8	8	-	**8**
	Procurement of optical measurement system	1	1	-	**1**
	Procurement of up to date mechanical testing system	1	-	1	**1**
	Procurement report for new/upgraded equipment	1	1	-	**1**
	Overall usage report for new/upgraded equipment	1	0	1	**1**
WP4	International conferences organized by IAE-BUT	2	0,9[2]	1,1	**2**
	Bilateral seminars with twinning partners	6	5	7	**12**
	Conferences & workshops attended by IAE-BUT	6	4	8	**12**
	International partners supporting IAE-BUT with organizing workshops & conferences	3	1	2	**3**
	Summary reports for workshops & conferences	2	1	1	**2**
WP5	CEDESA project website	1	1	-	**1**
	Published news - project events and results (3-4/year)	9	6	-	**6**
	Dissemination workshops with regional aircraft industry (1-2/year)	3	3	1	**4**
	Workshops to organize FP7 R&D proposal submissions (1/y)	3	2	1	**3**
	Market research report identifying commercial potential for aerospace engineering R&D services	1	1	-	**1**
WP6	International experts on CEDESA Evaluation Board	3	0	3	**3**
	Annual Monitoring Reports	3	2	1	**3**
	CEDESA Evaluation Report	1	0	1	**1**
	CEDESA Road Map Report	1	0	1	**1**

Table 2 – CEDESA Action Plan progress

1.3 Summary

All targets of CEDESA project were completed.

2. Work progress and achievements during the period

This chapter provides a concise overview of the progress of the work for all WPs.

2.1 WP1 - Know-How and Experience Exchange

The secondments between the IAE-BUT and the twinning partners were the main tool for know-how and experience exchange, which was the main CEDESA project goal. The WP objective was to develop IAE-BUT's strategic research partnerships and to work together with the partners to learn and receive know-how on partner defined specific themes. Each theme was solved from two sides – during the secondment at the partner institution and also at IAE-BUT after comeback. The detailed list of twinning research is provided in table 4 (see section 2.1.2).

2.1.1 Indicators

- **3. individual IAE-BUT researcher visits to EADS** **26 PM** / 25 PM

The cooperation with EADS was a significant and prestige opportunity in aviation, therefore the twinning here was very important for know-how exchange.

Here is the detailed list of IAE-BUT researchers who were on secondment to EADS:

- **Ondrej Lajza** - from 30-5-2011 to 15-12-2011,
  - from 6-1-2012 to 31-1-2012, topic T4 7,5M

  During his stay at EADS, Ondrej undertook training and work experience in the research topic *Optimization of aerodynamic shapes with respect to in-flight contamination and its behaviour (T4)*. He joined a team developing small scale high-speed wind tunnel for airfoil ice accretion contamination resistant coatings testing.

  Ondrej performed the following activities during his secondment stay - design of test wind tunnel section, detailed CFD analysis of the droplet delivery system, design of a flow quality calibration test section, experimental validation of lift and drag forces on testing airfoil, experimental validation of the flow quality and comparison to CFD analysis, and calibration of main experimental measurement equipment.
- **Pavel Zikmund** - from 30-1-2012 to 31-7-2012, topic T4 6M

  During his stay at EADS, Pavel has worked on the research topic *Optimization of aerodynamic shapes with respect to in-flight contamination and its behaviour (T4)*.

  His main task was to manage insect impact experiments in a wind tunnel. The primary use of the tunnel is for airfoil icing and insect contamination investigations. So, his work had required modifying the tunnel and its delivery system for the demanded tests. The work included CFD simulations, analytical aerodynamics analysis and CAD design.
- **Tomas Urik** - from 10-06-2012 to 05-12-2012, topic T5 6M

Tomas was focused on structure behaviour under static and fatigue loading, *Damage tolerance (T5)*. He was on the twinning stay from July 2012 (the 3M is calculated from to 1-9-2012). During

his stay at EADS, the four research topics were studied: 1. Finite element topology optimization of aircraft part for additive layer manufacturing technology with incorporation of bionic principles, 2. Analyses of behaviour of hybrid adhesive bonded overlap joints consisted of titanium and carbon substrates, 3. Experimental investigation of adhesive properties of ice on different kind of surface by dynamic vibration measurement technique, 4. Parametric study of pin pattern and shape in multiple pin joint by finite element analyses.

- **Tomas Katrnak** - from 01-08-2013 to 15-02-2014, topic T5 6,5M

Tomas was focused on structure behavior under fatigue loading, *Damage tolerance (T5)*. During his stay at EADS, Tomas undertook training and work experience in the research topic EFFECT OF SURFACE ROUGHNESS ON FATIGUE PROPERTIES. At this topic the analyses in ABAQUS FEM software and AFGROW analytical software, stress intensity factor and J-integral investigation on the crack tip, comparisons of numerical and analytical results, surface roughness analyses, notch and porosity analyses, and simulations of crack propagation were done.

- **4. individual IAE-BUT researcher visits to FOI** **24 PM** / 24 PM

The twinning secondments with the Swedish Defence Research Agency run exactly according to the plan. Here is the detailed list of IAE-BUT researchers who were on secondment to FOI:

- **Jiri Hradil** - from 4-5-2011 to 31-10-2011, topic T1 6M
  - from 3-3-2013 to 31-5-2013, topic T1 3M
  - from 4-8-2013 to 30-10-2013, topic T1 3M

During his stay at FOI, Jiri undertook training and work experience in the research topic Aerodynamic shape optimization. Jiri focused on main tasks connected with free-form deformation (FFD) parameterization of geometry and its development for use in aerodynamic shape optimization of complex shapes. He worked on cases of 2D airfoil optimization and wing shape wing shape optimization with CFD.

The following list summarizes the performed activities: adaptive Free-Form Deformation parameterization, aerodynamic airfoil and wing shape optimization (EDGE).

- **Jan Navratil** - from 15-4-2012 to 15-10-2012, topic T2 6M
  - from 3-3-2013 to 31-5-2013, topic T2 3M
  - from 12-8-2013 to 30-10-2013, topic T2 2,5M

Jan is focused on *Aerodynamic design and optimization of elastic wings* (T2). He was on the twinning stay from April 2012, than followed two more stays. He solved mainly fluid-structure interaction (FSI) problem. He gained knowledge related to principle of coupled field formulation of FSI, i.e. derivation of coupling matrix based on radial basis functions. The coupling was tested on highly swept transonic wing.

He worked on development of a tool for derivation of the equivalent beam model from complex finite element model of a wing. In an initial stage, a feasibility of an optimization based approach was evaluated. The target structure was a beam with linearly varying cross-section. An influence of a number of optimization variables on convergence to target structure was tested. It was shown that a simplified problem, i.e. assumption of the beam cross-section shape and its distribution (polynomial) along the beam, led to better posed problem. In future, relaxed

assumptions (distribution of cross-section according higher polynomial) and estimation of dynamic properties of structure will be incorporated to the tool.

- **3. individual IAE-BUT researcher visits to DLR** **8 PM** / 14 PM

The twinning secondments with DLR did unfortunately not proceeded according to the original plan. The reason was due to the long term (more than 1,5 year) reconstruction of testing facility and spatial adjustments at DLR. Next delay was prolonged by subsequent commercial tests. In order to keep the cooperation it was necessary to adapt the plan and there was given a priority to the simulations before testing and experimental activities. Here is the detailed list of IAE-BUT researchers who were on secondment to DLR:

- **Michal Malis** - from 17-1-2012 to 24-5-2012, topic T8 4M

During his stay at DLR, Michal worked on the research topic *Porosity – Effects of Defects* (T8). During his stay, Michal worked on collecting relevant data and learning software tools used in DLR. He was investigating the single perturbation load concept which is a promising approach for identification of buckling performance of an imperfection sensitive unstiffened cylinder from composite materials. The concept was invented by Dr. Christian Hühne in DLR in 2007. Many questions remain unanswered, which would enable greater application of the concept.

A brief description of some of his other work is as follows: Study relevant papers regarding unstiffened cylinders made of composite materials, Development of a tool for buckling load calculation using semi-analytical approach, Application of non-dimensional stiffness and stacking eccentricity parameters on semi-analytical buckling calculations.

- **Pavel Schor** - from 17-5-2013 to 24-7-2013, topic T8 2,2 M
  - from 5-1-2014 to 28-2-2014, topic T8 1,8 M

Pavel during his stay worked on topics: Visualization of imperfect composite cylinders, stochastic modelling of composite cylinders, gap detection on composite structures. He received experiences in topics non-linear post-buckling simulations in ABAQUS, experience with powerful visualization libraries VTK, matplotlib, openCV, development of large software projects, stochastic approach to design problems.

- **2. individual IAE-BUT researcher visits to MERL** **8,25 PM** / 13 PM

The twinning secondments with the Element Hitchin (MERL) was originally assumed in range 7PM, than during prolongation the range was increased up to 13PM. Real final amount was only 8,25PM. The selection did not allow identifying a suitable candidate. Finally only one new researcher attended twinning.

- **Jaroslav Juracka** - from 26-2-2011 to 28-3-2011, topic T9 1M

During the stay at MERL, UK the topic *Experimental Testing of Crack Propagation in Delaminated Composite Structure (T9)* was defined. Both participants (Jaroslav Juracka and Vladimir Matejak) were cooperating there.

Jaroslav participated in the following activities: Familiarisation with company activities and organization, presentation of BUT activity and discussion about possible joint activities and topics, study of Fracture Mechanics Analysis of Throuth-Tickness Cracks, learning of Abaqus FEM software control, ABAQUS FEM analysis software practices, first analyses, fatigue tests for crack initiation

and growth investigation of tapered carbon laminates, Open mode Fracture Toughness testing by ASTM 5528 of woven fabric specimens, Open mode Creep Toughness tests (specimen preparation, preliminary test realisation, reporting) of woven fabric specimens.

- **Vladimír Matěják** - from 23-3-2011 to 2-7-2011 topic T9 3 M
  - from 8.1.2012 to 5.4.2012 topic T10 3 M

Vladimir continued with the research topic *Experimental Testing of Crack Propagation in Delaminated Composite Structure (T9)*, which had originally been started by Jaroslav Juracka. During his stay Vladimir worked on several projects involving both experimental and numerical modelling aspects.

The main area of activity was the testing of composite materials for aerospace applications with particular emphasis on damage characterization. Because of client confidentiality issues, details of some of the projects he worked on cannot be reported. A brief description of some of the other work is as follows: Static and Creep delamination testing of composite materials under Mode I loading conditions, Mode I, Mode II and Mixed mode static testing of carbon-carbon composite panels for glider wings, Mixed mode static testing of Carbon-Glass reinforced composites specimens, etc.

Vladimir´s second stay was focused on the research topic *Global/local delamination modelling for damage tolerant composite structures (T10)*. He worked on several projects involving both experimental and numerical modelling aspects.

A brief description of some of the other work is as follows: FE modelling of complex mechanisms in Abaqus to identify reasons of in-service failure and evaluation of possible re-design concepts through FEA to prevent failure; Developing FE models of hail impact on composite panels; Experimental testing of ice impact on composite panel, development and calibration of ice firing facility.

- **Volodymyr Symonov** - from 08-1-2014 to 14-2-2014, topic T9 1,25M

During the stay Volodymyr started with learning of ABAQUS Standard and Explicit by modelling of metal and composite materials including elastic and plastic behaviour, damage, Linear and non-linear simulations, eigenvalue problems and contact and building and simulation of a business jet model for training and marketing purposes (using conventional shell elements, metal and composite materials, contact). Next he made parametric studies of metal and composite thin square plates shear buckling using ABAQUS Standard. The main purpose of these studies is to find buckling load/stress vs the plate side length to thickness ratio dependencies. Also Simulation of aluminium and composite laminate plates shear by four-link chain in order to check the parameters of the plates for real tests was done.

- **individual MERL researcher visits to IAE-BUT** **1 PM** / 1 PM

- **Vladimir Matejak** - from 10.1.2014 to 10.2.2014 topic T9 1M

Vladimir visited IAE-BUT at the frame of know-how transfer. He spent one month at the IAE-BUT during laboratory testing and simulation of crack progress. He supervised the young researchers and made introduction course to simulation technique, testing of specimens and test data processing on new test machine with optical measurement system.

2.1.2 Use of resources

The WP1 as major project activity had share of PM effort and table 3 shows that most of personal resources were used according to the plan done by Amendment No.1, where the number of PM was increased from the original plan 58PM.

	Project target	Done in Period I.	Done in Period II.	**Total.**
Twinning	76 PM	38 PM	28 PM	66 PM
IAE-BUT local CEDESA project activities	71 PM	28 PM	52,5 PM	80,5 PM
TOTAL	147 PM	66 PM	81 PM	146,5 PM

Table 3 – WP1 Use of resources

The IAE-BUT local CEDESA project activities were focused on project topics fulfilling at the IAE-BUT facility after or before twinning. The lower values can be explained by the delayed recruitment process of new experienced researchers explained in WP2 and individual delays of our partners. In the table 4 below, there is a list of experts involved in WP1 and their PM effort:

Name	Topic	Twinning	IAE-BUT local activities
Milos DANIEL	Mathematical description of dynamic moving soft body (parachutes) and UAS in air, aerodynamics of propellers	-	4 PM
Petr DVORAK	Aerodynamic shape optimization – surrogate models for global aerodynamic design		7 PM
Jiri HRADIL	Wing design and optimization, morphing model system (T1)	FOI 12,15 PM	12,35 PM
Ivo JEBÁČEK	Twinning preparation		0,5 PM
Jaroslav JURAČKA	Experimental Testing of Crack Propagation in Delaminated Composite Structure (T9)	MERL 1,0 PM	0,2 PM
Stavros KRAMPELAS	Air flow control	-	9,75 PM
Tomas KATRNÁK	Damage tolerance (T5) – crack propagation under surface layer	EADS 6,5 PM	0,5 PM
Ondrej LAJZA	Optimization of aerodynamic shapes with respect to in-flight contamination and its behavior (T4)	EADS 7,5 PM	3,5 PM
Michal MALIS	Stability behaviour of imperfection sensitive composite structures (T8)	DLR 4 PM	9 PM
Vladimír MATĚJÁK	Experimental Testing of Crack Propagation in Delaminated Composite Structure (T9)	MERL 6 PM	3 PM
Jan NAVRÁTIL	Aerodynamic design and optimization of elastic wings (T2)	FOI 11,5 PM	7,5 PM
Robert POPELA	Leadership of WP1	-	4,15 PM
Pavel SCHOR	Stability behaviour of imperfection sensitive composite structures (T8)	DLR 4,0 PM	4,0 PM
Volodymyr SYMONOV	Stability behaviour of composite structures (T8)	MERL 1,25 PM	0,25PM
Tomas URIK	New researcher - Know-how transfer: Damage tolerance (T5)	EADS 6,15 PM	14,45 PM

Pavel ZIKMUND	Optimization of aerodynamic shapes with respect to in-flight contamination and its behavior (T4)	EADS 6,0 PM	-
		66 PM	80,5 PM

Table 4 – List of experienced researchers involved in WP1

2.1.3 More information

More information about WP1 can be found in the following deliverables:

- D1.1 Secondments Plan which shows year-by-year the topics, objectives and duration of the secondments
- D1. 2 Mid-term report on know-how gained in aerodynamics and aircraft structures
- D1.3 Final report on know-how gained in aerodynamics and aircraft structures.

2.2 WP2 - Recruitment by IAE-BUT

The WP objective was to Increase IAE-BUT's Human Potential. The aim was to attract highly qualified researchers, who would be able to enhance the IAE-BUT's potential. The quantifiable aim was to hire 6 experienced researchers and 1 research manager. Overall, meeting the objectives of WP2 was very challenging due to the absence of available aeronautical research experts in Europe.

2.2.1 Indicators

- **Recruitment strategy for attracting experienced researchers & research manager 1 / 1**

The recruitment strategy was described in deliverable D2.1, which thoroughly describes the recruitment mechanism and approach to ensure sustainability of the recruitment at CEDESA project.

The report contains - the detailed description of the recruitment process including required skills, selection process, time schedule for the recruitment and the hiring and evaluation processes for selecting the researchers and the research manager.

- **Recruitment of experienced researchers** **6** / 6

The recruitment process started according to the mentioned recruitment strategy by ROUND 1 in 01-2011, when there were published 7 advertisements in specialized magazines and websites, in major public newspapers and the experts shortlisted for interview were contacted by letter. Even though there were 22 applications in this round, the campaign only resulted in 1 successful experienced researcher from Greece as an expert in topic A1.

ROUND 2 begun in 07-2011 and there were published 5 advertisements now only in specialized magazines and websites, 1 advertisement in HR website and the experts shortlisted for interview were contacted by letter. On this occasion, there were 6 applications with the result that 3 experienced researchers (experts in topics A1, B1 and B2) were hired from the Czech Republic and from Slovakia.

ROUND 3 started in 03-2012 and there were published 4 advertisements in specialized magazines and websites and the experts and universities shortlisted for interview were contacted

by the letter. On this occasion, there was only 1 application, which was successful, so the result was 1 experienced researcher (expert in topics A2) was hired from Slovakia.

The recruitment process progressed according to the recruitment strategy by ROUND 4 (the final round). The maximum priority was given to ensure the researchers have the necessary level of expertise rather than fulfilling the targets at any cost. It started in 08-2012 and the evaluation was in 09-2012. There were 2 applications (both international, Ukrainian and Greek) in this round and both candidates seem to fulfill requirements defined for the position. Finally, Volodymyr Symonov, from Ukraine, was chosen and he has been a member of CEDESA team since 1.11.2013.

The target and progress of the indicator is shown in table 5:

Research topic	Target	Done	Round	Name
Topic A1 - Aerodynamic Shape Optimization	2	2	1. 2.	Stavros KARAMPELAS Petr DVORAK
Topic A2 - Aircraft Parameters Identification	1	1	3.	Milos DANIEL
Topic B1 - Aircraft structure performance during extreme situations	2	1	2.	Michal MALIS
Topic B2 - Composite structure behaviour	3	2	2. 4.	Tomas URIK Volodymyr SYMONOV

Table 5 – The target and progress of the recruitment process of experienced researchers

- **Recruitment of experienced researcher manager** **1 / 1**

The recruitment process was run simultaneously with the process of hiring of experienced researchers. The only difference was in job description and professional requirements.

After 2 rounds without any applicants, in ROUND 3 there came an application from an experienced project manager (although from a different engineering branch). After a personal interview the applicant was accepted. The target and progress of the indicator is shown in the table 6:

Position	Target	Done	Round	Name
Research manger	1	1	3.	Lukas PALKO

Table 6 – The target and progress of the recruitment process of researcher manager

- **Midterm report describing recruitment activities** **1** / 1

The midterm report was submitted as deliverable D2.2 called Report on research activities and results of hired experienced researchers, where one can find all details about the whole recruitment process.

- **Final report describing recruitment activities** **1** / 1

The final report was submitted after the 42M of the project according to the plan as deliverable D2.3 called Report on research activities and results of hired experienced researchers, where one can find all details about the whole recruitment process.

2.2.2 Use of resources

The PM effort for WP2 was indicated earlier in Periodic report (First period). The lower values were done by the delayed employment of the new researchers described in the earlier section (Recruitment of experienced researchers).

	Project target	Done in Period I.	Done in Period II.	**Total**
Effort of existing research staff	10 PM	1 PM	1 PM	2 PM
Effort of new researchers	84 PM	19 PM	65,05 PM	84,5 PM
Effort of new research manager	0 PM	0 PM	0 PM	0 PM
TOTAL	94 PM	20 PM	66,05 PM	86 PM

Table 7 – WP2 Use of resources

2.3 WP3 - Development and Upgrade of Research Equipment

A major objective of the CEDESA project was the reinforcement of IAE-BUT's research potential. Part of the way to achieve that aim was through the upgrade of IAE-BUT's research facilities. In precise terms, that meant purchasing a high performance cluster computer to support complex computational fluid dynamics (CFD) calculations in the field of aerodynamic and for complex finite element modelling (FEM) calculations in structural design (Research Topics A1, A2, B1 and B2), purchasing new fatigue actuators, unique contactless optical measurement system (Research Topics B1 and B2) and high performance personal workstations for experienced researchers as CFD and FEM analysis preparation and evaluation (Research Topics A1, A2, B1 and B2).

As continuing of Period I. only the Up to date mechanical testing system was purchased in Period II (Research Topics B1 and B2). This additional planned equipment was also included in revision of Annex I / DoW for Grant Agreement No: 264084 from 19th March 2013.

2.3.1 Indicators

A significant portion of the budget was dedicated to purchasing and upgrading equipment. During the first 5 months of the project, a change in the requirements specification for the equipment was necessary. Part of the original budget allocated for personal computers (EUR 28,800) was used EUR 9,000 for the upgrade of the existing software CATIA with the new module "Aerospace Sheetmetal Design 3" (ASD3). Thanks to the upgrade to the new software it enabled significantly more effective preparation of CAD models for CFD and FEM analyses (in both major CEDESA topics, A and B) – using tools optimized for aerospace use.

Nevertheless, the remaining EUR 19,800 allocated for personal computers were used for its original purpose. Also, IAE-BUT used additional resources outside of the CEDESA project to

purchase personal computers for researchers. That helped to ensure that CEDESA researchers had access to both upgraded PC equipment and to state-of-the-art software tools.

Please note that these budget changes were approved by the CEDESA project EU officer Antonio Balestrieri (see details in deliverable D3.1), later by Lucas Janssen and finally according Annex I / DoW for Grant Agreement No: 264084 from 19th March 2013. The Amendment confirms also request for Up to date mechanical testing system. It was purchased close the end of project research activity (M42).

Equipment	Taxable date	Total cost	CEDESA budget
High performance computer cluster	29/02/2012	EUR 151,350	EUR 100,900
Testing equipment - fatigue actuators	29/03/2011	EUR 90,724	EUR 90,724
Personal workstations	17/10/2011	EUR 13,937	EUR 13,296
Optical 3D deformation measurement system	25/01/2011	EUR 129,050	EUR 129,050
SW CATIA- Aerospace Sheetmetal Design 3	08/12/2010	EUR 11,740	EUR 10,436
Up to date mechanical testing system	19/02/2014	EUR 144,446	EUR 144,446
TOTAL		EUR 542,487	EUR 490,092

Table 8 – Real purchased equipment

Next one can see images of the purchased equipment:

Figure 1 – Hydraulics actuator

Figure 2: Controllers

Figure 3: Optical 3D deformation measurement system: Aramis system setup (left), PONTOS system testes during VUT 061 aircraft fuselage test (right)

Figure 4: High performance cluster installed in Faculty of Mechanical Engineering (shared room for institutes IT equipment) cluster room, procured cluster consists of 32 computational nodes with 382 cores and more than 1800 GB RAM and headnode with distributed storage of 16 TB.

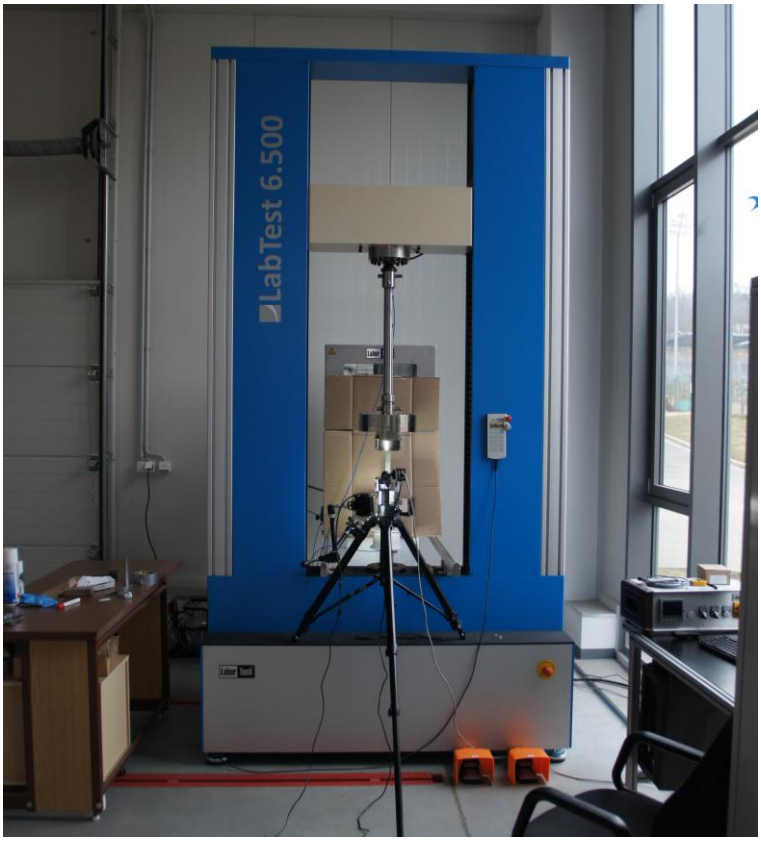

Figure 5: Universal mechanical testing system with thermal chamber installed at institute testing laboratory facility

The purchased equipment helps significantly increase the research capability of IAE-BUT and also supports cooperation with our twinning and research partners. For example, the material qualification tests for UK company Game composites can be mentioned.

2.3.2 Use of resources

WP3 required a major share of PM effort and table 9 shows that all personal resources were used according to the plan.

	Project target	Done in Period I.	Done in Period II	**Total**
Effort of existing research staff	4 PM	4 PM	0,3 PM	4,3 PM

Table 9 – WP3 Use of resources

Targets for WP3 were fulfilled. A detailed description you can find in deliverables:

- D3-1 Report documenting the equipment procured and installed
- D3.2. Report on use of new/upgraded equipment in annual PM report

2.4 WP4 - Workshop and Conference Organization

The WP objective was to increase IAE-BUT's scientific visibility. This WP was focused on raising scientific awareness of the IAE-BUT and its research and development possibilities. The targets were organization of international conference (2), bilateral seminars with twinning partners (6), conference and workshop participation (6), international partners supporting IAE-BUT with organizing workshops and conferences (3), reports (2).

2.4.1 Indicators

- **International conferences organized by IAE-BUT 2 / 2**

The organization of two international conferences at IAE-BUT was planned within the FP7 CEDESA project. The conferences should be open to researchers from EU countries as well as to industrial partners.

The first international conference (well-known conference READ 2012) was organized in October 2012. **The conference took place in Brno from 17th - 19th October 2012** and over 60 participants from not only European countries accepted the call (www.lu.fme.vutbr.cz/READ2012)**.**

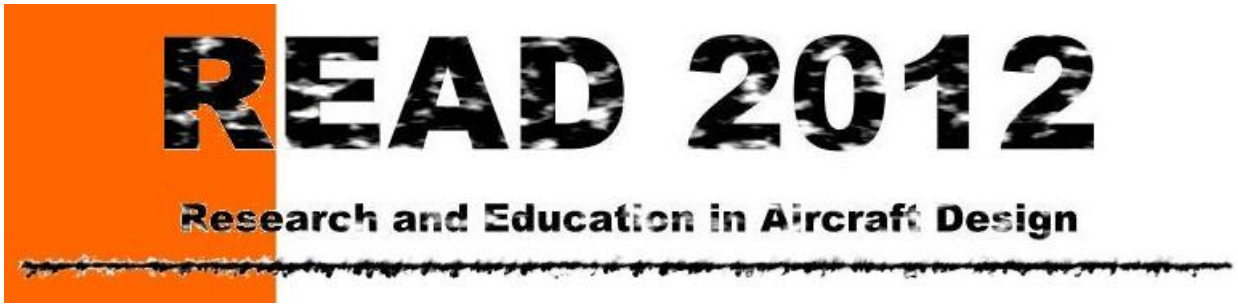

Figure 6 – Welcome screen of READ 2012 international conference

The conference topics were:

AIRCRAFT STRUCTURES AND PROPULSION	AIRCRAFT DESIGN	AERODYNAMICS AND FLIGHT DYNAMICS	AIRCRAFT AVIONICS AND ELECTROMECHANICS
AIRCRAFT MAITENANCE	AEROSPACE EDUCATION	AVIATION DEVELOPMENT	SAFETY AND SECURITY IN AVIATION

Table 10 – Participation of READ 2012

The second international conference (conference NTCA 2013) was organized in June 2013. **The conference took place at Zilina University Campus from 21st - 22nd June 2013** with 55 participants from 8 European countries (http://lu.fme.vutbr.cz/NTCA2013)**.**

Figure 7 – Welcome screen of NTCA 2013 international conference

The official language for both, presentations and papers, was English. The invitations were accepted by well-known researchers and scientist from institutions across the World:

Country	**READ 2012**	**NTCA 2013**
Austria		Diamond Aircrafts
Belgium	KHBO Aerospace	
Czech Republic	BUT IAE CTU in Prague, Faculty of Mechanical Engineering, Department of Aerospace Engineering Honeywell Aerospace - Advanced Technology	ABS Jets BUT IAE Czech Airlanes training Centre Česká letecká servisní Czech Technical University in Prague F-Air Let´s fly
Estonia	Estonian Aviation Academy	
Germany	DLR - Deutsches Zentrum für Luft- und Raumfahrt EADS - European Aeronautic Defence and Space Company	Lufthansa
Hungary	National University of Public Service	Budapest University of Technology and Economics University of Civil Service, Budapest
Italy	Politecnico di Torino University of Naples Federico, Department of Aerospace Engineering	Tecnam
Japan	Nagoya University	
Lithuania	Vilnius Gediminas Technical University VGTU Aviation Institute	
Nigeria	Nigerian College of Aviation Technology, Zaria, Kaduna State	
Poland	Military University of Technology Warsaw University of Technology	
Slovakia	University of Zilina	AIR – 3M University of Zilina
Sweden	FOI - Swedish Defence Research Agency	
Switzerland		Federal Office for Civil Aviation

Ukraine	Ukrainian Research Institute of Manufacturing Engineering National Technical University of Ukraine	National Aerospace University Kharkov
United Kingdom	Intelligentsia Consultants Limited MERL - Materials Engineering Research Laboratory Ltd University of Glasgow	
Russian Federation	Central Aerohydrodynamic Institute National Research University Moscow Institute of Physics and Technology, Department of Aeronatics and Flight Engineering TsAGI	

Table 11 – Participation of READ 2012 and NTCA 2013

Detailed description can be found in deliverable D4.3. International conference organization report and deliverable D4.4 Second international conference organization report.

- **Bilateral seminars with twinning partners** **12** / 6

The organization of six bilateral seminars was foreseen with the DoW of the CEDESA project. The seminars were organized by IAE-BUT to coincide with the know-how exchanges with FOI, DLR, EADS and MERL. Those seminars supported information exchange on research interests, knowledge, outputs from research, cooperation possibilities. They also helped to improve the visibility of IAE-BUT.

During project twelve bilateral seminars were organized:

- 18-10-2010 – 19-10-2010 Together with the Kick-off meeting, individual discussions with twinning partners were also organized with the aim to exchange information on research interests and to plan joint research activities. The topics for common research activities were defined, as well as the secondments for researchers.
- 13-04-2011 A bilateral seminar EADS - IAE-BUT was organized. In the frame of the meeting, actual research topics were presented and discussed. Also planned research topics for twinning were discussed.
- 22-09-2011 A bilateral seminar FOI - IAE-BUT was organized. The themes were: Received know-how at FOI, outputs, cooperation possibilities BUT-IAE (7FP, National…), cooperation possibilities FOI.
- 25-04-2012 – 26-04-2012 A bilateral seminar IAE-BUT – MERL was held. The meeting provided an opportunity to review the project progress and the secondment activities at MERL. Plans for the presentations at READ conference in October 2012 and the steering committee meeting were discussed as well as a proposed third secondment by IAE-BUT staff to MERL.
- 08-07-2012 - A bilateral seminar DLR – IAE BUT was held. The theme was details of actual and future cooperation.

- 16/10/2012 a bilateral seminar EADS - IAE-BUT was organized. The meeting was held during the READ2012 conference in Brno. In the frame of the meeting, actual research topics were presented and discussed. Also planned research topics for twinning were discussed.
- 17/10/2012 a bilateral seminar DLR - IAE-BUT was organized. The meeting was held during the READ2012 conference in Brno. In the frame of the meeting, actual research topics were presented and discussed. Also planned research topics for twinning were discussed.
- 28-30/11/2012 a bilateral seminar FOI - IAE-BUT was organized. In the frame of the meeting, actual research topics were presented and discussed. Also planned research topics for twinning were discussed.
- 21-28/02/2013 a bilateral seminar FOI - IAE-BUT was organized. In the frame of the meeting, actual research topics were presented and discussed. Also planned research topics for twinning were discussed.
- 09/10/2013 a bilateral seminar EADS - IAE-BUT was organized. The meeting was held during the 3Y steering committee meeting in Munich. In the frame of the meeting, actual research topics were presented and discussed. Also planned research topics for twinning were discussed.
- 09/10/2013 a bilateral seminar FOI - IAE-BUT was organized. The meeting was held during the 3Y steering committee meeting in Munich. In the frame of the meeting, actual research topics were presented and discussed. Also planned research topics for twinning were discussed.
- 09/10/2013 a bilateral seminar INTELIGENTSIA - IAE-BUT was organized. The meeting was held during the 3Y steering committee meeting in Munich. In the frame of the meeting evaluation methodology was presented and discussed

- **Conferences & workshops attended by IAE-BUT** **12** / 6

In accordance with the DoW, IAE-BUT researchers were expected to attend seven international conferences and two workshops. The researchers had to present their research results and the latest developments at IAE-BUT:

- 27th Congress of the International Council of the Aeronautical Sciences, 20.9.2010, Nice France (approx. 720 participants)
  - PÍŠTĚK, A.; HLINKA, J. VUT 001 MARABU: UNIVERSAL EXPERIMENTAL AIRCRAFT. In Proceedings of 27th Congress of the International Council of the Aeronautical Sciences. Edinburgh, UK, Optimage Ltd., Edinburgh, UK. 2010. p. 1 - 9. ISBN 978-0-9565333-0-2.
  - JURAČKA, J. ACOUSTIC EMISSION OF COMPOSITE WING SEGMENT DURING FATIGUE TESTS. In 27th Congress of International Council of Aeronautical Sciences. ICAS2010. Edinburgh, UK, Optimage Ltd. 2010. p. 1 - 10. ISBN 978-0-9565333-0-2.
  - HLINKA, J.; WEISMAN, A.; FINDA, J. Options for Interconnection of Safety Assessment Methods and Reliability Centered Maintenance in General Aviation. In Proceedings

of 27th Congress of the International Council of the Aeronautical Sciences. Edinburgh, UK, Optimage Ltd. 2010. p. 1 - 11. ISBN 978-0-9565333-0-2.

- JEBÁČEK, I. MEASUREMENT OF THE STRAIN AND BENDING MOMENT ON THE WING OF AN AIRCRAFT AND USING OF THESE FINDINGS FOR FATIGUE TEST. In 27th Congress of International Council of Aeronautical Sciences. ICAS2010. Edinburgh, UK, Optimage Ltd. 2010. p. 1 - 7. ISBN 978-0-9565333-0-2.

- Workshop „Computer fluid dynamics modeling for aerospace and industrial applications 2010“, 23.9.2010, VZLU (organized by VZLU, Prague, approx. 40 participants)
  - NAVRÁTIL, J. Praktické zkušenosti s tvorbou CAD modelu pro CFD výpočty vysokovýkonného větroně (Practical experience with CAD model preparation for CFD analysis of high-performance glider). In Transfer. Praha, VZLÚ a.s. 2010. p. 61 - 66. ISSN 1801-9315.
- “Advanced technologies, materials and devices for space application”, 6.-7.10.2010, Prague (organized by VZLU, Prague , approx. 50 participants)
  - HLINKA, J.; ŠPLÍCHAL, M. Brno University of Technology: Space Activities of Research Establishments and Academia in Czech Republic. Transfer. 2010. 2010(13). p. 39 - 46. ISSN 1801-9315.
- Workshop „Computer fluid dynamics modeling for aerospace and industrial applications 2011“, 20.9.2011 (organized by VZLU, Prague, approx. 30 participants)
  - VANĚK, F.; DOUPNÍK, P. Aerodynamické zatížení konfigurace křídlo-trup s využitím výsledků CFD simulace. *Transfer.* 2011. 2011(15). p. 38 - 40. ISSN 1801-9315.
- ICAS 2012, 23 - 28 September, *2012*, *Brisbane*, Australia
  - PISTEK, A.; Analytical method for limit load capacity calculation of thin walled aircraft structure. In ICAS 2012 CD-ROM PROCEEDINGS. Brisbane, International Council of the Aeronautical Sciences (ICAS). 2012. p. 1 - 7. ISBN 978-0-9565333-1-9.
  - MATĚJÁK, V.; JURAČKA, J. The determination of delamination energy release rate of composite bi-material interface. In ICAS 2012 CD-ROM PROCEEDINGS. Brisbane, International Council of the Aeronautical Sciences (ICAS). 2012. p. 1 - 7. ISBN 978-0-9565333-1-9.
- READ 2012 – 17-19/10/2012, 1st international conference organized by IAE-BUT with support of the CEDESA project
  - LAJZA, O. Delivery tube – CFD analysis. RESEARCH BULLETIN. 2012. 2012(1). p. 91 - 94. ISSN 1425-2104.
  - SKAROLEK, V.; KARAMPELAS, S. Energy Efficient Active Control of the Flow Past Aircraft Wings. RESEARCH BULLETIN. 2012. 2012(22). p. 1 - 22. ISSN 1425-2104.
  - HRADIL, J. ADAPTIVE FREE-FORM DEFORMATION PARAMETERIZATION FOR GEOMETRY AND MESH MORPHING IN AERONAUTICAL APPLICATIONS. RESEARCH BULLETIN. 2012. 2012(22). p. 1 - 7. ISSN 1425-2104.

- CEJPEK, J.; MALIŠ, M.; URÍK, T. APPLICATION OF FILAMENT WINDING TECHNOLOGY FOR CS22 CATEGORY WING CONSTRUCTION. RESEARCH BULLETIN. 2012. 2012(22). p. 1 - 13. ISSN 1425-2104.
- HLINKA, J.; TREFILOVÁ, H. Identification of Major Safety Issues for Futuristic Personal Plane Concept. RESEARCH BULLETIN. 2012. 2012(22). p. 1 - 11. ISSN\~1425-2104.
- MATĚJÁK, V.; GIANNIS, M.; MIRZA, S. Hail Impact on Composite Plates – Experiments and Numerical Modelling. RESEARCH BULLETIN. 2012. 2012(22). p. 1 - 10. ISSN\~1425-2104.
- SCHOŘ, P.; MALIŠ, M.; ŠPLÍCHAL, J. Composite landing gear design process. RESEARCH BULLETIN. 2012. 2012(22). p. 1 - 10. ISSN\~1425-2104.
- KATRŇÁK, T.; PLHAL, M. SHAPE MODIFICATIONS OF CRITICAL FUSELAGE PARTS ACCORDING TO FATIGUE DURABILITY. RESEARCH BULLETIN. 2012. 2012(22). p. 1 - 8. ISSN\~1425-2104.

- 43rd FLUID DYNAMICS CONFERENCE, 24.-27.05.2013, San Diego USA
  - KARAMPELAS, S., High Reynolds number flow past a flapping multi-element airfoil 43rd Fluid Dynamics Conference, San Diego, CA,2013
- POLYMER COMPOSITES 2013, 28.-29.05.2013, Pilsen Czech Republic
  - WEIS, M. The failure monitoring in laminate structures during loading. In POLYMER COMPOSITES 2013. Plzeň, Copydigital s.r.o. 2013. p. 1 - 7. ISBN 978-80-261-0213-7.
- NTCA 2013, 21.-22.06.2013, Zilna Slovakia
  - SYMONOV, V.; KATRŇÁK, T. FEM Approach to Estimate Large Deformations of Stiffened Fuselage Structure. In New Trends in Civil Aviation 2013. 1. Brno, Akademické nakladatelství CERM Brno. 2013. p. 90 - 92. ISBN 978-80-7204-843-4.
  - DANIEL, M.; MIHALIDES, D. PROPELLER DESIGN FOR ELECTRIC POWERED LIGHT AIRCRAFTS, In New Trends in Civil Aviation 2013. 2013. Brno: Akademické nakladetelství CERM, 2013. p. 9-11. ISBN: 978-80-7204-843- 4.
  - MALIŠ, M.; URÍK, T. COMPARISON OF THREE TYPES OF IMPERFECTIONS APPLIED DURING BUCKLING ANALYSIS OF CYLINDRICAL SHELL UNDER COMPRESSIVE LOAD. In New Trends in Civil Aviation 2013. 2013. Brno, Akademické nakladetelství CERM. 2013. p. 63 - 67. ISBN 978-80-7204-843-4.
  - HRADIL, J.; NAVRÁTIL, J. Free-Form Deformation parameterization for aerodynamic shape optimization. In New Trends in Civil Aviation 2013. 1. Olomoučany, AKADEMICKÉ NAKLADATELSTVÍ CERM, s. r. o. Brno. 2013. p. 22 - 27. ISBN 978-80-7204-843-4.
  - DVOŘÁK, P.; PEJCHAR, J.; ZIKMUND, P. Overview of Unmanned Aerial Systems Developed at the Institute of Aerospace Engineering. In New Trends in Civil Aviation 2013 conference proceedings. Brno, CERM. 2013. p. 16 - 21. ISBN 978-80-7204-843-4.
- 21st SVS FEM ANSYS Users Groupe Meeting and Conference 2013, Luhačovice, Czech Republic

- DVOŘÁK, P.; TIJSTERMAN, R. Parametric Study of a Cavitation Valve for Control of Oxidizer Flow in a Hybrid Rocket Engine. In 21st SVS FEM Ansys Users' Group Meeting and Conference Proceedings 2013. SVS FEM, 2013. pp. 1-15. ISBN: 978-80-905525-0- 0.

- 5th European Conference for Aerodynamics and Space Science, Munich, Germany
  - DVOŘÁK, P.; TIJSTERMAN, R. Numerical and experimental evaluation of the performance of a cavitating valve for the control of oxidizer flow in a hybrid rocket engine. In 5th European Conference for Aeronautics and Space Sciences EUCASS 2013 proceedings. Munich, Germany: EUCASS, 2013. pp. 1-9. ISBN: 978-84-941531-0- 5.
- 52nd Aerospace Sciences Meeting. AIAA, USA 11.-20.1.2014
  - AMOIGNON, O.; HRADIL, J.; NAVRÁTIL, J. A numerical study of adaptive FFD in aerodynamic shape optimization. In 52nd Aerospace Sciences Meeting. AIAA. 2014. p. 1 - 11. ISBN 978-1-62410-256-1.
  - AMOIGNON, O.; NAVRÁTIL, J.; HRADIL, J. Study of parameterizations in project CEDESA. In 52nd Aerospace Sciences Meeting. AIAA. 2014. p. 1 - 19. ISBN 978-1-62410-256-1.

Detailed description about the conferences, workshops and presented papers can be found in deliverable D4.1.and D4.2.

- **International partners supporting IAE-BUT with organizing workshops & conferences 3** / 3

The first international conference READ 2012, arranged by IAE-BUT was supported by international partner DLR. Dr Degendhart provided a workshop (for more information see chapter "Bilateral seminars with twinning partners".

The second international conference NTCA 2013 was arranged by IAE-BUT and Zilina University in Zilina, Slovak Republic. This join conference was supported by INTELLIGENTSIA Consultants, which took care about marketing of the event and preparation of conference materials for attendants.

- **Summary reports for workshops & conferences 2** / 2

There was a plan for two reports. The first one was published as a deliverable D4.2 Report on participation in workshops and conferences (M42), second D4.4. Second International conference organization report (M35).

2.4.2 Use of resources

The value of used resource compared to the target are shown below.

	Project target	Done in Period I.	Done in Period II.	**Total**
Effort of existing research staff	9 PM	5 PM	13,6 PM	18,5 PM
Effort of new researchers	16 PM	0 PM	3,4 PM	3,4 PM
Effort of new research manager	7 PM	0 PM	8,4 PM	8,4 PM

TOTAL	32 PM	5 PM	25,4 PM	30,4 PM

Table 12 – WP4 Use of resources

2.5 WP5 - Dissemination and Promotional Activities

The objective was to continue in increasing IAE-BUT's technology transfer for socio-economic needs. Continuous activities were linked with workshops organization and publishing news. The plan was to organize 3 workshops and to publish 1 news.

2.5.1 Indicators

- **CEDESA project website** **1 / 1**

The target CEDESA project website was a creation of a professional-looking CEDESA project website with regular updates of project news and events and publications throughout the project duration.

The website was created and published according to the plan at the domain www.cedesa.eu.

Figure 8 – Welcome screen of CEDESA website

- **Published news concerning project events and results** **6** /9

The plan was to publish 3-4 news about the project. News concerning the project were published regularly as a project Newsletter, which were sent via e-mails to project partners and for those who were signed in the project website for this. Then it was placed in the project website here: www.cedesa.eu/?q=node/12.

Figure 9 – CEDESA newsletter

The special occasion was to attend the EC workshop for institutions founded by Structural funds and REGPOT. The project manager took part there on 2013-06-23 in Brussels.

- **Dissemination workshops with regional aircraft industry** **4** / 3

A planned part of the CEDESA project in mentioned period was also the organization of regular workshops (1-2 per year) for two-way knowledge transfer about aerodynamics and aircraft structures research activities with regional industry, SMEs and other research institutions from the aerospace and non-aerospace sectors (e.g. automotive, marine and rail transport). The regional industry should receive news on the latest technological developments thus helping to give them to gain a competitive advantage). Also, feedback from industry should help to influence IAE-BUT's research.

Workshops organization:

- 1st CEDESA Workshop with Regional Industry took place at IAE-BUT 12-05-2011. The following regional industry companies participated on the meeting: HPH, s.r.o., Jihlavan Airplanes, Schempp-Hirth výroba letadel s.r.o., Phoenix Air
- 2nd CEDESA Workshop with Regional Industry was held at IAE-BUT on 12-04-2012. The topic of the workshop was "Aerodynamic optimization". The workshop was organized in joint cooperation with FOI (Mr. Amoignon). Representatives from industry were: Aero Vodochody, Aircraft Industries, Evektor and L.K. Engineering.
- 3rd CEDESA Workshop with Regional Industry was held at IAE-BUT on 26-04-2012. The topic of the workshop was "Modelling of delamination in composite materials". The workshop was organized in joint cooperation with MERL (Mr. Mirsa). Representatives from industry were: Honeywell, Evektor and Aero Vodochody.

- Final workshop „ IAE-BUT CEDESA workshop for industrial partners “, 21.2.2014, BUT IAE (approx. 21 participants). The following topics were presented:
  - Hradil, J., Navratil J. , Novel CFD based tools and their use in industry applied aerodynamic shape optimization
  - Lajza O., Aircraft engine cooling system testing
  - Popela R., Active flow control in aerospace and automotive applications
  - Dvorak P. Surrogate – based Optimization in aerodynamic design
  - Malis M., Design of composite structure of small aircraft using FEM analysis
  - Urík T., Bionic synthesis of aircraft structure
  - Schor P., FE modelling of imperfections in real composite structures
  - Juracka J., Symonov V., VCCT applied on composite bonded joints
  - Splichal J., The results of stiffened panels tests and comparison with computations
  - Katrnak T., More precise prediction of fatigue properties
  - Augustin P., Damage Tolerance analysis of metal wing

- **Workshops to organize FP7, H2020 R&D proposal submissions 3 / 3**

In order to increase IAE-BUT’s participation in the European Research Area (ERA) and EU R&D programmes - as well as increase IAE-BUT’s technology transfer for socio-economic needs – it was targeted to organize at least one workshop per year to focus on the preparation of FP7 R&D proposals.

Workshops organization:

- 1st FP7 Workshop took place at IAE-BUT on May, 12th 2011. The main objective of the workshop was to introduce the FP7 Research for SMEs and **EUREKA Eurostars** programs to a small group of Czech aerospace SMEs and discuss possible R&D proposal ideas of interest to them for the up-and-coming calls.
- 2nd FP7 Workshop was held at IAE-BUT from 2nd of July 2012 to 5th of July 2012. The main objective of the workshop was proposal discussion of National Aerospace University "KhAI" with its R&D manager Igor Rybalchenko. The project name is **CASCO** and it is still subject of negotiations.
- Final workshop „ IAE-BUT CEDESA workshop for partners “, 21.2.2014, BUT IAE (approx. 21 participants). The possibility of project financial support by **Horizon 2020** was presented.

For higher chances to participate on other EU FP7 projects there were made business travels to other meetings for proposals negotiation:

- 21-02-2012 – 23-1-2012, Robert Popela - **Jet Stream Airsail** - IAE-BUT helped to prepare and submit a FP7 proposal called “Jet Stream Airsail”. The proposal was submitted to the FP7 Transport Work Programme Topic: Breakthrough and emerging technologies, Activity AAT.2012.6.3-1, Call Identifier FP7-AAT-2012-RTD-L0. The proposal consortium consists of ONERA (French aerospace research institute), Delft University, SUPAERO Toulouse (French aerospace oriented university), IAE-BUT and Bauhaus Luftfahrt (German research organization focused on aerospace future designs).

- June 5th - 7th,2012, Luxemburg, Buxeles, Jaroslav Juracka - Hybrid Electric Powered Light Aircraft (**HEPLA**) – The proposal consortium involves IAE-BUT, University of Luxembourg, Skyleader a.s. (Czech), Electroengine SA (Luxembourg), Cleancarb Sàrl (Luxembourg), DM-Prop (Slovak), and Josef Božek Research Centre of Engine and Automotive Engineering (Czech). The project's original aim was to develop a hybrid electric powered version of the Skyleader SL600 light aircraft and demonstrate a 25% reduction in fuel consumption (currently approximately 16.2 l/h in cruise and 24l/h during take-off for typical engine – Rotax 912) and 50% reduction in exhaust emissions (compared to current fossil fuel version).
- Hybrid Electric Powered Light Aircraft (**HEPLA**) –Workshops took place in Abigdon, UK (Juracka) on September 3rd - 4th , 2012. Submied project did not be supported by EC.
- 24-05-2012 – 26-05-2012, Robert Popela - Non-Linear aerodynamic optimization in Industrial Aircraft Design (**ILIADE**), coordinated by FOI – the IAE-BUT team is involved in the project preparation, but all other information are not yet publishable.
- CLEAN SKY 2 Workshops - The main objective of the workshops was to introduce the JTI arrangement and the possibility collect partners for possible proposal. CLEAN SKY 2 Workshops took place in Warsaw (Palko) on April, 10th -11th , 2013, in Prague (Juracka) on January, 14th , 2014 and in Wien (Hlinka) on January 24th, 2014. As output of first meeting the proposal for "VibTor" project was submitted at SP1-JTI-CS-2013-02 on October 2013.
- **Advanced Aerostructure Research Centre** is proposal and workshops arranged for preparation of centre at the frame national Competence Centres Programme. The significant companies and research entities are covered in now negotiated project. Workshops and meetings were arranged in Prague in 14.11.2012, 21.3.2013, 28.3.2013. During summer 2014 the negotiation with Technology Agency started.
- Garteur AG52 face to face meeting (Dvorak) took place in INTA, Madrid on February 18th-21st 2014 focused on evaluation and comparison of surrogate-based global optimization methods in preliminary aerodynamic design. The main objectives of the meeting were review pending actions & update the project schedule.
- Dvorak – Köln on Rhein – AUVSI Unmanned Systems Europe conference was held in Collogne, Germany on 15-16/10/2013. The main aim of the conference and workshop was to discuss future prospects of unmanned systems in European context within the upcoming regulative workflow.
- Preparation of other national research projects ALFA program aims to support applied research and experimental development especially at the frame call by Technology Agency – 5 projects were submitted. Workshop was arranged in Prague in 21.11.2013
- Dvorak: Bilateral meeting with representatives of VTULaPVO took place in Prague on 16.4.2013. Negotiation regarding a proposed UAV consortium and funding possibilities was the main goal of the meeting.

Detailed descriptions can be found in deliverables:

- D5.4. Reports from Workshops to organise proposal submissions to relevant calls from the FP7 Transport and Research for SMEs Work Programmes

- D5.5. Reports from Workshops to organise proposal submissions to relevant calls from the FP7 Transport and Research for SMEs Work Programmes

- **Market research report identifying commercial potential for aerospace engineering R&D services 1 / 1**

The overall aim of the FP7 CEDESA project was to upgrade the existing research capacity in aerodynamics and aircraft structures at the Institute of Aerospace Engineering, Brno University of Technology (IAE-BUT), to the highest European level and create a Centre of Excellence for the Design of Efficient and Safe Aircraft. Within this context, and in order to ensure the sustainability of the Centre of Excellence, the purpose of this market research report was to help IAE-BUT to identify and exploit R&D opportunities in aerodynamics, aircraft structure and composite behaviour during the next 5 years. Consequently, the report was structured in the following sections:

1. Aerospace and Related Sectors – which provides a synthesis of the aerospace, road transport, wind and tidal energy sectors with respect to the factors driving industrial R&D
2. IAE-BUT's R&D Capabilities – which summarizes IAE-BUT's aerospace research activities and laboratory facilities
3. Potential Research Funding Sources – which highlights funding programmes in the Czech Republic and in Europe that can support aerospace related R&D
4. Potential Research Partners – which identifies and recommends European organizations that successfully participate in aerospace related R&D projects
5. Strategic Next Steps – which outlines practical steps over the next five years for IAE-BUT to exploit the available R&D funding opportunities

The report has 42 pages and it is published as deliverable D5.3. The deliverable was delayed for 7 days due to abnormal administrative load from the end of April 2012.

2.5.2 Use of resources

The presentation and know-how transfer based on the results of research cooperation gained during the past two years of the project.

Secondly, new project proposals for the Horizon 2020 program (covering ClenSky initiative) were developed. Potential proposal about possible cooperation were discussed.

	Project target	Done in Period I.	Done in Period II.	**Total**
Effort of existing research staff	5 PM	2 PM	4,5 PM	6,5 PM
Effort of new researchers	0 PM	0 PM	2,0 PM	2,0 PM
Effort of new research manager	8 PM	0 PM	3,4 PM	3,4 PM
TOTAL	13 PM	2 PM	9,9 PM	11,9 PM

Table 13 – WP5 Use of resources

2.6 WP6 - Evaluation Facility

The main objectives of WP6 Evaluation was definition of progress done during CEDESA project (comparison with other research and education entities) and future progress.

2.6.1 Indicators

- **International experts on CEDESA Evaluation Board** **3** / 3

For the quality evaluation, the attendance of 3 international experts on a project Evaluation Board before 05-2012 was planned. IAE-BUT proposed to the EC a number of international experts who could do the evaluation but the EC defined independently following international experts:

- Prof. Johan Wideberg, University of Seville - President of the Evaluation team
- Prof. Piotr Doerffer, Polish Academy of Sciences, Gdansk
- Prof. Argiris Laskarakis, Aristotle University of Thessaloniki

- **Annual Monitoring Reports** **3** / 3

For monitoring of CEDESA team activities the Annual reports were defined as deliverables:

- D7-4 Steering Committee's Annual Conclusions – Y1
- D7-5 Steering Committee's Annual Conclusions - Y2
- D7-6 Steering Committee's Annual Conclusions - Y3

- **CEDESA Evaluation Report** **1** /1

As a result of evaluation activities the report was required. After discussion in 3Y Steering Committee meeting (with participation of Evaluation Board) the two parts of report were defined. Firstly the CEDESA team fill the evaluation criteria (defined by Intelligentsia Consultants according international practice) and then Evaluation Board created main report after two visits February and May 2014). Details are in deliverable D6.1 Evaluation report, where the second part, contain self-evaluation of IAE-BUT and description of processes, was finished in January 2014. Then IAE-BUT was visited by evaluators (February 2014), and discussions with management and employees were arranged. Base on June visit of Head of evaluators the final Evaluation report was created.

- **CEDESA Road Map** **1** /1

As result of evaluation activities and as last deliverable the CEDESA Road Map report was required. Short and long time (to 2018) visions and tools were defined by management of IAE-BUT.

2.6.2 Use of resources

The evaluation activities spent following effort:

	Project target	Done in Period I.	Done in Period II.	**Total**

Effort of existing research staff	0 PM	0 PM	0,3 PM	0,3 PM
Effort of new researchers	0 PM	0 PM	0 PM	0 PM
Effort of new research manager	0 PM	0 PM	3,8 PM	3,8 PM
TOTAL	0 PM	0 PM	4,1 PM	4,1 PM

Table 14 – WP6 Use of resources

3 Project management during the period

This chapter provides a management summary of the consortium activities during the second period.

3.1 Consortium management tasks and achievements

The project proceeding was to meet the main objectives and tasks according to the plan. The main management task was to fulfil all planned targets despite the challenges. This task was achieved without important deviations.

During second period as main significant change the **prolongations** for 6 month was approved (amendment 01). Together with prolongation also redistribution of person-month and purchase of testing machine was approved.

3.2 Changes in the consortium

During the project no change was solved.

3.3 List of project meetings, dates and venues

Date	Event
18-10-2010 19-10-2010	IAE-BUT Brno, Czech Republic - Kick Off Meeting
13-04-2011	EADS, Munich, Germany – Meeting about project planning
22-08-2011	FOI, Stockholm, Sweden - 1st Steering Committee meeting
16-10-2012	IAE-BUT Brno, Czech Republic – 2nd Steering Committee meeting
10-10-2013	EADS, Munich, Germany – 3rd Steering Committee meeting EADS, Munich, Germany – Evaluation Board meeting
20-2-2014	IAE-BUT Brno, Czech Republic – Evaluation Board meeting
24-6-2014	IAE-BUT Brno, Czech Republic – Evaluation Board meeting

Table 15 – List of project management meetings

3.4 Project planning and status

3.4.1 PM effort consumed

Work Package	Type of activity	Project target	Done in Period I.	Done in Period II.	**Total**
WP1 Know-How and Experience Exchange	SUPP	147 PM	65,7 PM	80,5 PM	146,2 PM
WP2 Recruitment by IAE-BUT	SUPP	94 PM	20,3 PM	66,1 PM	86,6 PM
WP3 Development and Upgrade of Research Equipment	SUPP	4 PM	4,0 PM	0,3 PM	4,3 PM
WP4 Workshop and Conference Organization	SUPP	32 PM	5,9 PM	25,4 PM	31,3 PM
WP5 Dissemination and Promotional Activities	SUPP	13 PM	1,6 PM	9,9 PM	11,5 PM
WP6 Evaluation Facility	SUPP	3 PM	0 PM	4,1 PM	4,1 PM
WP7 Project Management	MGT	26 PM	13 PM	9,9 PM	22,9 PM
TOTAL		319 PM	110,5 PM	196,1 PM	306,6 PM

Table 16 – Project use of resources

3.4.2 Deliverables progress

Nr.	Deliverable name	WP	Date	Status
D1.1	Secondments plan	WP1	M3	Submitted
D1.2	Mid-term report on know-how gained in aerodynamics and aircraft structures	WP1	M18	Submitted
D1.3	Final report on know-how gained in aerodynamics and aircraft structures	WP1	M36	Submitted
D2.1	Report on recruitment mechanism and approach to ensure sustainability of the recruitment	WP2	M2	Submitted
D2.2	Report on research activities and results of hired experienced researchers	WP2	M18	Submitted
D2.3	Report on research activities and results of hired experienced researchers	WP2	M36	Submitted
D3.1	Report documenting the equipment procured and installed	WP3	M12	Submitted
D3.2	Report on use of new/upgraded equipment in annual PM report	WP3	M36	Submitted
D4.1	Report on participation in workshops and conferences – including agendas, IAE-BUT's presentations, conclusions and participant lists - in mid-term project management report	WP4	M18	Submitted
D4.2	Report on participation in workshops and conferences – including agendas, IAE-BUT's presentations, conclusions and participant lists - in final project management report	WP4	M36	Submitted
D4.3	International conference organization report	WP4	M15	Submitted
D4.4	Second international conference organization repot	WP4	M33	Submitted
D5.1	Plan for Workshops organization	WP5	M3	Submitted
D5.2	Report on structure and features of CEDESA project website	WP5	M4	Submitted
D5.3	Market research report identifying commercial potential for aerodynamics and aircraft structures R&D services and technology in the aerospace and on-aerospace sectors over the next 5 years	WP5	M20	Submitted
D5.4	Reports from Workshops to organise proposal submissions to relevant calls from the FP7 Transport and Research for SMEs Work Programmes	WP5	M14	Submitted
D5.5	Reports from Workshops to organise proposal submissions to relevant calls from the FP7 Transport and Research for SMEs Work Programmes	WP5	M36	Submitted

D5.6	Final Plan for Use and Dissemination of Foreground	WP5	M36	Submitted
D6.1	CEDESA Evaluation Report	WP6	M40	Submitted
D6.2	CEDESA Road Map Report	WP6	M42	Submitted
D7.1	Report on Project Kick Off Meeting	WP7	M1	Submitted
D7.2	Project Presentation Slides	WP7	M2	Submitted
D7.3	Project Quality Plan	WP7	M3	Submitted
D7.4	Steering Committee's Annual Conclusions – Y1	WP7	M12	Submitted
D7.5	Steering Committee's Annual Conclusions – Y2	WP7	M24	Submitted
D7.6	Steering Committee's Annual Conclusions – Y3	WP7	M36	Submitted
D7.7	Report on Awareness and Wider Societal Implications	WP7	M30	Submitted

Table 17 – Deliverables list

3.4.3 Milestones progress

Nr.	Milestone name	WP	Date	Status
MS1	Secondments plan	WP1	M3	Done
MS2	Final list of new equipment for procurement, final estimation of total costs, final specifications, and public call to tender on the website	WP3	M3	Done
MS3	CEDESA Website	WP5	M5	Done
MS4	International Conferences at IAE-BUT	WP4	M11	Done
MS5	Installation of equipment	WP3	M12	Done
MS6	Recruitment of experienced researchers and research managers	WP2	M18	Done
MS7	Market Research Survey	WP5	M20	Done
MS8	Recruitment of experienced researchers and research managers	WP2	M42	Done
MS9	Mid-term meeting of the project partners involving EC Project Officer and Reviewers	WP7	M24	Done
MS10	International Conferences at IAE-BUT	WP4	M34	Done
MS11	CEDESA Evaluation Report	WP6	M46	Done
MS12	CEDESA Road Map Report	WP6	M48	Done
MS13	Final meeting of the project partners involving EC Project Officer and Reviewers	WP7	M48	Done

Table 18 – List and schedule of milestones

3.5 Impact of possible deviations from the planned milestones and deliverables

During the project implementation, there were **no important deviations** from the plan.

3.6 Changes to the legal status of any of the beneficiaries

During the project solving, there were **no changes** of legal status to the beneficiary.

3.7 Financial review

The financial review of second period is shown below:

Work-package	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Suma
Personal cost	258 654,23	229 275,43	9 655,03	48 870,93	21 953,89	29 851,77	38 118,38	636 379,67
Travel cost	156 808,76	0,00	0,00	10 666,80	9 149,75	3 725,00	15 901,86	196 252,17
Durable equipment	0,00	0,00	483 755,88	0,00	0,00	0,00	0,00	483 755,88
Subcontracting	0,00	0,00	0,00	12 612,61	18 389,04	0,00	2 693,06	33 694,70
Consumables	114,17	1 022,57	0,00	1 901,14	181,08	0,00	94,00	3 312,97
Indirect 20%	253 117,29						56 807,31	263 940,14
Indirect 7%	88 591,05						15 995,87	92 379,05
EU contribution	1 385 179,14						10 822,85	1 445 774,44
Total cost	1 617 335,53							

Table 19 – Financial review of project in Euro

4 Conclusion

The original twinning activity was fulfilled, but increased MM for twinning defined during prolongation of project was not fully consumed, mainly with DLR and METL partners.

The partial delays at the beginning of the project, caused by the difficulties to hire new experienced researchers, were solved. Finally 6 researchers and 1 project manager were hired.

The lower capacity had also an impact on workshops and dissemination activities. In spite of this challenge, we can declare, that the situation did not have an important influence on the overall impact on IAE-BUT.

The CEDESA project was creating an invaluable impact on IAE BUT. The know-how exchanges, developed partnerships and university visibility are proving the key to the further integration into the international community. Received partnership is continuing in joint activities.