EUROPEAN COMMON TECHNICAL SEMESTER FOR DEFENCE AND SECURITY (EuCTS_DS)

PROJECT NO 2020-1-RO01-KA203-080375

INTELLECTUAL OUTPUT

O4 - Methodology and Guide for the Interdisciplinary Scientific Project

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CONTENT

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1. The aims of the Interdisciplinary Scientific Project

The aim of the interdisciplinary scientific project is to train students in teamwork and emphasize realistic and real-life situations applied in defence and security technical systems, to demonstrate the ability to use modern design tools and techniques, to demonstrate the ability to plan and run a team-based project and to show the ability to communicate clearly in writing (through a proper project report) as well as by other means.

The work has to be completed within the time schedule and to be presented at an assessment meeting simulated as a board meeting. Great attention is paid to the ability to plan, delegate, communicate and co-operate as a team towards a common objective. The cohesive process needs to be organised so that the team members develop shared commitments and work collectively to achieve objectives that are agreed.

2. Objectives of the Interdisciplinary Scientific Project

After completing the Interdisciplinary Scientific Project, the student should be able to:

- contribute actively as an individual in the group work.
- work alone, independent of the group, in context and co-operation with the team.
- understand the professional responsibilities of the member team in context with different task.

3. Role of the project coordinator

Every student will have his/her project coordinator by an academic member of staff. The scientific coordinator tutor will:

- make themselves available for regular meetings for the duration of the project.
- Organise scientific trip in industrial facilities, laboratory or military units.
- advise on the compilation of the project proposal forms.
- advise on the project's aims, objectives and structure.
- give technical advice and support.
- arrange laboratory facilities, equipment, and space as required.
- procure any agreed material that is required.
- be involved with the interim and final assessments.
- advise on the format and contents of the written report.

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4. Requirements of the student

- identify and distribute the project task among the team member, under the supervision of the scientific coordinator.
- attend and keep near perfect time keeping out of respect for the team members.
- arrange to have regular meetings the scientific coordinator and with the team member.
- start working on the project straight away and work steadily, do not leave it to the last minute.
- submit the interim assessment to the scientific coordinator by the due date.
- write the final written report.
- prepare for and attend the oral presentations.

5. Teamwork activity

The interdisciplinary scientific project requires to work in a team with other students from different countries/institutions/specialisations. Once the student is assigned to the project and to a team, considering the competences, knowledge and skills, a certain task will be distributes with the project. Among the main responsibilities: work as individual or as a team, take minutes, prepare and present intermediary reports, deal with unexpected problems, learn to communicate effectively within the team, prepare reports and prepare and deliver presentations.

6. Intermediary reports

The students will meet your scientific coordinators at least once a week, for about 1 hour, during which time you the student will be able to update on the progress of the work and receive support and guidance on the functioning of the team and of the project.

At least once at 2 weeks, the team has to present the intermediary results in front of the scientific coordinator and of the other teams. The student who will present the intermediary results has to be choose by rotation.

Reports and presentations must not be viewed as competitive but a shared outcome where the students and the project benefits from your involvement and participation. The format of the report will be discussed with the scientific coordinator.

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The midterm report should be of around 15 pages, including figures, tables and all sources and citations. The presentation needs to provide all the information that the student knows about the project, how he is tackling the problem. How the team is functioning to solve the problem, a summary on what has been achieved to date and the plans for the following weeks. Each individual must contribute.

7. Final report

The Final report must be substantial in that it must reflect the activities of the project team in reaching their goals. It will have the same format of content as the midterm report but will require fuller descriptions of the project, the research carried out, the solution to the problem (describing all the facets, options and why the selected option was chosen), the business case, the marketing, the finance statement, how the team functioned, conclusions and all the necessary supporting documentation in the appendices. A report of 30-100 pages, excluding appendices, would not be unreasonable but this is only a guideline and depends on the project, its outcomes, and final conclusions.

First has to be described the objective of the project. Remember it may be reviewed by a variety of academics and industrialists who may not be familiar with the specifics of the project. Revised and updated targets, the project plan, Gantt Chart, team members, the management structure and organisation of the whole Project until the end. Remember to forecast clearly, what the team want to achieve (and what not), how the objective will be achieved it and how the team finally was organised. Present important achievements identified during the project.

8. The final presentation

In the last week of the activity the member team has to present the project, based on a Power point presentation. Timeframe: 30 minutes is allocated for each team presentation, followed by a question-and-answer session (around 20 min). The total time should not exceed 50 min for each team. Everybody in the team must present their chosen part/contribution on preferably what he/she is in charge of in the team.

With group projects each team depends on every member to contribute. Sometimes some students will contribute little or nothing to the group's effort. Therefore to ensure that all team members are fully motivated, a Peer Assessment system will be used, which enables all team members to grade the contribution of themselves and each team member. This means that each student can influence the marks of the other member of the team.

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9. Examples of the projects

9.1. Multiple Launch Rocket Systems Effectiveness

9.1.1. Project description

The project is a one-semester course designed to train engineering students to work on international teams. During the semester and under the guidance of the project coordinators, an international team of four to six students works on the multidisciplinary project. Teams include students with different academic backgrounds from all over Europe.

The goal of this project is to study the effectiveness of an artillery missile fired by a multiple launch rocket system. The project will consist in an aerodynamic and external ballistics of an unguided missile, followed by the delivery accuracy study. An important issue is the study the multiple launch rocket system oscillations during the firing phase and its influence of the firing accuracy.

9.1.2. Prerequisites for participants

English: Common European Framework of Reference for Languages Level B1.

9.1.3. Competences

The project will enable students to apply technical knowledge acquired during the previous years of their engineering education to practical projects. The project also offers the opportunity to learn to work in teams in an international, multicultural and interdisciplinary atmosphere..

This project has been designed to train students in a broader range of disciplines, such as aerodynamics, ballistics, mechanics, fluid mechanics, CFD, modeling and numerical simulation, computer programming, international communication, teamwork skills, critical thinking, sustainability, languages. Students will develop both the ability to deal with frequent, unexpected changes and the skills required for working abroad.

9.1.4. Contents

No.	Main topic	Working hours	ECTS	Details
1	**Basics of multiple launch rocket systems**	10	**2**	- multiple launch rocket systems; - unguided missiles.
2	**Aerodynamics and external ballistics of an unguided missile**	70	5	- mathematical model of forces and moments acting on a missile in flight; - CFD simulation of a flow around a missile; - modeling and simulation of the unguided missile trajectory.
3	**Multiple launch rocket system oscillations**	70	5	- mathematical model of a multiple launch rocket system; - numerical simulation of a multiple launch rocket system oscillation;
4	**Delivery accuracy**	70	5	- accuracy of the rockets; - vulnerability assessment of the targets ; - modeling and simulation of the rocket delivery

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No.	Main topic	Working hours	ECTS	Details
				accuracy.
5	**Project presentation**	6	1	- final project presentation
TOTAL		226	**18**	

9.1.5. Bibliography:

1. Morris Driels, *Weaponeering. Conventional Weapon System Effectiveness*, AIAA Education Series, 2nd Edition, 2013
2. Robert McCoy, *Modern Exterior Ballistics. The Launch and Flight Dynamics of Symmetric Projectiles*, Schiffer Publishing, 2nd Edition, 2012
3. Șomoiag Pamfil. Moldoveanu Cristian-Emil, *Numerical Research on the Stability of Launching Device During Firing*, Defence Technlogy Journal, 2013

9.1.6. Assessment:

Type of activity	Assessment criteria	Assessment methods	Percentage of the final grade
Project	Continuum assessment	Student participation in the project evaluated by the project coordinators during the semester	20 %
	Team assessment	Student teams will assess the workload of each member of the team during the project	20 %
	Written report	The project coordinators will analyze the final written report	30 %
	Final presentation	Analysis of the written report	30 %

9.2. Blast Effects and Mitigation

9.2.1. Project description

The project is a one-semester course designed to train engineering students to work on international teams. During the semester and under the guidance of the project coordinators, an international team of four to six students works on the multidisciplinary project. Teams include students with different academic backgrounds from all over Europe.

The goal of this project is to study the loads and effects produces by blast waves on structures and methods for their mitigation. The project will consist in a study of blast waves propagation, reflection and dynamic loads impost by these waves, followed by the study of blast wave mitigation using porous materials.

9.2.2. Prerequisites for participants

English: Common European Framework of Reference for Languages Level B1.

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9.2.3. Competences

The project will enable students to apply technical knowledge acquired during the previous years of their engineering education to practical projects. The project also offers the opportunity to learn to work in teams in an international, multicultural and interdisciplinary atmosphere..

This project has been designed to train students in a broader range of disciplines, such as blast waves, mechanics, fluid mechanics, CFD, modeling and numerical simulation, computer programming, international communication, teamwork skills, critical thinking, sustainability, languages. Students will develop both the ability to deal with frequent, unexpected changes and the skills required for working abroad.

9.2.4. Contents

No.	Main topic	Working hours	ECTS	Details
1	**Basics of blast effects**	10	**2**	- blast waves; - blast effects; - mitigation of blast waves.
2	**Blast waves**	70	5	- blast wave parameters. Rankine-Hugoniot relations. Normal and oblique shock. Reflected shock. Mach stem. - modeling and simulation of shock wave propagation; - experimental tests of shock waves propagation.
3	**Dynamic blast loads**	70	5	- dynamic blast loads; - dynamic pressure, drag pressure. - modeling and simulation of blast loads on structures;
4	**Blast mitigation**	70	5	- modeling and simulation of blast effects mitigation using porous material panels; - experimental tests regarding the blast wave mitigation using porous material panels
5	**Project presentation**	6	1	- final project presentation
TOTAL		226	**18**	

9.2.5. Bibliography:

4. Needham C.E.-Blast waves, Springer, 2010
5. Bulson P.S.-Explosive loading of engineering structures, E&FN Spon, London, UK, 2003
6. Bangash M.Y.H., Bangash T. – Explosion Resistant Buildings- Design, analysis and case studies, Springer, 20066.

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9.2.6. Assessment:

Type of activity	Assessment criteria	Assessment methods	Percentage of the final grade
Project	Continuum assessment	Student participation in the project evaluated by the project coordinators during the semester	20 %
	Team assessment	Student teams will assess the workload of each member of the team during the project	20 %
	Written report	The project coordinators will analyze the final written report	30 %
	Final presentation	Analysis of the written report	30 %

9.3. Structural and aerodynamic analysis of composite wing

9.3.1. Project description

The project is a one-semester course designed to train engineering students to work on international teams. During the semester and under the guidance of the project coordinators, an international team of four to six students works on the multidisciplinary project. Teams include students with different academic backgrounds from all over Europe.

The goal of this project is to study the mechanical and aerodynamics characteristics of a wing. The project will consist in the static study of a woven composite material, focusing on the elastic characterics, followed by the 2D aerodynamic study (airfoil) and 3D (wing).

9.3.2. Prerequisites for participants

English: Common European Framework of Reference for Languages Level B1.

9.3.3. Competences

The project will enable students to apply technical knowledge acquired during the previous years of their engineering education to practical projects. The project also offers the opportunity to learn to work in teams in an international, multicultural and interdisciplinary atmosphere.

This project has been designed to train students in a broader range of disciplines, such as aerodynamics, ballistics, mechanics, fluid mechanics, CFD, modeling and numerical simulation, computer programming, international communication, teamwork skills, critical thinking, sustainability, languages. Students will develop both the ability to deal with frequent, unexpected changes and the skills required for working abroad.

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9.3.4. Contents

No.	Main topic	Working hours	ECTS	Details
1	**Basics of composite wing**	20	2	- Aerodynamics. Airfoil and wing. - Composite material. Strength of materials review, orthotropic materials, lamina calculus.
2	**Composite materials**	90	7	- mathematical model of lamina. - CAD modeling of lamina and laminate; - FEM simulation of laminate behaviour; - experimental determination of mechanical characteristics.
3	**Aerodynamics**	110	8	- mathematical model of forces and moments acting on wing; - CAD modeling of airfoil and wing; - CFD simulation of a flow around an airfoil; - CFD simulation of a flow around a wing; - experimental determination of aerodynamics characteristics.
4	**Project presentation**	6	1	- final project presentation
TOTAL		**226**	**18**	

9.3.5. Bibliography:

7. Anderson J.D., *Introduction to Flight*, McGraw-Hill Higher Education, 2015
8. Anderson J.D., *Fundamentals of Aerodynamics*, McGraw-Hill, 3ed., 2001
9. Jones, R.M., *Mechanics of Composite Materials*, McGraw-Hill, , 2nd ed,New York, 1999

9.3.6. Assessment:

Type of activity	Assessment criteria	Assessment methods	Percentage of the final grade
Project	Continuum assessment	Student participation in the project evaluated by the project coordinators during the semester	20 %
	Team assessment	Student teams will assess the workload of each member of the team during the project	20 %
	Written report	The project coordinators will analyze the final written report	30 %
	Final presentation	Analysis of the written report	30 %

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