

# EPMA – EUROPEAN POSTGRADUATE MASTER IN AERONAUTICAL ENGINEERING

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## ABSTRACT

With support from the European Commission, a new joint European postgraduate master programme for part time students is created. The programme awards a joint/double master degree at the end of the student's study period. Main partners in the programme are: Hochschule für Angewandte Wissenschaften Hamburg, Katholieke Hogeschool Brugge - Oostende and Université Bordeaux 1. The programme responds to a European shortage of highly qualified human resources in the field of aeronautical engineering by pooling trans-national expertise in those specialised fields of aeronautical engineering that are crucial to today's aeronautical development activities. Academia's and industry's expertise will be combined in teaching to deliver the best of both worlds to students. This will provide an international dimension for students (and lecturers). Target group are graduates with an aeronautical engineering (or related) degree who are working in the aeronautical industry. The participants have a minimum of 4 years of academic training (or equivalent credits) and some years of relevant industrial experience. EPMA short courses are already delivered regularly. The master programme will start officially in 2008.

## 1. RATIONALE AND BACKGROUND

The initiative for a European Postgraduate Master in Aeronautical Engineering (EPMA) comes from the situation of a dramatic shortage of aviation engineers qualified to work in the many large and demanding projects of the European aviation industry. The big well known projects are the Airbus A380, A400M and A350 XWB. Further Airbus projects are already appearing, like the new single aisle aircraft. These projects do not only generate work at the aircraft manufacturer but also with suppliers and engineering offices all over Europe. In addition, also smaller projects like the new Dassault Falcon 7X require aviation experts. A few numbers can help to highlight the need for aviation engineers: Limited to the Hamburg region, the Airbus A380 has created 2000 new jobs (mainly engineers) directly at the Airbus Hamburg plant and about the same number outside of Airbus [1]. New jobs will be created despite the Airbus dilemma named Power8 [2]. Europe-wide, Airbus employs 15000 engineers, which causes a "renewal rate" of 500 engineers each year [3]. The Hamburg government has established a task force "Qualifizierungsoffensive Luftfahrtindustrie" that addresses the problem of shortage of aviation engineers [4].

## 2. PARTNER UNIVERSITIES

Main partners in the EPMA programme are:

- Hochschule für Angewandte Wissenschaften Hamburg, **HAW** (Hamburg University of Applied Sciences)
- Katholieke Hogeschool Brugge - Oostende, **KHBO** (Catholic University College of Bruges – Ostend)
- Université Bordeaux 1, **UB1** (University of Bordeaux 1)

These three partners applied successfully for a EU grant under the scheme ERASMUS Curriculum Development in the category "study programme" [5]. The development of EPMA is funded by the European Commission.

Hamburg University of Applied Sciences takes the **lead** in this EU programme as well as in the EPMA programme as a whole. Logos of partner universities are given in Fig. 1.



FIG. 1 Logos of EPMA partner universities

## 3. AIMS AND OBJECTIVES

Universities are asked today to go beyond normal teaching activities. Life Long Learning (LLL) [6] as set out by the European Commission is but one of today's perceived needs of our society. The European Postgraduate Master In Aeronautical Engineering (EPMA) takes up the various

challenges. Its **aims and objectives** are:

- Respond to the European shortage of highly qualified human resources in the field of aeronautical engineering by pooling trans-national expertise in those specialised fields of aeronautical engineering that are crucial to today's aeronautical development
- Respond to student's ambitions to go for a further degree while continuing at work by creating a new joint ECTS-based European Postgraduate Master Programme for part time students and to award a joint/double master degree with a Diploma Supplement.
- Respond to the need for lifelong learning by offering short courses.
- Combine academia's and industry's expertise in teaching to deliver the best of both worlds to students.
- Provide an international dimension for students (and lecturers) to foster the understanding among Europeans from different nations.

With these objectives EPMA **addresses** all six **key points of the Bologna process** [7] as stated in the Bologna declaration [8]:

- Diploma Supplement [9]
- Two-cycle system: Bachelor and Master [8]
- Accumulation and transfer of credits: ECTS [10]
- Mobility
- Cooperation in quality assurance [11]
- European dimension

EPMA's **further intentions** are

- to teach innovative subjects in aeronautical engineering,
- to follow a closely knit European approach with the aim also to include new European member states (Romania and Hungary) as "associated partner",
- to follow innovative pedagogical and didactical approaches,
- to be based on a collaboration between academia and industry in teaching.

#### 4. TARGET GROUPS AND ENTRY REQUIREMENTS

EPMA targets **students at graduate level** ("master type"), studying for a further degree. EPMA is placed in the 5th year of a 5-year academic training programme. TAB. 1 compares consecutive Bachelor / Master profiles with postgraduate studies towards the EPMA. The fundamentals of EPMA entry requirements are:

- 240 ECTS (or equivalent)
- For participants from UB1 or KHBO the 240 ECTS have to be obtained after finishing with a first Master Degree (M1)
- For participants from HAW a 7-semester-Bachelor is required and additional relevant work experience.

EPMA also targets **lifelong learners** that do not intend to achieve a full degree, but would like to enhance their knowledge in selected areas. To these engineers the EPMA modules will be offered as **short courses**. Lifelong learners only get a certificate after participation of a short course. This second target group will help to finance the

whole programme to a great extend.

TAB 1. Comparison of different 5-year university programmes.

Consecutive Bachelor / Master					Postgraduate Master	
Semester		ECTS		UB1	HAW	EPMA
Master	4	30	$\Sigma = 120$	M 2	Master	60 ECTS
	3	30		M 1		
	2	30			Bachelor	entry requirements:  240 ECTS
	1	30		L 3		
Bachelor	6	30	L 2			
	5	30		L 1		
	4	30	$\Sigma = 180$			
	3	30				
	2	30				
	1	30				

#### 5. STRUCTURE AND ORGANISATION

EPMA is intended as a full one-year second degree programme at Master level. Due to the fact that it will be offered for part time studies, the 60 ECTS will be spread over a time of about 2.5 years until the Master can be awarded.

EPMA falls under the EU-subject area "**Aeronautical Engineering**". Code: 06.8 (see [12]).

The **course content** will highlight those areas in aeronautical engineering that are crucial to today's aeronautical development activities: composite structures, aircraft systems and maintenance, aviation economics. The proposed modules place emphasis on topics that are not necessarily part of consecutive Bachelor / Master courses.

The Master Programme is designed for **part time studies** based on short courses, home study and project work while participants work full time in industry. The programme finishes with a Master thesis. The students are encouraged to find a topic for their thesis in their company. The intension is to have EPMA activities **coupled as closely as possible with the work place**.

The programme structure is to award the degree "European Postgraduate Master in Aeronautical Engineering" after successful completion of **10 EPMA modules** (compare with TAB. 2) and delivery of a **thesis**.

Modules are developed by the three EPMA main partner universities and their associated partner universities in **three regions**. Following EU standards ([13], [5] Annex 1) these regions are:

- BE25: WEST VLAANDEREN in BE: BELGIUM
- FR61: AQUITAINE in FR: FRANCE
- DE6: HAMBURG in DE: GERMANY

**Associated partner universities** in the region are:

- In BE25: Katholieke Universiteit Leuven.
- In DE6: Technical University Hamburg-Harburg (independently delivering its short courses).

TAB 2. EPMA modules, regions, universities, areas of expertise and mandatory status

<b>Joint Module</b> <b>Introduction to Aeronautical Engineering (mandatory)</b>  Region BE25: <b>Katholieke Hogeschool Brugge - Oostende, Belgium</b> Avionic Systems Engineering and Flight Control (mandatory) Air Transport Economics (mandatory) Spacecraft Systems Design Noise and Vibration Engineering Unmanned Aeronautical Vehicles  Region FR61: <b>Université Bordeaux 1, France</b> Aircraft Maintenance Management (mandatory) Composite Materials and Maintenance (mandatory) Aircraft Propulsion and Maintenance Reliability and Integrated Logistic Support Finite Element Dimensioning for Composite Materials  Region DE 6: <b>Hamburg University of Applied Sciences, Germany</b> Aircraft Design (mandatory) Design of Lightweight Aircraft Structures (mandatory) <b>Technical University Hamburg-Harburg, Germany</b> High-Performance Composites for Aircraft Construction Aircraft Systems Technology Aircraft Systems Integration  <b>Associated Partner</b> CFD for Aircraft Aerodynamics
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Each partner is organising the activities in its region (whenever more than one university is active in one region).

**Further associated partner universities** (outside of the three regions) will be incorporated to achieve a broader European coverage. The intention is to incorporate partner universities from new member states (RO: ROMÂNIA, HU: MAGYARORSZÁG – Hungary) as well as universities from Airbus partner countries (UK: UNITED KINGDOM, ES: ESPAÑA).

The module **"Introduction to Aeronautical Engineering"** is a joint module that is organised by all main EPMA partners together (with support of associated partners). The module is the only module that is developed in the framework of the EU grant (all other modules are developed by the partners from own funds, because the EU grant covers primarily the development of the Master programme in its overall aspects). The introductory module is seen as a test case for

- the application of modern teaching methods,
- the cooperation of the partners on a real life task.

Teaching goal in the introductory module is to bring the new EPMA students on a common level with respect to applied aeronautical subjects on which can be built in

later modules. The aim is also to integrate students who hold only a Bachelor in a non-aviation discipline (but compensate this with relevant industrial experience in aviation). **The introductory module is mandatory.** It will be taught in the country of the partner university responsible for the module. Responsibility in running this module is rotated among the main partners.

There are **six other modules** that are **mandatory** are allocated to the three main EPMA partners. Each main partner is responsible for two mandatory modules. Each region contributes the **expertise** in certain aeronautical subjects. Mandatory modules cover these areas of expertise.

There are various option modules on offer (see TAB. 2). Each student must **choose three option modules** from TAB. 2. Not all of these option modules are ready for teaching at this time. Some modules still need to be prepared. The EPMA programme is flexible enough to include further universities as associated partners by giving them responsibility for new option modules.

Each **module** will start with **home studies** in which the students get prepared for the short course. Work at home before and after the short course can be based on different media related to the subject provided over the Internet. Each **short course** consists of one full week (five days) of contact time. Short course teaching will be done by lecturers from academia – often from different countries – and by engineers from the local industry. Following the short course, the students are asked to work on a small individual **project** or team project. This project will be prepared at home and is based on the information presented during the short course. Students get **support** during project preparation by an allocated lecturer **via e-mail** or other means of modern communication.

**Assessment of the students** is done **by** means of a **project**. Grades are allocated according to the European Credit Transfer System (ECTS) grading scale. Presently no written and formal **examination** is intended for student's assessment. If writing an examination should become necessary due to accreditation requirements, it could be written

- directly at the end of the short course or
- a few weeks after the short course supervised at all participating universities at the same time or
- a few weeks after the short course by means of an Internet-based examination taking part for all students at the same time.

Each module is worth 4 ECTS **credits**. The general idea is that for recognition of a module (worth 4 ECTS) will require a workload of 100 hours (1 ECTS = 25 hours of workload) consisting of:

- the short course with 30 hours (1 week = 5 days with 6 hours – equivalent to 8 teaching units à 45 minutes – per day),
- self study time preceding the short course: 20 hours,
- project work after the short course: 50 hours.

The ratio between self study time and project work may vary from one EPMA module to another.

Altogether the 10 modules yield 40 ECTS.

The **thesis** accounts for 20 ECTS. It is related to the subject of one module and can be prepared based on a topic that the students receives from his/her employer. The thesis will have a workload of about 500 hours. This follows from 20 ECTS multiplied by 25 hours/ECTS.

10 modules and the thesis account for a total of 60 ECTS, which is the equivalent of two semesters or one year of full time studies.

The structure for **student and/or staff mobility** is given by the modules normally being offered in that region and at the university that is responsible for the module. This university has the laboratory facilities and the contacts to industry that are necessary to make the short course a lively event. Students not from that region and participating lecturers from other regions will need to travel. In this way we create a natural and sensible **European dimension** to the EPMA programme.

## 6. PEDAGOGICAL AND DIDACTICAL APPROACHES

The EPMA programme combines modules consisting of home studies, short courses (lectures, tutorials, group exercises, short visits to industry) and project work. e-learning [14] [15], blended learning [16] and distance learning [17] are applied. The introductory module called "Introduction to Aeronautical Engineering" is prepared jointly by all partners. It is intended to deliver part of the course material using an e-learning platform. The experience gained from the introductory module may help in the application of modern teaching methods in the other EPMA modules.

## 7. QUALITY ASSURANCE MECHANISMS

For quality assurance, an **EPMA Academic Quality Management Board** (EAQ) was set up. Members of the EAQ are one person from each partner university, one from an associated university and one or several persons from industry. In contrast to the EAQ, the **EPMA Management Board** (EMB) deals with the organisation of the EPMA programme. Members of the EAQ are one person from each partner university. EAQ and EMB are in close contact with each other and report to the EPMA project coordinator (from HAW).

The quality of each module is assessed by the participants with help of a detailed **questionnaire** directly at the end of each module run. All partner universities have experience and know, how to conduct and evaluate student feedback activities. A questionnaire should include

- direct questions that can be numerically evaluated,
- space for participants to express their thoughts freely.

Also the **experience of the lecturers** gained during each module run is systematically recorded. The results from the assessment of the students could also be one aspect in search of quality.

## 8. JOINT AND DOUBLE DEGREE

HAW Hamburg intends to award the **joint EPMA degree** together with a Diploma Supplement [9] for all students who fulfil the EPMA requirements. The EPMA programme intends also to offers two **double degree options**:

- In addition to the joint EPMA degree, students can get a second degree from UB1 if they write a thesis supervised at UB1 on a subject from the UB1 area of expertise.
- In addition to the joint EPMA degree, students can get a second degree from KHBO if they write a thesis supervised at KHBO on a subject that is from the an area of aeronautical engineering at KHBO.

Awarding a double degree apparently falls under the present regulations of KHBO and UB1 and does not require additional regulations within EPMA.

Note, that the above is based on first intensions towards a joint degree and signatures given on the basis of the EU application. Friedrich in [18] highlights the many problems that come along when trying to put a joint degree really into practice. EPMA has still to go through this!

Legal issues in Europe may today still cause some **problems in awarding a joint degree**. In order to facilitate joint degrees the definition of a joint degree has been softened. EPMA will probably not offer a "Real Joint Degree", but fulfils more than enough criteria to award simply a "Joint Degree": One degree is awarded in the name of the participating institution at which the student is registered (HAW). An additional unofficial degree certificate is awarded on behalf of the whole partnership, to testify that the programme has been developed and taught jointly.

Tauch [19] explains: "Joint degrees are normally awarded after study programmes that correspond to all or at least some of the following characteristics:

- the programmes are developed and/or approved jointly by several institutions;
- students [come] from each participating institutions;
- the students' stays at the participating institutions are of comparable length;
- periods of study and exams passed at the partner institution(s) are recognised fully and automatically;
- professors of each participating institution also teach at the other institutions, work out the curriculum jointly and form joint commissions for admission and examinations;
- after completion of the full programme, the student either obtains the national degrees of each participating institution or a degree (in fact usually an unofficial "certificate" or "diploma") awarded jointly by them."

All six criteria seem to be fulfilled by EPMA. There are three options for a joint degree [18]. For EPMA option No. 3 seems to fit best:

"One degree certificate is awarded in the name of the participating institution at which the student is registered. An unofficial (... as a source of additional information only) degree certificate is awarded on behalf of the whole partnership, in addition to the national degree, to testify that the programme has been developed and taught jointly."

Tauch [19] also analysis the situation in different European countries. Germany is rather flexible and organised with respect to joint degrees. Hamburg government even financially supports the development of EPMA and its module development. Bureaucratic obstacles are not in sight.

"In Germany, the legal situation with regard to joint degrees is set out in two decisions of the Standing Conference of Ministers of Education and Culture (KMK), the first in 1991 and the second ... in 1996. Minimum requirements for joint degrees include the following: programmes should be offered jointly with at least one recognised foreign institution; they and any examination procedures - should be drawn up jointly; each partner should offer a substantial part of the programme; and programmes should reach a level commensurate with the award of a German degree." [19]

According to [19], the Flemish communities of Belgium are faced with the absence of legislation concerned specifically with joint degrees. This does not normally prevent the establishment of joint programmes with foreign institutions, as this is an area in which universities are generally free to act as they wish.

It is apparently not so clear, if the Belgium situation can also be applied to France. In any case in France "the award of joint degrees poses no legal problem as long as the partners agree to comply with the French model, namely the curriculum submitted to the Ministry of Education, which the French institution has been authorised to follow. Yet, because any requirements or obligations of the partners also have to be respected, two national degrees, instead of a single joint qualification, are normally awarded." [19]

For EPMA especially the French position on an EPMA joint degree is still open and under discussion.

## 9. CONTRACTS AND EXAMINATION REGULATIONS

During the time of curriculum development under the EU grant, the partners relate to each other based on details from their common **Application for Curriculum Development** (signed by all main partner university presidents) [5]. In addition the European Commission asks for a **Trilateral Partner Agreement** (templates in [20]).

When the EU funding ends, the EPMA programme has to be financially self-sustainable – even better if it yields a profit. The universities have to agree on the terms of how to handle and share student fees (revenues) and on how to handle expenses. This is done in a **Trilateral Partner Contract**.

The relationship between the university and the student is covered in the **Examination Regulations**. The student pays fees; he/she is the customer. The university is the service provider and delivers learning opportunities. On the other hand, the student delivers planned results and obtains the degree at the end.

The master programme can only run officially when all legal requirements (the Trilateral Partner Contract and the Examination Regulation) are agreed upon and signed by all partner universities.

## 10. DEGREE ACCREDITATION AND DISSEMINATION

Since HAW Hamburg takes the lead and will issue the joint degree, accreditation has to follow German regulations. At HAW Hamburg **accreditation** is done by the "Zentrale Evaluations- und Akkreditierungsagentur Hannover" (ZEvA Hannover). The ZEvA is founding member of the European Consortium of Accreditation (ECA), member of ENQA (European Network for Quality Assurance in Higher Education) and cooperates with the Joint Quality Initiative (JQI) who is defining criteria for Bachelor- and Master programmes (BaMa-descriptors) at European level [21].

Several measures can be applied to ensure the **dissemination** of results and to advertise for the EPMA programme:

- organisation of a local (EPMA) workshops
- organisation of an international (EPMA) workshop
- participation at an aviation congress
- participation at an aviation fair
- production of an EPMA website
- production of a poster
- production of a leaflet (flyer)
- mailings of leaflet and covering letter
- advertisements in an official aviation magazine.

Several of these measures have already been used for EPMA. One example is [22].

## 11. CORPORATE DESIGN

For a professional impression it is very important to have a Corporate Design [23] also known as Corporate Visual Identity being part of the Corporate Identity [24].

"A corporate design is the official graphical design of the logo and name of a company or institution used on letterheads, envelopes, forms, folders, brochures, etc. The house style is created in such a way that all the elements are arranged in a distinguished design and pattern." [23]

"Corporate Visual Identity plays a significant role in the way an organization presents itself to both internal and external stakeholders... a corporate visual identity expresses the values and ambitions of an organisation, its business, and its characteristics...

- First, a corporate visual identity provides an organisation with visibility and 'recognisability' ...
- Second, a corporate visual identity symbolises an organisation ... and, hence, contributes to its image and reputation..." [24]

For EPMA the corporate design encompasses:

- logo,
- poster,
- PowerPoint template,
- flyer,
- web design.

Logo, poster and PowerPoint template are given in Fig. 2 to Fig. 4.



FIG. 2 EPMA logo



FIG. 3 EPMA poster



FIG. 4 EPMA PowerPoint template

## 12. WEB SITE

The task of the web site for EPMA is threefold:

- to **attract students** to the Master programme (we need a glossy layout that is emotionally touching but providing key information at the same time, many pictures),
- to **inform students** and the interested public (more emphasis on information, less pictures; link to an application database, link to the e-learning resources),
- to **inform university partners** (well structured, clear, password protection for selected information, easy to maintain).

The Uniform Resource Locator (URL) [25] should be such that it is easy to remember. The Top Level Domain (TLD) [26] should be neutral i.e. it should not be the TDL of one partner country.

- .edu "educational". The TLD is limited to U.S. higher education institutions,
- .aero "air-transport industry". User must verify eligibility for registration; only those in various categories of air-travel-related entities may register.

We went for .aero and got

**[www.EPMA.aero](http://www.EPMA.aero)**

## 13. SUMMARY

The European Postgraduate Master in Aeronautical Engineering (EPMA) curriculum development project

- is addressing a dramatic shortage of aviation engineers,
- is intended for part time students with industrial experience,
- consists of 10 short courses and a Master thesis equivalent to one year full time studies (60 ECTS),
- is a joint programme leading to a joint/double Master degree,
- fulfils all requirements for a new Master programme



- set forth by the European Commission,
- is (with a few exceptions) based on existing modules,
- benefits from vast experience of its partners in international cooperation and design of financially viable short courses,
- is running modules already now under the EPMA logo,
- enables students to collect credits on short courses already now,
- will start officially in 2008.

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