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Relation of the AEROVET units to other modular approaches

Education and Culture DG

Lifelong Learning Programme

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1. Preface

The primary goal of the AEROVET project is to test the elements of the ECVET technical specifications in the context of transnational mobility of VET students in the sector of aerospace engineering. This objective also gave rise to the necessity and the development of the mobility units (see work package 4). It is not the mission of the project to convert national qualifications into learning units or to change the contents of the qualifications.

Nevertheless the relation of the learning units to the VET systems (cf. work package 3) as well as other systems remains a relevant aspect; as isolated approaches are unsatisfactory. In the aerospace sector the focus is not only on the sector-independent question of vertical permeability to tertiary education, but also the approach taken by the EASA. The first section of this report is concerned with the modules for the qualification of staff licensed to issue maintenance certifications (CAT A, CAT B) formulated by the EASA in the directive (part) 66, and with the responses of the four national education systems. It is hardly a surprise that these reactions depend on the system. Whereas the unit-based systems in England and Spain simply offer the EASA modules as stand-alone courses, the VET stakeholders in Germany and France are seeking an integration of these modules into existing programmes. These efforts are the topic of the annexes to this work package; they include the so-called Delta Report (23) of the German Federal Aviation Agency (LBA) on the recognition of learning outcomes of regulated German VET programmes, especially for aircraft mechanics, with a view to the certification of CAT A staff. The AEROVET consortium was not involved in the preparation of that report.

There is no similar document of the LBA for the qualification of electronics technician for avionics systems (ELS) because its school-based part, which is organised according to learning fields, cannot be accredited for the CAT A. The EASA modules are included in the learning fields only implicitly. Accordingly the annex 24, which was prepared in a workshop with VET teachers and trainers, has a different status than annex 23. It was made available to the LBA as evidence that the ELS curriculum includes the EASA modules as well. A similar approach was chosen in France and the result is documented in annex 25. However, it is not the aim of a European project to concentrate exclusively on the national education and training programmes. Therefore the AEROVET learning units, which cover the European professional tasks in this sector, were also compared with the EASA modules. The outcome was that a core occupation was defined which consists of 8 of the learning units plus another unit (engine maintenance), which fully incorporates the EASA CAT A requirements. The detailed results are documented in the annexes 26 and 27. Due to the

reorganisation in Germany (see also work packages 3 and 7), which is based on the AEROVET units, this comparison was carried out in Germany with the participation of representatives of the social partners, the VET schools and the chambers. The major progress compared to the situation described in the interim report consists in the fact that staff from the German Federal Aviation Agency reviewed the juxtaposition and accepted it (only marginal reformulations of the learning units might be required). To put it another way: an important milestone of the project, namely the definition of a European core occupation that integrates the requirements of the LBA, has been achieved. The agency is prepared to certify an *occupational profile* instead of particular *training institutions*.

In addition, it was investigated in the four participating countries to what extent the proposed units of learning outcomes, or other possible units of learning outcomes from VET in this sector, might be accredited in relevant degree programmes. The results and recommendations are documented in the second section.

2. The EASA modules and the responses of the VET systems in the four countries

Political context

Unlike the EACEA, the EASA (European Aviation Safety Agency) is not subject to a non-harmonisation clause. EASA enacts, modifies and supervises safety regulations in civil air traffic within the EU as well as to or from EU airports. The best-known example is probably the prohibition to take more than 100 ml of any liquid on board. The EASA regulation 66, which is treated here, addresses only skilled maintenance workers for licensed civil aircraft, i.e. the maintenance of military aircraft as well as production (and modification prior to licensing) are not explicitly concerned. From the point of view of horizontal permeability this limitation might be regretted, for it means that highly skilled workers from these two domains need to undergo extensive retraining if they change to a job at a civil airport. The regulation 66 imposes standardised, high quality requirements on the maintenance staff – formulated in 17 modules. (A complete overview is given, for instance, in sheet 2 of annex 23).
The licences are distinguished in three categories A, B and C according to the complexity of maintenance work. The corresponding licenses to issue maintenance certifications are ranked accordingly:

- Category A **Line Maintenance Certifying Mechanic**
- Category B:1 **Maintenance Certifying Technician Mechanical**
- Category B:2 **Maintenance Certifying Technician – Avionic**
- Category C: **Base Maintenance Certifying Engineer**

The modules were formulated on the basis of purely technical requirements and considerations. There were no considerations with regard to teaching methodology or education systems.

Structure of the licences

In the context of initial VET, category C (engineer) is not relevant and will not be discussed further. The categories for mechanics A and B1 are subdivided by EASA according to the type and propulsion system of the aircraft:

- Licence A1 or B1-1 for mechanics with the additional qualification (MC) jet engines;
- Licence A 2 or B1-2 for mechanics with the additional qualification (MC) piston engines;
- Licence A3 or B1-3 for mechanics with the additional qualification (MC) rotorcraft with jet engines;
- Licence A4 or B1-4 for mechanics with the additional qualification (MC) rotorcraft with piston engines.

Including the licence B2 for electronics technicians we have to examine a total of 9 licences. The common reference framework for these 9 licences contains 17 modules, whose volume varies considerably (e.g. Module 8 (Basic Aerodynamics) with only 14 hours and Module 7 (Maintenance Practices) with 257 hours in all CAT A licences).

The licences differ from each other by different learning hours in the individual modules. For instance, Module 15 (Gas Turbine Engines) is part of the licences A1, A3, B1.1 and B1.3, but not of the other five.

The modules are divided into sub-modules and sub-sub-modules. The excerpt (Tab. 1) shows the sub-modules 6.4 (corrosion) and 6.5 (connecting devices) of Module 6 (Materials and Components) and the associated sub-sub-modules for the CAT B1 licence.

The sub-sub-modules can be attained at three levels each (cf. difficulty in Tab. 1) with the level corresponding to the learning hours per sub-module and the number of multiple choice questions (last column). The excerpt documents, for instance, show that the sub-module 6.4.b) (types of corrosion and their identification) has to be learned at level 2 for the CAT A licence and at level 3 for the B1 licence. The total learning time for level 3 is 20 hours and the test for the sub-sub-module comprises 6 questions. If the candidate already has a CAT A1 licence and 2 years of professional experience, he or she is only required to learn for another 5 hours and to answer only 3 questions. If the levels of the sub-sub-modules are equivalent as in the case of 6.4.a. (chemical basics), a candidate with a CAT A1 licence does not have to prove any additional learning hours and does not have to answer any questions anew.

Fachmodul	**CAT B1.1**							
	kompletter Lehrgang					**462 Stunden**		
Nr. Bezeichnung	Sgrad CAT A	Sgrad CAT B1	Theorie Soll (h)	Praxis Soll	Anzahl Fragen MMC	Theorie Soll (h)	Praxis Soll	Anzahl Fragen MMC
6.4 Korrosion								
a) Chemische Grundlagen	**1**	**1**	**5**	**3**	**2**			
b) Korrosionsarten und ihre Identifikation	**2**	**3**	**10**	**10**	**6**	**3**	**2**	**3**
6.5 Verbindungselemente								
6.5.1 Schraubengewinde	**2**	**2**	**5**	**4**	**3**			
6.5.2 Bolzen, Nieten, Schrauben	**2**	**2**	**5**	**4**	**3**			
6.5.3 Sperrvorrichtungen	**2**	**2**	**5**	**4**	**3**			
6.5.4 Luftfahrzeugnieten	**1**	**2**	**12**	**20**	**4**	**2**	**1**	**2**

Tab. 1: Excerpt from the EASA modules

In the context of the AEROVET project the question arises why the EASA modules are not used as learning units for mobility. The modules have an institutional legitimacy, their assessment is clearly defined (multiple choice and in the case of 3 modules also open questions to be answered in writing), their relative weight corresponds to the learning time and would allow for crediting, and they are identical and binding throughout the EU. However, in the view of the consortium they do not comply with three essential criteria of the ECVET approach:

- The learning outcomes approach: The EASA modules are strictly input-oriented, the learning time being the relevant criterion for admission to the multiple choice test.
- The separation of theory and practice: The modules at the basic level of the CAT A licence do not describe “a coherent set of knowledge, skills and competences”. A subsequent work placement of half a year is mandatory.
- The independence from the context of learning: In order to be able to award licences, training providers themselves need to undergo an elaborate certification procedure (Part 147) at the respective national aviation authorities. As the modules concern only those VET students who are trained for the maintenance of civil aircraft, training providers in the areas of production, general aviation and military aircraft save the efforts and costs of certification – and accordingly they are not authorised to award licences (or parts thereof).

Response of the education systems to the introduction of the EASA modules

The reaction of the fragmented systems in the United Kingdom and Spain can be put very briefly: new training providers or courses emerge within the existing institutions and qualify learners in accordance with the EASA modules.

In Spain there are 10 vocational schools of which eight offer the qualification of higher-level technician for maintenance in the area of avionics as well as in the area of aircraft mechanics while the other two offer only the training course in the field of aircraft mechanics. On the other hand there are 15 EASA-approved training providers that prepare for taking the licence. Out of these, only two are also vocational schools.

As the qualifications of the Spanish learners are referenced to EQF level 5 (see WP 3) and thus the highest of all the qualifications examined in the project, Spain has a special provision that does not exist in the other education systems:

Anybody who has successfully completed a VET programme in the Spanish qualifications system can apply for a licence, but is required to pass a so-called ‘free examination’ as stipulated by the ‘Directorate-General of Civil Aviation’ (Dirección General de Aviación Civil - DGAC). This means that with regard to the B licences the relevant EASA training and the Spanish higher vocational education are considered equivalent by the Spanish Ministry of Education.

The occupation-based VET systems in France and Germany find it more difficult to react to these innovations. On the one hand, training providers who offer the modules apart from vocational training programmes are emerging in these two countries, too. On the other hand there are initiatives to integrate the contents into the training curricula. At present the situation is unsatisfactory. “The existing regulations do not allow that learners who have undergone an excellent VET programme in Germany, lasting 42 months, are also given the licence to work on airplanes when they finish their training. That means they could do a lot but are not allowed to do anything. While at the same time somewhere else people may have lots of knowledge but no skills, and nevertheless be allowed to do everything” (quotation from a training coordinator). Similar to the German aircraft mechanic, the current situation in France is also characterised by a validation of experience plus additional learning and assessment:

Parts of the curricula for graduates of the two Bac Pro versions are validated by the GSAC[1] with a view to recognition for the A and B licences. The consequence is that two cultures of the evaluation of knowledge and competences exist side by side: the traditional French examination model and the EASA multiple choice procedure. The situation is the same in the upgrading training of technicians: partial validation of the BTS[2] curriculum for the B1-1 and B2 licences.

In Germany the curriculum also covers the B licences to a large extent, but the qualifications are not recognised as equivalent. In the case of aircraft mechanics the LBA identifies a gap of 98 hours between the vocational qualification and the CAT A (see annex 23; until September 2010 it was only 55 hours). In the case of electronics technicians there is currently no recognition of learning outcomes. The major reason for the revocation of the partial validation is the organisation of the school-based part of the programme into learning fields. According to the LBA the competence-oriented formulation of the learning fields does not allow for a comparison with the contents of the modules. Another problem related to the principle of dual VET is the certification of training providers. As considerable parts of the training take place in the enterprises (e.g. by means of in-house courses), the enterprises would have to be certified according to regulation 147, too. Due to a lack of manpower the LBA feels unable to do this. Like in France, there is also the problem of diverse assessment methods: a highly specialised “company work assignment” in the training programme versus standardised multiple choice tests in the case of the modules.

[1] Groupement pour la Sécurité de l’Aviation Civile – Association for the Safety of Civil Aviation
[2] Brevet de Technicien Supérieur = Certificate of higher-level technician

In both countries re-regulation procedures were initiated. In France this was also due to the reduction of the training period (see work package 3). The formulation of the German policy paper once more reflects the approach of the AEROVET project. The employers association BDLI formulates the following objectives, among others:

- Orientation towards transnational competence areas in the shape of the BAG learning units
- Integration of the contents of (at least) the CAT A licences
- Confirmation of (at least) the equivalence of the final examinations and the EASA tests
- Integration of the certification by the LBA (concerning EASA) and the Ministry of Economics (concerning the appropriateness as a training provider)
- Admission to tertiary education

At the time of completion of this report it can be stated that the new regulations have been implemented in France, but without introducing any changes in terms of structure or content. The existing curriculum was simply condensed in order to achieve the reduction of the training period from 4 to 3 years.
In Germany the social partners attained their goal to develop an occupational profile which includes the EASA CAT A modules (see work packages 3 and 7).

3. Permeability

The project investigated the situation in the 4 countries concerning the *admission* of vocationally qualified learners to the system of higher education, the *recognition* of learning outcomes achieved in VET, and the willingness of stakeholders in tertiary education to modify this practice in the light of new developments in the VET system, especially the formulation of learning outcomes in accordance with the ECVET specifications. To anticipate the result: Similar to what was already found out by more comprehensive studies on this topic (e.g. ANKOM), the representatives of higher education institutions held the view that a recognition of vocational learning outcomes in traditional degree programmes of the engineering and technology sectors was almost impossible due to the fundamentally different theoretical (especially mathematical) requirements. For instance, one of the two projects concerned with permeability in science and engineering came to the conclusion:
"The degree programmes in question, 'mechanical engineering' and 'electrical engineering and information technology', put special emphasis on the theoretical fundamentals that are usually learned in the first semesters in the 'fundamentals of engineering' course. This theoretical knowledge builds upon the scientific and mathematical subjects at the level of the university entrance qualification and cannot be substituted with professional experience. When our cooperation partner PFS Erfurt tested the potential for accreditation of the IVET qualification of industrial mechanic and micro technologist and of the upgrading training of state-certified engineers with the specialisations mechanical engineering and electrical engineering, the result was that what can be expected from VET graduates transferring to higher education is at best a knowledge equivalent to the level of the university entrance qualification. Therefore there is only little potential for accreditation in the 'fundamentals of engineering' course. In the higher semesters teaching takes place in practice-oriented specialisations. Here we find potential for accreditation, but the opportunities are less extensive in broad degree programmes than in specialised programmes where accreditation is sought for closely related occupations" (http://www4.tu-ilmenau.de/bkus/dedi/bkus/media/pdf/TU-Ilmenau_bkus-ing_Abschlussbericht_2008_Bericht.pdf S.48). The model could not be tested during the project period due to a lack of interested students. The second ANKOM project in science and technology (University of Hanover) was exclusively addressing master craftspeople.

Given the anti-harmonisation clause, ECVET also aims only to reformulate (aspects of) existing curricula in a coherent way in terms of learning outcomes. Therefore the practice of recognition would not change if ECVET were implemented in the national VET systems. If technology-oriented vocational learning units were to be aligned with the 'classical' modules in higher education, one would have to add an amount of theoretical knowledge so great that the intention of the VET systems to include also 'practically talented' learners would be impeded. However, the expert interviews in this work package yielded valuable information on similar concepts which are very

interesting, namely the “Semta Higher Apprenticeship in Engineering Technology”, the “Licences Professionnelles” and the “Dual Studies @ Airbus”. These programmes combine vocational and academic qualifications in a non-consecutive way. The vocational part of the dual degree programme at Airbus is even organised on the basis of some AEROVET learning units, and the course includes compulsory mobility phases (see below).

France

In aircraft manufacturing and maintenance there are 3 Bac Pros, 2 of which were taken into account for the purposes of this project. The third one was established only in 2006. The two qualifications we examined are closely related and constitute two options within one common aeronautics qualification (Bac Pro aéronautique): one option for electronics technicians (mécanicien système avionique) and the other for mechanics (mécanicien système cellule). Both options are oriented towards manufacturing and maintenance alike.

A specialisation with a focus on maintenance is possible after the Bac Pros by means of a one-year additional course (Mention Complémentaire – MC), which includes four options:

- aviation MC option avionics (avionique)
- aviation MC option piston engines (moteurs à pistons)
- aviation MC option jet engines (moteurs à turbines)
- aviation MC option rotorcraft with jet engines

These additional qualifications are basically intended to prepare for the EASA Part 66 licences (see above).

Another opportunity for continuing education is to undergo a 2-year course that leads to a BTS[3]. In the French NQF this qualification is situated at level III (EQF level 5) and belongs to (short-cycle) higher education. In aeronautics there is only one qualification of this type, the BTS Aéronautique. It was reorganised in 2009, this time with the participation of manufacturing experts where formerly only maintenance and fitting personnel had been represented. This means that nowadays the reference profiles (référentiels d'activité professionnelle), which represent the contents of skilled work, take into account both types of activity. The qualification leads to functions in the middle management. Due to the fact that this qualification is classified as higher education it is included in the ECTS system.

Apart from the training of engineers the French VET system features another opportunity for specialisation in aircraft maintenance. Since 1999 the Licences Professionnelles (Professional Bachelor degrees) offer a qualification in this area. These courses are organised at university level and may be offered by any of the components of the university (IUT, UMR[4]…). The course takes three years, and like all the other qualifications discussed so far (CAP, Bac Pro, BTS) it may also be

[3] Brevet de Technicien Supérieur = Certificate of higher-level technician

[4] IUT = Institut Universitaire de Technologie = university institute of technology ; UMR = Unité Mixte de Recherche = combined research unit

undergone in the framework of an apprenticeship contract (apprentissage). The Bachelor degrees are situated at level II of the French NQF and level 6 of the EQF. Like the BTS they are subject to the ECTS.

This brief overview might suggest the idea that there is a continuum of qualifications, a 'ladder' that would allow for permeability. From a formal perspective the Bac Pro gives access to university, but official statistics reveal that despite this formal permeability the graduates who have completed a Bac Pro seldom proceed to a BTS course. Whether this is their own decision or due to coercion is not clear. Anyway, the selection mechanisms at schools in reality are favouring other types of the Baccalauréat: 86% of the students in the aeronautical BTS course have a technology-oriented Bac STI (Sciences et Techniques Industrielles – industrial science and technology), 10% have a general Bac S (Scientifique) and only 4% come from the Bac Pro track[5].

A similar "de facto" selection takes place in the admission procedures at universities fro the aeronautical Licences Pro. According to the statistics available to Céreq, which come from the Ministry of Education, it is only 1 to 5 Bac Pro graduates per academic year who complete a Bachelor course.

Permeability is limited by the fact that all programmes that belong to the level of university education (BTS, Licence Pro) include a large proportion of theoretical contents for which Bac Pro students are not adequately prepared. For the AEROVET project this means that there can be no immediate recognition of prior vocational learning.

On the whole the qualifications in the aerospace industry constitute an interesting and instructive example of the complexity of implementing the ECVET recommendation. The French system shows how big the gap can be between VET units that belong to a training programme, units that (simultaneously?) serve a certification process, and finally units that aim at the international standardisation of goods and services.

[5] Siehe letudiant.fr http://www.letudiant.fr/etudes/btsdut/mecanique-et-automatisme/bts-maintenance-et-exploitation-des-materiels-aero.html

Spain

The higher level technicians in the aerospace industry are *eligible* for access to the following university programmes in engineering:

- Diplomado en Máquinas Navales.
- Diplomado en Navegación Marítima.
- Diplomado en Radioelectrónica Naval.
- Ingeniero Técnico Aeronáutico (todas las especialidades).
- Ingeniero Técnico Agrícola (todas las especialidades).
- Ingeniero Técnico en Diseño Industrial.
- Ingeniero Técnico Forestal (todas las especialidades).
- Ingeniero Técnico Industrial (todas las especialidades).
- Ingeniero Técnico en Informática de Gestión.
- Ingeniero Técnico en Informática de Sistemas.
- Ingeniero Técnico de Minas (todas las especialidades).
- Ingeniero Técnico Naval (todas las especialidades).
- Ingeniero Técnico de Obras Públicas (todas las especialidades).

With regard to the aeronautics sector the Spanish system offers 5 academic titles, of which 4 (Ingeniero Técnico) are offered at the Bachelor level while the 5th is an advanced degree (Bachelor + Master).

Spanish academic degrees for the aerospace sector by SQS and EQF levels		
	SQS	**EQF**
Title		
Ingeniero Técnico Aeronáutico, especialidad en Aeromotores	*4*	*6*
Ingeniero Técnico Aeronáutico, especialidad en Aeronavegación	*4*	*6*
Ingeniero Técnico Aeronáutico, especialidad en Aeronaves	*4*	*6*
Ingeniero Técnico Aeronáutico, especialidad en Aeropuertos	*4*	*6*
Ingeniero Aeronáutico	*5*	*7*

Tab. 2: Spanish academic degrees in the sector

As the Spanish qualifications system does not allow for the recognition of elements of the vocational curricula in higher education, the modules recognised via ECVET cannot be used for university studies.

UK

Semta[6] has developed a "Higher Apprenticeship in Engineering Technology" including NVQ Level 2 (basic skills), Foundation Degree (or HNC / HND / Bachelors Degree), NVQ Level 4 as well as Key Skills Level 3. [These levels still refer to the old NQF (UK) since the programme was set up already in June 2008.] The estimate was that this programme would be appropriate for highly motivated and talented young people looking for an alternative to full-time studies. The programme is also regarded as a framework for the continuing professional development of skilled workers who wish to upgrade to the level of engineers within their enterprises. What is crucial about this programme is that it is an integrated one: The learners have to demonstrate the application of their knowledge, skills and competences in work and learning environments of the vocational part as well as of the academic part. As the programme is competence-based there is no need to complete the vocational parts before embarking on the academic track. All parts are open for permeability. The learning outcomes are completely independent of the context of acquisition (VET, HE or anywhere else) since the assessment of the NVQ components requires a demonstration of coherent competence. Individuals are thus given the opportunity to demonstrate their knowledge and experience in order to achieve higher-level qualifications in the VET system as well as in higher education. For the aeronautics sector Semta proposes a holistic demonstration of the acquired knowledge, skills and competences by means of a practical work assignment, which is in line with the considerations on assessment in the AEROVET project.

As the system is modularised, all learners have to complete a minimum of 6 units of the Level 2 NVQ Performing Engineering Operations (PEO) or an equivalent programme. This means that all learners are required to cover fundamental aspects of the practical training that need to be fulfilled by all apprentices in the engineering sector. At the top end there is also the possibility to be admitted to the Engineering Technician or the Incorporated Engineer Professional. Therefore Higher Apprenticeship is a professional pathway that supplies the industry with high-class technicians and engineers who have practical skills and a university degree. The pathway is recognised as the one that covers most of the professional requirements for the Incorporated Engineer qualification. The university qualification is attained through part-time studies while learning and working in the company occupies most of the participants' time – the workers continue to be on salary. What they learn during their work and training in the enterprise can explicitly be integrated into their study programme: for instance, work-based projects, learning logs and reflection on their experience in the workplace. Higher Apprenticeship thus includes full permeability. This permeability is also expressed by the fact that it is possible to

[6] SEMTA, the Sector Skills Council (SSC) for science, engineering and manufacturing technologies covers the core science, engineering technology sectors across the UK economy.

complete the work-based and university-based programmes side by side, which takes less time than undergoing them one after another. Companies, training providers, colleges and higher education institutions (HEI) can be involved in partnerships for the purposes of this programme. The Higher Apprenticeship programmes are supposed to respond to the change in the labour market, which is characterised by an increase in the employment of engineers and technicians at higher levels while employment in the traditional craft trades is declining. Technological evolution, quality improvement and the necessity to reduce costs are factors that fuel this tendency.

There are five features of the foundation degree that make the latter an instrument to support permeability between VET and HE: involvement of employers; development of skills, understanding and knowledge (technical and work-specific skills that are relevant for the sector); application of skills in the workplace; accumulation and transfer (foundation degrees include 240 credits, 120 at level 4 with at least 25% in-company training, and 120 at level 5 with 25% workplace training, too); and the option of at least one specific Bachelor degree. The optional Bachelor degree would consist of 120 credits at level 6. Further education, including the Initial Professional Development for a degree in engineering, comprises 60 credits at level 6; a Master's degree requires 180 credits at level 7. These programmes may have a duration of 2, 3 or 4 years. The learning process can be accelerated even further by the "Accreditation of Prior Experiential Learning" (APEL) when the learners are able to demonstrate equivalent knowledge and skills (acquired through VET, work experience or informal learning) covering the credits in question. APEL and credit systems are effective when there is a shared understanding of the learning outcomes from the foundation degree, the skills, qualifications and competences of the learners.

The development of Higher Apprenticeship is compatible with the principles of ECTS and ECVET. Accordingly the system makes it possible to accumulate credit points as well as modularised vocational qualifications, including permeability (and exemption according to APEL, if applicable) between vocational and higher education. This is possible because all qualifications in the two sectors are formulated in terms of learning outcomes as coherent sets of knowledge, skills and competences. There are also credit transfer arrangements; learning outcomes can be used as a basis for mobility in VET or HE. Compared to consecutive approaches the training period is shorter and can be further reduced with the help of APEL.

The framework does not impose any restrictions with regard to admission, e.g. minimum qualification requirements. However, the admission requires that learners demonstrate their potential to attain NVQ level 4 as well as knowledge and skills that are sufficient for learning Key Skills at level 3 and for a vocational qualification at level

4. The typical target users are people with appropriate A-Levels or vocational qualifications like a national certificate/diploma in engineering, or experienced workers who aim at continuing professional development.

The IET course should take place during the final year of Higher Apprenticeship in order to utilise the additional knowledge and skills acquired until then. Successful completion of the course is equivalent to a three-year Bachelor's degree. The IET course must be based on professional work and be independent of the learning units of NVQ level 4, but the work performed during the completion of level 4 may be used as a basis. The Institution of Engineering and Technology (IET) is responsible for the assessment. Learners are invited to submit a proposal for their training course to IET in order to have confirmed the appropriateness of the proposed work.

Germany

The situation is most complicated in Germany. Unlike the situation in the other three countries, the attainment of a vocational qualification in the sector does not give access to higher education. Some VET schools (e.g. G15 in Hamburg and TBZ Bremen) are offering, on their own initiative, additional lessons that make it possible for interested and motivated students to take an examination for the entrance qualification for universities of applied sciences at the end of their training. This qualification gives access to all universities of applied sciences in Germany. Students who complete a Bachelor's degree there can proceed to Master's courses at universities. On the other hand, VET students who do not take this extra examination or attend a VET school where this option is not available are excluded from all higher education programmes, even those related to their vocational domain. Access to higher education through a vocational pathway thus depends on the participation in an additional learning opportunity which does not involve any formal recognition of the vocational learning outcomes. However, the widely discussed shortage of graduates in the STEM (science, technology, engineering, mathematics) subjects has prompted universities and universities of applied sciences to strive for an increase in the number of *successful* students, and to reformulate their admission requirements so as to address wider target groups than they have traditionally been used to in the past. But there is some scepticism as to whether the admission of vocationally qualified learners is a promising approach. A professor of mathematics in the mechanical engineering department at a large university expressed her reservations as follows: "We already now have dropout rates of over 40%. And in 90% of these dropouts the reason is that the demands in mathematics are too high for them. This includes students who majored in mathematics in upper secondary education, so wouldn't VET students have even greater difficulties?" The universities of applied sciences also believe that the theoretical and mathematical contents of their modules are incompatible with vocational learning units. For instance, the "Mechanical Engineering B.Eng." programme at the Hochschule Bremen University of Applied Sciences offers students with relevant vocational qualifications only the opportunity to recognise their qualification as a substitute for the compulsory 13-week work placement prior to the first semester.

It has to be concluded that recognition of vocational learning beyond the coverage of internships within traditional study programmes is impossible when the universities wish to stick to the contents of their programmes while at the same time the vocational orientation of the vocational learning units is maintained.

Nevertheless a closer linkage of vocational and academic qualifications remains on the agenda in Germany, especially in view of the fact that the existing upgrading qualifications in the sector are considered not exactly future-proof: "The normal, at least the formal qualification steps are master craftsman and state-certified engineer [*Techniker*]. And it should be known to everybody that these two pathways are dead ends. This is to say that once you have attained these qualifications you hardly can go any further" (a training coordinator). According to the consortium's view an option

for the future would be to establish specific learning opportunities for VET graduates at universities, i.e. a vocationalisation, as it were, of parts of higher education instead of an academic drift of vocational education. This approach could help the qualification of state-certified engineers out of its present dead end and allow for the recognition of vocational learning outcomes at the tertiary level. Our cooperation partner Airbus has already developed a number of “dual study programmes” that make it possible to acquire a skilled worker’s qualification and a Bachelor’s degree side by side. Unlike the existing *Techniker* programmes these study programmes are fully connective, i.e. graduates have the opportunity to transfer to a Master’s programme.

The training contents defined by Airbus as shown in the sample time frame of the study programme in Fig. 1 (turquoise areas) correspond to the AEROVET learning units 1, 2, 4, 5, 6 and 11.

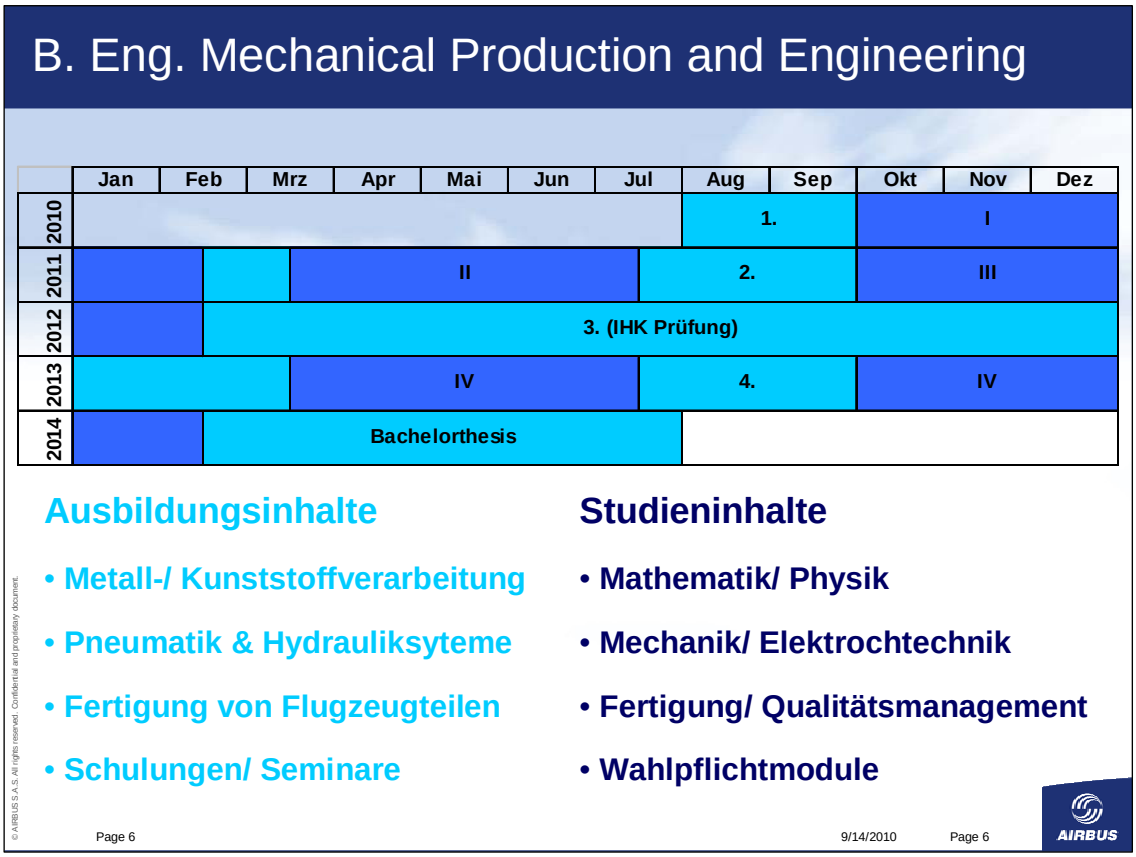

Fig. 1: Time frame for the dual study programme © Airbus

Like the UK Higher Apprenticeship programmes, the dual study programmes were developed recently. The difference from Higher Apprenticeship is that there is no possibility to attend the vocational and academic parts consecutively, and admission is not possible without an entrance qualification for a university or university of applied sciences. However, it must be emphasised that the vocational training is an add-on, i.e. learning outcomes in one part of the programme cannot be accredited in the other. In addition, these approaches exist only at universities of applied sciences.

University degree programmes, which are oriented towards research, are not available in this dual form.

4. Summary

According to the findings of the consortium, the obstacle that prevents more than marginal recognition of vocational learning outcomes in traditional tertiary education lies ***not*** in the formulation of these outcomes (input vs outcome or coherent vs isolated), but in the contents hidden behind these formulations. Although the sometimes identical formulations may suggest the opposite, the learning outcomes in the technology sectors are ***not of the same type***. This statement is emphasised here because one often meets with statements to the contrary. In order to achieve a meaningful recognition in traditional study programmes in engineering, it would be necessary to supplement the vocational learning units with mathematical and theoretical contents to such an extent that these units would lose their vocational character. The approaches of "Higher Apprenticeship", the "Licences Professionnelles" and the dual study programmes are more promising. They take the differences as their starting points; the university modules (usually corresponding to those in traditional study programmes) complement the vocational learning units, which are different in type. Here we find an advantage of the two-cycle structure in tertiary education: After completion of a dual study programme students have the opportunity to proceed to a traditional Master programme if they are interested and meet the admission requirements.

Another result is that there is a high degree of correspondence between the contents of the EASA modules on the one hand and the AEROVET learning units and the German and French VET curricula on the other. Here the reorganisation appears to be an example of good practice, especially with regard to the integration of the EASA modules into the learning units or the learning fields. Due to the principle of subsidiarity this solution cannot simply be "exported", but it may well serve as an example for other countries.