

# PROQUALINT, LEONARDO DA VINCI PROGRAMME. DEVELOPMENT OF NDT STUDY MATERIAL IN DIFFERENT LANGUAGES

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*The qualification of Non-Destructive Testing (NDT) personnel is guaranteed through the certification process. The diverse standards of personnel certification require a minimum of training previous to the examination, and establish training schemes.*

*Several standards have been written. The training, experience and visual acuity requirements have been established, even a big interest exists on the development of syllabuses for every method and level; furthermore, for the time being, an international standard has been published devoted to the certification of NDT technique personnel.*

*However, didactic material for teachers and students comprising the knowledge according with the syllabuses, have not yet been developed; they have to acquire this knowledge regarding the qualification level foreseen.*

*The objective of the project is to work out an European schemes for the NDT personnel training, for level 1, level 2, and level 3 in the different methods, contributing to the later qualification.*

*In this sense, the PROQUALINDT project, funded by the European programme Leonardo, has been developed, resulting in study manuals written in four languages: German, English, French and Spanish, and, now, the PROQUALINDT 2 project is devoted to the review, updating and translation to the languages of the partners countries (Czech Republic, Hungary, Croatia and Portugal), the documents coming from the first project.*

*It provides a common document for training and study, reinforcing the harmonization obtained through the certification standard.*

## 1 INTRODUCTION

The European standard EN 473 devoted to the qualification and certification of personnel performing NDT was issued in 1993. After the review done in 2000, it is a harmonised standard for the application of the essential requirements included in the European Directive on Pressure Equipments 97/23/CE, and, recently (2012), and important new step on this harmonization has been done with the issue of the EN ISO 9712 standard, which merges both EN 473 and ISO 9712 standards. This standard establishes that the certification must be done by independent bodies and has been adopted by the majority of the European Union countries.

In this way the action to develop the certification tests for the personnel performing NDT is defined and harmonised for all the UE countries; however, it is necessary to give an answer to the lack of methodology as well as to unify texts that develop the minimum required programme recommended in the EN 473 and ISO 9712 standards, as well as to provide to the bodies, teachers and candidates an uniform material integrated with the norms and recommendations of the UE.

These lacks have been detected thanks to the continuous participation in the different international forums of the partners. As it will be explained afterwards, the partners of this project are, in each of the respective countries, the person in charge of the personnel certification, and therefore, without any doubt, they are the ones that have a more exact knowledge about the training in this sector.

Along the years 2004 - 2006 the first PROQUALINDT was developed. The project constitutes a fundamental advance in the professional training of the NDT technicians in different education fields (ruled, occupational, continuous) and implies an innovation in diverse aspects. On the one hand, every training centre has prepared their texts in a isolated way; so, it is a question of developing among all the partners, educational tools for the NDT operators, with the consensus and acceptance of all, what will make easy the acknowledgement, the transfer and the acceptance of the operators training among the various countries and, on the other hand, will strengthen the relationships and the information exchanges among the bodies that certify NDT operators. As a practical example, a worker, that had performed his NDT training in Spain, could be able to apply to be examined in other of the participant countries.

To prepare the material that set up the final product of the project we count on:

- The partners experience in the preparation of European norms and standards.
- The CEN documents, standards and technical recommendations on qualification and certification.

## **2 THE PARTICIPANTS FIRST PROQUALINDT THE PROMOTER**

The CNFPO (National Centre of Vocational Training) of Cartagena (Spain) is a training centre depending on the Servicio Regional de Empleo y Formación of the Autonomous Community of the Murcia Region. It seeks, as project promoter, to furnish its experience in the starting and development of European projects, coordinating all their phases but, at the same time, as well as its experience in the NDT field as Centro Nacional de Control de Calidad (National Centre of Quality Control), and in the preparation of didactics means under methodologies related with the professional training.

The Cartagena centre belongs to the occupational training national centres network in Spain and it is considered as National Centre for Chemical Industries and Enterprises Services. Among its functions are the unemployed training in different areas (chemistry, NDT, welding, informatics), training of trainers, preparation of programmes for courses to obtain the professional certificates in the areas above mentioned, and so on.

## **THE PARTNERS**

The association created for this first project was composed by AEND (Spain), COFREND (France), BINDT (United Kingdom) and DGZfP (Germany) that represent in the respective countries the maximal authority in all aspects related with the NDT; among their activities is the certification of the operators that work in this tests sector.

In the table 1 is shown the NDT method whose documents has to be developed by each partner.

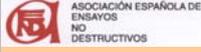
PARTICIPANT PARTNERS	
<b>PROMOTER</b>	
	CNFPO National Centre of Vocational Training Cartagena – Spain
	<b>PENETRANT TESTING</b> <b>PARTNERS</b> Spanish Society for Non Destructive Testing Madrid – Spain
	<b>MAGNETIC PARTICLE TESTING</b> German Society for Non Destructive Testing Berlín – Germany
	<b>RADIOGRAPHIC TESTING</b> British Society for Non Destructive Testing Northampton – United Kingdom
	<b>ULTRASONIC TESTING</b> French Society for Non Destructive Testing Paris – France
	<b>EDDY CURRENT TESTING</b>

Table 1 Partner and method

### 3 OBJECTIVE

The project objective is the preparation of an European programme for the training of professionals that perform NDT in the levels 1, 2 and 3, in the test methods included in the previous table, and that accomplishes with the requirements demanded in the certification.

After a study of the state of the art in the partners countries, it is sought the preparation of didactic materials for students and teachers, the same for all the participating countries, issued in every one of the languages. As basic documents to start are:

**EN 473** *Qualification and certification of personnel performing END. General principles.*  
**CEN ISO/TR 25107** *Non-destructive testing. Guidelines for NDT training syllabuses.*

Once finalised the project it will be at disposal a model of uniform training in the 5 methods shown in the table and in the 3 qualification levels mentioned in the standards on personnel certification.

This model will be composed by:

- ❖ A didactic guide for each method, in the three levels.
- ❖ A student manual for each method and level.
- ❖ A teacher manual.

### 4 DEVELOPMENT

The structure of the project is shown in the Fig. 1 and it is divided in the following work packages.

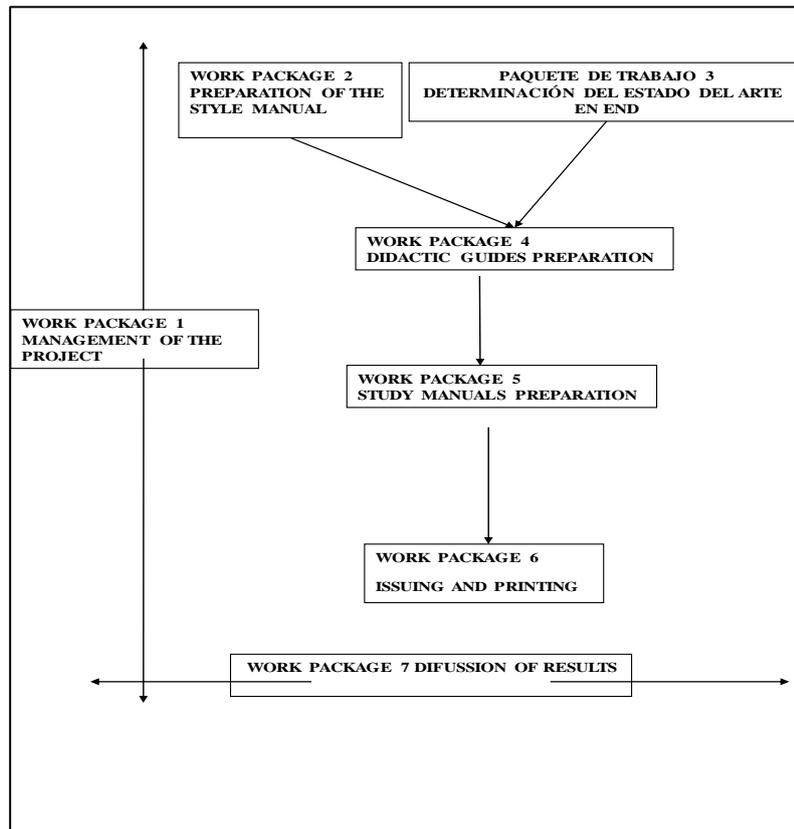


Figure 1 Structure of the project

### **WORK PACKAGE 1: PROJECT MANAGEMENT.**

It comprises the leadership, coordination and continuous monitoring of the project during the whole execution period. In it, are established the type and number of evaluations needed to ensure the fulfilment of the marked objectives, implementing a quality management of the project.

### **WORK PACKAGE 2: PREPARATION OF THE STYLE MANUAL.**

It includes the preparation of a style manual where are collected the writing rules, including terminology, symbols, abbreviations, typography, and so on. Its use is mandatory for all the partners and therefore any document generated must be adapted to it.

#### **Objectives**

To establish the mandatory norms for the issue of all the writing material.

To collect the reference documentation for the issue of the texts.

To suggest rules related to the terminology, typography, design, abbreviations, symbols, and so on.

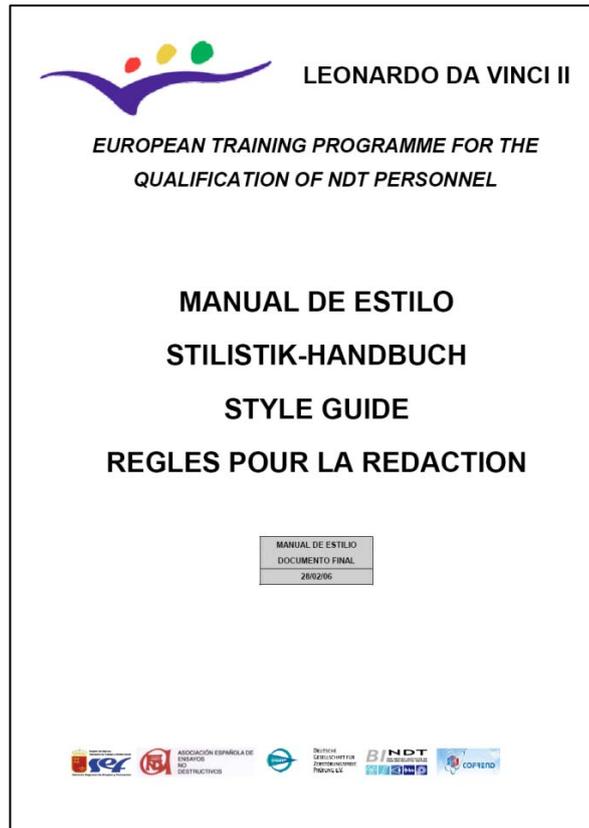


Figure 2 Cover of Style Guide

The international standards on terminology are referenced in the style manual. The terms not included in the standards are also considered, to reach agreement among the authors that are of different nationalities.

### **WORK PACKAGE 3: KNOWLEDGE OF THE STATE OF THE ART**

Leaving an unique questionnaire for the collection of data for each one of the partners, a final document of conclusions has been prepared that allows to know the state of the art regarding the training in non-destructive (NDT) testing as for the didactic existent means and the necessities of the same ones in each participant country in the project, and that will serve as departure for the realization of the works included in the work packages 4 and 5 of the project, establishing the reach of each one of them.

### **Conclusions**

From all that has been exposed, it can be established the student type which attends the non-destructive testing courses of training, this student is characterized by: Man with ages comprise between 25 and 40 years old, with an academic education/training of High (Secondary) school, these two characteristics make that in the training is necessary to think of people that, between their academic studies and the formation in NDT, there is a time in which they have left the studies.

As for the type of imparted training it is observed that there is not implemented the education/training On-line, and that the semi-presencial teaching is only observed its use in Spain, being majority the present training. The teaching runs to private

companies that impart the training to their own workers or that among their activities they lend training services.

From among the existing programs of topics used in the training stand out the recommendations of the ICNDT and those published by CEN.

The material used by the training centres that is surrendered to the students is prepared by each training centre in a specific form, although they exist a series of bibliography of advisable reading besides the standards that are published with general character, see series of EN and ISO standards, and others of widespread use as ASTM, ASME, etc norms and codes. Data have not been obtained as for program of practices neither as for means, which makes to think that it will have to be focalized this aspect in the realization of the didactic guides as in the preparation of the study materials.

#### **WORK PACKAGE 4: DIDACTIC GUIDES PREPARATION.**

Didactic guidelines for every one of the methods and levels have to be prepared. The starting point will be the document obtained as result of the work package 3. These guides will contain general orientations, the description of every didactic unit and the evaluation tools.

This document will be a novel advance very important in the harmonization of the personnel qualification and certification, since it gives general orientations to prepare the study manuals contents as well as the didactic helps to impart courses.

The general orientations consist in:

Objectives. Student requirements. Courses requirements. Subjects. Courses timetable. Facilities. Equipments and materials. Bibliography.

#### **WORK PACKAGE 5: STUDY MANUALS PREPARATION.**

Starting from the directives collected in the didactic guides performed in the work package 4, to prepare study manuals that meet all the contents for the methods and levels that are object of the project.

#### **WORK PACKAGE 6: ISSUING AND PRINTING.**

Every partner will prepare the corresponding material in his own language, afterwards every one of the other partners material will be translated to his own language, taking in charge its issuing and printing using the means previously determined.

### **5 PRESENT DEVELOPMENT**

At present a second project, under the umbrella of the Leonardo European programmes, is being carried out: TRANSFERING EUROPEAN TRAINING PROGRAMME FOR THE QUALIFICATION OF NON-DESTRUCTIVE TESTING PERSONEL "TRANSFER PROQUALINDT", consisting of the review, and updating of the didactic materials

obtained in the previous project to be, later on, transferred to other EU countries, contributing to a bigger harmonization. In this case the participants are:

### **THE PROMOTER**

The national center for vocational training of Cartagena (from now on CNFPO) is a training center under the regional service for employment and training (from now on SEF) of the autonomous community of Murcia (CARM).

Its main task in the project will be to act as a promoter, carrying out the coordination, management and control of the project, but also participating actively in all work packages included in the project.

### **PARTNERS**

#### **ASOCIACIÓN ESPAÑOLA DE ENSAYOS NO DESTRUCTIVOS (AEND)**

The Spanish Society for Non-destructive testing (AEND) is a non-profit organization. The main targets are: To promote and to facilitate the implantation of techniques for the NDT improvement. To promote the investigation in the different methods from tests. To promote and to sponsor meetings, conferences, congresses, colloquies and others. To lend technical attendance to that asks for it. To promote the formation of the personnel who takes part in activities related to NDT. AEND maintains a wide range of set training programs on non-destructive testing. Certification of NDT personnel by an independent body CERTIAEND accredited by ENAC (Spanish accreditation body). It collaborates in the preparation of standard, participating in national and international committees. It promotes and it organizes studies, meetings, seminars and interchanges of documentation and publications, workshop and congresses. It publishes periodic and scientific publications.

The role of AEND in this project is essential, as it is the meeting point between the project serving as a reference (PROQUALINDT) and the present. As an active partner of the project, its tasks will include: Carry out the review and updating of the reference materials in Spanish, as well as the English translation thereof.

#### **CZECH SOCIETY FOR NON DESTRUCTIVE TESTING (CNDT)**

Czech Society for NDT is a non-profit public organization whose main objective is to promote the research, development, and practical use, activities in the field of NDT/NDE of materials and structures in all industrial areas.

Czech NDT Society seeks to assure quality and proficiency in the field of NDT. CNDT informs its members, and also the common public, about the latest NDT achievements, acquaints them with the newest testing technologies. CNDT gradually builds up an Open Information System in NDT, provides consulting, and joins specialists with industrial users of NDT methods. CNDT significantly participates in the implementation of standards in the Czech Republic. Society is involved in the certification and accreditation procedures and effectively collaborates in preparing and organization of training and qualification courses of NDT personnel at all levels. Considerable attention is paid to supporting of students and young people interested in the NDT.

### **HRVATSKO DRUŠTVO ZA KONTROLU BEZ RAZARANJA (CrNDT)**

Croatian Society of NDT (CrSNDT) is a non-profit association of experts and professionals with an overall mission to promote NDT for the benefit of the NDT profession, users of NDT and the wider community in relation to safety and security. CrSNDT is a full member of EFNDT (European Federation for NDT). One of the very important goal of CrSNDT is Education, Qualification and Certification of personnel in accordance with EN 473 and ISO 9712 for which CrSNDT have been accredited by National accreditation agency according to EN ISO 17024 and signed the Mutual Agreement on Recognition of Certification, MRA, of EFNDT.

Education is CrSNDT priority since NDT is very demanding profession for the benefit of safety and safety is national priority in Croatia.

CrSNDT Education center provide training on Croatian language for Croatian industry and wide, since the Croatian language is understandable in neighbor countries like, BiH, RS, SIO, Macedonia, Monte Negro etc. Education and certification is provided for the 3 levels of qualification and the 7 following methods: VT, MT, ET, PT, UT, RT and IT.

### **MAGYAR RONCSOLÁSMENTES VIZSGÁLATI SZÖVETSÉG (MAROVISZ)**

Marovisz represents the NDT Hungarian Community: promotes and protects the interest of both labs and NDT specialists in the public life, at a national and international level. It also makes easier the training and certification of NDT personnel and participates in the applications of training actions and certifications. It also contributes in increasing, in a permanent way, the competences pertaining to NDT personnel. MAROVISZ represents its members' interests in different national organizations. (Hungarian Association for Welding Technology and Material Testing, Hungarian Standards Institution, Scientific Society of Mechanical Engineers, National Accreditation Body, etc). The work at MAROVISZ is organized in special commissions, management of presentations, meetings, round tables, etc. Moreover MAROVISZ organizes at NDT Biannual Conference and an exposition with international participation, as well as international conferences in Hungary.

### **ASSOCIAÇÃO DE LABORATÓRIOS ACREDITADOS DE PORTUGAL (RELACRE)**

RELACRE, Association of Accreditation Laboratories in Portugal, performs in the community of labs and tests, contributing to its development and offering more reliability in its results.

The Non Destructive Testing Sectorial Forum was set up within RELACRE and its main objective is to contribute to the enhancement, development and progress, both technical and scientific in the NDT areas in Portugal.

In order to achieve its objective, the Forum is responsible for promoting and facilitating the implementation of management and improvement techniques applied to the NDT , in industries and services; promoting the professional improvement of technical staff in the NDT, the development of methodologies and procedures, the exchange of experiences and information; contribute to the enhancing and development of NDT, related rules and certification processes; contribute to investigation, teaching and training;- promoting the organization of seminars and technical conferences.

As active partners of the project, its tasks will include: Attend all meetings of the association to be made during the life of the project. Cooperate with AEND in the process of reviewing and updating reference materials. Translate to mother languages all materials (didactic guides and study guides) once completed and validated the review process.

Organize and prepare the agenda with the project promoter at the meeting to be held at your institution. Edit both the didactic guides and manuals, as described in the existing style guide, so that all the material is available in electronic format, developed in paper and / or magnetic media at least the number of copies agreed by the association. Actively participate within the scope of its influence, in dissemination activities and publicity for the project.

It will be also support in incorporation of Project results in educational materials and the presentations will be organized for experts involved in education in your country and wider to help in better understanding of educational materials.

The structure of the project is shown in the Fig. 2 and it is divided in the following work packages

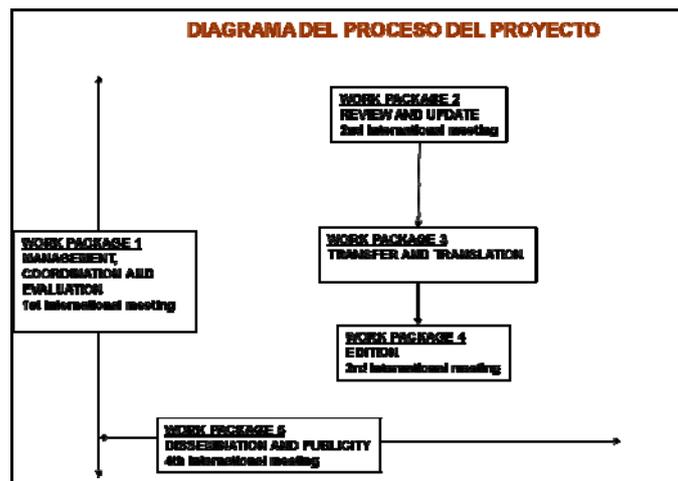


Fig. 2 Workpackages

## 6 PROJECT MAIN ADVANCES

### DIDACTIC GUIDELINES

During the review of the previous didactic guidelines, based on the technical report CEN ISO/TR 25107 IN can be pointed out 2 changes making this document fundamental with respect to the training courses programmes.

It refers to the new structure of the knowledge body of each method an each level, consisting of 12 didactic units, making possible to identify those parts which are common to all methods.

Other point is the description of every didactic unit through a file card in which, resides the programme, the general and specific objectives, as well as their evaluation, are identified

DIDACTIC UNIT Nº 4 LEVEL 2	TITLE: INSPECTION TECHNIQUE	Nº OF HOURS
<p><b>GENERAL AIM:</b> At the end of this Didactic Unit, students should distinguish the basic stages of the test by penetrant testing, as well as the advantages and disadvantages of the different process of penetrants which could be applied to inspect a component or item.</p>		
<p><b>SPECIFIC AIMS:</b> Students should be able of experimenting the test process by penetrant testing, as well as the materials used in each of them, and verify the compatibility between the different materials used in the test. The student will be able to:</p> <ul style="list-style-type: none"> <li>• State the requirements for treatment and identification of the work pieces to be tested.</li> <li>• Explain the operating conditions required for the materials used in the proper application of the various techniques involving liquid penetrants, including the stage of precleaning.</li> <li>• Describe the use of various drying procedures.</li> <li>• Explain the application of liquid penetrants to carry out a valid inspection. choose an appropriate procedure and determine the thresholds of the inspection.</li> <li>• Carry out the inspection of the work piece interpreting correctly the results.</li> <li>• Obtained and determining whether the findings correspond to real discontinuities or whether they are spurious indications</li> <li>• Describe the conditions required for the observation, interpretation and recording of the indications.</li> <li>• Interpret, evaluate and record the findings of the test in accordance with the written procedures.</li> <li>• Explain liquid penetrant methods for leak detection.</li> </ul>		
<p><b>CONTENTS:</b></p> <p><b>4.1 Basic stages of test by penetrant testing</b></p> <p>4.1.1 Preparation of the surface to be tested</p> <p>4.1.2 Application of the penetrant liquid, time of penetration</p> <p>4.1.3 Elimination of the excess of the penetrant, use of water, solvent and emulsifications</p> <p>4.1.4 Drying techniques</p> <p>4.1.5 Application of developers</p> <p>4.1.6 Observation conditions. Inspection and register</p> <p>4.1.7 Final cleaning</p> <p><b>4.2 Compatibility of the materials used in the test by penetrant testing</b></p> <p><b>4.3 Advantages and disadvantages of the different products and families of penetrants</b></p>		<p><b>Nº OF HOURS</b></p>
<p><b>PRACTICAL EXERCISES:</b></p> <ul style="list-style-type: none"> <li>- Tests of superficial preparation on the pieces subjected to test</li> <li>- Tests of application of the penetrant and penetrant removal</li> <li>- Tests of application of the developer</li> </ul> <p>Application of the test by penetrant testing on the pieces subjected to analysis and observation of the appearance of the indication</p> <p>Non-recommended practices in the carrying out of the different stages and observation of the influence of mentioned practices in the appearing of the indications.</p>		<p><b>Nº OF HOURS</b></p>
<p><b>DIDACTIC AND METHODOLOGICAL AIDS:</b></p> <p>Transparencies or computerized presentation will be used by the teacher to explain the subject, as well as the proper documentation of the equipment to be used if necessary.</p>		
<p><b>EVALUATION:</b> Open questions activity, as well as exercises with practical demonstration.</p>		
<p><b>DIDACTIC MATERIALS AND RESOURCES:</b> The practical exercises will be done using metallic brushes, cloths and products belonging to the family of coloured removable penetrants with Solvents.</p> <p>Items which have been working with characteristic discontinuities of them, metallic brushes, cloths and products belonging to the family of coloured removable fluorescent penetrants which could be removed with solvents, pyrometer, luxmeter or radiometers to measure the intensity of white light and UV-A radiation, UV-A radiation lamps.</p> <p>Overhead projector, computer, projection tube, board, projection screen</p>		

Table I Example of didactic unit

## STUDY MANUALS

Once structured the contents in the 12 didactic units described in the didactic guidelines, have been identified those common to all methods, also, it has been considered as very important the materials technology knowledge, their fabrication

processes and the types of defects associated, as well as those other materials damages coming from their use or service. All this has been structured in an independent manual common to all methods.

Besides, in the study manuals are included guidelines to evaluate according with the European standards.

## **7 CONCLUSIONS**

The materials obtained from this Project, namely didactic guidelines and study manuals, will be in Spanish, English, Portuguese, Croatian, Hungarian and Czech languages what will give a study common way in a broad European Union territory.

On the other hand, it gives continuity to the works which are been performing for the harmonization by means of standards, technical reports, mutual recognition agreements, etc, since it answers the requirements contained in these documents and deepens in the knowledges common base that the NDT technicians must possess