



## The World Organisation for NDT

Volume 7 Issue No 11

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October 2008

### CHAIRMAN'S MESSAGE

#### Good leadership will inspire others

It has been over four years since I was nominated and elected at the 16<sup>th</sup> WCNDT as the Chairman of the International Committee for Non-Destructive Testing in Montreal, Quebec. I hope I have been able to live up to your expectations.

During my presentation in Montreal, I addressed four objectives, which I felt were most important to continue the growing success of ICNDT:

- Complete and implement ICNDT Operating Policies and Procedures
- Legalisation of ICNDT
- Utilise resources available to the Chairman/Secretariat, *ie* communications, etc.
- Develop a Business Plan with tasks and critical path for implementation



I can now look back at the ICNDT activities during my term and be proud of what our membership has accomplished with respect to the objectives above. The most significant activities were the legalisation of ICNDT, the rewriting of our terms of reference and approval and utilisation of resources outside of the ICNDT Secretariat to improve the administration and communication of our organisation. The development of a business plan was built in stages as it lagged behind the approval and implementation of the operating policies and procedures and the legalisation. Now that the objectives have been completed, the stage has been set for the development of a Leadership Plan to take ICNDT to a new level.

#### What should be our goal for the new level?

ICNDT Terms of Reference identify *in the purpose* eight primary activities, two of which I would like to address:

1. "to encourage the formulation of international standards on non-destructive testing in collaboration with the International Organisation for Standardisation, and other standards bodies"; and
2. "to promote best practices in NDT and to encourage international harmonisation in this area".

It is this Leadership Plan that will direct us as leaders to accomplish the two activities above. We can no longer spend time talking about harmonisation of one standard, as we have worn out the word "harmonisation". We must now address a leadership plan that encourages our regional groups to take an international view of our purpose and address the activities as leaders who will do the right thing to accomplish the tasks to obtain recognition of non-destructive testing certification programmes. If we are to be true leaders in non-destructive testing, we will become further involved and do "the right things" to accomplish our goal and let the certification programmes' implementers "do things right" to meet certification requirements.

Good leadership will inspire others to do well.

Once again I would like to express my appreciation to all of you who have supported ICNDT and our activities. Our executive members, Policy and General Purpose Committee and regional representatives have gone beyond the call of duty to support our organisation. It would be remiss of me if I did not take this opportunity to thank my sponsor, the Canadian Institute for NDE, for its generosity in supporting my activities as ICNDT Chairman and ICNDT Secretariat. Through its funding, I was able to attend and represent ICNDT during the AFNDT Conference (Tunisia), EFNDT Conference (Berlin), APNDT (Auckland) and PANNDT (Buenos Aires). The following pages include some photographs depicting my involvement in some of these events.

Finally, on behalf of the ICNDT Executive and Policy and General Purpose Committees, we would like to express our appreciation for the hospitality shown by the regional organising committees and their host societies to organise our full assembly, committee and working groups meetings during their respective conference.

The hard work of our members has made my job much easier and very appreciative. I thank you and please enjoy the hospitality shown by the Chinese Society for Non-Destructive Testing (ChSNDT) at the 17<sup>th</sup> World Conference on NDT.

Douglas J Marshall  
ICNDT Chairman

Continued on pages 2, 4-5



## ICNDT Journal



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Your new ICNDT  
Journal is available  
for downloading from  
[www.icndt.org](http://www.icndt.org)

### ICNDT Workshop on Harmonisation of third-party NDT Personnel Certification to ISO9712 and aligned standards

**27 October 2008 – 09h00-12h00**

**Shanghai, China**

The Workshop will explore the  
following questions:

1. What do industry, regulators, and NDT personnel need from third-party certification schemes?
2. What are the key differences between ISO9712, EN473 and CP106? Why do they exist?
3. How can these differences be resolved? By choosing a preferred alternative, by compromise, or by allowing options?

and is intended to deliver recommendations to Standards Committees and Certification bodies.

### Dr Baldev Raj chosen for Distinguished Alumni Award of the Indian Institute of Science

Past Chairman and Honorary Member of ICNDT Dr Baldev Raj, Distinguished Scientist & Director, Indira Gandhi Centre for Atomic Research, Kalpakkam, steers the Fast Reactor Science & Technology programmes in India and is a specialist in materials science and engineering. He has been elected a Member of the German National Academy of Sciences, a unique distinction for his contributions to science-based technologies and passion in nurturing of young scientists and engineers in the country and the world.



He was selected for the Distinguished Alumni Award of the Indian Institute of Science, Bangalore, for the year 2007, for his contributions to science and technology of non-destructive evaluation of high performance materials and structures. His work on developing a robust fast reactor and associated fuel cycle technologies in India, which is paving the way for large-scale energy production through indigenous uranium resources in India, is recognised by the Indian Institute of Science.

### ICNDT Award Winners

#### **Pawlowski Award – For Major Contribution to Promotion of NDT International**

Award winners: Gerhard Aufrecht (Austria)  
and Anthony Sonneveld (Australia)  
Other nominee: Xu Yongchang (China)

#### **Roentgen Award – For Major Contribution to Science and Technology of NDT**

Award winner: Prof Vladimir L Chakhov (Russia)

Other nominees: CIVA the NDT Simulation Software (France), Drs V Vengrinovich and V Artemjev (Belarus)

#### **Havercroft Award – For Major Contribution to NDT Education, Training and Certification**

Award winners: Zemfira S Nikiforova, Svetlana A Popoudina, Svetlana I Zinovjeva, Vera V Levkovich (Belarus)

Other nominee: Dr Biryukova Nadezhda Petrovna (Russia)

#### **Sokolov Award – For Major Contribution to NDT Research**

Award winner: Rong S Geng (China)  
Other nominee: Gorkunov Eduard Stepanovich (Russia)

#### **Young Achiever Award – For Achievement of Young People in NDT**

Award winner: Andrey Evgenievich Bazulin

*Continued from page 1*

Special thanks to the following members of ICNDT who have dedicated endless time and resources on our behalf.

#### **ICNDT Executive Members:**

Chairman	D Marshall
PGP Chairman	G Nardoni
WCNDT President	R Gong
General Secretary	J M Farley
Membership	T Sonneveld
Treasurer	G Aufrecht
Member	R Link
Secretary	S Bond

#### **ICNDT Policy and General Purpose Committee Members** (in addition to the above):

Regional Members	F Herelli M Shafy L Dick M Ooka V Krstelj E Romero J Conte W Holliday C Guo V Klyuev H Kopineck M Onoe H Theiretzbacher S Vahaviolos
Honorary Members	
ICNDT Journal	D Gilbert – BINDT G Nardoni S Bond
ICNDT website	S Culman – German Society



**EF** European Federation for  
Non-Destructive Testing  
**NDT**



The Russian Society  
for Non-Destructive Testing  
and Technical Diagnostics

# 10<sup>th</sup> European Conference on NDT

[www.ecndt2010.ru](http://www.ecndt2010.ru)

Moscow 2010

June 7-11

**NDT - basis of safety**

## CHAIRMAN'S MESSAGE

### The Chairman spreading the word (1992 – 2008)



Austria (2007)



Egypt (2006)



Scotland (2007)



Berlin (2006)



Rome (2000)



Tunisia (2008)



Korea (2003)



Berlin (2006)

## CHAIRMAN'S MESSAGE



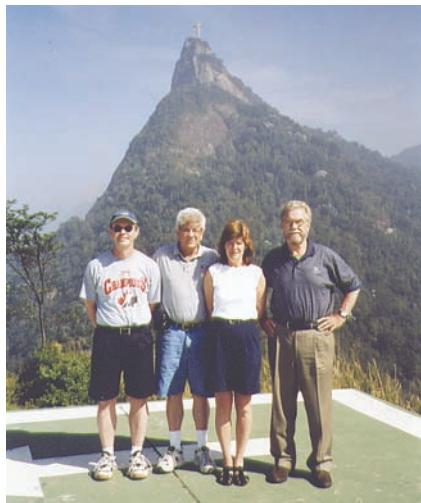
Korea APCNDT



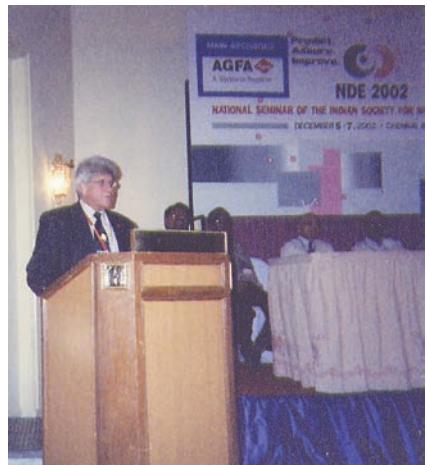
Morocco (2001)



Brazil 13th WCNDT (1992)



Brazil 3rd PANNDT



India (2002)



England (2000)



Australia APCNDT



New Zealand (2007)



USA (Anaheim)



Germany

**ASIA-PACIFIC****News from Malaysia (MSNT)**

*1st Technical Working Group (TWG) of Malaysian Inspection Body Accreditation Scheme (MIBAS), 5 March 2008 Training Courses on ISO 17024*

In responding to the need for the NDT laboratories to be accredited in accordance with ISO 17020, Malaysian Accreditation body, namely the Development of Standard, has established a TWG. The Group comprises representatives from Malaysia Nuclear Agency (nuclear Malaysia), PETRONAS, Construction Industry Development Board(CIDB), Atomic Energy Licensing Board(AELB), Malaysian Society for NDT (MSNT), Tenaga National Berhad Research (TNBR), Intestmal and SIRIM Bhd. The Development of Standard acts as secretariat for this group.

The TWG had its first meeting on 5 March at the Development of Standard, Putrajaya. It is expected that the Group will produce a supplementary document, which will be used by Malaysian members of the NDT community in conjunction with ISO 17020 documents in their effort to get them accredited.

Contact: The Malaysian Society for Non Destructive Testing (MSNT), Industrial Technology Division (BTI), Malaysian Nuclear Agency (Nuclear Malaysia), Bangi, 43000 Kajang, Selangor. Tel: +60-3-8925-0510; Fax: +60-3-8925-0907; E-mail: nassir@nuclearmalaysia.gov.my

**The 2nd Workshop on NDT with Asia-Pacific Countries****November 2008, Tokyo, Japan**

The Japanese Society for Non-Destructive Inspection (JSNDI) has been planning contributions to Asian countries for promoting NDT technologies from the twenty-first century onward. IAEA had been promoting NDT industrial application among the East Asian countries in the last century. The future planning committee in JSNDI took up this matter, and planned to hold a workshop as one of its most important subjects for the purpose.

JSNDI held the workshop on NDT for enhancement of cooperation with Asia-Pacific countries for three days at the JSNDI Office in Tokyo from 5-7 November 2007. A number of resolutions were adopted at the end of this workshop. The workshop was finished with great mutual understanding among the participating countries for the first time trial.

The 2nd Workshop on NDT with Asia-Pacific countries will be held from 13 to 15 November 2008 with the aim of improving cooperation between Asia-Pacific countries.

**Plenary Lectures at APCNDT 2009**

The 13th Asia-Pacific Conference on Non-Destructive Testing (APCNDT) Organising Committee picked up four plenary lecturers, and received informal consent. Plenary lectures and its affiliations are shown below. Plenary lecture title and further

information will be updated on the APCNDT 2009 website (<http://www.apcndt2009.com>) soon.

**Plenary lectures**

1. Speaker to be arranged  
The Tokyo Electric Power Company, Inc, Japan
2. Dr Glenn M Light  
Southwest Research Institute, USA
3. Prof Joon Hyun Lee  
Pusan National University, Korea
4. Dr Ibrahim Abd Nassir  
Malaysian Nuclear Agency, Malaysia

**Sponsorship opportunities at APCNDT 2009**

If you are interested in being a sponsor of APCNDT 2009, please contact the following conference secretariat.

**Major sponsor**

As a major sponsor you will receive the following benefits:

- 18 square metres of premium exhibition space
- One complementary registration including attendance at all conference sessions, lunches, morning and afternoon teas and social events, including the conference dinner
- Company logo and acknowledgement as a Major Sponsor in all printed materials
- Company logo and acknowledgement as a Major Sponsor on the conference website with hyperlink from your logo to your own website
- Introduction as a major sponsor at opening ceremony
- Full-page colour advertisement in the conference proceedings
- The opportunity to include promotional materials in the satchels
- A list of participants (full contact details of those participants who have agreed to name disclosure) at the conclusion of the conference

**Sponsor**

As a sponsor you will receive the following benefits:

- 9 square metres of premium exhibition space
- Company logo and acknowledgement as a sponsor in all printed materials
- Company logo and acknowledgement as a sponsor on the conference website
- ½ page colour advertisement in the conference proceedings
- A list of participants (full contact details of those participants who have agreed to name disclosure) at the conclusion of the conference

The Japanese Society for Non-Destructive Inspection (JSNDI), MBR99 Building, 67, Kanda-sakumagashi, Chiyoda-ku, Tokyo, 101-0026 Japan. Tel: +81-3-5821-5105; Fax: +81-3-3863-6524; E-mail: [apcndt2009@jsndi.or.jp](mailto:apcndt2009@jsndi.or.jp); website: <http://www.apcndt2009.com>

**International Conference on Operating Pressure Equipment**

Pressure vessels and pipework are the heart of most industrial activities. They are costly and complex pieces of infrastructure, which need to be designed, built, operated, inspected, repaired and decommissioned to the highest standards.

The demands on technology are high.

A conference, to be held 26-28 August 2009 on the vibrant and exciting Gold Coast of Australia, will aim to update and expand research cooperation and industrial knowledge in the wide area of piping, pressure vessels, valves and non-destructive testing and engineering analysis.

The conference has a tradition of industry/research interaction with important international contributions and an emphasis on practical applications.

Papers are thus invited for the Ninth International Conference on Operating Pressure Equipment (OPE) incorporating the Biennial AINDT Conference.

Papers will be accepted in two categories: research/technical and industrial/management areas.

An abstract of 100 words, outlining the content and conclusions, should be e-mailed to the Conference Secretariat: [events@materialsaustralia.com.au](mailto:events@materialsaustralia.com.au) or register your interest and abstract on-line at [www.materialsaustralia.com.au/OPE09](http://www.materialsaustralia.com.au/OPE09)

For further information, contact Materials Australia, Suite 205, 21 Bedford Street, North Melbourne, Victoria 3051, Australia. Tel: +61 3 9326 7266; Fax: +61 2 9326 7272; E-mail: [events@materialsaustralia.com.au](mailto:events@materialsaustralia.com.au)

## EUROPE

## EFNDT recognise voluntary effort in NDT

**E**FNDT wishes to recognise the work of individuals and organisations who provide outstanding voluntary effort in support of NDT Societies' activities.

So, each year, member NDT Societies are invited to nominate individuals or organisations they wish to be recognised.

On the occasion of the French Congress held in Toulouse in May 2008, Jean Farré, Treasurer of the COFREND South West Branch, was recognised for his continuous and voluntary action in promotion of NDT at the regional level.

He received a letter and certificate from Rainer Link, Director of EFNDT, on behalf of Mike Farley, EFNDT President.



R Link and J Farré

## International Symposium on NDT in Aerospace and Exhibition

**3-5 December 2008**  
**Stadthalle Fürth, Germany**

**T**his symposium, organised by DGZfP and Fraunhofer EZRT, intends to address scientific issues in the field of Non-Destructive Testing in Aerospace.

During the two days, different aspects and methods will be presented and discussed. You will have the opportunity to attend sessions addressing thermography, ultrasound, optics and all aspects of X-ray testing as well as structural health monitoring, reliability and adhesive bonding. Moreover, the latest results of the project 'ZeLuR' specifically designed to address various aspects of NDT in aerospace will be presented.

You will also have the opportunity to exhibit and present your own NDT-related Research and Development results in a poster session during the conference.

For further information contact: Deutsche Gesellschaft für Zerstörungsfreie Prüfung eV, German Society for Nondestructive Testing, Max-Planck-Strasse 6, 12489 Berlin, Germany. Tel: +49 30 67807-120; Fax: +49 30 67807-129; E-mail: tagungen@dgzfp.de; website: www.ndt-aerospace.fraunhofer.de

## Slovenian Society to hold International Conference

**T**he Slovenian Society for Non-Destructive Testing has issued a Call for Papers for its 10<sup>th</sup> International Conference, 'Application of contemporary NDT in Engineering', to be held 1-3 September 2009 at the Faculty of Mechanical Engineering, Ljubljana, Slovenia.

Papers are invited on the following topics:

- Applications of non-destructive methods for testing of constructions;
- Control of materials and constructions with various non-destructive testing of materials and constructions;
- Mathematical modelling in non-destructive testing;
- Computer-aided methods for non-destructive examination of materials and constructions;
- Applications of various non-destructive methods for materials testing in manufacturing and operation;
- Automation of non-destructive testing of materials and products in mass production;
- Innovations in non-destructive testing techniques;
- Evaluation in indications, reliability estimations and estimation of defect acceptability;
- Training, personnel qualification and certification for non-destructive testing;
- Facilities and equipment qualification and authorisation of non-destructive testing;
- Standards and application of standards in the fields of non-destructive testing.

Authors willing to participate in the conference with their contribution should submit the title of the article, name of author(s) and name of the organisation/institution and a short one-page abstract, including the conference heading and keywords before 15 November 2008.

The abstract, together with the announcement of participation or registration form, should be sent to: Professor Janez Grum, The Slovenian Society for Non-Destructive Testing, Faculty of Mechanical Engineering, Aškerceva 6, 1000 Ljubljana, Slovenia. Tel: +386 1 4771 203; Fax: +386 1 4771 225; E-mail: ndt-ljubljana@fs.uni-lj.si

## New President for Slovak Society

**A**t an extraordinary meeting of the Slovak Society for Non-Destructive Testing (SSNDT) that took place in June, Ing Erich Eckhardt, a long-standing worker in the NDT field, was appointed President and a new Committee elected.

President:	Ing Erich Eckhardt
Tel:	+421 918 859 407
Address:	VÚZ-PI SR SSNDT Raciánska 71 SK-83259 Bratislava Slovak Republic
E-mail:	ssndt@ssndt.sk
Website:	www.ssndt.sk

## Materials Testing 2009 Exhibition

**15-17 September 2009**  
**Norbreck Castle Hotel, Blackpool, UK**

[www.materialstesting.org](http://www.materialstesting.org)

Organised by The British Institute of Non-Destructive Testing

## News from the Brazilian Society for NDE (ABENDE)

### Bolivian Hydrocarbon Chamber (CBH) and ABENDE will sign a cooperation agreement

The Bolivian Hydrocarbon Chamber – CBH – will implement with ABENDE's support personnel training activities in NDT in Bolivia. This is the first step to implement the Bolivian personnel certification system similar to the SNQC/END that will be developed by IBNORCA, the technical standardisation body of the country. Activities will begin with a market survey in order to identify the real needs in terms of staff demand. The aim is to implement professional certification in several industry segments as well as to provide qualification training and test in the entire country. This subject was addressed by Engineer Youssef Akly, Strategy Manager of CBH, during his recent visit to ABENDE.

### International companies become members of ABENDE

ABENDE has gained new members: the German Helling GmbH and the French M2M Phased Array Technologies. Both companies work with non-destructive testing equipment for parasite current, ultrasound, magnetic particles, radiography, eddy current and other methods; and phased array (ultrasound and parasite current) respectively. Companies interested in becoming an ABENDE member can go to [www.abende.org.br/socios\\_fili\\_como.php?w=1920&h=1200](http://www.abende.org.br/socios_fili_como.php?w=1920&h=1200) or send an e-mail to [socios@abende.org.br](mailto:socios@abende.org.br) (Members' Department).

### International events

ABENDE is now publishing the calendar of international events related to non-destructive testing and inspection on its website in addition to the list of national events in the area. Visit [http://www.abende.org.br/down2/Calendar\\_Of\\_NDT\\_Events.pdf](http://www.abende.org.br/down2/Calendar_Of_NDT_Events.pdf).

### CONAEND&IEV2008

CONAEND&IEV2008 was a mega event and attracted people from several industrial sectors. It had 130 presentations, among lectures, technical papers and round tables and 35 exhibiting companies. More than 600 people attended the event, interested in information, technological novelties and NDT & Inspection products and services. The technical part held several debates on the value of certification, NDT applied in several sectors such as aeronautics, automotive, civil construction, basic sanitation, nuclear and petrochemical, among others.

The National Congress on Non-Destructive Testing & Inspection and the 12th International Conference on Integrity Assessment and Expanding the Lifetime of Industrial Equipment – CONAEND&IEV2008 – was held from 9-12 June in the city of São Paulo.

The next events are: 3<sup>rd</sup> ENDUTOS, 6<sup>th</sup> NE meeting, 10<sup>th</sup> COTEQ and the 2<sup>nd</sup> Forum on NDT Technology.

### 2nd National Meeting of NDT Certified Professionals

During CONAEND&IEV2008, ABENDE organised a meeting exclusively for professionals certified by SNQC/END: the 2nd National Meeting of NDT Certified Professionals. The purpose of the meeting was to discuss the market, ethics, rules and needs of certification in Brazil, and novelties related to the sector, as well as the importance of the professional to be aware of companies' and market's needs.

### Explosive atmospheres

ABENDE, ABP-Ex\* and COBEI\*, representative of the CB-03\*, are working jointly to meet the needs

of personnel certification in explosive atmospheres. CB-03 is elaborating the draft for the PN03:031:01-006 standard, "Working Competence with electric equipment in explosive atmospheres", and ABENDE, with the collaboration of ABP-Ex, will use the draft text to elaborate documents for the personnel certification system of the segment.

The draft text of the standard is based on the document ExMC/296/CD – Competencies for working with electrical equipment for hazardous area – adopted by 26 countries and will be followed by Brazil. Competences in question apply to any industry or company that has something to do with the explosion protection in applicable areas.  
*\*ABP-Ex – Brazilian Association of Explosion Prevention. COBEI – Brazilian Committee of Electricity, Electronics, Lighting and Telecommunications.*

*CB-03 – Brazilian Committee of ABNT dealing with Electricity.*

### Dimensional control

Starting this year, ABENDE will handle the entire process of personnel certification on the Dimensional Control method. The decision was made in an agreement with Petrobras. For more information, contact the Certification sector at [qualificacao@abende.org.br](mailto:qualificacao@abende.org.br)

### Re-establishment of the Parasite Current Committee

The Parasite Current Committee was re-established on 28 April with the attendance of representatives from Petrobras, Brasitest, Inox Tubos, REM, Nacional Tubos and Persico. The commission has already developed seven national standards (NBR), as mentioned below, and is now working on the development of standards to be published in Mercosur, as well as the participation in the meetings of the ISO Parasite Current sub-committee. The new working plan of the commission is under revision with the standards NBR 8860 and NBR 8861, in addition to the development of standards based on ASTM E 309 and ASTM E 426. The Parasite Current Commission, one of the oldest in the structure of the Standardisation Body (ONS 58) of ABENDE, aims at the development of national standards for this method as well as the participation in the elaboration of international standards (ISO). It has already developed seven national standards (NBR). Those interested in participating in the commission should contact the Standardisation Sector – [normalizacao@abende.org.br](mailto:normalizacao@abende.org.br)

ISO – International Organization for Standardization. NBR 8860 – Steel Piping – Detection of discontinuities by Parasite Current (eddy-current), with magnetic saturation NBR 8861 – Austenitic Stainless Steel Piping and similar alloys – Detection of discontinuities by Parasite Current (Eddy Current), without magnetic saturation. ASTM E 309 – Eddy Current Examination of Steel Tubular Products using Magnetic Saturation. ASTM E 426 – Electromagnetic (Eddy-Current), Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys.

### Manual and automated systems in the steelworks sector

#### Recognition

Considered strong and in full expansion by experts, the Steelworks sector needs support in inspection and quality activities. Collaborating with this demand, the Steelworks Committee of ABENDE recently approved the NA-005 and DC-020 documents, aiming at the certification of professionals who work in this area. The new qualification for automated systems will help companies that have equipment installed in their

production line. In addition, hands-on tests will be carried out by the employer, under the responsibility of L3s. The Association has already prepared the certification for professionals that work with automated systems, and in the first phase, recognises the Ultrasound L3, in accordance with the DC-020.

The Sectorial Steelworks Committee of ABENDE is building the database with the questions for the ultrasound qualification test for automated and semi-automated systems.

Today, the methods used in the sector for automated and semi-automated systems are parasite current, magnetic flux leakage, penetrating liquid, magnetic particles, radiographic essay and ultrasound.

Edson Eufrásio, coordinator of the Steelworks Committee, believes that this qualification will have the recognition of a third-party body, making the process transparent. He also adds:

"Companies will have their professionals duly qualified and certified according to the pre-established requirements. Professionals will be recognised for the quality of the service provided and will meet the specific market needs."

"In the NDT segment, qualification is synonym to a two-way credibility road: on one hand, it gives managers tranquillity, since processes depend on reports reliability and/or results presented by the inspectors and, on the other hand, to the customers who, when buying from a company with qualified professionals, know that the risks are minimised," states the representative of Usimac and one of the collaborators in the Steelworks Committee, Joventino Pereira Rezende. *NA-005 – Qualification and Certification of NDT Personnel in Automated Systems DC-020 – Recognition and Certification of Level 3 Personnel in Automated Equipment*

More information at: certificacao@abende.org.br

## NDT Certification Programme in Mexico

### Part 2. Developing written examinations

#### Introduction

To prepare the written examinations, the technical committee prepared a specification to be followed by the working groups. The specification consists of both the required body of knowledge and the way in which the candidates are expected to be able to use that knowledge.

Usually a good exam must explore three aspects. The knowledge itself, the understanding of its significance and their application to solve a practical problem or situation, but not necessarily each on the same degree.

#### The body of knowledge

The first step was to prepare the bodies of knowledge (BOK) of each method to be certified and the statement about the degree of coverage of each topic of BOK and the degree to which each usage of that topic should be covered in the exam.

Taking into account the educational level of the NDT technicians in Mexico, our committee gave special attention and emphasis on the understanding and significance and how to use the knowledge to solve a practical situations.

The examinations must contain a sufficient number of questions to assure reliability of results. The working groups decided each method must have a different quantity of questions. For VT, PT, and MT the examinations should have 60 to 90 questions and for RT and UT they should have 120 to 160 questions. If an examination has few questions, a candidate mistake could have an excessive effect on the candidate's rank in the group being examined.

Table 1 shows an example of the UT BOK; it gives 120 questions to evaluate the knowledge itself, its understanding and its application.

**Table 1. Example of BOK matrix, UT level II**

BOK topic	Know	Understand	Apply	Total
Introduction to NDT	2	2	3	7
Advantages and limitations of NDT method	2	4	4	10
Physical principles	2	5	6	13
Equipment	2	5	5	12
Inspection procedures	5	5	9	19
Interpretation of indications	5	10	10	25
Evaluation of indications	5	10	10	25
Code and standards	3	4	3	9
Totals (questions)	26	45	49	120

#### The questionnaires

Preparing good multiple choice items really is a hard task even for experienced people because it requires at least a large quantity of

time, creative ability, technical language skills, in-depth knowledge of the examination subject and understanding of how the potential examinees think.

A good item is about the important knowledge that most experts agree that candidates should be expected to know, it is clear and unambiguous, sufficiently difficult, and sufficiently discriminating to distinguish between weak candidates and strong candidates.

The challenge to prepare good test items has led many educators to formulate some rules and suggestions to assist the process. They are divided into general rules, rules for developing the stem of the item, rules for developing responses and miscellaneous rules.

Some of the general rules are:

- The test items should cover knowledge or problems specific to the method.
- The test item should concern knowledge or deal with a problem that most experts in the method would agree is important to the proper performance of that method.
- The test item must be expressed as clearly as possible.
- The test items should be independent of each other.

Some of the rules for developing the stem are:

- An item is desirable that calls for understanding and application of facts and principles to typical job problems, rather than those items requiring only knowledge of facts.
- In most cases, is preferable to state the question or problem positively than negatively.
- The problem or question must be stated as clearly and specifically as possible.
- The stem must have a definite correct answer that is unlikely to be challenged by competent practitioners.
- The stem should include all the qualifying information needed to allow selection of the correct response, or
- The information to answer a stem could be available in reference material to which the examinee has access.

Some of the rules to develop the responses are:

- All the responses shall be grammatically correct with regard to the stem of the item.
- All distracters (wrong responses) should be plausible.
- All distracters should be appropriate to the stem.
- Distracters should not confuse the competent examinee but distract the weak one.
- Avoid the use of ambiguous words like "none", "always", "all" or "never" and so on.

Some of the miscellaneous rules are:

- Avoid questions that can be answered by simply locating the correct statement or value in the reference data.

- ❑ Avoid negative questions and never use double negative questions
- ❑ Avoid changing units of measure within an item or response. An exception is if mixed units are commonly used in actual practice (like in Mexico). In this case that particular mixture could be used in an item of a specific method.
- ❑ It is desirable to use charts, graphics, monograms and tables, but they must be clear, legible and complete. Instead, it should be presented in the same way as it would be normally be encountered in actual practice.

## The question banks

To prepare the question bank of each method, it was divided by topic, the items were loaded and reviewed as a block of topic items.

The working groups interchanged the blocks and they were reviewed by at least two independent groups to reduce the "writer blind". The stem or the responses were reviewed or corrected if necessary.

All the items were reviewed by a Spanish letters style corrector with experience of NDT to be sure all the items and its responses shall be grammatically correct with regard to the stem of the item.

The final items were loaded and prepared the first group of examinations to validate the items and the exams.

The committee selected a computer programme to prepare the exams, print them and make the statistical analysis of each one.

Figure 1 shows an example of an exam item.

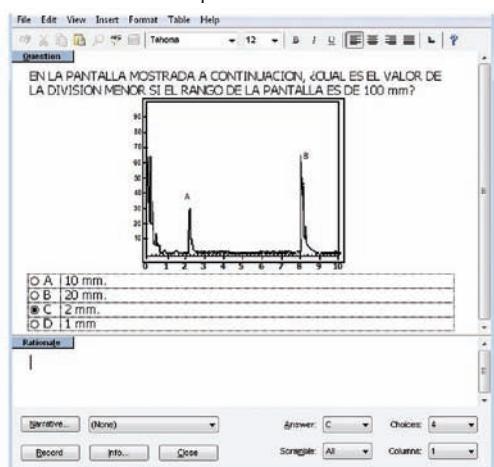


Figure 1. Example of an exam item and responses

Figure 2 shows an example of BOK topics (chapters), the number of questions by topic

Quest #	In Test	Chapter Title	Figs	ES	SA	FD	MA	ID	TF	MC	MO
1	35	INTRODUCCION UT								35	
2	96	PRINCIPIOS FISICOS UT	3							96	
3	35	PALPADORES Y TRANSDUCTORES UT	8							35	
4	47	CONTROLES DE LOS EQUIPOS	9							47	
5	51	BLOQUES DE CALIBRACION	2							51	
6	63	DETECCION DE DISCONTINUIDADES UT	1							63	
7	92	TECNICAS DE EVALUACION								92	
8	63	TECNICAS DE INSPECCION								63	
9	92	PROCEDIMIENTO Y PRACTICAS								92	
10	35	CODIGOS UT								35	

Figure 2. BOK topics and number of questions on each topic

The items were evaluated preparing some questionnaires with only 60 questions each. The items were selected randomly using the computer programme and it has the option to prepare up to 15 versions from the same items selection, an example is shown in Figure 3.

Figure 4 shows the first page of one questionnaire.

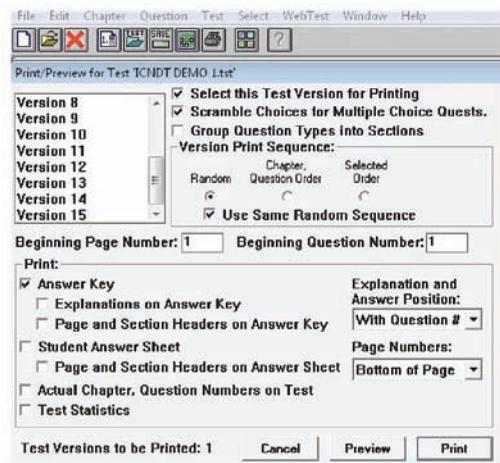


Figure 3. Printing menu and printing options



Figure 4. First page from a questionnaire

## The questionnaire evaluation

To administer the examinations, the committee prepared examination instructions and trained the monitors, taking special care on the selection of examination sites. All of these to simulate a certification examination, one problem detected with the applicants was the previous information to be given to prepare their exam, the committee prepared some notebooks explaining the examination procedure, the kind of questions in the exam and gave some tips to prepare and answer successfully the questionnaires. This info was helpful for the volunteers who took the examinations.

The evaluation of examination results was made using another computer programme and at the same time the examinee comments were analysed to detect and correct the mistakes.

## The statistic analysis

Two general types of statistics are usually studied when evaluating examination results, one is the item analysis and the other is the overall statistics.

The item evaluation includes the item difficulty, the item discrimination and the effectiveness of each response.

The overall examination attributes that are usually evaluated includes the number of examinees attaining each score or grade, the distribution of the scores and the mean, median and mode of the scores.

# PAN-AMERICA

The validity and reliability are the two most important characteristics of the results of examinations.

The validity concerns the appropriateness of the evaluations made of the candidates by the analysis of the results of the examination. And it requires an examination to measure the required knowledge and understanding to produce scores, which measure these without giving advantage or disadvantage to any group of candidates. The validity depends on the test reliability.

Test reliability concerns the consistency of the results of the examination each time it is administered. It means no matter how valid the measurement should be, if equally competent candidates do not obtain similar scores, or the same candidate does not obtain similar scores on repeated exams, the test is unreliable.

There are statistical methods for analysing the results of a single examination that yield a good estimate of reliability from a reasonable number of candidates and a reasonable number of test items. The most widely used is the "Kuder Richardson 20" or KR20 coefficient, also called index of reliability.

The KR20 is useful as an overall measure of the test quality. A high KR20 value indicates that the examination results or scores are relatively free from error; theoretically, a KR20 around 0.90 is the best, but in practice and taking special care controlling examination content, the difficulty and the discrimination, it could be possible to attain values around 0.80.

Finally, the standard error of measurement provides a means of estimating what the variability of a candidate's score would be if he took the same examination repeatedly.

## The results

The results obtained with a demo test, are shown in the following tables. The sample is 8 examinees.

**Table 2. Grade report by student**

Student Statistics Report				
Overall Student	Grade	Total		Benchmark Difference
		Total	Percent	
01	C	40.00 / 60.00	66.67	-0.33
02	B	60.00 / 60.00	100.00	0.00
03	C	40.00 / 60.00	70.00	-0.20
04	B	60.00 / 60.00	100.00	0.00
05	B	61.00 / 60.00	85.00	0.00
06	B	37.00 / 60.00	61.67	(-0.23)
07	C	40.00 / 60.00	73.33	3.33
08	B	40.00 / 60.00	66.67	1.67
09	B	40.00 / 60.00	66.67	1.67
Mean		45.43	72.41	2.41

**Table 3. Overall statistic report**

Test Statistics Report	
Overall	
<b>Score Data</b>	
Number of Graded Items	60
Total Points Possible	60
Maximum Score	51
Minimum Score	30
<b>Statistics</b>	
Mean Score	43.44
Mean Percent Score	72.41
Benchmark Score	-
Range of Scores	21.00
Standard Deviation	6.84
Variance	46.78
<b>Percentiles</b>	
Percentile (25)	39.00
Median Score	44.00
Percentile (75)	49.50
Inter Quartile Range	10.50
<b>Confidence Intervals</b>	
1%	36.80
5%	38.19
95%	48.70
99%	51.09
<b>Test Reliability</b>	
Kuder-Richardson Formula 20	0.85
Kuder-Richardson Formula 21	0.76
Coefficient (Cronbach) Alpha	0.78

Table 2 shows the students' statistics report. The green lines indicate the candidate passed the exam, the red one indicates the candidate failed. The benchmark is 70% (42 or more correct answers).

Table 3 shows the test statistics report, it shows the score data, test statistics, percentiles, confidence intervals and test reliability.

Table 4 shows the statistics report by item; it shows the questions, summary statistics, descriptive statistics, and percentiles.

**Table 4. Statistics report by item**

Item Statistics Report													
Item	Question		Summary Statistics			Descriptive Statistics				Percentiles			
	Stem	Response	N	Mean	Varience	Std. Dev.	Std. Error	Skewness	Kurtosis	T-Value	Min. Abs.	Max. Diff.	Average
0exitem1	10	0	250	0.40	0.63	0.20	-0.16	10.00	11.00	0.36	3	300	3
0exitem2	10	0	260	0.71	0.84	0.27	-1.28	1.41	9.78	0.64	3	300	3
0exitem3	10	0	250	2.00	1.41	0.45	0.88	-1.39	4.17	1.20	1	100	1
0exitem4	10	0	250	0.54	0.74	0.23	-1.91	6.33	12.43	0.38	3	300	3
0exitem5	10	0	320	0.18	0.42	0.13	1.75	1.41	24.00	0.32	3	300	3
0exitem6	10	0	120	0.90	0.95	0.30	3.16	10.00	4.33	0.54	1	100	1
0exitem7	10	0	120	0.40	0.63	0.20	3.16	10.00	4.00	0.34	1	100	1
0exitem8	10	0	140	0.71	0.84	0.27	1.78	1.41	5.25	0.64	1	100	1
0exitem9	10	0	100	0.00	0.00	-	-	-	-	0.00	1	100	1
0exitem10	10	0	100	0.00	0.00	0.00	-	-	-	0.00	1	100	1
0exitem11	10	0	210	0.10	0.32	0.16	3.16	10.00	21.00	0.18	2	200	2
0exitem12	10	0	400	0.00	0.00	0.00	-	-	-	0.00	4	400	4
0exitem13	10	0	100	0.00	0.00	0.00	-	-	-	0.00	1	100	1
0exitem14	10	0	400	0.00	0.00	0.00	-	-	-	0.00	4	400	4
0exitem15	10	0	220	0.40	0.63	0.20	-0.13	0.18	11.00	0.48	1	200	3
0exitem16	10	0	210	0.10	0.32	0.16	3.16	10.00	21.00	0.18	2	200	2
0exitem17	10	0	320	0.18	0.42	0.13	1.78	1.41	24.00	0.32	3	300	3
0exitem18	10	0	360	0.03	0.97	0.31	-2.66	7.19	11.28	0.64	4	400	4
0exitem19	10	0	310	0.10	0.32	0.16	3.16	10.00	31.00	0.19	3	300	3
0exitem20	10	0	120	0.18	0.42	0.13	1.78	1.41	9.00	0.32	1	100	1
0exitem21	10	0	400	0.00	0.00	-	-	-	-	0.00	4	400	4
0exitem22	10	0	180	0.10	0.32	0.10	-0.16	10.00	19.00	0.18	1	200	2
0exitem23	10	0	280	0.40	0.63	0.20	-3.16	10.00	14.00	0.36	3	300	3
0exitem24	10	0	220	0.40	0.63	0.20	3.16	10.00	11.00	0.36	2	200	2
0exitem25	10	0	360	0.21	0.94	0.47	-1.28	1.41	12.50	0.64	4	400	4
0exitem26	10	0	160	0.03	0.97	0.31	1.96	4.19	6.24	0.12	1	100	1
0exitem27	10	0	200	1.11	1.05	0.33	0.09	-2.87	6.00	1.00	1	200	3
0exitem28	9	1	133	0.25	0.50	0.17	0.86	-1.71	8.00	0.44	1	100	2

With the statistics report the committee prepares a revision in deep to adjust the items difficulty, either changing the level of knowledge required or refining the responses. Select the items with a good discrimination index, if all the better performers correctly answered an item while none of the poorer performers did so, the item has a discrimination value of 1.0, but if none of the strong candidates answered correctly while all the weak ones did it correctly then the item discrimination is -1.0; the discrimination value proposed is 0.3 to 0.5.

Lower values indicate the item could be too easy, higher values indicate the item could be extremely difficult. To establish the desirable average item difficulty, the items with difficulty between 0.60 and 0.65 were selected. After this item evaluation, more than 35% of them must be reviewed, some on their stem, some others on their responses and some rejected. Second and third rounds were made to evaluate the corrected items to have the final question bank on each method.

## Conclusions

Preparation of a good examination is a difficult demanding task, especially if is for a NDT national certification programme, even for those with experience in such work.

The determination of what constitutes a good examination requires careful consideration of the validity and reliability of the examination. A good examination requires well-phrased questions about the body of knowledge and it means a large investment of time, economical and human resources, and patience to finish the task.

The multiple-choice questions provide the most objective and reliable results.

Well-prepared multiple-choice questions can be designed to evaluate the knowledge as well its understanding and its application to solve practical problems. These kinds of question are objective, easy to administer, and can be graded by mechanical or electronic means and are easy to evaluate statistically.

Statistical data obtained from questionnaire results, readily detect errors, ambiguities and weakness in items, the understanding and use of statistics make it easier to improve the questions and the examinations.

It is important that examinations must be prepared, administered and graded with scrupulous attention to their honesty, and fairness in addition to their validity and reliability.

The final part of this report is the practical examination samples.

## CALENDAR OF NDT EVENTS

<b>Month</b>	<b>Date</b>	<b>Venue</b>	<b>Event</b>	<b>Contact</b>
October 2008	14-16	Munich Germany	MAINTAIN: International Trade Fair for Industrial Maintenance	info@maintain-europe.com www.maintain-europe.com
	21-23	Gdansk Poland	37th Polish National Conference	odk.simp@neostrada.pl www.odksimp-szczecin.neostrada.pl
	25-28	Shanghai China	17th World Conference on NDT	ichsndt@public2.sta.net.cn chsndt2008@163.com www.17wcndt.com
November 2008	4-6	Brno Czech Republic	38th International Conference and NDT Exhibition, DEFEKTOSKOPIE 2008	cndt@cndt.cz www.cndt.cz
	10-14	Charleston USA	ASNT Fall Conference and Quality Testing Show	conferences@asnt.org www.asnt.org
December 2008	3-5	Fürth Germany	International Symposium and Exhibition on NDT in Aerospace	tagungen@dgzfp.de www.ndt-aerospace.fraunhofer.de
	4-6	Varanasi India	17th National Symposium on Ultrasonics 2008	rksingh_17@rediffmail.com rajan@bhu.ac.in www.bhu.ac.in www.ultrasonicsindia.com
	9-12	Kyoto Japan	19th International Acoustic Emission Symposium	acd@jsndi.or.jp
March 2009	18-20	Moscow Russia	8th International Exhibition and Conference for NDT and Technical Diagnostics	artemiev@spectr.ru
August 2009	26-28	Gold Coast Australia	International Conference on Operating Pressure Equipment	events@materialsaustralia.com.au www.materialsaustralia.com.au/OPE09
September 2009	1-3	Ljubljana Slovenia	10th International Conference – 'Application of contemporary NDT in Engineering'	ndt-ljubljana@fs.uni-lj.si
	14-19	Essen Germany	3rd Quality Testing International Exhibition 2009	info@messe-essen.de www.messe-essen.de
	15-17	Blackpool UK	Materials Testing 2009 and NDT 2009 Conference	karen.cambridge@bindt.org www.materialtesting.org www.bindt.org
November 2009	8-13	Yokohama Japan	13th Asia-Pacific Conference on Non-Destructive Testing 2009	apcndt2009@jsndi.or.jp www.apcndt2009.com
June 2010	7-11	Moscow Russia	10th European Conference on NDT	spektr@co.ru www.rsnttd.ru
April 2012	18-20	Durban South Africa	18th World Conference on NDT	saint@acenet.co.za www.saint.org.za