Training and Certification for Automated Ultrasonic Testing (AUT)

Michael Moles
Olympus NDT
28 Espana Lane, Toronto, Ontario, Canada M2N 7K8
Tel: +1 416 831 4428. E-mail: Michael.moles@olympusndt.com

Abstract

The company organizes over 200 public phased array and TOFD training courses per year. (In practice, AUT, or Automated Ultrasonic Testing, refers only to phased arrays and TOFD as of today. Other techniques, such as SAFT, haven’t really become commercial yet).

These AUT courses are comprehensive, but are primarily aimed at the lower end of the market, i.e. portables and related instruments. The rationale behind this decision is that higher end instruments in the past have required specialized, well-trained operators, while lower end instruments require more support and general training.

Training times vary from one week to several. Also, certification is a significant unknown. In North America, American Society of NonDestructive Testing or ASNT (essentially company certification) is the norm, whereas in most other places some form of third-party certification is standard. The upcoming American Society of Mechanical Engineers (ASME) NDE (or ANDE) certifications in North America seem likely to alter the balance towards third party certification. In addition, ASNT is now looking at a new phased array approval process. This uses standard headings, formats and questions for training; however it is unclear when this will be in use.

Ultimately, our objective is to get all training companies to use the same (or similar) certifications, which probably means ISO 9712. However, nuclear has a habit of "doing its own thing", so perhaps special certifications will be required for them.

Keywords: Phased arrays, TOFD, training, global courses, certification, ISO 9712, ASNT (American Society for NonDestructive Testing)

1. Introduction

Olympus NDT started phased array training courses some years ago with the introduction of the OmniScan portable phased array unit (1). Initially, courses were run by a single operator out of Houston, Texas; then evolved (rapidly) to the Training Academy (2). The training courses were originally quite limited, and only six companies were asked to join the Training Academy. The Academy has since expanded, with around twenty-plus companies now Training Members. These companies now run in excess of two hundred courses per year in all continents, excluding private courses on company premises or specialized courses. In addition, the courses have expanded in content from the initial two-day Introduction to Phased Array course up to single and double week courses. Not surprisingly, TOFD (Time-of-Flight Diffraction) courses were added. The courses also include TomoView versions (Olympus’s advanced software program), Phased Array Level III, and training in multiple languages.

Besides the OmniScan MX2 (the encoded OmniScan for linear scanning), other instruments have been added to the list for training: courses include the OmniScan M (manual) and EPOCH 1000i (see Figure 1). Olympus makes a full range of phased array equipment, including Focus LT, QuickScan and TomoScan III (see Figure 2). However, these latter instruments tend to be quite specialized, so do not require training in the conventional sense.
Figure #1: Photos of (left) OmniScan MX2 and M; (right) EPOCH 1000i. Note that the OmniScan MX2 and OmniScan MX2 manual look identical; the only change is in the module at rear.

Figure #2: Photos of (top left) Focus LT; (top right) Focus; (bottom) QuickScan PA.
2. Objective

As stated in the Abstract, the main objective of this paper is to demonstrate that Certification is a key feature of the Olympus NDT training academy. Specifically, Olympus looks at two main factors for training - as a viewer, not as a regulator:

1. Classroom hours, and
2. Certification.

As a global manufacturer, ONDT wants to ensure that all operators have globally recognized certification. This works reasonably well in Europe, Asia, Australasia and maybe Africa, where ISO 9712 and its related codes - EN 473, PCN and CSWIP are functioning. However, this leaves us with a significant deficiency in North America, where ASNT (American Society for NonDestructive Testing) is dominant.

When a new company wants to get into training (either PA or TOFD), we ask them to review and approve our Training Agreement. Once accepted, they are asked to provide:

- Company logo
- Brief company description
- Course descriptions, and
- Course schedules.

In addition, we ask the new training companies to provide us with their proposed course material, which we then edit for technical accuracy.

3. North American Certifications

ASNT has two types of certifications: one is the well-known company certifications, which have their uses. To quote, “Employers are responsible for administering the visual acuity, practical and any job-specific examinations required by their written practice to complete the certification process.” This type of certification is “company-specific”, and cannot be transferred by the operator on changing jobs.

The other is the ASNT Central Certification Program (6) or ACCP, which is exam-based and transferrable. Neither certification really includes advanced techniques like phased arrays and Time-Of-Flight Diffraction (TOFD). Thus there is also a gaping hole in North America’s AUT NDT certifications. According to the ASNT web site, the ACCP Level II UT meets the ISO requirements (though which version of ISO is not clear – see below).

ASNT is developing a Body Of Knowledge (BOK) for phased arrays. This work is still in progress.

ASNT has also developed their own version of ISO 9712 (7), with local adaptations – as permitted by the World Trade Organization. Here, we have some interesting modifications, for example, reducing the required hours for Level II Phased Array training from 80 to 40 (see Figure 3, compared with Figure 4). In reality, these changes may not be globally acceptable, as Non Tariff Barriers (NTB) may be erected to eliminate manufactured North American goods in export markets.

<table>
<thead>
<tr>
<th>NDT Method</th>
<th>Level I (hours)</th>
<th>Level II (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>MT</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>PT</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>RT</td>
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<td>40</td>
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<td>UT</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>VT</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>

**Table 1: Minimum Training Requirements**

**National Explanatory Note:**
The Training hours in Table 1 have been modified to reflect current national NDT certification requirements used by the majority of U.S. industry. Arbitrarily increasing these hours to reflect the ISO 9712 training hours, without technical justification, would result in an excessive burden on industry.

The additional training hours for Level III personnel shown in ISO 9712:2005 has been removed here as current national practice accepts the time in grade as a Level II as being sufficient for eligibility to sit for Level III examinations.

*Figure #3: Extract from ASNT ISO 9712-2008 (7).*
4. Nuclear Certifications

There are also nuclear-specific qualifications, in both Europe and North America. In Europe, we have the ENIQ (European Network for Inspection Qualification) (8). This is more of a general framework, with each country having qualification rights to regulate NDE procedures and techniques. ENIQ allows judgement in assessing the need for and extent of physical trials in demonstrating adequate performance.

In the USA, ASME has recently permitted another type of qualification, through ANDE (American Society of Mechanical Engineers - NonDestructive Examination). This does not use ASNT as a certification body, but uses the ASME certification requirements instead from Section XI Article VII 4000 on Qualification Requirements (9). The summary of classroom hours is shown in Figure 5. Thus, for a direct-to-Level II candidate, 80 hours of classroom training would be needed. More important, this would be a third-party certification, not a company certification. This program will be run through EPRI.
### Table VII-4220-1

**INITIAL TRAINING HOURS**

*(CLASSROOM/LABORATORY)*

<table>
<thead>
<tr>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
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</thead>
<tbody>
<tr>
<td>40/40</td>
<td>40/40</td>
<td>40/0</td>
</tr>
</tbody>
</table>

**GENERAL NOTES:**

(a) To certify a candidate directly to Level II with no time at Level I, the total hours of training required for Level I plus Level II shall apply.

(b) To certify a candidate directly to Level III with no time at Level I or Level II, the total hours of training required for Level I plus Level II plus Level III shall apply.

(c) Industrial or academic training courses covering the topics listed in 9.0 of Supplement 1 may be credited toward the training required for Level III personnel.

(d) The hours of instruction devoted to each subject in Supplement 1 shall be determined by the NDE Instructor.

*Figure #5: Extract from ASME certification rules (9).*

ANDE will develop a Body Of Knowledge, which ultimately will be turned over to ASME’s certification body. This BOK will cover all techniques, e.g. UT, EC, MT, PT, and presumably PA as well. However, ANDE’s development has only recently started, and previous experience with EPRI’s certification requirements has shown that their certifications fragment quickly. For example, it appears that for full qualification in EPRI, around 55 test areas (read: qualifications) are required.

Perhaps the main question for ANDE certifications is: Will they be acceptable outside the North American nuclear industry? Based on hours in classroom, the answer is uncertain.

In contrast, Figure 6 shows the qualification requirements for (non-nuclear) ASME Section V Article 4 for AUT inspections (10). For Section V, the assumption is that ASNT will still perform the certification.
VI-423 Personnel Qualifications

Only qualified UT personnel trained in the use of the equipment and who have demonstrated the ability to properly acquire examination data, shall conduct production scans. Personnel who analyze and interpret the collected data shall be a Level II or III who have documented training in the use of the equipment and software used.

The training and demonstration requirements shall be addressed in the employer’s written practice.

Figure #6: Extract from ASME Section V Article 4 Mandatory Appendix VI (10)

There are notable differences between ENIQ and ANDE. Specifically with ENIQ, there is no qualification of equipment and probes by themselves. As each inspection procedure is case-by-case, a manufacturing company like Olympus NDT cannot develop a general inspection process to get their equipment qualified. Only service companies can run qualification of their NDT system that includes procedure, manpower, instrument, probe etc.

With ANDE, there is the possibility/probability of getting equipment approved by EPRI to go onto their acceptance list. As such, the direct involvement of an inspection company per se is not essential.

5. Other North American Options

With the major absence of globally-acceptable phased array certifications, North America has developed other qualifications. One of these is the Performance Demonstration Qualification (PDQ), currently limited to one oil company or two in Alberta. This is a hybrid between a single phased array qualification (e.g. ISO 9712) and the EPRI qualification. Specifically, instead of a single or focused certification, multiple certifications are required – and their portability is questionable. The main problem with the PDQ and other certifications is cost: they rapidly become a major financial burden on inspection companies.

6. And Where Now? Certification

So, where does Olympus NDT stand with certification in North America? Reading this paper, it sounds like North America in particular is in a major rut, but in practice life is not that bad. Specifically, Olympus NDT has been promoting the introduction of ISO-related phased array training courses into North America, with some success. Lavender International is introducing PCN courses for phased arrays and for TOFD; Davis NDE is introducing ISO-related courses, as is Eclipse Scientific. As these are three of the original six training members (and the only three original members from North America), we are reasonably happy with progress. In addition, Global School of NDT, Jubail Industrial College and others are developing, or have developed, ISO courses.

Given that it has taken many years to get EN 473 and ISO 9712 to settle their minor differences, our progress can be considered as reasonably brisk (11). However, Olympus NDT will be happier when all training course can effectively offer globally-acceptable phased array certifications, most likely based on the ISO model. Not surprisingly, there are issues with the ISO approach as well. For example, ISO breaks down components into several sectors, as shown in Figure 7.
A.2 Product sectors

a) Castings (ferrous and nonferrous materials) [0].
b) Forgings (all types of forgings: ferrous and nonferrous materials) [7].
c) Welds (all types of welds, including soldering, for ferrous and nonferrous materials) [w].
d) Tube and pipe (seamless, welded, ferrous and nonferrous materials, including flat products for the manufacture of welded pipes) [t].
e) Wrought products, except forgings (plates, bar, rods) [wp].

Figure #7: Extract from ISO 9712 on different product sectors (3)

7. And Where Now? Training Hours

The other issue, from an Olympus perspective, is the number of hours appropriate for training. When Olympus started organizing training, we ran a two day course only – called “Introduction to Phased Arrays”. Naturally, this course was not planned for certifications, and proved totally inadequate (for certifications). This short course was really only useful for engineers and managers, to get an idea of what phased arrays could do. These courses have now expanded to 40, then 80, hours – many in keeping with ISO, PCN and other certifications. In fact, some training companies are even running (private) courses of three or more weeks.

8. Conclusions

1. The Olympus NDT phased array training courses have been very successful, with over 200 (public) courses per year.
2. These courses have evolved from a two-day overview to two weeks (or more), some with certifications.
3. Ideally, Olympus NDT would like to see all courses using the same certification, but this is unlikely to happen in the near future.
4. There is a significant difference between ISO third-party certifications and ASNT-company certifications – for both global acceptance and for content.
5. Overall, there is a mish-mash of certifications, but we are slowly iterating towards acceptable, transportable certifications – probably ISO 9712.

References

10. ASME Section V Article 4 Mandatory Appendix VI, “Ultrasonic Examination Requirements for Workmanship Based Acceptance Criteria”, 2010.
11. http://www.nordicinnovation.net/article.cfm?id=1-834-685