The Path to Effective Training – Part 1 “The Economics of Mentoring”
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ABSTRACT

With a shortage of properly trained NDT technicians in Canada, and the current roster getting older, the need to train replacements becomes more and more urgent. Without a plan and a clearly defined goal, training and mentoring is left in a muddled and confused state. In Canada we have what may be the best certification scheme in the world, but we need to find ways to bring new people along in a systematic and efficient way, while strongly supporting our certification scheme. Careful consideration was given to the needs of the clients, service providers, senior technicians, and the new recruit when devising a plan, and the explanation of how each step benefits all stakeholders along the way. Input from each was weighed, added to the mix and distilled into a set of efficient moves toward effective training to produce highly trained and capable NDT technicians.

Most technicians who make a career of NDT take many years longer than necessary to achieve certification and earn the rewards of greater certification and responsibility. Many wait because they are not confident that they will be able to fulfill their new responsibilities properly. Our step-by-step approach shows how a new technician can be trained and given more responsibility in steps so that they can be confident of their own abilities with each level of certification. Training competent, confident technicians will answer our current shortage; by having an efficient system to bring new trainees through the certification system we will have a more responsive industry, able to expand or hold as necessary during the normal cycles of business.

Industry requires our technicians to be confident, competent, experienced and certified. By following a clearly defined training and certification strategy, we can meet these requirements, and exceed them in the future. The strategy we have defined offers benefits to all stakeholders, and the “Economics of Mentoring” shows the financial benefit at each level.

Keywords: Training, NDT Certification; NDT Instruction, trainee benefit, mentoring.
1. Introduction

With a recent sharp increase in capital projects and continuous growth in maintenance requirements, the number of positions for competent NDT technicians in Canada has outgrown the available manpower. The old practice of waiting until there was a contract or a project before looking at training and certification options has put us in this position. We need to change our training strategies. We need to identify how we can bring new people into the business, have them learn the correct ways to do a good inspection, inspire them to achieve excellence, and when they become certified, encourage them to lead other new people along a good path.

We are going to explore such a strategy in broad terms. What we have put together is adaptable to small or large companies, and will respond appropriately to changing market forces in our industry. We believe mentoring is not only efficient, it is a cost-effective way of helping a raw recruit learn the best ways to do the job, gain useful experience, and prepare for that time when he or she is the person in charge.

We will start by discussing changes in our business that have created new knowledge requirements for the NDT technician. Next will come some ideas and explanations of how a new technician can learn to do the job well, how supervision and feedback changes as the technician’s understanding grows, and how to set up an environment that encourages practice and learning. This naturally flows into statements about different levels of certification, when each is appropriate, and that the certification scheme in Canada must be protected.

Personal and corporate goals are often thought to be in conflict; one place where they can meet harmoniously is in a training program. The employee’s desire to learn more fits well with the company’s desire to offer more services. Making a plan and engaging the people involved will generate the energy required to make the plan a success.

2. Instruments

2.1 Inspection Instruments

Advances in technology have made inspection instruments more complex, more accurate, and more widely available. One of the first “sonic” inspections was of train wheels, where the inspector would hit the wheel with a hammer: if the sound was clear, the wheel was OK; if the sound was “off”, the wheel was rejected.

Early ultrasonic testing equipment was too large for a single person to move, and cost several times the technician’s annual salary to purchase. Advances in electronics, computing power, miniaturization, and industry acceptance of the testing method have created competition and huge technological improvements. Some of today’s simpler instruments can measure thickness in parts of a millimeter, for a fraction of earlier costs.
With advances in equipment have come increased requirements for training, and understanding more than just the “basics”. Along with being good at inspection, today’s technician has to know and understand electronics and computer programs, along with engineering and design of inspection equipment. We have come a long way from “testing” a part by hitting it with a hammer.

3. Tools

3.1 Modeling tools

Industry has developed tools to help do a better inspection. Computer Assisted Drawing (CAD) programs have simplified the modelling of equipment for manufacture or inspection.

Beam modelling programs such as ESBeamTool help the technician more easily visualize the area of interest, and the required steps for a proper ultrasonic inspection. From simple beam tracing have come much more complex programs, with more realistic representation and more accurate calculations. Simulated “A” scans are routinely included in some programs. Changes due to temperature variation are also included in some programs.

Complex programs require training and practice so that our technicians know how to use their tools well. You want your mechanic or doctor to be able to competently use their tools; your NDT technicians need to know how to use their tools also.

3.2 Inspection tools

Inspection tools are being developed at a feverish pace. Welds are still inspected by a technician who holds one probe at a time, and re-inspects the same area several times with different probe angles. Today we have AUT girth weld scanners that will scan a weld on a 36” pipeline in less than three minutes, and allow the technician to accept or reject the weld in less than two minutes more.

Corrosion mapping data of each square millimeter can be reviewed and checked against previous scans to monitor changes. Bridge span welds can be inspected with encoded UT, and the data saved and audited and shared corrosion mapping can give 3-D results in seconds.

With new more capable instruments and with the help of new innovative fixtures designed to help deliver probes, the opportunity to inspect parts that were previously deemed impossible to inspect...
are now being revisited. In many cases these complex components are now being inspected successfully based on the improved technology applied.

3.3 Reporting tools

Tools for reporting have also changed drastically. We used to make judgements based on handwritten reports of data that no longer exists. “UT OK” was all that was required – or available. Once the technician lifts the probe from the part, the “data” of the inspection is gone. Drawings, explanations and recommendations are not data.

Radiographic testing has the data (radiograph) available after the inspection, but film is vulnerable to breakdown over time. In order to share or audit the data, the film must be physically present. Making copies to share for training or collaboration is not very representative.

Today we have digitally processed inspections where the data is recorded electronically. Along with the graphical representation of an inspection, encoded UT inspections record the “A” scan at each millimeter. This is the raw data, and once captured it can be shared, audited, copied, and processed as necessary. Reports can be generated from a single entry of data, and calculations made directly as new data is recorded. Conclusions, acceptance or rejection can be part of the programming. Keeping track of what has been inspected, what needs to be inspected, and the next scheduled inspection can be part of a comprehensive program that allows the decision makers and technicians to be more efficient. Using these programs properly requires training.

4. Experience

Here we discuss experience as layers of increasing responsibility

4.1 Observation

When we want a trainee to learn from a senior technician, this is best done in steps where over time, and with practice, the trainee is given more and more activities to perform, and more responsibility for the outcome.

At first the trainee should be observing the activities of the senior tech, and assisting in ways that make the overall inspection process more efficient. By participating in the regular activities required for the inspection at hand, the trainee absorbs processes and activities on a daily basis. Hearing the specific vocabulary of the job, understanding the culture of a particular work environment, and seeing the results from the proper use of techniques will encourage the trainee to adopt “best practices”. A trainee can do many entry-level activities, allowing the senior technician to spend more time with advanced techniques. Having a second person present increases the safety of
both. This combination of higher efficiency and improved safety, added to the economics of using trainees means that the cost of inspection for the amount of work accomplished is greatly improved by including a trainee. Trainees represent dollars well spent.

4.2 Over-the-shoulder Supervision

As a trainee’s abilities and understanding increase, he can be given more inspection duties to perform. At first the senior technician needs to watch closely – often “over the shoulder” supervision is necessary for a time. As the senior technician becomes confident of the trainee’s competence, close supervision can relax to more of an auditing role. This increases the efficiency of the inspection, and will benefit the client greatly. Having two competent people working together who have developed a routine for proper inspection will improve the ratio of dollars spent for measureable results.

Experience is not gained by repeating a series of activities the same way every time for many days, months, or years. Experience is gained by making mistakes, finding and fixing these mistakes, and learning why some things work better than others in a given situation. It is important that a trainee makes mistakes in order to learn from them. It is also important that these mistakes don’t lead to catastrophic failure of equipment that could cause harm. Having supervision, auditing and review of inspection results allows the mistakes to be made, caught by the responsible supervisor/mentor and learned from, and protects the client’s interests at the same time. Returning to the inspection and correcting the mistake completes the learning process. Recognizing the error, understanding the need to return and correct it is critical to learning and it will not be forgotten, nor should it happen again.

Once the trainee has experience and is confident and competent to perform the inspection on his/her own, it is time for the individual to be certified.

4.3 Certification as responsible person

The various layers of certification need to be clearly defined. The first certification a technician might aim for could be job-specific or project-specific certification (Level 1 or in-house). The technician needs to show the ability to correctly follow a set of instructions for a particular inspection situation. This would come after suitable training, testing, and review of the technician’s activities as they relate to the inspection in question.
Next, industry-specific certification would need to show a deeper understanding of the inspection method and how it is applied in various situations (Level 2 ASNT-TC-1A). The technician’s experience would need to be broad enough, and training thorough enough, that certification would be issued to a technician who demonstrates ability to properly carry out an inspection in a particular industry sector. An understanding of the materials used and the processes that form them is critical. Being able to correctly identify how an inspection technique can be used to inspect a particular part, and recognising when a certain method might not be appropriate, would be required by a certified technician.

Internationally accepted certification would require an even better understanding of the inspection method, its applications and limitations, and the technician would need to demonstrate the ability to properly inspect a wider variety of parts (Level 2 CGSB/ISO/EN). A better understanding of engineering principles, failure mechanisms, and manufacturing challenges is required. The technician should have experience using a variety of techniques and equipment. Being able to explain the steps necessary for a successful inspection of a given part is also necessary.

A properly trained, experienced and certified Level 2 NDT technician should also be able to write a detailed, comprehensive set of instructions that a junior technician can follow, and achieve proper results. Certification standards that require this as part of the testing help the technician clarify efficient activities to successfully complete a given task. In order to instruct another, the technician must first have a clear understanding of the task.

4.4 Responsible person writing procedures, etc.

As knowledge and experience grow, the technician might be called upon to write or review inspection procedures. This requires that the technician have an even better understanding of the method in question, and other NDT methods that may be part of a specific inspection process. Knowledge of engineering principles and applicable codes and standards must be strong enough for these inspection procedures to be valid. High standards in NDT certification to Level 3 must be maintained in order for our industry to remain reliable and effective. Finally, an advanced technician may become one of the experts reviewing standards, codes, and practices. These must be updated and refined continuously to adapt to new technology, new materials, and changing environments. Only those people with enough desire, training, knowledge and experience should be included in this group.
5. Conclusion

From a career start in NDT as a green trainee to being one of a group of experts overseeing codes and practices, we see a bright future for people entering the trade. It is now, and has always been, economics that drive our industry. The current situation dictates that we encourage more young people to join us. We need to promote a healthy pride in what we do. Our industry is becoming an industry of older folks, many of whom have much more certification and qualification than necessary for most projects. The cost of not mentoring new people will be significant, and will continue for a long time.

By purposely adopting a culture encouraging training and mentoring, by asking new people to work in this field, and by allowing them to gain experience in a safe environment, we will improve our industry, improve the quality of inspection, and reduce the number of catastrophic failures which cause so much grief. We need to make a plan; we need to start now.