Flash radiography is radiographic testing (RT) without intermediate data carriers (films and storage plates). Flash radiography produces a quick image and provides for low-cost testing and the capability of multi-angle, real-time monitoring of internal discontinuities in objects.

In film radiography, if the relative photometric density is greater than four, then the snapshots become virtually unreadable and can be difficult to digitize. Current film-free technologies do not have this disadvantage and, besides, provide for results in a digital form without special digitizing systems.

Digital information contains radiographic images of internal discontinuities, expands flaw detection possibilities, and reduces testing cost. Flash radiography is based on portable X-ray television, which is the observation of X-ray testing results on a monitor screen. The capability to examine internal discontinuities from different angles is provided.

Flash radiography with digital solid-state transducers is the most prospective technique, with sensitivity up to 0.1% of thickness of examined metal at resolution exceeding 10 line pairs per millimeter (lp/mm). The application of small-sized, movable, solid-state transducers opens new technological capabilities. These transducers can be set and moved in the zones where positioning of film holders and storage plates is impossible. New X-ray mini technology expands the application of nondestructive testing (NDT). Examples of the practical application of flash radiography on the basis of solid-state miniature transducers are presented in this paper.
Introduction

RT is a widespread NDT method of the quality of welded joints, materials, and parts. It can be used for parts of any material, geometry, and shape. RT is preferred for the testing of the quality of welded and brazed joints as well as in mastering the number of process solutions due to illustrative results. This method is also used for validation of other NDT methods.

Significant qualitative changes have taken place in recent years, expanding the possibilities of RT, first of all due to the appearance of new, multi-element semiconductor radiation image detectors as well as intensive implementation of the means for producing, processing, and analyzing digital images, which are illustrative and easy to archive and transmit electronically. Such detectors use an electron means and transform ionizing irradiation, passed through the object being examined and containing information about its internal discontinuities, into an electric signals package. After that the signals are digitized, processed, and used for formation of a digital image of the object being examined. Digital images can be observed directly during inspection, that is, in real time. Such an RT technique without consumables or intermediate carriers of information is called flash radiography (Troitskiy, 2013). Virtually, it is a portable X-ray television with electron recording of information, which can be delivered to a technician, put online, archived, and stored on memory cards without additional digitizing and decoding.

A distinctive feature of flash radiography is the absence of intermediate carriers of information, radiographic film, and semiconductor store plates with photo-stimulated memory. Adjustment of the mode in widespread technologies with intermediate carriers of information requires multiple exposures, highlighting, processing, and expensive devices for digitization and the reading of information. Therefore, the absence of intermediate carriers of information (films, semiconductor plates) allows for increased efficiency and significantly reduces the cost of quality testing.

Digital Imaging Acquisition Techniques

Examination of an object’s internal discontinuities with the help of portable X-ray television equipment having digital image processing provides for principle changes in the technology of RT. The frequency of application of optical and radiographic digital images has increased in recent times. Hardware and software complexes used for the processing and digitization of X-ray film and providing digital images are finding more and more distribution. Digital images can also be produced by means of storage plates instead of X-ray film. Digital image processing techniques and algorithms are the same for all three variants of RT (Figures 1 to 3).

This is an important direction for current radiographic flaw detection. Currently, digital images are typically produced by means of X-ray pattern digitization. Rarely, they are produced by processing the latent image being read from reusable storage plates. The same result can be received from flash radiography digital detectors without additional expenses related to intermediate information carriers.

The digital image produced by any of the three indicated techniques can be similarly interpreted. The results of radiographic digital image processing are not inferior to the sensitivity and resolving power of the results of radiographic film received via a film viewer. Image quality is evaluated using the reference specimen images. For digital images, these are similar to the reference specimen images of X-ray films examined using a film viewer.

There are three technologies (see Figures 1 to 3) for receiving digital image results of RT in electron form, but the principles of processing and further decoding of these images are the same (Varlamov, 2014).

Figure 1 shows a classic process for digital image production by means of digitization of film X-ray patterns. This traditional technology is widespread in all branches of industry. It requires preparation of film cartridges and screens. Chemical treatment, film drying, reading of information on a film viewer, and digitization of the results with the help of a corresponding computer complex follow inspection. This technology is mainly used for compact archiving of NDT results in electron form and receipt of additional information that cannot be obtained without digitization.

Figure 2 shows an example of a more perfect technology for digital image production based on storage plates, which is called computed radiography. In comparison to the previous example of digital image production, this technology provides for the possibility of multiple uses of intermediate carriers of information (storage plates). This makes the process quicker, but does not reduce its price, since it requires highly skilled and qualified personnel, a lot of time for auxiliary operations, and expensive readout equipment. Often, the storage plates have their own inherent discontinuities. Excluding the details of this technique’s disadvantages, it is necessary to note an appearance of “sandwich” technology, which allows exposing on film and storage plates simultaneously.

World manufacturers of film have kept the technique of film replacement using semiconductor multiuse storage plates. Different equipment was developed for the realization of this technology. The E.O. Paton Electric Welding Institute in Kiev, Ukraine, has spent a lot of time on implementation of selenium plates and other intermediate carriers of information. All of these technologies with reusable carriers of information have not gained ground because of two reasons, that is, due to expensive equipment and the necessity of highly skilled personnel.

Figure 3 shows an example of X-ray technology (flash radiography) based on fluoroscopic and solid detectors. This is the quickest and cheapest technique of
producing digital images in electronic form, which does not require the processing and reading or equipment and corresponding additional time.

Both types of RT without the use of X-ray film (Figures 2 and 3) can provide better results than those of digitized images produced with the help of X-ray film.

The Quality of Digital Images Obtained by Different Techniques

It is known that the higher the optical density and the greater the exposure provided, the more information exposed film contains. Therefore, a good scanner is necessary for digitization of high-density films to collect all the data available on the film. Reading devices and cheap scanners cannot provide high-quality digitization of X-ray images if their relative optical density is above three. Attempts to receive satisfactory digital images from denser films have not been successful. Thus, a satisfactory digital image in the film variant (see Figure 1) is possible, if the optical film density lies only in the 1.5 to 2.5 range. At such values, the digitizer noises do not introduce irreversible distortions in the digital image. Conducting digitization of film images with a 3 to 3.2 order density has previously shown unsatisfactory results, because the fine information is difficult to display. For example, images of small pores less than 0.2 mm in diameter and cracks with small openings are lost. Therefore, film digitization has significant limitations. A portion of the discontinuities, detected with the help of a film viewer, cannot be found on the digital image. This is a significant disadvantage of traditional film radiography, which is virtually impossible to eliminate in real production.

Technologies without the use of film, shown in Figures 2 and 3, do not have this disadvantage; they differ by a large dynamic range that expands the possibilities of NDT. Analysis of digital images by the technological schematics of Figures 2 and 3 verified that the detectability of small pores, cracks, and different inclusions in the welded joints exceeds the information about them than that on the film. The technology shown in Figure 3, based on solid or optoelectronic transducers, is particularly prospective. It provides for the possibility after digital image computer processing to obtain up to 0.1% sensitivity and examine a moving object. The discontinuity detectability is increased due to the fact that small moving images are better distinguished by the human eye than they are in static form. It is possible to change the inspection direction if intermediate carriers of information are absent during inspection, as in Figure 3.

Digital images received by the three technologies, as shown in Figures 1 to 3, are easily archived and webcast. The
ratio of time consumption and the cost of information being received using the presented technological scheme approximately correspond to 10:5:1 and 5:20:1. Film radiography, shown in Figure 1, requires many procedures, which are sometimes repeated several times to get satisfactory results. There are no such procedures during flash radiography. Film radiography takes approximately 10 times longer than flash radiography (Figure 3) to receive the same result. When using storage plates, fewer auxiliary procedures are needed to obtain the same information about an object. Therefore, the time spent is correlated approximately to 10:5:1.

As for the cost, the ratio of 5:20:1 means that during X-ray technologies, shown in Figures 1 and 2, the equipment for information reading, highly qualified specialists as well as repeated exposures should be used to receive the same results as in flash radiography.

The technologies represented in Figures 1 and 3 do not require expensive maintenance. Certainly, the numbers 5:20:1 depend on many factors, including the living standards in a given country.

For flash radiography, the time and cost are taken to be 1. The two other techniques (Figures 1 and 2) require more time, 10:5:1, and cost, 5:20:1. Exposures taken at the dentist or fluoroscopy done in the hospital can be performed in a few seconds, and the pictures cost a few cents, while similar results based on the technologies shown in Figures 1 and 2 take significantly longer and are much more expensive.

Surely, in a short time, detection of internal corrosion damage with the help of portable flash radiography equipment would become mandatory for all oil and gas auxiliary pipelines, which have virtually no control at the present time, since X-ray film testing is expensive and ultrasonic testing (UT) is low efficiency.

Figure 4 provides a structural schematic of RT image production in electronic form on the three described technologies (see Figures 1 to 3). The procedures for these technologies differ in the stage of digital image production, while digital image processing is the same for all three. Therefore, the expenses for carrying out these procedures and the equipment for digital image receipt are also different.

A general disadvantage of the first two technologies with intermediate carriers of information (see Figures 1 and 2) is the necessity of re-inspection, sometimes multiple inspections, for the determination of optimum values of anode voltage, exposure time, and focal distance as well as auxiliary procedures with intermediate carriers of information. Usually, an operator, when working with new unknown objects, needs to find the correct inspection mode and procedure for the intermediate carrier of information. Typically, this is performed by means of selection and multiple exposures, that is, the repetition of all preparatory operations before inspection.

The most important advantage of the technology, presented in Figure 3, is the possibility to observe image changes on screen during inspection. This is the way to determine the optimum modes. Additionally, there is the possibility of multi-angle examination of the internal defect images.

Technologies based on small, a few square centimeters, solid digital electron transducers are of specific interest. They do not have limitations related to cartridges, screens, and storage plates. Mobile transducers can move freely over the object surface. Such possibilities are included in the widespread use of the diagnostics of large customs objects, which can be of unlimited size (Kolkoori et al., 2015). Testing of such objects with the help of intermediate carriers of information (films, storage plates) is virtually impossible (Kolkoori et al., 2015). Miniature solid transducers can be imbedded in structures of different shapes. Images from separate small transducers are then joined in a general image of the complex shaped object.
Flash radiography allows for the variation of all main parameters (focus distance, exposure, anode voltage, and current) and the observation of changes in the image on the display screen in real-time mode. This significantly reduces the time and number of consumables. Besides, artifacts from film, screens, storage plates, and cartridges in the technologies with intermediate carriers of information are difficult to remove. In the case of real-time images, that is, as with the technology shown in Figure 3, with the possibility of varying the testing mode parameters, the artifacts are easy to detect and further remove. There are algorithms of electron image operation; these provide for accumulation and extraction of separate fragments in the digital image.

**Flash Radiography Equipment**

The United States, Japan, Russia, and other countries carry out intensive works on the improvement of solid electron transducers and mobile X-ray television flaw detectors, which are replacing ultrasonic equipment thanks to better detection capabilities. In time, this practice will also come to other countries. Therefore, it is necessary to study the process capabilities of flash radiography. Many companies manufacture different scintillation panels. A significant part of such devices is described in previous work (Troitskiy et al., 2015). The E.O. Paton Electric Welding Institute, for example, cooperates with a commercial photonics company in Japan. Figure 5 shows two design principles of solid detectors by this company, and Table 1 provides some characteristics of their detectors.

In Table 1, light output and contrast transfer function were measured with the help of a charge coupled device matrix at 60 kV voltage on an X-ray tube. An aluminum filter of 1 mm (0.04 in.) thickness was used.

Scores of companies in the United States, Japan, and Europe produce solid digital transducers for virtually any RT problem. Figure 6 shows the process of examining pipeline corrosion damage with the help of a commercial solid transducer, providing wireless transmission of a digital image onto an operator screen; the technical characteristics for this instrument are listed in Table 2.

Image quality is categorized by specific indices, including the following (Mayorov, 2009; Zscherpel et al., 2007).

- Basic spatial resolution is measured with the help of a duplex image quality indicator (EN 462-5), and it equals half the registered sharpness or effective pixel size (BSI, 1994).
- Spatial resolution is determined by the distance of neighboring resolvable elements in an image.
- Spatial frequency is the value reverse to the distance of neighboring resolvable elements in an image being measured in line pairs per millimeter.

<table>
<thead>
<tr>
<th>Panel</th>
<th>Panel type</th>
<th>Size (mm)</th>
<th>Effective area (mm)</th>
<th>Substrate thickness (µm)</th>
<th>Scintillator thickness (µm)</th>
<th>Light relative output (%)</th>
<th>Contrast transfer function lp/mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOS</td>
<td>High light output</td>
<td>50 × 10</td>
<td>47 × 7</td>
<td>3</td>
<td>150</td>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>FOS</td>
<td>High resolution</td>
<td>50 × 10</td>
<td>47 × 7</td>
<td>3</td>
<td>150</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>FOS</td>
<td>High light output</td>
<td>50 × 50</td>
<td>47 × 47</td>
<td>3</td>
<td>150</td>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>FOS</td>
<td>High resolution</td>
<td>50 × 50</td>
<td>47 × 47</td>
<td>3</td>
<td>150</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>ACS</td>
<td>High light output</td>
<td>50 × 50</td>
<td>48 × 48</td>
<td>0.5</td>
<td>150</td>
<td>125</td>
<td>10</td>
</tr>
<tr>
<td>ACS</td>
<td>High resolution</td>
<td>50 × 50</td>
<td>48 × 48</td>
<td>0.5</td>
<td>150</td>
<td>150</td>
<td>10</td>
</tr>
<tr>
<td>ACS</td>
<td>High light output</td>
<td>468 × 468</td>
<td>440 × 440</td>
<td>2</td>
<td>600</td>
<td>250</td>
<td>3</td>
</tr>
<tr>
<td>ACS</td>
<td>High light output</td>
<td>468 × 468</td>
<td>440 × 440</td>
<td>1</td>
<td>150</td>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>ACS</td>
<td>High light output</td>
<td>468 × 468</td>
<td>440 × 440</td>
<td>1</td>
<td>600</td>
<td>150</td>
<td>3</td>
</tr>
</tbody>
</table>
| FOP = fiber optic plate with scintillator; ACS = amorphous carbon plate with scintillator; ALS = aluminum plate with scintillator.

**Figure 5.** Design variants of flat flaw detectors: (a) design in which the image is transferred from screen to sensor by fiber optic plate; and (b) design with direct positioning of scintillation screen over the sensor (charge coupled device matrix).

**Figure 6.** Examination of corrosion damage of pipeline with the help of a commercial solid transducer.
Fuzziness of the image has a multifactor origin due to geometry and projector conditions, detector fuzziness.

Signal-to-noise ratio (SNR) depends on the exposure and quality of the radiation dose. This relationship increases proportional to the square root of the area of the operating pixels.

Contrast-to-noise ratio depends on the relationship of SNR to the absorption coefficient of an object’s material.

Dynamic range should be taken into account in when comparing the possibilities of different RT techniques. These are thicknesses of the object available for tolerable analysis on one image. A large dynamic range provides for significant advantages for the technologies presented in Figures 2 and 3 in comparison to film radiography. Usually, a large dynamic range is achieved due to exposure dose, which in film systems is limited by a relative optical density of 3 to 4. Further, they become unreadable at greater film densities. In the case of digital detection systems (without intermediate carriers of information) “exposure,” that is, information storage, has no limitations due to computer technologies. At that, SNR rises proportional to the square root of the dose. It is equivalent to exposure time or the amount of averaged images. Thus, SNR, being equal to several thousand pixels and a high-quality digital image is achieved. In practice these processes are limited by a contrast sensitivity of 0.1%, which corresponds to SNR of the thousandth order.

Therefore, it is obvious that RT without intermediate carriers of information (storage plates, films, and so on) and with elements of scanning and the possibility of changing the direction of object irradiation is the way of the future.

Digital processing of images (see Figure 4) is accompanied by reporting procedures. These include evaluation of digital image suitability, measurement of gray intensity and optical density, and determination of sensitivity. The gray digital scale is usually 16 bits, has thousands of tones, and a digital image histogram should be approximately in the middle of this scale in order to prevent under- or overexposure (Tsetkova et al., 2014). Central positioning of the histogram provides for the possibility of higher quality digital processing, that is, it allows scaling of gray intensity. Size calibration is also used, which allows for the measuring of defects and performing other procedures not typical for traditional film radiography and UT.

It should be noted that there has been great success of radiation transducers based on shuffle bars with detectors, which are finding application in customs. All attempts to use such transducers for welded joint testing have been unsuccessful as of yet, but these systems are continuously being improved (Yatsenko et al., 2015).

**X-ray Mini Technology**

X-ray inspection systems can be developed based on mini R-transducers (Figure 5), at which the X-ray transducer is moved over the object surface, as takes place in UT.

The solid-body transducers allow for the elimination of the exposure of large areas and checking of only small zones where interval discontinuities are expected. Such mobile flash radiography was used (Figure 7) for the examination of a testing bench with critical bolts used for joining of power reactors, where internal discontinuities could not be found by other techniques.

### Table 2

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (thickness × width × length)</td>
<td>2.2 × 29.5 × 36 cm (0.9 × 11.6 × 14.2 in.)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.7 kg (8.16 lb)</td>
</tr>
<tr>
<td>Power source</td>
<td>110–240 B, 215 W</td>
</tr>
<tr>
<td>Temperature range</td>
<td>10–40 °C (50–104 °F)</td>
</tr>
<tr>
<td>Connection to computer</td>
<td>USB 2.0, LAN</td>
</tr>
<tr>
<td>Safety class</td>
<td>IP 65</td>
</tr>
<tr>
<td>Active operating zone</td>
<td>204.8 × 204.8</td>
</tr>
<tr>
<td>Digital capacity</td>
<td>14- or 16-bit</td>
</tr>
</tbody>
</table>

**Figure 7.** Test bench for bolts of nuclear reactors: (a) total view; (b) plunger; (c) body; and (d) bolt being tested. 1–3 = cracks in the plunger and body appearing in testing of high-strength bolts; 4 = one-section solid-state radiation transducer; 5 = two-section solid-state transducer; 6 = three-section solid-state transducer; and 7 = radiation source (isotope, R-tube).
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Mini R-transducers are recommended for objects similar to that shown in Figure 7. Such a variant of flash radiography is called “X-ray mini” technology. This can be done using any solid-state transducer, including the one shown in Figure 5. Mobility of the R-transducer as well as an R-emitter (isotope, ceramic tube) is used in X-ray mini technology. Mini-detectors, which are 10 times smaller than large-panel ones (Figure 6), can easily perform tangential inspection of pipes and stop valves in heat and nuclear engineering (Troitskiy, 1997). X-ray mini technology could find wide application in monitoring the technical condition of aircraft, lifting, and other dangerous equipment. Mobility of the R-transducer and emitting source expand the capabilities of NDT. Thus, the success of X-ray mini technology is in its software. Each object has robotically performed individual programs, which are performed at the user’s request depending on technological processes using X-ray mini technology. The E.O. Paton Electric Welding Institute, for one, manufactures scanners for X-ray mini testing with corresponding software. X-ray mini testing can have complete or partial automation.

Figure 8 shows flash radiography in an X-ray mini variant. It was used for testing 1.5 km (0.9 mi) of main pipeline consisting of four pipes of 18 mm (0.71 in.) diameter at an oxygen plant. The program was designed in such a way that it was possible to simultaneously examine all pipes or each separately. This could be done using only a small-sized solid-state transducer, the positioning of which is determined by an operator. Similar RT with intermediate carriers of information requires much more money and time than flash radiography.

**Conclusions**

Flash radiography with digital solid transducers is the most prospective RT technology. It can provide sensitivity of up to 0.1% thickness of inspected metal at resolution exceeding 10 lp/mm. Additionally this technology is compatible with film radiography, that is, it can be carried out on the same X-ray equipment. All branches of industry are in need of quick and cost-effective flash radiography.

Application of small-sized movable solid transducers opens up new technological capabilities. Solid transducers can be set and moved in the zones where positioning of cartridges with films and storage plate is virtually impossible. Digital solid transducers reveal new process capabilities for NDT not available using other physical techniques. X-ray mini technology is the future of an expanding application of NDT in industry.

The R-transducer and R-emitter in X-ray mini technology should move on agreed trajectories with recording at each exposure: time, coordinates, energy, and distance to object, orientated in relation to each other. Finally, current equipment allows for the production of very small-sized R-detectors and R-emitters; therefore, X-ray mini technology expands the capabilities of NDT as for the inspection of objects of any complex geometry and that require automation of RT processes.

**ACKNOWLEDGMENTS**

Commercial products were used in this work. The author is grateful to Dürr NDT, GmbH and Co. KG (Figure 6) and Hamamatsu Photonics K.K. (Japan) (Table 1 and Figure 5).

**REFERENCES**


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Exposing students to a variety of disciplines can shape their path through school and ultimately translate into a lifelong career and passion. But, as many technicians have encountered, nondestructive testing (NDT) is not exactly a well-known term among the general population. For that reason, student outreach is especially important. And for ASNT and dedicated volunteer members, that means starting kids early. In March, Golden Gate Section member Dan Kerr “the Science Sir” visited an elementary school, grades K–5, in a small rural town in California’s central valley, to introduce the next generation to all things NDT (Figure 1).

The school, whose name is being withheld to protect the privacy of its students, has been holding a career day for the past eight years. This year’s event saw a total of 600 students. Groups, averaging about 30 in size, spent the two-and-a-half hour event touring interactive stations set up by volunteer speakers. In addition to Kerr, there was an army soldier, a farmer, firefighters, a programmer, and a dance studio owner representing small businesses.

At his station, Kerr handed out ASNT compasses and heat sensitive pencils. Introduced incorrectly as an “aerospace scientist,” Kerr joked: “I would have suggested something different, but I didn’t have the time to explain.” He continued, “I talked about NDT—how fun it is.” He also told the students that NDT, “although not well known, is used many places to keep our world safer, and there are many career opportunities with good pay.”

And like with most specialty fields, this means that a good foundation in the core curriculum is paramount. As Kerr attested, students “need to learn their science and math first.”

For the demonstration portion, Kerr set up basic experiments showing different NDT methods in a way that could be relatable to young, curious minds (Figure 2). For one, he presented an acoustic sensor, which can “hear things” that dogs often might hear but humans cannot, such as small leaks and early electrical arcing behind walls; he also had the kids stand 10 to 20 feet away and used the sensor to detect them rubbing their fingers through their hair.

Kerr also demonstrated how a magnetic particle yoke could find a crack that could not otherwise be seen and had the students play with the powder, showing the difference between a permanent magnet and an electromagnet. The
electromagnet, he demonstrated, could “vacuum” up the powder and drop it into the garbage without having to work hard to brush it off, as one would have to with a permanent magnet. This demonstration was very similar to, and used much of the same equipment as, the one presented by ASNT at the 2014 and 2016 STEM festivals in Washington, D.C.

Towards the end of the career day, a smallish kindergartener raised her hand to ask Kerr, “Can little people be scientists too?” It was clear that the event had been a success (Figure 3).

Kerr commented on the importance of student outreach: “I wish everyone did this kind of thing more regularly at all elementary schools, especially retired and experienced people. Otherwise, all that life and work experience just goes to the grave with us!” He concluded by adding, “This is the best age to reach the kids.”

ACKNOWLEDGMENTS
Kerr credits his parents especially, for their example.
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Correction

In the July 2016 issue of The NDT Technician, the value of $M_{\text{min}}$ listed on page 3, second column following Equation 1, was incorrectly labeled. The line should read: $M_{\text{min}} = 1.7987X (1.8X)$. The text appears correctly in the digital edition. The NDT Technician regrets this error.
Gian Suazo is the recipient of the Lou DiValerio Technician of the Year Award for 2016. This award is made annually to an individual demonstrating exceptional merit as an NDT technician or in service to the Society. Suazo is active in the Air Capital Section, where this year he will be serving as chair. Previously, he has served as vice chair, program chair, and helped with the Section yearbook.

Q: How did you first become involved in NDT?
A: It all started when I was 17. My stepfather landed me a job on second shift as a part washer in liquid penetrant testing. It was just going to be temporary until I finished high school and figured out what I wanted to do, but it became a career.

Q: Can you tell us about your training and education?
A: My first training was in PT; I was still part washing but once I did well in a penetrant class I was trained as an inspector. I moved into MT after that. Since I started to like the job I decided to enroll at Cowley County Community College’s NDT program. While I was in the program I moved over to RT, then learned LT as well.

Q: Do you have ASNT certification?
A: I recently achieved my ASNT NDT PT Level III and passed the IRRSP last year.

Q: Describe the work you do. What are your responsibilities?
A: Typically, I’m responsible for the X-ray department so I work on orders using film and computed radiography. This can change from day to day though. I sometimes go help in penetrant inspection or UT. I’m also a lead auditor so I get assigned to perform audits in methods I’m certified in and chemical processing.

Q: Is your work focused on a particular field?
A: Particularly aerospace, but we also work on amusement park rides, military vehicle components, missiles; we’ve X-rayed body armor as well as helped local fire departments with special assignments.

Q: What kind of materials are you testing?
A: We perform inspections on all types of metals and composites but working in RT the parts I mostly see are castings, welds, and composites. There’s always the chance of something new coming in the door that we haven’t seen before.

Q: What’s been your most interesting application of NDT?
A: Penetrant and leak testing of some missile fuel tanks was by far the most interesting project I’ve worked on; every other day there was something new going on to check out and solve.

Q: Do you work alone or with a crew?
A: We do cross-training and can move around to different methods. For about the past year I’ve been handling the X-ray department alone, but I recently received a trainee that is helping with day-to-day operations.

Q: How has NDT changed during your career?
A: I think everyone would agree that technology is the biggest game changer. I still feel new to NDT only being in it eight years so I don’t feel like I’ve seen drastic changes that someone from the ’80s or ’90s has seen, but I’m looking forward to seeing where the industry goes 10 to 20 years down the road. I do believe the biggest advantage is communication. We had an X-ray customer in Singapore, and with computed radiography we were able to send images of rejected parts and discuss them quickly as opposed to having to ship the film back and waiting, especially since it has to go to another country and through customs.
Q: How do you keep up with changes in technology?
A: ASNT does a great job of keeping members up on new changes with *Materials Evaluation*; every time I read through it I find an interesting article or paper. In the company we try to stay up to date with technology and software but that is usually limited to the industry and methods we perform, whereas *M.E.* goes through all NDT applications.

Q: What areas of NDT would you like to learn more about?
A: I’m up to learning more about any area, even if it’s troubleshooting and solving something simple or going to a conference and seeing the newest UV lights. I’ve recently enjoyed learning more about quality concepts and auditing. Taking a step back and watching people go through the process and discussing whether or not it is done perfectly has been a great experience. It’s not as interesting as checking for discontinuities with images on the computer or film but it’s still an important role in NDT that needs to be done.

Q: What are your professional goals?
A: Additional training is always a goal but I would also like to do some of my own training in the future. With obtaining my PT Level III I plan to learn more on Level III responsibilities and possibly land some training and consulting jobs. In the meantime I want to go for Level IIIs in RT, MT, and possibly LT and just keep learning and getting better at what I do.

Q: What can the ASNT do to encourage careers in NDT?
A: Local sections are important; they can be the quickest resource by visiting high schools and colleges to increase awareness of NDT, but I believe ASNT is already on the right track to encourage careers in NDT. With increased incentives on research, waived student fees for conferences, local section websites, and an extremely helpful staff, ASNT is truly the leader in the industry and continues to show that year to year.

Q: How has ASNT involvement benefited your career?
A: Meeting other people in the field—I find that when you meet people in your section or go to conferences and meet individuals that go to work with the same goal it makes you want to take it a step further and learn more. More information is always better, so the more individuals get involved the more experiences and knowledge that can be spread around.

Q: What advice would you offer to individuals considering careers in NDT?
A: Talk to experienced individuals in the field; if you have an interest in science and want a technical career NDT may be for you. There are many opportunities, but go for the education first, then continue to move on to the next level.

Q: What characteristics do you think define a good NDT technician?
A: Integrity and hard work: any technician that shows both of those qualities and has a plan will go far in life.

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