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**Editors**

- Phil Keown
- Mark D Aubele
- James E Bennett
- Louise Belak
- Jennifer Walker

**FROM THE CHAIR**

In reviewing the results of the Nadcap program over the past year, a disturbing trend becomes very evident. The number of NDT suppliers on merit is declining, and the number of failed compliances, even for re-accreditation audits, is on the rise. Although NDT is still among the leaders in percentage of eligible suppliers on merit, the fact that this number is going in the wrong direction says there is something wrong. Unfamiliarity with the program or lack of understanding of the requirements should not be a problem for suppliers who have gone through three or more Nadcap audits. And, understanding that the compliance jobs represent conformance to customer requirements, this tells us that we have a growing concern in the NDT world. It would be encouraging if some of the suppliers who have faced this problem would communicate with the Task Group to let us know why we are seeing an increase in major findings, an increase in compliance failures, and an overall decline in suppliers attaining, or keeping, merit.

The baseline requirements are being balloted and that program is on-track. A number of Prime requirements have been adjusted as a result of this initiative, making it just a little easier for the Suppliers, the Auditors, the Staff Engineers and the Task Group. We hope to see this consolidation effort continue in the New Year.

The NDT program is gaining support from the supplier base. A core group of suppliers is working at developing a support group that focuses on NDT, NDT related issues, and helping the Task Group in its effort of continuous improvement. We all hope that each of you can find a means of communicating with this team either by attending the quarterly meetings or by e-mail / telephone. More and more we are trying to provide a venue for the supplier base to express their ideas, concerns and constructive criticisms of the program. The new and improved newsletter, for which we need to thank Jim Bennett, Louise Belak, and a host of others at PRI, provides the names and email addresses of the Task Group so you have lots of opportunities to interact with us. We would also like to remind everyone that your ideas and contributions to the newsletter are not only welcomed, but needed.

Finally, the NDT Task Group would like to take this opportunity to wish you all a very happy new year. It would be nice to see you all at one or more of the meetings in 2005, so please try to make it a priority for the new year.

Phil Keown - Chairman

**Nadcap Meeting Schedule**

	2005	2006	2007
January	Fiesta Inn Phoenix, AZ January 24-28	Crowne Plaza Redondo Beach Los Angeles, CA January 23-27	TBD Phoenix, AZ January 22-26
April	Frankfurt Holiday Inn Frankfurt, Germany April 18-22	Europe TBD April 24-28	Europe TBD April 16-20
July	Holiday Inn Kensington Forum London, England July 18-22	Asia TBD July 17-21	Asia TBD July 16-20
Oct	Marriott Downtown Pittsburgh, PA October 14-20	Marriott Downtown Pittsburgh, PA October 13-20	Marriott Downtown Pittsburgh, PA October 19-26

## Filmless Radiography

Wouldn't you know it? GE penning an article on the subject! Well, I've been involved in filmless radiography since 1980. First with Eastman Kodak telling customers why it wouldn't work, then with Ridge telling the same folks why it would. Now, over 20 years later, I'm here as the NDT Task-Group Method chair for Radiography still touting filmless RT.

Much has been developed in these two decades and the inspection method has surely matured. Whether it is digital or analog, image plate or detector array, we are seeing applications being developed. These applications reduce pollution by eliminating environmentally unfriendly chemicals, reduce archiving costs and increase inspection sensitivity through advanced image enhancement.

All this progress! But where are we using filmless radiography? Well let us know. Tell us some applications you have.

We have an ad hoc group assigned to define the need for Nadcap to audit filmless RT, but so far the response is not too positive. So we would like to hear from interested parties (Primes and Suppliers). Do we have a base that justifies a Nadcap Audit Program? You can email the Staff Engineer at PRI or me. Note: for contact details refer to page 6 & 7.

Ron Rodgers – GE Transportation

## Prepare for the Nadcap Audit (How to succeed by really trying).

Just like the Boy Scouts, "be prepared" should be your motto when faced with an upcoming Nadcap audit. It doesn't start a day or a week before, but well up to three months before (90 days for those of us who like bigger numbers). The point is to be ready for the audit, the auditor and the seemingly ever-present non-conformances (better known as "opportunities to improve" since we are positive thinkers).

- First, do a complete and thorough assessment using the appropriate Nadcap checklist(s). These can be found on-line (eAuditNet) and down-loaded. Answer the questions honestly. If the checklist asks for the procedure and paragraph for a particular item, find it and write it down in the checklist. Don't rely on your memory to serve you faithfully. Document that it exists and verify objective evidence is available to review that substantiates you meet the requirement. Compare your procedure to the latest standard or specification to which your facility is contractually obligated. You signed an agreement to be audited to AS7114, consider this as your contractual requirement also. Be prepared.
- Why do this 90 days before the actual audit? The answer is it allows you the opportunity to fix the things you identify as nonconforming. If this is a re-accreditation audit, it allows you to verify that corrective actions taken during the previous audit are still effective. Better if you find it and fix it than for Nadcap to identify it and classify it as "non-sustaining", which means "good-bye" to supplier merit for at least two more audits. Be prepared.

- Planning this far ahead allows you to assure the necessary personnel will be available for the audit. Arrange low priority meetings around the Nadcap audit, too much time is wasted when an auditor must wait for personnel to be available. The audit will be completed, whether it is during the time originally scheduled or if an additional day need tacked on (at the supplier's expense). Make sure that escorts know who is responsible for various aspects of your NDT system. Nothing makes you look worse than to receive a nonconformance because the escort did not know where the data was located or who to see to get it. Be prepared.
- Last, but not least, make sure you will have aerospace production hardware available for the compliance portion of the audit. The Nadcap primes want to see their hardware processed, not a job you may do for a paper mill or a medical device company. Check with internal production control or your customers to arrange for work to be available. It is important to them for you to attain or maintain accreditation. Be prepared.

This is not "another" audit. This is a Nadcap audit. It will take time and energy to prepare for this audit. The lesson to be learned is it does not matter if this is your first audit or tenth, nothing beats preparation as the audit will test compliance to every aspect of your quality system. Just one last thought...say it with me..."BE PREPARED".

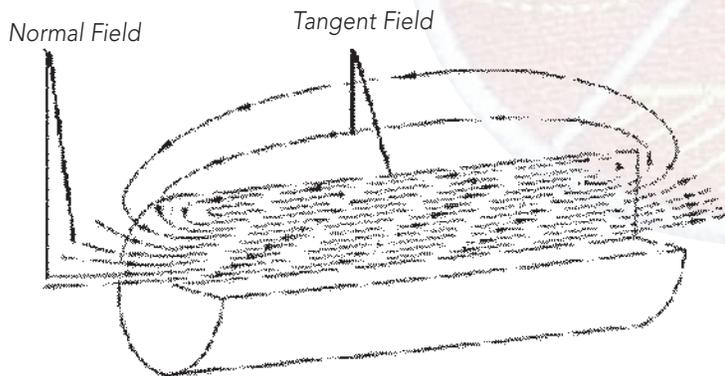
P. Michael Guttridge – NDT / Welding Staff Engineer

## Hall Effect Gauss Meter Practice

The internal field strength within a magnetized part is impossible to measure. However, the Hall effect gauss meter is capable of measuring the magnetic flux density a short distance above the part surface. ASTM E 1444, the industry standard, gives the option of using the Hall Effect meter for determining adequate field strength or verifying the amperage estimate derived from empirical formulas. Specifically, the ASTM E 1444 requirements are:

- Should measure the peak value of the tangential field. (6.3.1.2)
- Tangential field strengths in the range of 30 to 60 Gauss measured at the part surface are normally adequate magnetization levels for magnetic particle examination. (6.3.2).
- Gauss meters are not allowed when determining field strength of a multi-directional magnetization. (6.2.6)

Either circular magnetism or longitudinal magnetism as illustrated below may generate the field tangent to the surface. This tangential field is the applied field whereas the normal field is produced by flux leakage from the magnetic domain generated field. Carl Betz stated that the magnetic domain generated field is normally 1000 to 2000 times the strength of the applied field. Measurements taken in the vicinity of the normal field will skew the Hall Effect meter reading much higher. Studies have shown that 30 gauss is adequate minimum field strength. An AS 5371 (QQI) shim will give a good to bright indication in the 10 to 30 gauss range. No studies have verified the validity of the 60 gauss limit. The current draft of ASTM E 1444-05 takes off the upper limit of 60 gauss, limiting the upper range to that which does not produce excessive background.



Non-mandatory information included in Annex X3 of ASTM E 1444 include:

- Care must be exercised when measuring the tangential applied field strengths specified in 6.3.2.

- The active area of the Hall effect sensor should be no larger than 0.2" by 0.2" and be located no more than 5 mm (0.197") from the part surface
- The plane of the probe must be perpendicular to the surface of the part at the location of measurement to within 5 degrees.
- If the current is being applied in shots, or if alternating current or half-wave rectified alternating current is being used, the gauss meter should be set to read the peak value during the shot.
- The gauss meter should have a frequency response of 0 to 300 Hz or higher.
- The direction and magnitude of the tangential field on the part surface can be determined by two measurements made at right angles to each other at the same spot.

Some meter manufacturers provide a shoe to hold the sensor perpendicular. Users have also fabricated plastic shoes to maintain the optimum orientation. However, it should be recognized that the Hall sensor itself is not inherently sensitive to small angular variation. The Hall sensor response is proportional to the sine of the angle between B and the plane of the Hall sensor. In other words, if one were off 5° from normal, the response would be 0.4% less. For 10° from normal, the response would be 1.5% less; not very significant.

The following guidelines for the use of the Hall Effect gauss meter using FWDC on a uni-directional unit are based upon the industry standard, an article published in Materials Evaluation and various papers presented at ASNT conferences.

- A transverse Hall Effect gauss meter probe shall be used in all cases.
- The probe should be positioned perpendicular to the circular or longitudinal field, within 50 perpendicularity in both axes.
- For longitudinal field measurement the probe may be positioned either inside or outside the coil.
- For longitudinal field measurement, the probe shall be positioned away from geometries such as the part ends, root of gear teeth, sharp corners, and keyways that will lead to misleading non-relevant readings.
- All measurements shall be taken in the dynamic mode, i.e., with the current energized.
- Two magnetization measurements are recommended for each shot.

George Hopman - Honeywell Engines & Systems,  
george.hopman@honeywell.com

## **P3TF2 & P3TF47 Revisions**

On February 11, 2004, GE Trans issued revisions to both of their Fluorescent Penetrant Inspection specifications. Months earlier a letter, along with the draft change notice that detailed the changes, was sent to all approved FPI suppliers in the GE Trans system. The suppliers were required to acknowledge receipt, and provide a date at which the new requirements would be implemented and, where appropriate, when the new requirements would be flowed down to sub-tiers. The change notice explained that the new revision would be effective as of February 29, 2004. The usual 18-month implementation period was not applied to this revision.

This new revision defines the requirements and conditions for etching of blended areas prior to re-inspection. This is not a mandate to pre-penetrant etch all parts, it is a requirement to etch those areas where blending, benching or machining has been done to remove indications found during FPI inspection. It is required when working with softer materials (aluminum, magnesium, copper) or if the parts were inspected using a level 3 or level 4 sensitivity penetrant.

Anyone performing Fluorescent Penetrant Inspection on GE Trans hardware shall meet the requirements of P3TF2-S29 or P3TF47-S5. If you do not have the current revisions, please contact your GE sourcing representative and request them immediately. Not having these revisions available at the time of your audit, or if the requirements have not been incorporated into your working procedures, will result in a major non-conformance. If these requirements have not been added to your process and are found during the compliance portion of the audit, it will be considered a compliance failure with potential for product impact.

Phil Keown – GE Transportation

## **Baseline Audits - Conclusion**

In the last news letter I gave a report on the pilot audits carried out in the UK using the baseline checklists. To follow on from this I have put together a further report, which covers the NCR's raised. The following gives a breakdown of the NCR's recorded during the pilot audits. As these were pilot audits the NCR's were not categorised as major or minor and each single item in the checklist that was not met was issued an NCR. Under normal audit conditions several of these NCR's would be grouped and placed under 1 NCR but for clarity and review purposes this was not done.

### **AC7114:**

3 NCR's were noted; 2 were written as the company written practice was raised to comply with EN 4179:2000 rather than NAS 410. The other NCR written covered sections 4.2.4 and 4.2.4.1, which states *"Is there a documented annual review of processing and inspection of hardware for each certified individual"*, which is not required in EN 4179:2000 or NAS 410.

### **AC7114/1:**

10 NCR's were noted; the supplier is working to their customers requirements and meeting them. The NCR's covered the calibration frequencies, calibration tolerances and control check frequencies as they are different, with some of the checks not required by their prime.

### **AC7114/2:**

11 NCR's were noted; the supplier is working to their customers requirements and meeting them. The NCR's covered the use of a non-digital UV light meter; the UV output was

below the checklist requirement and calibration tolerances. The remaining NCR's covered the procedure/technique and the baseline requirement for the minimum amount of data that is required in this document.

### **AC7114/3:**

Baseline document not available at present.

### **AC7114/4:**

15 NCR's were noted; the suppliers are working to their customers requirements and meeting them. The NCR's covered the use of the PMC strips, which if used as per the manufacturers instructions do not meet the baseline tolerances and range, calibration frequencies, density requirements when using plaque type penetrameters, calibration tolerances and control check frequencies as they are different from their primes. Other NCR's covered dark adaptation times, the supplier information required to be permanently on the film and the mandated compliance to ASTM E1254. The rest of the NCR's covered the procedure/technique and the baseline requirement for the minimum amount of data that is required in this document.

The baseline checklists and standards are in for ballot, at present, with the primes. This ballot will be completed on the 17th December 2004 and after any small changes required due to typographical errors the checklists and standards will be sent to the NMC and then on to SAE's committee "K" for final ballot prior to release and implementation.

Phil Ford – NDT Staff Engineer

## **Did you know.....?**

On the 15th day of every month, PRI publishes a Supplier Corrective Action Past Due List for each commodity for which responses are delinquent based on the established time limits. The list includes the audit number, response due date and company representative, which is then forwarded to the representative Task Group voting member / prime participants.

On the 15th day of the next month, if the supplier remains on the Supplier Corrective

Action Past Due List, a "last chance" failure notification (e-mail or fax) is sent to the supplier giving them three business days to reply with the information requested or fail.

All the above information is contained in Nadcap Internal Procedure 008 (NIP 008) and is available for review on [www.eauditnet.com](http://www.eauditnet.com) and selecting "View User Documents" (under Applications) and then "NIP 008".

Susan Malsch – NDT Committee Service Representative

## The Role and Approval of on-the-job Training

### Introduction

Since the General Theory requirements for training are fairly comparable and covered by many (if not all) training schemes, this article looks in detail at how companies should address the requirements and delivery of the Specific and Practical parts of company certification, particularly in relation to NAS410/EN4179 and on-the-job training.

NAS410 Revision 2, Section 6: Training and Experience, states in section 6.1 Training: *Candidates for certification as Level 1 "Limited", Level 1, or Level 2 shall complete sufficient organised training to become proficient with the principles and practices of the applicable test method and technique(s). The training shall be conducted in accordance with a detailed course outline approved by the responsible Level 3 or NANDTB (National Aerospace NDT Board). At a minimum, the training shall cover basic theory, test principles, products, equipment operation and standardisation, safety, operating procedures, applicable techniques, the applicable specifications, codes and written instructions used by the employer, and, if applicable, interpretation of indications. The outline shall include a list of references from which the training material is derived.*

General, specific and practical training may be obtained with the employer or outside agency and shall always be supplemented by practical on-the-job training with the employer.

The important points here are:

- a) The training, as well as general theory, SHALL cover ..... products, equipment operation and standardisation, safety, operating procedures, applicable techniques, the applicable specifications, codes and written instructions used by the employer.
- b) Whether the employer or an outside agency does the training, the training SHALL ALWAYS be supplemented by practical on-the-job training with the employer.

#### 1. 'Specific' operational considerations

In order to achieve the Specific training (for the specific theory examination), it is mandatory that the evaluation of actual **products** inspected at the company be reviewed. Then the operation of the **actual equipment** in use at the company is reviewed along with the standardization (calibration) and set-up. For radiography in particular, but not exclusively, the aspects of safety are mandated to be covered by the training, but this should also cover COSHH regulations (Control Of Substances Hazardous to Health), safety data sheets, along with ventilation, fume, electrical safety and fire risks. Finally, the actual operating procedures; techniques and specifications; codes and written instructions, **in use at the company** are reviewed so that an understanding of the application and interpretation of these codes/standards can be assessed in the examination. Again this will be very company specific depending upon the client being supplied and could cover Military Standards, Industry Standards, Customer Specifications, etc.

In certain cases where the company performs NDT for more than one Aerospace customer, that company may take the most stringent requirements from a range of standards and develop one single procedure, which meets all their customer's requirements. It is then this document, which must be covered in the training and examination program.

#### 2. 'Practical' operational considerations

In order to achieve the Practical training (for the practical examination), it is mandatory that on-the-job training is included in any training course, in order to confirm the candidates ability to apply his skill and knowledge to actual product, inspected by the company. Even where an outside agency is used to provide the General and Specific elements of training, the requirements for Practical training are as stated in NAS410 Section 6.1.3

Training Facilities: ... a sufficient number of representative test samples containing natural or artificial defects shall be available to cover the entire range of testing to be used by the candidate.

And

*To ensure that the candidate fully benefits from the practical exercises, the training facility shall have equipment sufficiently comparable to that which the candidate will use at the employer.*

Here the problem becomes more intractable. As the Aerospace sector, particularly airframe manufacture, moves more and more to composites, laminates, GRPs and other non-metallic materials, inspection becomes more part specific. Even where metallic materials are used, such as flight control and engine component manufacture, the exotic alloys and design characteristics require very specific test procedures, often designed by the manufacturers since nothing is available in the general marketplace.

Therefore, not only are part-specific procedures in use, but also the components/parts are very company specific and often large. The testing equipment is also company specific, having been designed for the specific part and application of the method. Hence the requirement that - training SHALL ALWAYS be supplemented by practical on-the-job training with the employer.

All of these considerations must be addressed by the *detailed course outline approved by the Level 3 (or the NANDTB where one exists).*

### Conclusions

So who will be in a position to approve the *detailed course outline*, in particular, the Specific and Practical elements, which have been developed and delivered by the employer? Alternatively, (in Europe) the Specific and Practical elements of each *detailed course outline* could be reviewed and approved by an NANDTB (where one exists) but - **on an individual company basis**, presumably using associated Level 3 personnel with the relevant experience for the company specific methods.

Peter Stephens – PRI Auditor & Independent NDT Consultant of NDTplus

## New Delegated Staff Engineer

The NDT Task Group would like to congratulate Jim Bennett on the great work he has been doing since making the transition from Task Group representative to Staff Engineer. Jim has been a great addition to the best team of Staff Engineers in the program, reviewing audits, keeping and organizing metrics, producing a great newsletter, and providing comic relief both in the office and at the meetings. This last item is not always intentional, but effective nonetheless. The Task Group expressed their confidence in Jim at the October meeting by waiving the two-year probationary period and granting him delegation. Congratulations, Jim, and keep up the great work.

*Phil Keown – Chairman*

## Categorizing an NCR – Major or Minor

In accordance with Nadcap Internal Procedure 008, (NIP 008) (Issuing, Processing & Response Time Frame for Nonconformance Reports):-

Major Nonconformance: Any nonconformance that could:

- adversely affect safety as related to products, persons or property;
- impact the usability of a product, performance of a service, or the integrity of the quality system;
- significantly increase product cost;
- potentially affect the ability to meet the customer's requirements. Examples: incorrect process parameters, missing inspections or processing steps, failure to record required data, missed or out-of-tolerance calibration;
- result from failure to implement a corrective action from the previous audit.

Minor Nonconformance: Any non-systemic, isolated nonconformance that does not:

- adversely affect the usability of a product, performance of a service, or the integrity of the quality system;
- affect any product or process output. Example: paperwork oversights, minor changes to procedures for clarification.

One of the most common questions asked of the Staff Engineer is "why is this NCR classified as Major and not Minor; there is after all no

impact to hardware"? There are many different scenarios which affect the categorization of an NCR. In an attempt for those not familiar with the Nadcap categorization system (which may well differ from other NCR categorization systems), give a shot at categorizing the following NCR's:

NCR 1 - FPI Procedure PT123, specifies ambient white light checks shall be performed weekly. The control check log sheet used by the inspectors record the check as being performed daily (ASTM E 1417) with acceptable results.

Category: Major / Minor

NCR 2 – Calibration of oven is performed semi-annually, requirement per ASTM E 1417 is quarterly. No evidence exists that the calibration frequency was extended and results from previous calibrations show no out of tolerance conditions.

Category: Major / Minor

NCR 3 – Supplier measures indications using fluorescent comparators. The customer involved requires indications to be measured using pin / feeler gauges.

Category: Major / Minor

For answers and explanations to the above, refer to the last page of the Newsletter.

*Jim Bennett – NDT Staff Engineer*

## Staff Engineer Contact Details - NDT Task Group

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## Categorizing an NCR – Major or Minor (Answers)

**NCR 1** – This would be categorized as a minor NCR. In practice, the inspectors were working to the correct requirements with objective evidence demonstrated via the control check log sheet, albeit the procedure failed to correctly identify the frequency.  
*Minor Nonconformance: Any non-systemic, isolated nonconformance that does not affect any product or process output. Example: paperwork oversights, minor changes to procedures for clarification.*

**NCR 2** – This would be categorized as a Major NCR. Although no product impact was suspected, the customer requirement was not met with potential for the Quality system being affected (calibration system, flow down and review of customer requirements, etc).  
*Major Nonconformance: Any non-conformance that could: impact the usability of a product, performance of a service, or the integrity of the quality system; potentially affect the ability to meet the customer's requirements. Examples: incorrect process parameters, missing inspections or processing steps, failure to record required data, missed or out-of-tolerance calibration;*

**NCR 3** – This would be categorized as a Major NCR. Customer requirement was not met.  
*Major Nonconformance: Any nonconformance that could: potentially affect the ability to meet the customer's requirements. Examples: incorrect process parameters, missing inspections or processing steps, failure to record required data, missed or out-of-tolerance calibration;*

## In Step with the NDT Staff Engineer



**Name:** Philip Ford (Phil)  
**Title:** NDT Staff Engineer  
**Duties:** Manage the European Auditors, Review Audit Reports.

**Background:**

1973 to 1982, Aircraft Weapons Technician in the Royal Air Force where I was introduced to the red and green stuff.

1984 to 1989, worked for British Aerospace Dynamics in Hatfield and carried out NDT in all the major methods including MT, PT, RT, UT and ET which included immersion inspection of diffusion bonded super plastic formed titanium product and real time micro focus radiography of product.

1989 to 1991, worked for British Aerospace Saudi Arabia in Riyadh Saudi Arabia and carried out NDT in all the major methods.

1991 to 2002, worked for The South West School of NDT in Cardiff and carried out training, examinations and consultancy in all the major NDT methods including the inspection

of composite materials. During this period I became a Nadcap auditor for NDT.

2002, I began my current position with PRI.

**Certifications:**

ASNT Level III PT, MT, UT, RT & ET. Have held PCN Aerospace Level III PT, MT, UT, RT & ET, Rolls-Royce plc Level III PT, MT & RT, Honeywell Level III PT, MT, UT & ET, Pratt & Whitney Canada Level III PT, BAE SYSTEMS Level III PT, MT, UT, RT & ET.

**Other:**

Held the chairmanship of The British Institute of NDT Aerospace Group, The British Institute of NDT South Wales Section and The North Atlantic Section of ASNT. I am an ASNT NSO Supervisory Monitor for the North Atlantic Section.

**Personal:**

Married with 2 boys, one 8 and the other 13 who are trying to become rock stars, so they do not have to work for a living! Enjoys renovating houses, a Laverda motorcycle (20 plus years so far) and tormenting the brain with OU courses.



## Auditor Training 2004 - Pittsburgh

Auditor training in October 2004 for the NDT supplier's were invited to participate and many took advantage. The clear advantage of having the suppliers present as well as the Primes and Staff, was that questions and issues could be addressed from a number of unique perspectives. Secondly, we diverted from the normal format of "lecturing" and presented topics in several interactive modes. Proper on-site audit behavior was addressed by having suppliers, auditors, staff and primes "act out" situations in a "Role Playing" event. Also used were the techniques of; Small Group

Discussion, Brainstorming, Worksheets/Exams/ Discussion and Question and Answer periods.

Though it is quite understood that it is impossible to please everyone, many favorable comments were received from all parties involved. Many thanks are in order to all who had a part in the training, particularly those who spent a significant amount of time developing the issues and format, the suppliers who participated for the first time and of course the primes. We had over 30 auditors participating, and even with that number; for the first time, the number of suppliers/primes exceeded auditors for a total of over 70 attendees on Sunday. Last and definitely not least, (to use a popular phrase), the auditors are well deserving of thanks for their active and enthusiastic participation. See you all next year.

Mark D Aubele – Senior NDT Staff Engineer