



# Nadcap Measurement & Inspection Newsletter

June 2019

## Issue Highlights

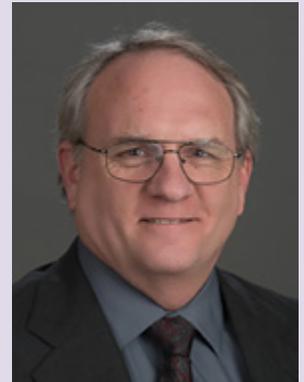
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### Editors

Joyce Benkart  
 Dave Marcyjanik  
 Steve Row



## Meet Steve Row



My name is Steve Row, and I am the new Chairperson of the Measurement and Inspection (M&I) Task Group. I am a native of San Diego, California, and I have been working at the same facility (currently Collins Aerospace) for over 34 years. I began with the company (ROHR Inc. at that time) as a tooling apprentice.

After 4 years as an apprentice and another year as a journeyman Jig and Fixture Builder, I joined our Coordinate Metrology Group where I created inspection plans, wrote programs for our Coordinate Measuring Machines (CMMs), and supervised the inspectors operating the CMMs. After that, I accepted a position as QA Supervisor of Tooling Inspection & Calibration.

During my 15 years managing the Cal Lab, I was introduced to Nadcap Checklists, as it seems that every commodity has at least a few calibration questions. As my responsibilities naturally progressed, I took over direct supervision of our Pyrometry Group to ensure AMS2750 & Nadcap Heat Treat checklist compliance. In 2007, I joined our Core Compliance Team (CCT), which manages all Nadcap compliance and accreditation activities. There I served as the Calibration and Pyrometry focal and concurrently returned to school to earn a BS in Design Engineering at National University.

In my years of experience with Nadcap audits and addressing Nadcap NCRs, I earned a reputation for questioning auditors to avoid subjective interpretations of checklist questions and requirements. At the Dallas Nadcap meeting in February of 2013, I attended the newly formed M&I Task Group meeting to see what it was all about. I was surprised to see that the experiences of my career path seemed to be a unique fit that would be beneficial in advancing the task group's objectives. After receiving endorsement from our Corporate Quality Group and NMC representative, I attended my first meeting as a voting member in June 2013 at the Nadcap Meeting in Paris, France.

I am excited to serve as the latest Measurement and Inspection Task Group Chairperson and look forward to working with Subscribers and Suppliers alike in what I believe to be the most collaborative and synergistic Nadcap Task Group.

Steve Row

M&I Task Group Chair  
 Collins Aerospace (Staff Engineer -Metrology, Tooling Quality, & Calibration - Aerostructures)

### M&I Newsletter – Want to be on the Circulation?

The M&I newsletter is published periodically throughout the year. The newsletters are read by the Nadcap Subscribers, Suppliers, Auditors and anybody that happens to click on the latest M&I newsletter on the PRI website (<https://p-r-i.org/about-pri/media-center/key-documents/>). The aim of the Newsletter is to communicate information relating to M&I within the Nadcap program to improve our process and to promote the sharing of best practices at all levels.

Have you stumbled across the M&I Newsletter by chance? Want to receive it on a regular basis? Keep up-to-date regarding the latest Nadcap M&I information by being added to the distribution list! To receive notification when a new edition has been published, please contact PRI (contacts on the last page) with your name, company and email address.

### From the Chair

The Task Group meeting in February 2019 experienced a transition of the leadership and I have accepted the Chair position for the next two years. Currently, the Vice Chair is open. From a Task Group meeting standpoint, there was a total of 72 registrations and there were typically 25-35 individuals attending each open session at the meeting. There were some very proactive and engaged Suppliers and Subscribers present, including some equipment manufacturer representatives providing technical guidance. We would like to see an increase in participation and hope that other Suppliers, Subscribers and equipment manufacturer representatives will attend as we revise and upgrade the checklists.

This meeting (February 2019) was a very busy meeting and we are seeing much progress on the checklists from work done at the last nine Nadcap meetings, as all the M&I checklists are currently in some form of revision or currently in the balloting process. Please be advised that the checklists have been updated with the requirement for attachment of the Auditees self-audit into eAuditNet more than 30 days prior to an audit. Auditees need to attach the self-audit and the other requested pre-audit information in eAuditNet on the Audit Details page. Several other changes were made to the Compliance Assessment Guidance (CAG) and checklist questions. Future revisions of the checklists AC7130/1/2/3 will have questions added to accommodate Auditees that utilize scanners attached to Coordinate Measurement Machine (CMM)s, Laser Trackers and Articulating Arms.

The checklists have been revised with four questions at the end of each to answer the Remote Compliance Audit (RCA) requirements to support where work is performed only at a remote facility, not under the ownership of the Supplier. At this most recent October 2018 meeting, the Auditor conference was held the previous weekend. For M&I this gave the Task Group (Subscriber and Supplier Voting Members) the opportunity to meet the Auditors ‘face to face’ and provide updates. This also allowed the Auditors to ask questions of the Task Group representatives regarding checklist question expectations. Many changes incorporated into the checklists were from direct auditor observations and Auditor requested clarifications. The checklists are very dynamic and evolving and the Task Group requests that all Subscribers, Suppliers and Auditors make suggestions for clarifications in the checklists to Staff. Staff will make an entry into the Document Change Spreadsheet (DCS) for your suggested change and verbiage, and the issue will be discussed at the next Nadcap meeting by the entire Task Group.

Your technical support would be appreciated at the Nadcap meetings as the meetings are very much “Working Group Meetings” and many changes and decisions are made there. The more technical experts in the room, the better the work the group will do.

With the word spreading about Nadcap M&I and other possible mandates, meeting attendance is expected to increase in the next few years. With additional interest in the program, there is still reason to introduce and explain the program to new representatives in the Supplier community. It is still planned that a series of ‘Introductions’ about the M&I program will be given during the Task Group meetings, and the Task Group will be reviewing a slide presentation discussing how to meet

expectations of each question in the AC7130 and the AC7130/1 checklist on Wednesday of every meeting. For further information, please contact PRI staff.

2018 was a successful year for the M&I Task Group even though audit scheduling has slowed:

- The GE mandate for Airflow accreditation (AC7130/5) is still moving forward and many Suppliers are on Merit
- Release of the AC7130/4 (3D Structured Light) checklist
- Airbus, Airbus Defense and SAFRAN mandating Nadcap M&I
- Boeing is accepting Nadcap for Digital Product Definition (DPD) audit frequency extensions
- Task Group updated the M&I Handbook
- Task Group updated of all checklists with technical changes and CAG’s
- Task Group updated the technology checklists to support Remote Compliance Audits

All of these actions are moving forward and there is still a great deal of work ahead and the TG is ready for the challenges as we head into 2019 and continue throughout the 2020’s with more mandates.

Nadcap understands that budgets and availability do not always support taking a business trip, however, we encourage you to take the opportunity to learn more about the Nadcap program and M&I, by attending the face to face Task Group meetings. There are two more to be held in 2019 (Europe - Paris, and US - Pittsburgh). There is also opportunity at these meetings to obtain free training associated with the Nadcap programs.

Steve Row – M&I Chair and Collins Aerospace (Staff Engineer - Metrology, Tooling Quality, & Calibration - Aerostructures)

### Nadcap Meeting Schedule

Nadcap meetings take place three times a year in locations around the world and are open to all Nadcap stakeholders and interested parties. There is no charge to attend. The table identifies the meeting dates and locations through 2021.

2019	
June	Paris, France
October	Pittsburgh, PA, USA
2020	
February	Beijing, China
June	London, UK
October	Pittsburgh, PA, USA
2021	
February	Garden Grove, CA, USA
June	Berlin, Germany
October	Pittsburgh, PA, USA

The October meeting is held annually in Pittsburgh. The Saturday and Sunday prior to the Task Group meeting is comprised of an annual conference

where all the Nadcap Auditors are updated on the program, policies, expectations and commodity (e.g. M&I) related issues.

The M&I Task Group meetings are comprised of open and closed meetings. Open meetings are for all Nadcap stakeholders and interested parties when items of a confidential nature are not discussed. Some examples are checklist discussions, procedural requirements, technical clarifications not associated with an audit, metrics, general M&I information, etc. A closed meeting is held for Nadcap Subscribers where confidential information is discussed, for example: mandate discussion / status, auditor issues, process escapes, supplier advisories, audit report packages, etc.

There are many advantages to participating in a Nadcap meeting:

- Learning about and participating in Task Group activities, such as

checklist development

- Attending Nadcap Management Council (NMC) and Supplier Support Committee (SSC) meetings to learn about current activities in the Nadcap community and sub team initiatives
- Networking with other delegates including aerospace Prime contractors, Suppliers and PRI Staff
- Benefiting from free eQualLearn training, such as Root Cause Corrective Action, Nadcap Audit Preparation and Introduction to Pyrometry

If you are interested in attending the Nadcap Task Group meeting, please register at <https://p-r-i.org/nadcap>

Dave Marcyjanik – PRI Senior Staff Engineer

## Job Audits - Hardware Availability

Job audits, compliance jobs, witnessed jobs, paper audits, historical jobs, etc. The list goes on. There are many terms used when a Nadcap Auditor watches a part being processed by the Supplier. This is considered one of the most critical aspects of the Nadcap audit. This is where all the procedures, calibration certificates, PO's, training records, inspection records, software control, program control, operators capability, etc, are verified to confirm compliance with the requirements. Compliance applies to all the Nadcap accreditations.

From an M&I perspective, we use the term 'job audit'. Within the M&I checklists there is an expectation that two 'job' audits be witnessed for each of the technologies. Now, depending on the number of technologies audited and the types of technologies, this can differ. For example, in M&I there are two types of Measurements. The first is measuring by using coordinates known as CMS (Coordinate Measurement Systems). CMM (Coordinate Measurements Machines), LT (Laser Trackers) and AA (Articulating Arms) falls into this category. The second is measuring by mass airflow. The latter does not mean a whole lot if you do not deal with mass airflow. For those that do, it is a very important aspect.

- For a CMM accreditation, two job audits are required
  - For an Airflow accreditation, two job audits are required
1. What happens if you add LT accreditation to CMM?
  2. What happens if you add CMM accreditation to Airflow?

To help explain, please refer to the table below.

JOB AUDIT COMPLIANCE TABLE

CMS Accreditation (CMM/LT/AA)	
One Technology	2 jobs
Two Technologies	2 jobs for one technology 1 job for remaining technology
Three Technologies	2 jobs for one technology 1 job for each remaining technology

Airflow Accreditation
2 job audits

So to answer the earlier questions

Question 1 = 3 job audits

Question 2 = 4 job audits

Some are under the impression that because the current primary mandate for M&I is Airbus, that when an Auditor is on-site for an audit, only Airbus hardware should be reviewed for compliance. Certainly, Airbus hardware would be expected to be reviewed on the production floor for compliance; to confirm that the supplier can and does appropriately flow-down specifications etc. However, the expectation is that a Supplier can and should produce other customer hardware for compliance jobs.

For compliance job witnessing, the Supplier is expected to ensure that there is adequate aerospace hardware available on-site for processing during the audit. During any M&I audit, the Task Group requires witnessing of two compliance jobs for the first technology checklist run by the Auditor. For every technology checklist thereafter, the Auditor is required to witness one compliance job for each additional technology process that is audited.

However, the Nadcap Auditor is not necessarily restricted to witness only Airbus hardware for compliance. As a matter of fact, the Nadcap model has always been that all Subscribers that are part of the Nadcap Task Group (regardless of whether they mandate or not) will accept the compliance job witnessing of another Subscriber's hardware as evidence that the Supplier can process the hardware to any other Subscriber's requirements.

It is not the intent of Nadcap to restrict hardware witnessing only to a mandating Subscribers hardware. For example, the Auditor may witness an Airbus job, and if the Supplier also works for Goodrich, the Auditor can select a Goodrich job as witness for the second compliance job. Or, it's also possible that if for some justifiable reason, the supplier does not have any active Airbus work on-site during the audit, the Auditor can select aerospace work of any other Subscriber or other customer to witness. This validates the Supplier's capability to process hardware to the other customers' requirements.

The Task Group has also clarified that if no production parts or tooling are available, demo parts can be processed utilizing production equipment, artifacts or something

## M&I Mandate Status - Update

representative of supplier work to demonstrate the process. Production hardware is certainly preferred to confirm flow-down. If demo work is selected on the production floor (only in the case of no-work on-site), it is expected of the auditor that in conjunction with the demo work, an additional historical record (archive job, no more than 12 months old) shall be reviewed for one customer job to review flow-down.

During the compliance witness portion of the audit, the auditor is observing and witnessing the Suppliers ability to flow-down requirements and to process work that confirms the use of current specifications, and to confirm the supplier's ability and use of their document control system. All that to say that all M&I Task Group representatives will accept the other Subscriber compliance jobs as acceptable for final accreditation to the M&I process.

Suppliers should ensure that there is work available during all audits for compliance witness and should contact their customer representatives to ensure onsite work or obtain / request hardware prior to the audit. If Suppliers have any questions, they are directed to each checklist as the requirements are clearly defined in each checklist immediately before each compliance job section. Any other technical questions can be directed to the Staff Engineer for clarification.

There are many different scenarios that occur during an audit that can make witnessing job audits a little more difficult. Examples being, lack of parts, inspection of a single part taking longer than two shifts to complete, etc. Each scenario does vary, so it is not easy to capture in such an article. If such situations occur, discuss with the Auditor or request clarification from the Staff Engineer.

There are many different scenarios that occur during an audit that can make witnessing job audits a little more difficult. Examples being, lack of parts, inspection of a single part taking longer than two shifts to complete, etc. Each scenario does vary, so it is not easy to capture in such an article. If such situations occur, notify the Auditor and Staff Engineer.

Dave Marcyjanik – PRI Senior Staff Engineer

Just to keep everyone abreast of current M&I Mandates, the current Nadcap mandate from GE Aviation for the Airflow process has accredited 41 facilities with a total of 133 total audits completed for Airflow since its inception in 2014. Additionally, Rolls Royce has indicated a possible upcoming Airflow mandate for a small number of Suppliers in the very near future.

The mandates issued in 2018 for Airbus, Airbus Defense and SAFRAN have certainly placed M&I on the map again. Many Suppliers have been in contact with PRI directly to ask various questions about the program. This is great news, as the M&I Task Group is working to emphasize the need to prepare and obtain as much information as possible, to prevent some of the common hurdles that new suppliers face.

Coordinate Measurement Systems Audits currently include audit checklists for Coordinate Measurement Machines (AC7130/1), Laser Trackers (AC7130/2) Articulated Arms (AC7130/3), 3D Structured Light Scanning Systems (AC7130/4) and Airflow (AC7130/5).

Since the inception of CMS audits in 2015, there have been a total of 346 Audit Accreditations for Coordinate Measurement Systems using various combinations of the AC7130/1/2/3 and /6 checklists.

Several Subscribers including Airbus, Airbus Defense and SAFRAN have moved forward with mandates for the AC7130/1/2/3 Nadcap Checklists. The Boeing Company is now accepting a Nadcap audit for AC7130/1/2/3 and giving those Nadcap accredited Suppliers extended frequency for their Digital Product Definition (DPD) audit.

Even though Nadcap has released the General Inspection Checklist (AC7114/6) for calipers, micrometers, run-out gages, plug gages, no-go gages etc., there is no current mandate for that checklist. However, quite a few Suppliers have chosen to be audited for the AC7130/6 and have been accredited to that checklist to enhance their internal programs.

Rolls Royce has been very instrumental in the creation and release of the 3D Structured Light Scanning checklist (AC7130/4) which is now active, and the Rolls Royce requirement for Supplier mandate has been published into the new release of the MCL127 document.

Continued on next page

### Top NCR's Findings for Each M&I Checklist

Hopes are that 2019 will see an even greater increase in the number of mandates in M&I, which will benefit both the Suppliers and Subscribers. The largest benefit of Nadcap is realized when multiple Subscribers mandate, which would result in a decrease of redundant audits. How does it benefit you as a Supplier if three Subscribers audit your facility in the same year? As news of additional mandates and other news becomes available, we will publish that information in upcoming Newsletters.

Currently, a side issue needs to be resolved for other Subscribers to mandate. One of the issues is field work accreditation. Currently, only Supplier work that is performed at the Suppliers on-site address is accredited by Nadcap. However, the Laser Tracker process is largely mobile and at some Supplier facilities the actual work is performed only at a remote facility, not under the ownership of the Supplier. A team at PRI has been writing the procedures to govern the process and has established how the Remote Compliance Audits (RCA) will function in eAuditNet. Much more to come on this matter and it is possible that the process could be up and running well before the end of 2019.

As a side note, it is important to mention that there is a very limited Auditor base for M&I, as with all commodities within Nadcap. Waiting until the last possible moment to schedule an audit will likely result in longer lead times and not meeting mandate deadlines set forth by the customer. Please contact the Scheduling department to schedule your audit in advance of your deadline.

Dave Marcyjanik – PRI Senior Staff Engineer

As mentioned in the previous article, since the M&I Task Group began, there have been 346 Audit Accreditations for Coordinate Measurement Systems and 133 total Audit Accreditations for Airflow Suppliers. The M&I Task Group routinely gathers data from all audits and compiles that into presentations that are shown at each Nadcap Meeting open session.

Contained in this article are summaries of the findings (by Checklist Paragraph) identified during these audits. Further content and how to address compliance of the NCR's, is provided during the M&I Audit Preparation courses and is also available in the M&I audit handbook.

#### Baseline Checklist (AC7130)

- Para. 4.1.3 - Is there evidence that the calibration requirements have been flowed down to the calibration laboratory?
- Para. 3.10 - Did the Auditee upload a copy of their completed self-audit to eAuditNet at least 30 days prior to the audit - utilizing the version of the checklist(s) applicable to this audit?
- Para. 4.1.1.1 - If measurement equipment did not meet the calibration requirements, is there evidence of appropriate action taken?
- Para. 3.12 - Does the self-audit include one compliance job per each applicable technology checklist?
- Para. 3.9 - For re-accreditation audits, were corrective actions from the previous audit implemented?

#### CMM Checklist (AC7130/1)

- Para. 4.4.3 - Is there evidence the measurement method used is capable to perform the required inspection?
- Para. 4.6.3 - Is there evidence to show that environmental conditions have been assessed and appropriately controlled?
- Para. 4.4.1 - Is there a process addressing the verification checks of CMM operation and accuracy, and is it being followed?
- Para. 4.3.3 - Is the stylus qualification sphere or master tip calibrated and in good condition (clean and fit for purpose)?
- Para. 4.6.2 - Is there a process to manage the temperature around the CMM, and is it being followed?

#### Laser Trackers (AC7130/2)

- Para. 4.4.2 - Is there evidence the measurement method used is capable to perform the required inspection ?
- Para. 4.4.3 - Is there a documented procedure that addresses verification checks performed at the beginning, during and at the end of the measurement process?

- Para. 4.4.3.1 - Is there evidence of verification checks performed in accordance with the documented procedure?
- Para. 4.5.4 - Is the calibration status of the equipment identified with the next due date?\*
- Para. 4.5.3 - Does the Laser Tracker equipment identified, display appropriate calibration status?

#### Articulated Arms (AC7130/3)

- Para. 4.5.1 - Does the documented procedure address verification checks performed at the beginning, during and at the end of the measurement process to determine continued stability of the arm alignment to the part?
- Para. 4.5.1.1 - Is there evidence of verification checks performed in accordance with the documented procedure?
- Para. 4.5.2 - Is there evidence the measurement method used is capable to perform the required inspection?
- Para. 4.7.2.1 - Is there evidence of the part temperature being monitored and/or managed?
- Para. 4.7.3 - Is there evidence to show that environmental conditions have been assessed and appropriately controlled?

#### Airflow Checklist (AC7130/5)

- Para. 4.4.3 - Does the Airflow equipment identified, display appropriate calibration status?
- Para. 4.4.4 - Is the calibration status of the equipment identified with the next due date?
- Para. 4.2.1.3 - Is the Dewpoint measured in accordance with customer requirements?
- Para. 4.8.1.4 - Does the documented procedure include dismounting and remounting of the AIS / Master in the test fixture for the repeat measurements?
- Para. 4.3.7 - Are the acceptance limits for the verification check compliant to customer requirements?

Note: The data for the AC7130/4 does not exist as the first audit has not yet been conducted at the time of publishing this article. The AC7130/6 checklist data is so minimal as not to be presented here until enough data is available to indicate trends.

### Current M&I Checklist Status Updates

The current checklist status is illustrated in the chart below, and all these ballots should be completed by the dates:

Checklist	Revision	
AC7130 - Core Checklist	D	02-2020
AC7130/1 - CMM	B	10-2019
AC7130/2 - Laser Tracker	A	10-2019
AC7130/3 - Articulating Arms	A	10-2019
AC7130/4 - 3D Structured Light	A	02-2020
AC7130/5 - Air Flow	A	02-2020
AC7130/6 - General Inspection	B	10-2019

Dave Marcyjanik – PRI Senior Staff Engineer

### M&I Audit Handbook Updated

Please be advised that the M&I Audit Handbook has been updated extensively from actions at each of the last three Nadcap meetings. It seems that there will be many more additions to the M&I Handbook in the very near future.

The handbook should answer most issues that any Auditor or Supplier may run into, and the clarifications in the handbook could be invaluable for any Auditee prior to an audit.

If anyone can think of a topic that should be included into the handbook, please email me [dmarcyjanik@p-r-i.org](mailto:dmarcyjanik@p-r-i.org).

Suppliers and Auditors are encouraged make frequent reference to the Handbook which is posted at:

eAuditNet / Resources / Documents / Audit Criteria / Measurement and Inspection / handbooks and Guides / M&I Audit Handbook

Dave Marcyjanik – PRI Senior Staff Engineer

## Self-Audit and Pre-Audit Information Attachment

As most Auditees know there has been a change to OP 1105 that requires an Auditee to attach the Nadcap self-audit to eAuditNet at least 30 days prior to any Nadcap Audit, excluding a Verification of Corrective Action Audit. Each Task Group has been directed by the Nadcap management Council (NMC) to add 3 new questions to all commodity baseline checklists regarding the self-audit.

1. Did the Auditee upload a copy of their completed self-audit to eAuditNet at least 30 days prior to the audit?
2. For each question in the checklist, has the Supplier identified where the means of compliance or evidence of compliance may be found?
3. Does the self-audit include one compliance job per each applicable technology checklist?

The actual attachment of the self-audit has been the most problematic for quite a few Auditees. The self-audit is required to be attached at least 30 days prior to the audit start date. Even at 29 days attachment prior to the audit, the Auditor is required to write an NCR at that facility. In eAuditNet, there is an area specifically for the attachment of a completed Supplier self-audit using the

AC7130 and all other applicable slash sheets (AC7130 and AC7130/1/2/3/4/5/6).

Separately, there is a location for all requested pre-audit general information such as lists of applicable subscribing Nadcap users, current quality systems approvals, procedures, processes to be approved and M&I equipment lists.

All the a-for-mentioned information is to be uploaded 30 days or more prior to the audit start date so that the Auditor can begin to review documentation prior to the actual start of the audit. Auditors are quite busy auditing during the week and the availability of the information well in advance of the audit accommodates the Auditor review on any weekend or other unscheduled time prior to the audit.

Excluding the self-audit itself, if at any time pre-audit information such as procedures cannot be attached, the Auditor can accommodate the Auditee with an extra day on-site to conduct review of those procedural materials. Please contact the PRI Scheduling department for pricing to coordinate the addition of an extra day on-site for the Auditor to conduct that review.

The screenshot shows the eAuditNet website. At the top, there is a navigation bar with 'Resources', 'Task Group', and 'Internal Applications' dropdown menus. Below this is a section titled 'Self-Audit and Pre-Audit Documents'. Under 'Self Audit', there are two items: '1. AC7130 Uploaded: 25-Jan-19' and '2. AC7130/2 Uploaded: 25-Jan-19'. Under 'Pre-Audit Documentation', there are two items: '1. Operators\_Equipment\_01.22.2019.docx Uploaded: 25-Jan-19' and '2. Procedures and Subscribers Uploaded: 25-Jan-19'. At the bottom, there is a section for 'Subscriber/Customer Identification' with a note: 'Ensure the Subscribers/Customers List are up to date as they will need to be reviewed with the auditor during Scope Verification.' and a button labeled 'Update Subscriber/Customer Identification'.

## Terms and Definitions Common to the M&I Checklists

<b>ACCEPTANCE TEST</b>
Verifies the performance of the measurement system and that the system is as stated by the manufacturer of the device. It is the test carried out during the installation of the device.
<b>AIRFLOW INSPECTION STANDARD (AIS)</b>
The AIS serves as a single-point verification reference for the Airflow Measuring System. It is not a means of calibrating the Airflow Measurement Stand. The AIS is used to qualify a Fixture and Gasket combination which is used for the inspection of parts. As such, the AIS shall have a geometric interface to the fixture, gasket, and seals that is identical to the inspected part. Usually, an AIS is a PART of the configuration to be inspected which has known flow and pressure values accurately established following the procedure defined by the Customer. The AIS can also be referred to as a MASTER.
<b>AIRFLOW MEASURING SYSTEM</b>
The combined entity of the airflow measurement stand and the test fixture.
<b>AIRFLOW MEASUREMENT STAND</b>
Equipment made up of devices such as regulators, valves, temperature measurement devices, pressure transducers, and flow measurement devices and their associated electronics that measures airflow to predetermined accuracy and repeatability.
<b>COMPETENCE (OR COMPETENCY)</b>
Combination of knowledge, skills and behavior to perform a specified job or specific role to meet requirements as outlined by Company procedures, Subscriber and/or Customers.
<b>EQUIPMENT</b>
Refers to singular or auxiliary items that are used to allow the inspection process to take place in accordance with document procedures, E.g. targets for laser trackers, reflectors, styli's, etc.
<b>FACILITY</b>
Area, location, premises where the inspection process is performed.
<b>FLOW TRANSFER STANDARD (FTS)</b>
The flow transfer standard is used for in-line calibration of flow measurement devices. The FTS is calibrated to a higher accuracy than the device being calibrated. The flow transfer standard is placed on the output of the flow measurement stand and is used to calibrate the combination of the flow measurement device and supporting pressure and temperature devices. Depending on the flow range of the measurement stand more than one FTS may be needed to perform the entire calibration.
<b>INSPECTION PLAN</b>
A planned series of events to achieve the goal of inspecting and validating a component against design requirements.
<b>JOB AUDIT</b>
A part witnessed during the audit to demonstrate compliance to the customer / Nadcap checklist requirement.

<b>LEAK CHECK STANDARD</b>
A special PART with sealing geometry identical to those being inspected that is used to check the Airflow Measurement System for leaks. This PART (usually) has the exit passages of the circuit (flow path) to be measured sealed. When no possibility of leakage from one circuit to another exists, the entrance passages may be sealed if there is no effect on the action of any Test Fixture seal. A given PART, with several flow circuits, may require several leak check PARTS, each with a given circuit sealed.
<b>KEY CHARACTERISTICS</b>
The features of a material, process, or part whose variation has a significant influence on product fit, performance, service life, or manufacturability.
<b>MANUFACTURING AID (MA)</b>
A part of the configuration to be inspected which has known flow, pressure or flow and pressure value(s) which were established by flowing the component 50 times on equipment that has passed a qualification procedure. The MA replaces an Airflow Inspection Standard for monitoring the condition of a Component Fixture and Gasket combination during production inspection operations.
<b>MASTER</b>
Refer to Airflow Inspection Standard (AIS).
<b>MAY</b>
Used to express an optional process and/or equipment.
<b>MEASUREMENT SYSTEM</b>
The collection of instruments or gages, standards, operations, methods, fixtures, software, personnel, environment and assumptions used to quantify a unit of measure or fixed assessment to the feature or characteristic being measured; the complete process used to obtain measurements.
<b>PART</b>
A real or sample component, typically of Aerospace design and origin, used during an audit to witness a manufacturing process and/or inspection to confirm Job Compliance by an Auditee.
<b>PROCEDURE</b>
As used in this Checklist, is a specified way to carry out an activity or process. This means that the procedure is established, documented, implemented and maintained. A single document may address the requirements for one or more procedures. A requirement for a procedure may be covered by more than one document. Documentation for the procedure can be in any form or type of medium, including work instructions, drawings, inspection plans, technique card, traveler, route card, skills matrix, etc.
<b>PROCESS</b>
As used in this checklist, is a specified way to carry out an activity or task. This means that the method is established, implemented and maintained, but not necessarily documented. Throughout this checklist the word "process" is utilized when a specific procedure is not required. The expectation for evidence of compliance to a process could be a procedure, or a written work instruction or an understood defined series of actions or steps taken to achieve a particular end, which can be demonstrated to be understood and consistently explained by those responsible for performing the process.

<b>REDUCED INSPECTION</b>
Inspecting a subset of features as opposed inspecting all features.
<b>REMOTE SERVICE PROVIDER</b>
Supplier facility that only conducts compliance work Off-Site from the main Non-Nadcap Accredited address, the remote address not under the ownership of the Accredited facility.
<b>SAMPLE INSPECTION</b>
Inspecting a subset of the parts as opposed to all the parts.
<b>SEALS</b>
The interface between the part fixture and the component under test. This interface is usually made of a soft material such as rubber. The interface could be molded to adapt to complex part surfaces or be as simple as an O-ring.
<b>SHALL</b>
Used to express a required process and/or equipment.
<b>SHOULD</b>
Used to express a recommended process and/or equipment.
<b>SONIC NOZZLE</b>
A device through which gas flow can be measured by achieving the proper pressure ratio of inlet pressure to exit pressure.
<b>TECHNICAL PLAN</b>
A documented package that includes sequence of operations, detailed instructions for each operation, product and process verification requirements, machine descriptions and maintenance plans for dedicated set-ups (if applicable).
<b>WILL</b>
Used to express a declaration of intent.

### Common Acronyms in M&I Checklists

AA	Articulating Arm	ISO	International Organization for Standardization
ADM	Absolute Distance Measurement	KPI	Key Performance Indicators
AIAG	Automotive Industry Action Group	KSB	Kinematic Scale Bars
AIS	Airflow Inspection Standard	LLP	Laser Line Probe
ARS	Auxiliary Reference System	LT	Laser Tracker
AS	Aerospace Standard	M&I	Measurement and Inspection
ASME	American Society of Mechanical Engineers	MCU	Master Control Unit
BB	Ball Bar	MSA	Measurement System Analysis
BCS	Ballot Comment Spreadsheet	NCR	Non-Conformance Report
CAG	Compliance Assessment Guidance	OEM	Original Equipment Manufacturer
CMM	Coordinate Measurement Machine	OJT	On the Job Training
CMS	Coordinate Measurement System	PO	Purchase Order
CTE	Coefficient of Thermal Expansion	PRI	Performance Review Institute
DCS	Document Change Spreadsheet	R&R	Repeatability and Reproducibility
DPD	Digital Product Definition	RCA	Remote Compliance Accreditation Audit
DRO	Digital Read Out	SBR	Spherical Ball Reflector
EAR	Export Administration Regulations	SMR	Spherically Mounted Retro-Reflector
EC-LR	Export Controlled – License Required	SPC	Statistical Process Control
FAI	First Article Inspection	TMR	Tracker Mounted Rest
FTS	Flow Transfer Standard	TRS	Tool Reference System
GD&T	Geometric Dimensioning and Tolerancing	WO	Work Order
ID	Identification	3DSL	Three-Dimensional Structured Light Scanning Systems
IFM	Interferometer Measurement		
ITAR	International Traffic in Arms Regulations		

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**Previous Newsletter Articles**

Periodically, a reference table is published that lists all the subject matters from the M&I newsletters up to the latest issue. This can help provide useful articles from old newsletters that still apply, but also a good way of letting new readers know whether a subject matter has been addressed already. If there is a topic that you don't see and would like to know more, please notify PRI Staff for consideration on future newsletters. Below is a table of some of the articles that have been covered so far:

Title	Issue
Audit Handbook	October 2014
Audit Preparation	March 2015
Audit Report / Accreditation Timelines	May 2015
Auditors	June 2014
How to address Nadcap M&I Findings (nonconformances)	May 2015
Top Findings for M&I	October 2014
What happens to the Audit Report from my recent Audit?	May 2015
What is M&I?	June 2014
Why M&I?	June 2014

The newsletters can be found on the PRI website as follows: <http://p-r-i.org/about-pri/media-center/key-documents/>

