Surviving a NADCAP Audit – 10 Simple Rules

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For a traditional metal finishing firm, subjecting them self to a Nadcap audit is akin to signing up to be a kamikaze pilot. All shops have been audited by prime contractors for decades and heck, most of us are even ISO approved. So you ask yourself, how bad can Nadcap be? You've all heard horror stories from shops that have been so struck; the auditor landed his plane directly in the heart of the ship, the ship's deck is awash in flames and the ship is going down. If Nadcap is in your future or you have an audit upcoming, man your battle stations and prepare to fight for your life. On the other hand, it doesn't have to be so. Nadcap provides those to be audited a thorough checklist and if you're diligent about it, you can make it through without as much as a surface scratch. Take it from someone whose been through it, the choice is yours: sunken dreams or flag ship of the admiral's fleet. Follow ten simple rules to keep your ship afloat.

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The first question a chemical processor might ask, is why do we need Nadcap in the first place? We have to look no further then ourselves and our former practices to discover the roots of Nadcap. For years platers have permitted the mystique of plating to exist relying on aged veterans to pass on their sage wisdom from one generation of platers to the next. It should come as no surprise then that many in this industry are family businesses passed from one generation to the next. We've relied on "bull of the woods" foreman to take the newbies under their wing and show them their stuff. The newbies look on in amazement as the wizard works his magic – turning lead into gold right in front of their eyes! Training was limited to the mandatory OSHA and EPA minimum, if that, and the norm was "follow me, do as I do." Process control was limited to analyzing the tanks and a few periodic tests that were performed under conditions that seldom resembled actual hardware plating conditions. Infrequent audits by primes in the aerospace industry kept us on our toes every two or three years, but once alone we always reverted to our former ways. Findings led to corrective actions that stated all the right intended actions, but once the primes cleared them, we forgot to implement our intended actions.

This wasn't the only motivating factor for Nadcap. Surly the primes knew that increased scrutiny by a third party auditing agency would eventually decrease the need for their own supplier quality and auditing personnel, but a slide taken from Nadcap's auditor training : alchemy to science illustrates the primes' perception of our industry and the need to establish Nadcap. We have to look no further than our own shop to see this manifestation: following our initial Nadcap audit, the auditor commented that in his opinion there were far too many thickness measurements being taken based on the steady backup at our 2 XRF thickness testers. In a way he was correct, we put parts in adjust the voltage (that's right voltage) and after 10 or 20 minutes check the thickness to see if they need more or less. Nothing too scientific about that – had they all forgotten about Faraday's Law and that the thickness achieved is a direct function of current and time? Oh yeah, we neglected to train them in the basics of electrochemistry.

In all honesty, many fought against the need for Nadcap. When we initially heard about the initiative in 1993, some shops including ours tried to organize a vigilant coalition of prominent aerospace platers to attend the chemical processing organization meetings. If it was going to be forced upon us, it was going to be reasonable we argued. Platers from across the US attended several of the initial meetings, we spoke up at times but the primes had done their homework and planted what they perceived as the best suited shop to serve as the Nadcap benchmark to attend as well. We'll call them KK Plating. Each time a discussion ensued and the plating coalition would raise a concern, the primes would state their perspective and solicit input from KK Plating who would shake his head in agreement with the primes. Either KK Plating was heads and tails above the others or the primes had fashioned one hell of a good puppet. The coalition's opinion and reasoning was typically squashed at every turn so it eventually decayed. Looking back to those early days, every one of the informal coalition have become Nadcap accredited. Over their own objections, one by one, they realized that in order to serve the aerospace industry today and

in the future, their survival depended on successfully completing the Nadcap auditing process. Some took longer than others to come to this realization, or in the case of Anoplate, it had a ways to grow before such an undertaking.

Part of Anoplate's hesitancy was rooted in the business model it had pursued – offer a wide variety of processes to a broad myriad of industries. The foundation of Anoplate's business throughout the 60's and 70's was comprised of local tool and die shops and metal fabricators serving computer and business machine manufacturers as well as the local GE radar / sonar facility which dealt directly with the government. With that initial foray into the military and defense market came a natural progression into the related military aerospace market. Upon returning to the family business in 1980 one of the authors recalls finding an audit report from Hughes Aircraft citing several deficiencies in our still developing quality system. Those were the days when we put a thickness and specification on the order an turned it over to an "experienced" operator who in turn did his best conform. In those days, we might not even have had a copy of the specification so we had no clue whether we were in conformance or not – they were all pretty close to the mil spec we reckoned. As for process control testing, in our naivety we presumed that if we kept the bath within the manufacturer's recommended window the hardness, purity, corrosion resistance would all conform. After all, the manufacturer's data sheet said it would! The Hughes audit was a wake up call to Anoplate that if it was going to dabble in the aerospace market, its quality system and process control methodology needed upgrading.

In the early 80's, Anoplate's sphere of influence stretched from Rochester to Utica. With the exception of Long Island, some 250 miles from Syracuse, New York had never been a hot bed for aerospace. That changed in the mid-80's when a local small sailplane manufacturer secured the rights to manufacture the 2-seater Hughes 300 helicopter. Almost overnight the need for a local aerospace finisher blossomed. While Anoplate never pursued closing the previous Hughes audit, it had been diligently working to upgrade its ability to satisfy the demands of the aerospace industry. A subsequent Hughes Helicopter audit resulted in approval for several finishes and Anoplate still serves as one of the primary suppliers to that former sailplane manufacturer today. Over that same period of time, Anoplate's percentage of aerospace business has ballooned from less than 5% to about 25%.

While Anoplate dragged its feet in pursuit of Nadcap, several primes were slow to endorse the new initiative. From the outset, it was the engine manufacturers, namely GE and Pratt & Whitney, that built momentum for Nadcap. Few if any of Anoplate's customers during this time were requiring it, so the impetus for change wasn't present. That all changed in 2002 when Boeing took the dive and indicated that as of all Boeing sub-tiers would be required to be Nadcap accredited. For Anoplate the decision was made for us, to survive it would have to ready itself for the Nadcap audit. Since then Nadcap had expanded globally with the likes of aerospace giants Airbus and Rolls Royce and has its eyes firmly set on further penetration into the non-aerospace defense sector.

While becoming ISO 9000 registered in 2000 was an achievement, especially considering the fact that we gained concurrent ISO 14001 registration, Nadcap loomed as a more daunting task in that it focused on only a portion of Anoplate's business. Furthermore, while ISO's broad scope destined it to make vague requirements that could easily be met with little depth in any single area, Nadcap focuses intensely on contract review, process control, and inspection & testing. Also, while ISO auditors go from a beauty parlor, to a shipping terminal before coming to your plating shop (i.e. they have had little if any exposure to our industry), the Nadcap chem processing auditor's life is auditing plating shops – there is little they haven't seen, only see in 2 distinct colors (that is black and white), and see right through a smoke screen and go straight to the ignition source. Herein we've come to the first rule.

#1. *Don't try to bull shit them!* Unlike any type auditor we've seen before, the Nadcap chem process auditor knows our business. They have a background in it before they hired on with Nadcap, they've been specifically trained by staff engineers back at PRI what to look for in plating shops, have access to hundreds of prior audit reports done on our industry, and congregate regularly to exchange war stories on the most commonly overlooked requirements. Like late night TV show host, David Letterman, auditor training even maintains a top ten list of initial audit findings (in no particular order).

TOP 7 AUDIT FINDINGS	
1.	Test Failure, Replacement Testing & Retesting
2.	Test and Data Review
3.	Specification Compliance
4.	Job Documentation, Planning
5.	Training, Qualification, and Evaluation
6.	Stress, Hydrogen Embrittlement & Ovens
7.	Statistical Methods
8.	Solution Control
9.	Equipment Maintenance
10.	Appendix A Milestone Plan

2. *Do your homework*. You've taken the dive and are determined to comply. Prior to the scheduled audit date, you're expected to submit particular documents to PRI. Long before that date, download a copy of the audit checklist. Ensure that everything on it, you have a response for. It's just like you're back in school, how well you do your homework is likely to determine whether or not you pass or fail. The library or in this case the PRI website is loaded with supplemental reading that will greatly enhance your ability to survive the audit.

3. *Compare and contrast Table 1's.* One of the easiest ways to determine specification compliance is to create your own list of tests and requirements. Nadcap has done this for you and refers to it as Table 1. Create your own Table 1 and compare it to Nadcaps – highlight any discrepancies and be ready to answer any variation. Be particularly wary of any spec wherein a specific frequency of testing is not explicitly defined. In such cases, Nadcap has defined defaults which are intentionally most stringent whereas our own firm had established more laxed

4 *Be selective about processes.* Don't be afraid to drop a class you're not prepared to pass! The scope of the Nadcap audit is entirely up to you. If you offer 20 different coatings, you may not be in a position to qualify for each one. Similarly, you may be fully compliant with the mil, ASM, ASTM, Bell and Boeing specifications for a particular finish, but Honeywell's contains a dielectric requirement that you can't consistently meet. It's simple, don't include Honeywell's spec in the scope of your audit. Anoplate boasts of offering more processes than nearly any other plating shop on this earth, however, when it came time to define the scope of our Nadcap audit, we intentionally left both zinc and gold off the list. We continue to offer 3 types of zinc plating and 4 grades of gold plating, however, the process control in these areas wasn't up to aerospace standards so we excluded these from our list of Nadcap approved processes.

5. *Prepare your personnel.* The audit, particularly the job audit portion, will extensively involve those directly responsible for producing the work. Unlike other audits, more than ½ the audit is comprised of the auditor interfacing directly with your operators. This isn't a paper audit; in decades gone by we had auditors that never got out of the front office. They aren't going to assume that the written procedure is exactly the way the operator is going to do the job. The auditor will stand over their shoulder in a potentially intimidating manner. Whether intentional or not, they try to induce a little added tension to see how the operator responds in an attempt to see how natural they are performing their daily tasks. If your operator appears overly nervous or is constantly re-reading their router between every step, it's going to make the auditor uneasy. Similarly, if you've got 30 operators and one senior operator performs all the work on each job audited, it raises similar uneasiness. Management should practice this with your operators – take a router and walk tank to tank with a stop watch and thermometer in hand (make sure they're calibrated!). Record the exact tanks, times, sequence, etc. How closely does their observation mirror the router? Coach your operators on how to respond - advise them not to be evasive, not offer extraneous information, and most importantly follow the paperwork exactly.

6. *Line your jobs up ahead of time*. If you've got a strength or expertise in one finish, make sure to have plenty of them in-house when the auditor arrives. If a job requires lots of masking and other preparation prior to actual finishing, those are ones to avoid. They won't audit 3 anodize jobs if you're intending to include plating. Similarly, if you do plating, anodizing and any sort of conversion coating (e.g. black oxide, chemical film or phosphate), they're likely to

audit one of each. Lastly, if you're a painter, Teflon™ or dry film lubricant applicator there is a separate checklist and this will require an additional job audit.

7. *Be exact.* Ordering information, sampling plans, test methods, documentation; leave no stone unturned. Remember, you're an integral part of aircraft parts manufacturing whose failure could pose serious threat of injury or death to those in the air and those beneath. As such, Nadcap auditors always default to the most stringent interpretation. If a spec lists five or six tests that can be run, unless otherwise directed the auditor will look to see that all five or six have been run or specifically (and formally in writing) waived by the customer. Also, any assumptions or interpretations your firm makes in processing an order must be divulged. "No plater ever does it" is not the proper response unless it's accompanied by "this plater doesn't do it" on your certification. During our first surveillance audit following the initial audit, one of our plater assistants was inspecting a tin job as part of a job audit. She took the 4 witness coupons plated concurrently with the actual hardware and subjected them to the familiar "bend & break" adhesion test. She then inspected them under the requisite 3.5x magnification and recorded the passing results on the inspection traveler. The only problem is that the order specifically cites the "bend over mandrel" adhesion test. While breaking the panel through repeated bends in a vise is clearly a more stringent adhesion test, we received a minor non-conformance for not only performing the wrong test, but more broadly, not following the specification stated in the ordering documents. Clearly, while the specific incident cited wasn't that big a deal, it could be systemic of a system that has poorly flowed down critical information.

8 *Prepare your customers.* If your customer isn't the prime, they'll need education too! Every spec has ordering requirements which are basically the minimum amount of information your customer should be supplying to avoid any ambiguity in doing their job. I can almost guarantee that your customer calling out DOD-P-16232 has never gone through a) thru h) on each lot he sends to you! We're lucky if we get the material hardness so we know when to stress relief or hydrogen embrittlement bake. Any missing pieces of information must be filled in prior to issuance of the parts to the floor. A good place to remind your customers of the needed information is at the quoting stage – plating customers will do anything to speed up the turn around on orders processed; convince them that they'll get them back quicker with them doing a more thorough job on issuing the contract with all necessary elements addressed.

9. *Review the auditor's report closely.* In general the auditor will afford you the opportunity to review the audit report before they submit it to PRI for assignment to a Staff Engineer. Review it carefully word for word. Failure to do so could result in your having to respond to a finding for something that never occurred! Once any event or action has been recorded in the audit report, whether it happened that way or not, you'll have to absolve yourself to the Staff Engineer prior to their closing the audit. One of the strangest things we've noted about the whole Nadcap process is that once the report is issued, there is little to no communication between the

assigned Staff Engineer and the auditor or the auditee and the auditor. Take advantage of this opportunity to save your self not only time but a whole lot of explaining.

10. *Get over it!* The fact that continual improvement and the corrective action system exists supports the notion that perfection is difficult, if not impossible, to achieve. Despite audit preparation, anticipate findings and prepare your staff for them. We've been told that a typical Nadcap chemical process first time audit averages 2 dozen findings. With that Anoplate was thrilled upon our initial audit when we only received 17 findings, however, during our second audit we were cited for 13 more. It's not that we hadn't prepared ourselves or were blatantly negligent in processing orders, we're in a tough business which demands a high degree of thorough process control. Don't engage the auditor in an argument – again, they only see black and white. Following the auditor filing their final audit report, you'll get your chance to be heard by the Staff Engineer. Gray is only within their spectral range of vision. Now that you're resolved to the fact that you will have findings, Nadcap has a "responding to findings" course and website guidebook – devour them! Use the 5-Why process, dig into process and don't stop until you've reach the absolute root cause. If you use their process and pry down into the heart of the problem, you'll save yourself needless iterations back and forth with insufficient responses. Your Staff Engineer will be tolerant once or twice, but their time (like ours) is limited too.

Like any new process, there are bugs in it that need to be worked out but the motivating factors behind the Nadcap chem process audit are irrefutable. Over the last decade Nadcap has continued to gain momentum to the point where it's a global movement and an undeniable force. If you're into aerospace finishing of any sort, you have two choices: comply or seek business elsewhere! If your choice is compliance, follow these 10 simple rules and survival will be within your grasp.

REFERENCES

1. AC7108 Revision B – Nadcap Audit Criteria for Chemical Processing, Performance Review Institute, Warrendale, PA 15086.