Preserving Your Antique Arms Collection

By David Arnold,
Conservator, Springfield Armory NHS Museum.

GCA members who attended the 2005 Convention were treated to a lecture by David Arnold, the Conservator at Springfield Armory, on how he cleans and preserves the priceless artifacts in the Springfield Armory NHS collection. Requests for attendance required that he give it twice, and some people attended both! Mr. Arnold has graciously agreed to repeat the highlights of his talks for the benefit of those who could not attend the Convention. Dave received his BA in American Studies from Michigan State University in 1986 and his Masters of Science in Art Conservation from Winterthur / University of Delaware Program in Art Conservation in 1994. He treated the entire Fuller Gun Collection (some 370 historic military arms) as a Contract Conservator to the National Park Service at its Harpers Ferry Conservation Center in Charles Town, West Virginia, over an 18 month period between 1998 and 1999. Dave joined the National Park Service in August 2000 as Conservator of Arms for Springfield Armory NHS.

The following are *guidelines* to help you care for a collection that will be preserved for as long as possible and will never be fired. It represents the safest, most conservative advice I can give without thoroughly examining your specific firearm. Methods recommended here may *not* be the most efficient. There are many more treatment options available to conservators which I cannot responsibly share in this forum. What may work beautifully in one situation can be a disaster in another. I treat every gun as a unique object and the treatments I perform can vary considerably from what follows. The following advice is limited in scope and cannot cover every possible situation. It is based on my training and experiences as a conservator, and my experience working (so far) mainly with military firearms made during the last three centuries. I continue to learn more with every treatment I do. As a consequence, these guidelines are a work-in-progress, and I am interested in any comments or questions you may have. Feel free to contact me with your concerns. Doing so will contribute to the improvement of these guidelines.

A. Preventive Care

1. Environment

• Avoid dramatic swings in relative humidity (RH). Try to keep stable between 40 and 50%.
• Consistency is more important than precise maintenance of a specific RH reading.
• RH control is most critical because of an unusual physical property of wood called *anisotropy*. Wood cells expand or contract very differently in response to changes in relative humidity – *depending on their specific grain orientation* (axial, transverse, or radial) in the log from which they came. Large swings in RH can result in cracks caused by compression-set shrinkage.
• *If humidity remains fairly constant*, changes in temperature make little difference to either metal or wood - better to concentrate on controlling relative humidity. A rapid rise in indoor temperature can pull the moisture out of the environment (including your artifact), causing a drop in RH. Cell shrinkage and cracking or splitting can occur.

2. Handling

• Wear gloves when handling your collection. No protective coating – appropriate for conserving an artifact (see below) can stand up for long against repeated bare-handed handling. Best thing is to *always* wear gloves.
• Nitrile examination gloves[i] are recommended when cleaning and coating your collection.
• Once an item has been coated, wear plain cotton gloves.

3. Housekeeping

• Keep dust-free. Dust can trap moisture increasing the likelihood of corrosion occurring.
• Do not use commercial dust cloths. They often leave an oil film behind. Oil films trap dust. Dust traps and collects water vapor in the air.
• When dusting, use a soft cotton cloth very lightly dampened with water
• Without moisture, dust merely gets shoved around and will not be picked up.
• Do not use alcohol of any kind when dusting or cleaning a stock. It can skin or strip an historic finish.
• Dry immediately with a clean cloth.
• Never use liquid or spray dusting products. Most leave mineral oil behind, which traps dust. Dust traps and collects moisture. Starting to see a pattern?

4. Storage / Display

• Narrow hooks or loops of wire should not be used to support collection pieces either in storage or on display. The weight of most long arms on such devices is sufficient to result in indentations in their stock at the points of contact.
• Use broad, padded supports. We use thin sheets of a closed-cell Polyolefin foam material[ii] to pad our display fixtures.
• To avoid mold and mildew during long-term storage – avoid at least two of the three conditions known to promote bloom outbreaks: elevated temperature, still air, and elevated humidity.

B. Cleaning and Coating Historic Firearms

1. Cleaning Wood Stocks

a. Separate wooden and metal parts. They are cleaned and coated differently.

b. Unless absolutely necessary, leave unfinished interior wooden surfaces alone.

c. Clean exterior of stock as follows:

(1.) Use a few *drops* of a mild detergent[iii] in a gallon of warm, distilled water, applied with a slightly damp soft cloth, and rinsed with clean cloths dampened with distilled water.

(2.) Dry with soft cloths immediately after rinsing.

(3.) Clean again with mineral spirits, using a soft cloth to apply. Work in fresh air or a well-ventilated area.

d. Avoid using "oil soaps" as their pH can be in the caustic range and may damage an historic oiled surface. They sure do a nice job on floors though!

2. Cleaning Barrels and Other Metal Parts

Please note: *It is essential to practice any new technique on a sacrificial piece first*, before applying it to something irreplaceable.

• Use nylon or animal-bristle bore brushes[iv]. Wherever possible, avoid using brass or steel brushes. Such hard materials can scratch, but also might (under certain conditions) cause galvanic (bi-metallic) corrosion (specifically when using a copper-alloy brush on ferrous metals) by leaving a slight metallic smear behind.

• Use mineral spirits to soften accretions. Work in fresh air or well-ventilated area. Are there other solvents that are "stronger?" Yes, but they are difficult to work with *safely*.

• Swab clean with a cloth patch.

• Use only extremely fine abrasives such as oi1-free 0000 steel wool[v]. Use only if absolutely necessary to remove stubborn rust deposits or other accretions. Work slowly and be alert to any changes in the surface. There is always an element of risk in such work. If you are at all uncertain, hire a conservator before causing irreversible damage.

• When cleaning brass parts never use metal-cleaning products that contain ammonia. Ammonia can damage old copper alloy materials. In addition, such products often include abrasives which may prove too harsh. Elbow grease and mineral spirits should be tried first. If something slightly stronger is needed, try applying small amounts of wet tooth powder with a cotton swab and rinse with water.

• A general comment about commercial rust removers. To date, I have not found a rust-removal product which is entirely safe to use on historic metal surfaces. The problem is that most rust removers can't tell the difference between iron oxide and iron metal, and will leave an etched surface even where there is no rust. Some products seem to come close. Often they require extremely close attention and precision - too much for most of us. In short, there are no magic solutions which are risk-free and I advise against their use on anything you value.

• Most surface rust can be removed by first lubricating the area with a light penetrating oil[vi] and *cleaving* it off with a sharp scalpel held at a very low angle to the metal. It requires close attention, a steady hand, and some patience, but if you are careful, you will probably get most - if not all - of the surface rust off without leaving so much as a scratch. When done, remove any remaining oil with mineral spirits.

3. Disassembly and Reassembly

• If you are organized and systematic – you should be able to safely disassemble and reassemble most firearms successfully.

• Probe the floor of every external screw slot with a sharp point. It's amazing how much dirt can be packed into a "clean-looking" slot. All foreign matter must be removed for the screwdriver to fill the slot completely and work safely.

• A good selection of screwdrivers is a must. Their tips must be matched perfectly to each slot in order to maximize the area of mechanical contact. Taking this precaution will minimize slippage and the scratching and scarring that can result. The internal shapes of screw slots have changed a lot since their inventionvii and screwdriver tips often have to be ground or filed in order to get a good match. Keep this in mind when regrinding a screwdriver's tip.

• There are many publications that offer exploded drawings and disassembly/reassembly tips[viii]. There is also a brilliant web site that illustrates with moving images how various types of firearms work[ix].

4. Coating Stocks

• Wood is neither thirsty nor hungry. It is usually covered by a finish which may have become corrupted in some way, making it look "dry." The wood beneath the finish does not need to be "fed", despite what wood-care product commercials may claim.

• Never put oil of any kind on an historic finish. There may well be unintended but permanently damaging consequences to ignoring this advice.

• A cautionary word about linseed oil. While it may be an appropriate material to use to finish a modern historic replica, consider the following:

a. Linseed oi1 takes forever to dry and will trap dust. It will not stop water penetration either.

b. When linseed oi1 oxidizes, its molecules cross-link with one another, making it increasingly more difficult to remove as time passes.

c. Oxidized linseed oil (linoleic acid) eventually becomes linoxin, better-known commercially as Linoleum! Repeated, or seasonal, applications eventually develop into a surface that can look like very dark brown alligator skin, and can become almost impossible to remove.

d. Applying a modern finish over an equivalent historic finish can forever confuse the finish "history" of a stock by making it difficult, if not impossible, to tell what (if anything) is original,

Oiled Lock after Hurricane Katrina

A Hot-Waxed Lock after Hurricane Katrina

A Cold-Waxed Lock after Hurricane Katrina

and what is a restoration material - even with an analytical microscope. Therefore, you would not want to touch up, say, a shellac finish with shellac.

• Use paste waxes only. I prefer carnauba-based furniture waxes such as Kiwi Bois, Mohawk or Behlen, or Black Bison on wood stocks[x]. I also recommend using pigmented paste waxes. "Clear" waxes can collect in pores and appear as white specks against a dark wood background.

• Avoid wax mixtures which include a high percentage of bee's wax. They are not especially harmful, but are relatively soft (fingerprint easily) and can be slightly acidic.

• Some collectors are wary of using water on stocks for fear of raising the grain, and their fears are well-founded. I would never recommend using an aqueous cleaning system on an unfinished or uncoated stock. Even then, I don't work sloppy-wet, but work one small area at a time and rinse-and-dry, working systematically over the exterior surfaces until done. So, we're not talking about any substantial amount of exposure to liquid. If the wood fibers have a coating over them, then the grain cannot imbibe water through the cell walls, and therefore cannot raise.

5. Coating Metals *(this advice is strictly for guns which have been "retired" from use and will never be fired.)*

• Avoid using oils. They are not the best material for long-term protection of collection pieces as they trap dust and dirt, eventually break down and have to be periodically replaced. A high-quality light oil is fine for maintaining a gun you still shoot, though.

• Use a microcrystalline wax, such as Renaissance Wax[xi] as a protective coating. Such waxes are practically inert, remaining stable for a very long time. Apply and buff out with a soft cloth or brush. I coat all parts this way - inside and out[xii]. Ferrous metals (iron, steel) should be preheated for a half hour or so to about 210 degrees F so that the wax will form a complete seal.

• There is no special treatment for Parkerized surfaces. I've had no problem with their accepting microcrystalline wax as a protective coating. It can always be removed later if necessary (mineral spirits, brushes and rags – oh, and lot's of elbow grease!).

These examples are from guns sent to our Conservation Lab from the Chalmette Visitor Center's exhibit after exposure to salt water following Hurricane Katrina. The lock on the left is a modern reproduction that appears to have only been oiled. The other two were treated in 1985 – and their reports indicate one was hot-waxed and the other was cold-waxed (just as you would polish and buff your dress shoes).

• Brass parts can also be coated with wax. I prefer, however, to use Incralac[xiii] acrylic spray lacquer because it is easily removed with solvents but bonds especially well to copper-alloy metals, and will withstand more abuse and last longer than wax.

6. Minor Stock Repairs: *If a split or detached piece of a stock must be repaired, use an adhesive that is both strong and reversible (i.e. can be safely removed at any time in the future). There is only one: traditional hide glue[xiv].*

• Do not proceed if there is evidence that the damaged site has been previously repaired. In this case, consult a conservator.

• Unless you work with hide glue every day - make it up fresh in small amounts as needed. It doesn't take long to prepare and it

will do a better job than using old glue. Hot hide glue is preferable to liquid hide glue as it is less affected by humidity.

• Dampen the area to be glued with hot water. Blot the area and wait a few minutes. Then apply hot glue to both surfaces with a brush and clamp immediately. An appropriate clamp can be as simple as a few pieces of masking tape, rubber bands, bicycle tire strips, or small padded weights. Use the least force needed to do the job.

• Clamps can usually be removed in a few hours, but it takes at least 24 hours for the repair to fully harden.

• Excess glue can be removed with a lint-free cloth dampened with hot water. The best time to do this is usually right after removing clamps.

7. If you still need help

• Seek the services of a professional conservator.

• Contact the American Institute for Conservation of Historic & Artistic Works (AIC)[xv] for a referral.

• There are few, if any, conservators who treat nothing but firearms. Look for an "Objects" Conservator with experience working with metal and the other materials (wood, celluloid, leather, etc.) that are part of your artifact.

Photograph B below shows the group of barrels in photo A (page 12) partial disassembly, their brass sliding barrel-guides, and lock nuts that secured these guides to one of two arms that controlled the spread of fire for the Requa-Billinghurst Volley Gun (Sr.# 1) that I have recently been treating. The image of the completed treatment (photo C) shows the full assembly after restoration. The gun has 25 .50 Cal. barrels which fired at once when the friction primer or percussion cap (either method could be used) were set off.

Prepared by David H. Arnold, Conservator
Springfield Armory N.H.S, Springfield, MA.
Tel. (413) 734-6478 x244 david__arnold@nps.govxvi

[i] **Nitrile** examination gloves come in every size and can be purchased from most medical supply stores and some pharmacies. I'm recommending them here for two reasons: some people have serious allergic reactions to latex rubber; also, latex breaks down if it comes in contact with many paste waxes and cleaning materials.

[ii] **Voltek** produces sheets of **Volara** in a range of thicknesses, color, and hardness which have proven to be very stable, conservation-grade materials used in many museums for padding storage shelves and exhibit fixtures. For your nearest supplier, contact VOLTEK, Division of Sekisui America Corporation, 100 Shepard Street, Lawrence, MA 01843 (800) 225-0668, or at www.voltek.com.

[iii] **Kodak Photo-Flo** is a non-ionic detergent available at photographic darkroom supply stores in a variety of sizes from 4 oz. and up.

[iv] **KleenBore** makes a stiff Nylon bore brush which I like a lot. They even make a series of "black powder" brushes with bristles that extend to the tip. Contact Kleen-Bore, Inc. 16 Industrial Parkway, Easthampton, MA 01027, (800) 445-0301, or at www.kleen-bore.com.

[v] **Liberon/Star Finish Supply** offers a very good 0000 grade of steel wool. They can be reached by mail at P.O. Box 86, Mendocino, CA 95460, (800) 245-5611, or on the web at www.liberon.com. Another source is Conservation Support Systems in Santa Barbara, CA. They can be reached at (800) 482-6299 or on the web at www.silcom.com/~css.

[vi] Choice of oil for this purpose is not critical. I happen to use **CRC 3-36, but WD-40** or any similar product will work fine as a scalpel lubricant.

[vii] See Warren E. Roberts, "Wood Screws as an Aid to Dating Wooden Artifacts," *The Chronicle*, 3/1978 *An Early American Industries publication*. Also, The Canadian Conservation Institute's excellent Technical Bulletin #17, "Threaded Fasteners in Metal Artifacts" by George Prytulak, 1977. The latter includes additional information on cleaning metals.

[viii] **The National Rifle Association** is a very good source for books on firearms assembly. Their address is: 11250 Waples Mill Road, Fairfax, VA 22030-9400. Internet: www.nrastore.com Search their technical references.

[ix] Take a look at: **http://home.howstuffworks.com.** Search on either Machineguns or Flintlocks.

[x] **Kiwi Bois** can be ordered from Hummer Capital, Inc., 1018 Stuyvesant Ave., Union, NJ 07083, (800) 552-9952, or www.hummercap.com. Kiwi Bois comes in seven different wood tones. I frequently use "walnut."

As far as I can tell, **Mohawk** and **Behlen** are the same product with different packaging. Mohawk's Blue Label brown wax can be ordered directly from Mohawk Finishing Products, 4715 State HWY 30, Amsterdam, NY 12010-9921, (800) 545-0047, or at www.mohawk-finishing.com. Behlen Blue Label brown wax can be ordered from Olde Mill Cabinet Shoppe, 1660 Camp Betty Washington Road, York, PA 17402, (717) 755-8884, or at www.oldemill.com.

Black Bison waxes are available through Liberon/Star (see iii above).

[xi] **Renaissance Wax** can be ordered from Woodcraft (formerly Woodcraft Supply), 560 Airport Industrial Park, PO Box 1686, Parkersburg, WV 26102-1686, (800) 225-1153, or at www.woodcraft.com.

[xii] I recommend reading "Preserving the Metal on Your Guns and Swords" in the October 2004 issue of *Man at Arms*. It is a very thorough, balanced discussion of options for coating historic arms.

[xiii] **Incralac** acrylic lacquer is offered in 12 oz. spray cans by Custom Aerosol Packaging, P.O. Box 1411, Piqua, OH 45356, (937) 773-1824.

[xiv] **Hide** glue is actually made up of tendons and other connective tissues. It is easy use and should be prepared in small batches whenever needed. It is available from Woodcraft, Olde Mill, Liberon (see above), and many other fine woodworking suppliers. It is the only wood adhesive I use and recommend.

[xv] **AIC.** 1717 K Street N.W., Suite 301, Washington, D.C. 200006. (202) 452-9545, fax (202) 452-9328. Best done initially on their web site: http://aic.stanford.edu/ Click the button entitled: "Find a conservator."