"Don't Give Up On That Old Scope" - Breathing new life into old equipment. *By Darren Hennig, M.Sc.*

In this three-part series on how to breathe new life into old equipment, I will cover such topics as cleaning and reconditioning optical surfaces, cleaning and recoating interior surfaces of telescopes and binoculars, and the introduction of baffling in older scopes, to name a few. I hope this information will be of value to those of you who enjoy a challenge in keeping up older equipment, or properly maintaining existing newer or home-built units as well. Any additonal questions regarding the techniques outlined in this series, or any additional information that I might find useful may be sent to me at: dhennig@sprint.ca.

Part 1 - Proper Cleaning of Older Optical Surfaces.

As an amateur astronomy enthusiast of many years, I always try to find new and better ways to improve on many aspects of my hobby. One area which I came into almost right away was "reconditioning" several older telescopes that I received as gifts from family members and friends. As a young lad of 14, my financial resources were, understandably limited, and I needed a way to enhance the equipment I had on hand.

To ensure optimal performance of any telescope system, clean and dust-free surfaces are essential. Every telescope, particularly older ones, have optical surface considerations that make it important to identify which type of cleaning procedure is applicable.

In general, a good to excellent-quality scope has low dispersion glass or flourite for refractors, or high reflectance aluminum mirrors in Newtonians or catadioptrics. Many of the more modern designs have varying degrees of coatings to enhance light transmission and minimize chromatic aberrations; these coatings also provide additional protection of the optical surfaces. Older equipment may not have this luxury, or the coatings are not as extensive. Vacuum-deposition and sintering have come a long way in 60 years!

The most important first step before attempting a thorough cleaning of your system is to identify (if possible) the type of lens or mirror materials, and whether or not there is some form of coating on them. For refractors, coatings usually appear as a deep bluish-purple color when the lenses are viewed in low light, or at an angle from the optical axis. The deeper the color, the more extensive the coating usually is. For reflectors, the mirrors usually have aluminum coatings, and they may be of the enhanced-reflectivity type - some very old systems may employ silver coatings. Uncoated silver mirrors will exhibit a faint greyish or grey-brown color with time. This is simply oxidation, or "tarnishing" of the surfaces with extended exposure to the atmosphere, and will rapidly degrade the performance of a home-built scope over many years if left unchecked. Cheaper systems may employ acrylic-based "plexiglass" lenses, or have very uncoated aluminum mirrors. If you are not sure of the type of material your equipment has, it is best to consult the manufacturer (if possible), or consult a good camera shop or telescope vendor - they usually have well qualified personnel to assist you in identifying the materials used for the optics of your system.

..Now on to the good stuff - eyepiece and objective lenses first!

The best way to clean your system, once you know what you've got, is to remove the surface(s) you wish to clean, and inspect them thoroughly. Does it have flaws? Are there any obvious scratches or blemishes on the surfaces? It may well be that an older scope may have some "personality", especially if it was poorly treated by its previous owner. Make a note of the wheres and whats for the flaws: they will tell you pretty quickly whether it is worth the attempt. But you'd be surprised what you can do with "old glass"!

For most eyepieces and lens materials made of glass (or better), I recommend using initially a mild soap solution. A good quality dish soap or liquid soap works very well. You may apply the soap directly to the optical surface by pouring it on the surface - DO NOT RUB!! Rinse the surface under a steady low pressure stream of luke-warm tap or bottled water (if your local supply is quite "hard"). Eyepieces usually come in sealed cells - don't open them if it's not necessary! They are usually set up for optimal alignment of the lens components. Run the water over the OUTSIDE top surface first, after applying the soap solution, then gently shake the excess off. Let dry. If an eyepiece has some "fog" after this treatment, some of the moisture may have gotten into the lens cell itself. If the rinsing is performed quickly and carefully, usually no hassles are encountered. If you see some "fog", most of this moisture will go away after about 1 hour. If not, apply a low power hair dryer along the body of the cell in a sweeping motion [DO NOT APPLY TO THE LENS DIRECTLY!!]. This should heat up the air inside the cell and should remove the dew on the inside lens surfaces. Hold the freshly-cleaned and dryed lens to a small light, or well-lit window: It should be clear of most specks. If the fog or dew remains, the cell should be opened CAREFULLY with a small blade screwdriver (The jewelery types are best). Apply the blade to one of the edge notches of the rear portion of the cell - there are

usually between two and three of these on a threaded ring insert on the underside of the cell. Keep firm pressure on the driver and ensure a smooth turning motion of the insert. Counter-clockwise motion should loosen the assembly. Slight heating of the cell may be necessary to loosen the ring. Just loosen the insert ring slightly, and allow about 1 hour to see if the fog has disappeared. If not, Then the lens cell should be carefully opened, and the lenses should be GENTLY set onto a generous piece of new, dry, high quality lens paper. [DO NOT TOUCH THE GLASS SURFACES IF AT ALL POSSIBLE!]. If the lens is tricky, or you feel that you won't be able to remove the lenses without touching them, then use a piece of moist lens paper between your fingers and the surface of the lens when removing it.

Kimwipes, used for cleaning of scientific-grade optical surfaces works better than standard lens paper and is the best; This product can be obtained by a local laboratory supply company at a reasonable price. Don't skimp on the lens paper - cheaper, poor quality products tend to pill and collect dust, and may actually scratch the lens or embed small specks that may be difficult to remove. Do not use a soft cotton cloth, or any other fabric either! Also, make sure you have a clean, large and fairly dust-free working area; no sense going to all this trouble in your garage if a you bump a wrench and have it smash your glass! Take your time, and work carefully. You normally only need to do this extensive cleaning every 10-15 years if necessary, so take the time to do this properly. It IS worth it, especially with uncoated older optics!

When disassembling a lens cell, make sure to set the lens components EXACTLY as they are on the lens paper - this will ensure that you can re-assemle the lens the way it was! If interior surfaces were still foggy, or had specks of dust on them, then apply soap to all surfaces and rinse gently, holding the lenses by their edges only. Shake excess water off after rinsing, and allow to dry on a fresh piece of lens paper. Inspect them under light carefully. If some of the surfaces are still "speckled", or have a filmy appearance, then lightly soak a piece of lens paper with a soap solution and GENTLY run it along the surface of the lens, then re-rinse. Most larger dust and grit should have been removed by the initial rinse, so this should remove 95% of the remaining grime on the lens. If you suspect that the grit poses a threat to the integrity of the surface, then repeat the general rinse step again. Use your judgement and some common sense.

After the surfaces are dry, obtain 99% Isopropyl alcohol**, and apply a generous portion over the surfaces of the lens components. If you did not have to disassemble the lens, only apply this on the outside surfaces you have just rinsed with soap and water after allowing to dry for about 15 minutes.

**I recommend using ONLY 99% Medical-grade Isopropyl (rubbing) alcohol as a drying and de-greasing agent; It absorbs excess moisture very well, reduces spotting and streaking, is virtually non-destructive to most plastics and external components of the cell body, and should not degrade the coatings on optics. 70% Isopropyl tends to leave streaks, and ethanol (also labelled as rubbing alcohol) can damage or soften some the plastic housings of some lens cells, and tends to lighten or smear any paint labels on the lens body. Get the good stuff - read the label carefully!

After rinsing with the 99% alcohol, allow to dry in air for about 15-20 minutes. The lens surfaces should be VERY clean and free of streaks and smudges. If there are some residual smears, use a lens pen* [recommended] or a fresh new piece of lens paper. Breathe over the surface lightly to fog it slightly, and gently apply the pen or paper to the area of concern and rub in a small circular motion. Reassemble as necessary. Your lenses are now as clean as they can get without getting them professionally done, for less than $20!!

*the lens pen is an invaluble tool for general maintenance of your optical surfaces, new or old. They run about $10-12, and will provide years of service. Celestron, Optex, and several other companies offer this product, and it is available at most camera shops. It is AWESOME for cleaning virtually any optical surface - if you don't have one, I strongly recommend that you get one!

Prisms, color filters and binocular optics can be cleaned as above, but I recommend removal of the binocular objective lenses prior to extensive cleaning - it may be difficult to remove any moisture inside the tube assembly, unless the unit is water-proof! I often clean any new optics as well (before using them). Then I'm certain of their condition prior to use.

...Now, for all you Newtonian fans - Mirrors!

The procedures described above are applicable to mirrors as well - the exception to this is applying a lens pen after the 99% isopropyl alcohol treatment. I recommend AT LEAST two good medium-pressure soap and water rinses for very dirty aluminum-coated mirrors before the alcohol. If after the soap rinses there are still "schmootz" on the surface, moisten a fresh piece of lens paper or KimWipe with clean soapy water, and apply to the surface gently. Leave this on the surface for about 10 mintues, then remove it carefully, and rinse. If the spots are very stubborn, then VERY GENTLY run a moist [and soapy] fresh piece of lens paper over the surface. I must emphasize that most mirrors are not heavily coated, and may be scratched much more easily than lenses. Use your common sense and discretion with the last procedure, but if done with "TLC", this should

work very well for 99% of those stubborn spots. Apply 99% isopropyl alcohol after allowing to dry for 10-15 minutes, shaking off the excess carefully.

Aluminum-coated mirrors of virtually any age and type should be extremely clean and free of blemishes after this treatment. If any residue still remains after the above procedure, use EXTREME caution with a lens paper or lens pen in removing the smudge. Breathe lightly on the area of concern, and rub carefully the area, again using small circular motions.

For you "do-it-youselfers", and those with silver-coated primary mirrors, I recommend a different procedure:

First, rinse the surface with soap and water, and rinse. Allow to dry. Repeat as necessary to remove dust and dirt from the surface. Next, obtain a clean ALUMINUM cake pan, wide and deep enough to immerse the mirror assembly up to the middle of the glass body of the mirror. Use a kettle to heat water almost to boiling, and pour into the pan. Add a water-softening agent, such as Calgon, into the water and stir. Let cool for about 2 minutes. SLOWLY immerse the mirror, ensuring that the outside edge of the surface comes into contact with the aluminum pan. If you have a glass one, clean it first, then use a generous amount of ALUMINUM foil. Pre-rinse the foil with soap and water and take care to keep it as flat as possible. lay it in the pan gently to ensure the surface of the foil (dim side up) won't scratch the mirror surface when it is resting on it! Leave the whole mess for about 5 minutes. Some bubbling of the solution may occur. This is natural, so don't panic! Depending on the degree of tarnishing, you may even notice a slight sulfur smell - this is normal. What is happening is that you've created a galvanic cell: The oxide and sulfides of sulfur are being reduced back to metallic silver, and the aluminum in contact with the mirror is being oxidized. The Calgon is complexing with the aluminum and sulfide ions, keeping them in solution. Electron transfer is occurring at the junction of the two surfaces! The higher the water temperature, the faster the reaction, but given the fact that you don't want to crack the mirror blank, you may only want to use warm water; 40 to 50 degrees Celsius works well. Then inspect the mirror - any grey silver sulfide (tarnish) should have been removed, and you should have an optically sound mirror again. If you need to repeat the procedure for a heavily-tarnished mirror, go ahead. You are not losing silver, but preserving it. Rinse clean after the process has completed to satisfaction, then rinse immediately with generous amounts of 99% isopropyl alcohol. Let dry. Awesome, hey?! Try it!

The general populous tends to want to re-polish a surface. This practice removes the silver, often reduces the quality of the surface finish, and eventually recoating becomes necessary. This cleaning and maintenance procedure should provide many more years of service from a silver mirror, but eventually, some polishing and recoating may be eventually necessary (the cons of a silver mirror!)

..Finally, Plastic or Plexiglass optics!

These surfaces should be cleaned with soap and water, then dried. Light dusting with a lens pen or paper can be done, but lower-quality plastic lenses tend to fog permanently with repeated applications of alcohol, especially ethanol and methanol. Don't attempt this if you are unsure! You may permanently degrade the performance of the scope or binocular, making it less than fun to use!

I hope these techniques will provide all enthusiasts of the hobby many years of enjoying "optimally clean" optics. The proof of these procedures is in the pudding: I continue to use a 48 year old 100mm reflector at near theoretical resolution. When I got the scope, the mirror had about 4mm of dirt and dust on the surface; the eyepieces (minimal coatings!) were dirty, and had dust specks inside the lens cell assembly. Both are as good as new, and continue to add to my enjoyment of the hobby. I also re-conditioned several old silver mirrors, all of which performed better than when I first got them! What can I say?!

Finally, I would like to say that cleaning of optical surfaces is always important for continued satisfaction of use for observing equipment. Although the above techniques are somewhat labour and time intensive, they ARE worth the effort in the long-term. It may only be necessary to perform this level of cleaning once every 5-15 years, depending on the upkeep of the equipment and how it is stored when not in use. Regular general maintenance should involve lightly blowing dust off the optics, occasional use of a lens pen to remove small smudges on eyepieces, and perhaps annual rinsing of Newtonian mirrors. Once clean, much less effort is then required for regular upkeep. I must emphasize that being over-zealous on keeping optics clean can be worse than doing nothing at all - do what is necessary, then relax and enjoy! Nothing can be done about heavily-damaged or scratched surfaces, however, and sometimes these must be accepted as is - I have noticed a definite improvement in performance of a mid-priced refractor with slight scratches on the objective lens after proper cleaning!

...That 'old glass' may still have some gas...

Part 2 - Performance Enhancing Modifications to Scopes and Binoculars.

In this article, I'm going to cover quite a wide assortment of modifications to existing equipment to enhance the performance of "that 'ol scope" or binocular that has been hanging around, not getting much use. Before we go into all of that, I'd like to make an adjustment on the lens cleaning procedures that were covered in the last article:

For those of you with fairly new or expensive ocular lenses, or those who do not wish to disassemble their lens cell assemblies, DO NOT run the cell under a stream of rinse water if it is not necessary! This will make too much work for the drying step, and if done carelessly, could draw contaminants [such as dust and soap] inside the cell. I have found that by using a piece of dampened soapy lens paper or Kimwipe, you may be able to remove most of the "smootz" on your lens surfaces without introducing excess moisture into the internal cell. Use your better judgement, but if you don't know the whole history of the lens, the more elaborate procedure may be the best way of getting a reference point for the condition of the lens. For both yearly maintenance or quick, hassle-free cleaning on newer oculars, the following approach is recommended:

Gently apply the piece of material with a diluted soap solution onto the surface(s) of the ocular, and carefully wipe the surface. Take a new, very moist [Water only!] piece of paper and run it gently over the lens to remove most of the soap residue left over from the previous step. It may be necessary to repeat 2-3 times. Once this is done, take 99% isopropyl [Rubbing] alcohol and generously soak a fresh piece of lens paper. Gently rinse the lens first with a larger amount of isopropyl alcohol to remove excess moisture, and gently shake the excess. Then apply the lens paper in the same manner as was done for the soap step. Allow to dry for 15 to 20 minutes. If some residue or streaking remains after drying, repeat as necessary. You may want to apply a thin film of alcohol on the lens after the drying step and let dry again. This will help draw the excess moisture absorbed by the alcohol surface film left on the lens from the last step as it was drying. You should have a very clean, streak-free surface, which is now very easy to "touch-up" and maintain.

...Now, onto the modifications...

We'll start with simple, easy improvements that will make that old scope run better than new. I'll begin by mentioning interior baffling and recoating the interior of the optical tube.

Remove the optics [you may want to do these modifications while cleaning the optics!] and place them on a clean, large piece of lens paper. You may want to store them in a cool, dry, dust-free place until the reconditioning is completed. Remove all peripheral accessories and assemblies, such as focusers, sighting scopes, etc., ensuring to keep track of how they were situated before removal. Take the optical tube and inspect it for scratches, flaws, and the integrity of the interior coating. Take a generous amounts of wet, soapy pieces of paper towels, and thoroughly wipe all areas of the tube. Re-wipe clean with a water-soaked paper towel to remove residual soap on the surfaces. Let the tube dry well for about 1 hour. You should have a pretty good idea of what condition the tube is in at this point.

If it is in good condition, such as having no major dents, then decide on what improvements you wish to accomplish; you may wish to only coat the interior of the tube, or perhaps "soup it up" to make it look as the day it was new. I recommend definitely ensuring that the tube interior is optimized for the design of the scope to minimize internal reflections - This will enhance the unit's overall performance on deep-sky objects as well as contrast for planetary bodies!

For most designs, I recommend using a very good coverage flat black acrylic enamel paint. The quick drying works best. The nice thing with this type of paint is that it is easy to work with, and it is water-soluble when still wet, but water-proof once dry! This type of paint usually comes in spray can and standard 1 quart [litre for you metric fans!!] formats. I recommend the spray type as best. As an alternative to the acrylic enamel, you may also use a good quality flat latex paint. It also is water-soluble when wet, but the quality of the finish will depend on the quality of the product. Don't scrimp too much! A more expensive, better quality paint will last longer, do a better job, is easier to apply, and achieves a better finish when dry. K-Mart has a good quality acryilic enamel spray product that is not too expensive and works VERY well. The reason for using water-soluble products is that they can be cleaned up nicely with water, and you don't require expensive or harsh solvents [such as acetone or terpentine] to clean excess paint off the tube or your hands! Also, much less ventilation is needed to apply them and have the coat dry properly. Neat, eh?

Decide what color you want for the outside of your scope, and select either a semi-gloss or a gloss product in spray format - again, choose the acrylic enamel spray format when you do! I recommend finishing the exterior of the tube assembly first, as any inadvertent overspray onto the inside of the tube will be easier to remove, or can be coated later by the flat black paint coat. It also makes it easier to achieve an aesthetically pleasing look to the outside of the tube, since it is easier to mount, and any scratches by that procedure on the inside of the tube can be fixed by the interior coat later as well.

It is recommended that you first sand off any oxidized layers on the outside of the tube prior to applying the first new coat. This not only provides a great "primer" which is already on the tube surface, but the rougher underlay will assist the new coat(s) in

adhering much better once dry. I suggest a synthetic steel wool product, as it is non-metallic, and less harsh than standard steel wool - you also avoid having to deal with steel filings that may persist after the procedure. Vigorously sand the ENTIRE outside of the tube only to the point where the underlying coat of paint becomes dull. DO NOT REMOVE the coat if it is not necessary! Once a dull but even finish is achieved, apply several wipes with water-soaked paper towels. This will remove the residue from the sanding step. You may use a solvent, such as varsol, or laquer thinner to the surface instead, but this is much more expensive and messy than the step needs to be. Also, the slightly damp surface [if wet from water!] will allow the water-based acrylic paint to stick like mad, minimizing runs.

I normally use two coats of paint for the exterior - I don't recommend more than three, as this risks having runs, not to mention is wasteful of paint. Before the first coat is applied, mount the tube in a manner that allows you to rotate it freely, to evenly apply the paint, but also in a way that both hands may be free during painting. I suggest placing a rake handle or pole inside the tube, and putting the ends on sawhorses, or old chairs. Mask anything that you don't want to be painted with - you guessed it - masking tape and old newspaper.

Apply the first coat in a sweeping motion; try to get a good coverage of the paint on the tube, but don't make the first coat very thick - it can be spotty in areas, because the second coat will fill in the gaps. Allow the first coat to dry at least 4 hours. Even though most acrylic paints will be fairly dry to the touch after about 1 hour, there may be some residual moisture [from the wiping step] underneath the coat, and it takes time for this to migrate through the layer of paint as it dries. Before putting in a cool, dry place to set, quickly inspect the fresh coat for runs. If you do see a minor run, dampen a clean, lint-free coton shammy or cloth, and wipe the area to remove the paint. Use a dabbing type of motion, and recoat the area, flowing the paint outward from where the flaw was. The flaw(s) should flow out and dry evenly. Apply the second coat in a similar manner, but take care not to overcoat the tube, or running will occur. This is especially important with gloss coats, as they tend to run more easily, and become increasingly harder to touch up running as more coats are applied. If you find "that run that won't quit", let the whole mess dry for a day, and sand that area, wiping the area with a damp cloth afterwards; recoat, flowing the paint smoothly away from the affected region to achieve the desired smooth finish.

Once you are happy with the second coat, let cure for about 2-3 days. 4 is even better! Acrylic [or, really, any] paints have a solvent in them to help them flow out for maximum surface coverage, and some residual solvent may be present underneath the coat for up to 2 weeks to 1 month in some cases; don't despair - after about 3 days, the coating is intact enough to survive 90% of any rough treatment. Avoid the tendency to heat or sun-dry either the finished coat, or the undercoat - The drying is a natural process, and if hurried can degrade both the integrity and quality of the finish! Take your time and the job will be well worth the wait! A good-quality acrylic finish will be VERY durable and scratch resistant, giving years of service.

Now for the interior....

Deside first whether or not you wish to add or replace baffles inside the tube. A baffle is an annular [ring] light-stop that does NOT reduce the aperature of the scope. It aids in preventing stray reflections inside the optical tube assembly, and usually enhances contrast, especially in deep-sky objects, or bright subjects, such as planets. They may be fabricated by metal or wood, or plastic, or you may wish to use thick black weather stripping [similar to that used for windows and doors. The nice thing with stripping is that it is easy to apply, and can be replaced and removed easily if the need arises. I recommend putting a primary coat an all baffles prior to insertion; If they are to be permanently affixed inside the tube, modify the tube prior to putting on the exterior coat. 2 or 3 baffles are all that are required, and I suggest making the to the edge of the primary's aperature in diameter, so as to not "stopping" any light from getting through. In refractors, you may wish to estimate the light-path inside the tube, and make the baffles progressively thicker as you travel away from the objective. For reflectors, keep their inside open aperature a bit larger [say 5%] than the diameter of the primary mirror. I suggest positioning the first baffle back by at least 10% of the tube's entire length. This will assist the scope in achieving the baffle effect without reducing the widefield performance of the scope at low magnifications - this is especially important for "slow" or long focal length systems f/8 or longer.

Paint the baffles first using flat black, and allow to dry as with the outside coat. Mask the exterior of the tube well. Paint the tube interior by rolling the tube while spraying. For long tubes, Use an extension nozzle, such as those found on WD-40 cans, and apply as evenly as possible from both ends of the tube. The surface finish is not as critical as the exterior, but if a very bad run is left to dry, it will be slightly more reflective than the rest of the surface and may degrade the absorption ability of the interior. Inspect the tube for runs and dab if possible. Let dry as per the exterior coat. Recoat, and leave for about 3 days again. You MAY wish to add charcoal to the surface after the coating has cured - This is usually done using lampblack, or soot. This material is VERY black, and absorbs light very well. If you wish to apply this, do so on all interior surfaces by wiping fairly hard using a dry lint-free cloth, and wiping the surfaces evenly. Try to get the coat as consistant as possible. Blow off the excess, then gently rewipe the interior with the sooty cloth to remove the material not readily adhering to the surface [It will

tend to come loose later, and cause dust and speck problems otherwise]. Blow again, using canned air product. You are now ready to unmask the tube, insert the baffles and reassemble the scope!

I do NOT recommend using flat black felt for lining scope interiors - this material collects dust and lint, and will tend to pill after several months of use, particularly when used in a variety of temperature and humidity environments. If you choose this route, expect to clean your optics about twice as often! Lampblack works very well as a final interior coating, but it is messy, and if not applied properly will flake and dust off on to the optical surfaces inside the tube. Usually the baffles with a good dark flat black paint will perform very well, with little maintainance, save the occasional dusting of the interior of the tube [for reflectors].

If you wish to apply the above procedures to recondition a pair of binoculars, DO NOT use the lampblack. Pay careful attention to how your pair is contructed. If the tubes thread off of the body close to the prisms, GREAT! You may recoat most of the interior without risking affecting the collimation of the optics. If you are only able to remove the objectives from the tube fronts, you will have to settle to masking the prism fronts prior to painting. I suggest not removing the prisms, as they are usually aligned by the manufacturer. If this pair has been dropped or treated poorly in the past, a laser can be used to pre-check the prism alignment. Don't make unnecessary work for yourself! To mask a prism, first clean it with canned-air to remove most of the lint. Obtain a cluster [10 or so] long-shafted Q-tips, and bundle them together. Take several pieces of lens paper, and apply over one end. Secure using tape or a good, clean rubber band, and take care not to touch the paper surface that will be in contact with the prism. Use initially 99% isopropyl alcohol to soak the paper, and apply to the prism gently using small, but fairly firm, circular strokes. Take care not to have the paper contact the tube interior prior to application to the prism! Take you time, and work carefully. Let dry in air. Inspect the surface. Repeat if necessary, but if some "smootz" won't come off, repeat the standard cleaning procedure for optics as described previously in part one, but use water and soap and water-soaked lens paper or KimWipes on the bundle, instead of trying to reach into the tube. This should not be necessary for over 98% of the cases, as prisms are usually sealed inside the tube, and only some dust or a light film would normally get on the surface.

Then, mask the prisms by using fresh lens paper [about at least 4 layers!] and tack the bottom layer [furthest from the prism!] to a piece of coffee-can lid or other stiff but flexible material, using a gluestick or double-sided tape. Let dry for about 5 minutes, then cut a tad smaller than the prism front surface. Apply the remaining layers of lens paper [trim carefully - leave about 3/4 to 1 inch outside the outline of the lid material!] to the mask, and insert gently with tweasers or foreceps. Go only until you feel it come in contact with the prism, then stop. Make certain that the lens paper excesses are away from the prism, and pressing snugly along the tube about 1/2 inch. Apply the interior coat quickly, and lightly with each coat. An extinsion tube should not be needed, but ensure to mask the exterior of the pair first. Let dry for 1-2 hours, then CAREFULLY remove the mask avoiding any linting on the inside surface. A small tab made with masking tape works well to position, apply, and remove the mask. Inspect the prism. If any overspray has occurred, immediately obtain another "bundle" and lightly moisten with 99% isopropyl alcohol. Take EXTREME care to to drip excess solvent onto or touch your fresh coat. Gently wipe the prism again - the acrylic enamel paint is fairly easily removed by isopropyl alcohol, and a clean lint-free prism should remain. If some residual linting had occurred. leav this until the interior coat has cured for four days. The tubes will be sealed once the optics are replaced, and any further curing will be slowed if the unit is assembled too soon. Use 1 week if you can. use this same procedure for considering refractor recoating. 1 week allows most of the curing to finish, and you don't risk any fogging of the interior lens surfaces by solvent or moisture.

I hope these simple steps allow you fans of older equipment to get that glass to it's best looking, and best performance. Try not to do more than is necessary. This just makes more work for you, and you may find yourself asking: "Why am I doing this, anyway?". TRUST ME!!! It is worth the effort, and the rewards in using the finished product will make you wonder why more people don't take the care to nurse that old scope or binocular back to health. Older optics can surprise you, and give you a conversational showpiece!!

Stay tuned next article for a discussion on how to again improve the performance of older equipment, but we'll look at replacing damaged optics, as well as suggestions for mounting the units once you've done the work...

Have Fun!