CAST BULLET LUBRICANTS

(Revised Edition, 2016)

by Ralph Schneider and Steve Hurst

The majority of this work was done by Ralph Schneider, who had the original idea. Ralph formerly sold copies of the list by mail. This list is available free for your examination, if you find it valuable you might put a few dollars in an envelope and send to:
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These pages contain information on lubricants for cast bullets—those which have been used, those which are currently used, and those which may merit experimentation.

Part I Lists commercial lubricants, their ingredients (if known) evaluations of their performance (if done), and the manufacturer.

Part 2 Lists homemade lubricants from published articles, their ingredients and evaluations of their performance.

Part 3 Lists ingredients used, sometimes refers to the completed lubricant(s) of which they are components, and, if necessary information about them.

Part 4 Is a miscellany, a collection of other information about cast bullet lubricants and related materials.

Part 5 Notes on experimentation.

Part 6 Offers data about the relative popularity of some cast bullet lubricants.

These listings of lubes and ingredients are undoubtedly incomplete; there are bound to be lubes and ingredients out there that our researches have not discovered. (Major Ned Roberts and Ken Waters, in The Breech-Loading Single-Shot Rifle, noted the existence of at least 557 bullet lubricants at that time!)

If you can supply additional information about lubricants or ingredients (particularly new lubes made with currently available ingredients), or if you discover errors here, please post them on the Cast Bullet Association Forum in

the lubricants section. When doing so, provide all the information you can about lubes, their ingredients, and sources of information. Many experimenters on internet sites contributed valuable information enabling this revision to be developed; we all owe them a debt of gratitude.

While successes are great to report, failures are important too because they will prevent other experimenters from wasting time and money. Let’s keep the information available.

Readers should be aware that some of the information here is certainly "dated" in that the manufacturers may have gone out of business or moved, or the lubricants or ingredients may have been taken off the market. Nevertheless, I have not deleted such information because it may still be valuable in some circumstances; you never know what you may find in a dusty box at some gun show or in the back room of a hardware store.

Warnings: since bullet lube ingredients are often flammable, and since they are often heated for mixing, making your own lubes is a potentially dangerous activity; if you do it, you must accept the risks. Similarly, it is conceivable that one or several of the lubes or ingredients listed here could be injurious to guns or other equipment. Some ingredients are toxic and commercial products may contain ingredients which are benign in the intended use, but are toxic when aerosolized in shooting. I've indicated such dangers where I know of them, but it is impossible to predict the results of all combinations. Once again, the risks are yours.

Some abbreviations for sources of information are as follows:

ABC = Art of Bullet Casting (followed by pages)

AR = American Rifleman (issue date then pages)

Boolets = Cast Boolets at gunloads.com

CB = E. H. Harrison's “Cast Bullets” (followed by pages)

CD/ASSRN = "Bullet Lubricants" article by Charlie Dell in the American Single Shot Rifle News, vol. 42, no. 2 (and continued in a subsequent issue).

CGH = Philip B. Sharpe's Complete Guide to Handloading (followed by pages).

EHH = Colonel E. H. Harrison who did the first scientific research into cast bullets and lubricants in the 1950'S and published the results in the American Rifleman. Developer of Alox 50-50.

FS = Fouling Shot —the journal of the Cast Bullet Association until April 1992 (first number is issue, then pages)

HL = Handloader Magazine (first number is issue, then pages)

LASC = Los Angeles Silhouette Club - website

MSDS = Material Safety Data Sheet, available on the internet for many commercial products. Lists known safety information for intended uses and sometimes ingredients, but unknown dangers may exist for other uses such as bullet lubricants.

RAF = Harold Vaughn's "Rifle Accuracy Facts" (followed by pages).

TCB = The Cast Bullet—the journal of the Cast Bullet Association from May 1992 (first number is issue, then pages)

TCBF = The Cast Bullet Forum - Cast Bullet Association website

RS comments by Ralph Schneider

SH comments by Steve Hurst

PART I: COMERCIAL CAST BULLET LUBRICANTS (entries alphabetized).

Accu-Lube — Barniskis (FS 37 24) mentions it as being no longer available, though he liked it for some loads. See Alox 2138F/synthetic beeswax formula below.

Alox-Beeswax — Often referred to as the NRA formula: 50% Alox 2138F, 50% pure yellow beeswax; rated highly effective (CB 55, 69, 141). Developed by EHH and published in the American Rifleman. (AR July 65) The literature includes many positive comments on this lube, not all of which are referred to here. Dave Scovill mentions it as a standard against which other lubes are measured; it's very good, but rather sticky and may not produce good results in hot weather (TCB 105 15), and it does not do well in a hot barrel (HL 134 16). Mike Venturino, who has used it as his standard, tested it against several other lubes and reports he will continue to use it (HL 95 41-42). Alox 50-50 continues to be a very popular lube among cast bullet shooters, but black powder enthusiasts may want to be aware of possible problems. One Pyrodex shooter found that it caused erratic grouping at the range. He was about to sell his rifle when he tried SPG lube and groups immediately shrank. Hereinafter referred to as Alox 50-50.

Alox 2138F/Synthetic Beeswax — apparently this was a creation of the Alox company which was offered (1979?) to cast bullet shooters. C.E. Harris reported results as good as with the NRA formula (FS 18 4). Was this called "Accu-Lube"? (FS 37 24).

Apache Blue Lube — Developed and made by Paco Kelly, one-time columnist for FS. Apparently intended as a hot weather lube, but can be softened with hot linseed oil (FS 74 15). Paco somewhat vaguely describes the ingredients: Lithium grease (not ordinary automotive grease, but pure [?] lithium), a hard microcrystalline wax, some black stuff (that may be carbon black?), and some sort of very slick oil deriving from a plant in the Southwest (possibly jojoba oil) (FS 57 11). A review by Forrest Asmus reports it to be the equal of M&N (FS 67 26-29). Another review by Keith Johnson found it to be the equal of Alox 50-50 and superior to Mirro-lube and LBT Blue (FS 69 17-19). Paco Kelly's formula is once again available, now from The Hanned Line, P.O. Box 2387, Cupertino, CA 95015-2387 (FS 143 12).

Black Powder Moly Lube — This lube is advertised as able to render bore cleaning unnecessary during a full day's shooting. I cannot attest to the validity of

this particular claim, but I have found this lube to be the equal of any other black powder lube I've tried in terms of accuracy, preventing leading, and ease of cleaning at the end of a range session. RS Available from Lee Shaver, 559 NW 7th Rd., Lantha, MO 64759. Phone (417) 682-3330.

Automobile door latch stick lubricant, U.S. patent 1,920,161 (1931) — 5 paraffin wax, 3 petroleum jelly, 2 oil (CB 43).

B.P.C. Lube — Said to promote accuracy, soften fouling, and ease cleaning, this is advertised to work with both black and smokeless powders. It was once available from Montana Bullet & Lube, P.O. Box 1454, Big Timbers, MT 59011, but a recent letter to that address was returned as undeliverable.

Bullet Master — Apparently a "dry" lube—which is applied wet (?) or in liquid form via tumble-lubing. Some good results (FS 35 2-3). Reported by Dennis Marshall to be somewhat inferior to the better grease-type lubes such as M&N (FS 43 8-11 and FS 44 11-17). Mike Venturino found it to be very promising in terms of accuracy, but overall found little advantage in it due to lubing time (HL 95 41-42). Made by BMS/McMullen Co., Suite 208, 5420 SW Alfred St., Portland, OR 97219.

Bull-X — This cast bullet company is now making some of its bullets available with a moly coating. An article by Layne Simpson notes that such bullets do not lead, and that the coating they leave in the bore even prevents subsequently fired naked bullets from leading for a time. They also cause less smoke than conventional grease-type lubricants—a particular advantage in competition pistol shooting (HL 189 14 and HL 193 26-29, 75). Available from Bull-X, P.O. Box 182, 520 N. Main, Farmer City, IL 61842.

CF Ventures Wax Gas Checks — Supplied in small sheets that are pressed against the case mouth to cut and insert the check, these are best used in straight-walled or long-neck cases, like other such wads or "grease cookies." Used behind plain-base bullets, they can prevent leading (HL 185 5). Available from CF Ventures, 509 Harvey Drive, Bloomington, IN 47401.

DBL — Dropkick Bullet Lube; a commercial lubricant intended for blackpowder and schuetzen shooting. Once available from Dropkick, 29 West 4th St., Williamsport, PA 17701, but since April 1996 it has been handled by the American Bullet Co., 159 Creek Road, Glen Mills, PA 19342.

D.G P. Bullet Lubes — A number of lubes, from Odorous Orange to others. Al Miller's review found it enabled higher velocities than Alox 50-50, and that it produced the same accuracy (HL 129 59-61). Available from D.G.P., P.O. Box 1164, Covina, CA 91793-1164.

Dragon Bullet Lube -- www.dragonbulletlube.com

- NRA 50/50 the name says it all
- Yellow Dragon
- Red Dragon
- Black Powder
- Draylox 350 (Alox 350)

Formula 99 — A dry lube made by H-R Research, P.O. Box 888, Los Angeles, CA 90025. Reported by Dennis Marshall to be somewhat inferior to the better grease-type lubes such as M&N (FS 43 8-11 and FS 44 11-17).

GAR Bullet Lubes (available from GAR, 590 McBride Ave., West Paterson, NJ 07424);

- Half & Half Lubricant-50% Alox 2138F and 50% natural beeswax. Apparently, according to limited tests; it was better than other Alox lubes (FS 42 27). Tests by Mike Venturino indicate that the Gar Fola lube does enable higher velocities, but his conclusions about accuracy were unclear (HL 113 63).

- Pro Lube — Described as a hard lube for pistol or reduced rifle loads (ingredients not specified). Heating is required if the lube is to flow through a lubrisizer.

- Rifle Lube — Described as a lubricant suitable for rifle or magnum pistol loads (ingredients not specified). Heating is required if the lube is to flow through a lubrisizer.

Gray #24 — Developed by Tom Gray, who reported good results at 2600 fps in the .30 Gray cartridge (TCB 115 6). In an article about cast bullet lubricants and high velocity, he writes that it meets his criteria: it enables l/2 moa accuracy, it eliminates leading, it maintains barrel condition (no lube or fouling buildup), it is suitable for cast bullets of conventional design, it will flow in lubrisizers at room temperature, it will stay on bullets at temperatures of over 100 degrees, it is not sensitive to hot or cold barrels, and it is simple to make from easily available materials (not specified) (TCB 116 6-8). He reports that he has had good accuracy at 3150 fps when using this lube.

GSB — Applied via a melting-and-dipping technique, Scovill found that this lube produced no leading and representative accuracy for the gun involved (HL 134 17, 48).

IPCO Colloidal Graphite Grease — Once popular, but the company (Industrial Products Company, Wakefield, Massachusetts) is defunct and the products unavailable—they apparently also manufactured IPCO graphite wads, a soft waxy material containing castor oil, Japan wax, petrolatum, and colloidal graphite, according to Al Miller (HL 160 52). These apparently performed the

same functions as CF Ventures' soft gas checks (wax gas checks) (FS 49 2). Ken Waters mentioned that they were once available in three thicknesses: .033, .046, and .064 inch. He believes that they may help seal off powder gasses when used behind plain base bullets, and perhaps contribute to increased accuracy—but with jacketed bullets and high pressure loads, they seemed to do little but raise pressures. The wads were supplied in small sheets or ribbons to be pressed against the mouth of the charged case to cut and insert the wad (HL 94 16-17). See Silver Eagle graphite wax.

Jakes bullet lube www.jakesproducts.com

- Purple Ceresin
- Moly Ceresin
- Scarlet Ceresin
- 50/50 (Beeswax/ Alox 350)
- Alox 350

Javelina Bullet Lube — A popular Alox 50-50 lubricant, available from Javelina Products, P.O. Box 337, San Bernardino, CA 92402.

Lead Bullets Technologies Lubricants (available from Lead Bullets Technologies, HCR62, Box 145, Moyie Springs, ID 83845):

- LBT Blue — this is an excellent lube which I have found to be somewhat superior to Alox 50-50 RS. John Ardito found it the best of a number of lubes tested (FS 73 20). A review by Keith Johnson found that bullets lubed with it did not group as well as those lubed with Alox 50-50 or Apache Blue (FS 69 17-19). Dave Scovill says that it has become his standard; though it is sticky stuff, it keeps lubricating even when rifle barrels are very hot. He mentions that it is one lube that you can use too much of (HL 134 17). Al Miller notes that it is "always an excellent choice for high-velocity cast loads" (HL 167 34). Mike Thomas used

it for development of a wide variety of .308 loads and got minimal leading (HL 171 38-41, 63).

- Blue Soft — A new lube which is identical to LBT Blue except that it is a softer formula which will flow through lubrisizers down to 60° F, and in some circumstances gives better leading control in extreme cold.

- LBT Commercial — described as a firmer formula which keeps bullets from getting tacky. Lubrisizers must be warmed to about 100° F to get a good flow.

- LBT Magnum — LBT's first lube, this is a somewhat softer lube which will flow through lubrisizers in temperatures as cold as 45°F. It is, however, being discontinued; when current stocks are gone, no more will be available. LBT advises that Blue Soft is Magnum's replacement.

Lee Precision Lubricants (available from Lee Precision, Inc., 4275 Highway U, Hartford, WI 53027):

- Liquid Alox — A mineral spirits solution of Alox 606, this is intended for tumble-lubing. One report in AR (Jan 1990 57) indicated that this lube enables very acceptable accuracy with some leading in one part of the test but not in another. In my tests it does not seem to be better than conventionally-applied lubes, and it's somewhat messier, at least until it dries. Disliking the recommended method of application, Wayne Harms now uses a foam pad inside a 35mm film canister (TCB 115 8). Dave Scovill says that one of the lubricant's advantages is that it coats the entire bullet—an advantage in some cases (HL 134 17). C. E. Harris likes it as an additional lube for commercial swaged bullets (FS 82 9). Several silhouette shooters reported using it thinned with mineral spirits and found its performance was equal to or better than LBT Blue or Alox 50-50 (FS 92 14). Another test found that a batch of soft commercial .38 Special bullets which leaded quickly in their original form did much better with a moderate coating of Liquid Alox (AR Jan 90 57). One .22 centerfire shooter found that it enabled cast bullets to perform well in a number of such calibers (AR Oct 90 26-30). It has been successfully used as a paper patch lube (TCB 105 16). August Rubrecht notes that Lee Liquid Alox turned a marginal .45-70 load into an excellent one—particularly when the entire bullets (not just the rings) are coated. See also the entry under Action of Bullet Lubes in Part 4

- Lee NRA Formula Alox Beeswax Mix—The name says it all.

Lithi-Bee or Lithium/Beeswax Lube — Composed of unspecified percentages of lithium grease and beeswax, this was once made by Garth Choate (Choate Machine & Tool, Box 218, Bald Knob, AR 72010) and later by S&S Precision Bullets of CA. But Choate isn't making the lube any more, and S&S seems to have gone out of the business; but it has more recently been available from Lithi-Bee Bullet Lube, 2161 Henry Street, Muskegon, MI 49441 (but a recent letter sent to that address was not answered). Dean Grennell, who likes it better than anything else, cautions against trying to make it yourself, since the melting point of the grease is very close to the flash point of the beeswax (Grennell & Clapp, The Gun Digest Book of 9mm Handguns 66-67). Shooter Robert Bailey wrote that it prevented leading where other lubes did not, and that it leaves a film of grease in the cylinder and barrel—thus preventing rust formation. I've used a lot of this myself; it's rather sticky stuff, but it seems to do a fine job of preventing leading and permitting accuracy at handgun velocities. RS See also Carl Johnson's formula. One lube list reader writes that Lithi-Bee is again available—from Mr. Patrick Holtz, 1728 Can Rd., Muskegon, MI 49442. Phone (616) 788-4479.

Lyman Bullet Lubricants (available from Lyman Products Corporation, 475 Smith St., Middletown, CT 06457):

- Ideal Bullet Lubricant — Apparently made of waxy materials (CB 19). This is the original Ideal formula, reputedly developed by the late E. A. Leopold.

- Liquid Alox — Presumably intended for flood coating or dipping, but also successful as a paper patch lubricant (HL 175 8).

- Alox-Lube — A solid lube, presumably Alox 50-50.

- Orange Magic — A relatively hard lubricant requiring a heated lubrisizer, this is said by the manufacturer to provide high velocities without leading and to produce low smoke. I have used Orange Magic in pistol and revolver loads with excellent accuracy and low residue in the gun. SH

• Black Powder Gold and Super Moly lubes Paul Matthews reports that these two new Lyman lubes perform very well. They work through a lubrisizer without heating and they give superior performance at the range. Black Powder Gold does not soften excessively at high ambient temperatures up to 130° F. He believes that these lubricants will be found effective in both black powder and smokeless powder applications (Single Shot Exchange Compendium 3, pages 2904). Al Miller, reviewing Super Moly, found it gave slightly improved accuracy in one rifle, and that it provided leading-free shooting; he believes that Super Moly is Lyman's best-ever lube (HL 191 54-55). Lyman is also marketing a number of moly coating products under their "Super Moly" brand name: a moly aerosol spray for jacketed or cast bullets, a bore cream for conditioning barrels, and bullet-coating kits for use in a tumbler. Available from the Lyman Products Corporation, 475 Smith Street, Middletown, CT 06457.

Magma Blue — Manufactured by Magma Engineering Co., P.O. Box 161, Queen Creek, AZ 85242, this is said to be effective for a wide range of bullets in a wide range of firearms (AR Feb 9216-19).

M&M Lube — Once available from M&M Engineering,10642 Arminta St., Sun Valley, CA . 91352, but a recent letter to that address was not answered.

M&N Lube — Apparently composed of Alox and an unknown wax (TCB 120 4), this is one of the lubes most highly regarded by FS writers; for some, it is the standard against which other lubes are measured. Once available from M&N Bullet Lube, P.O. Box 495, Madras, OR 97741; but as of 10/18/89, M&N is no longer being manufactured.

Marmel Bullet Lube — From Marmel Products of Utica, Michigan. In a test by Mike Venturino, this lube performed creditably but not as well as Bullet Master, RCBS Lube, or Alox 50-50 (HL 95 41-42).

Micro-Lube — Gives fine accuracy and does not break down in hot weather, but is hard to use in a lubrisizer unless it is heated, (HL 176 22-23). Available from Micro-Lube, 9430 McCombs St., El Paso, TX 79924.

Midway Drop Out Mold Release — A number of companies which sell bullet casting products also market a mold release intended to permit cast bullets to drop out of the mold more easily. One such product is NEI's Mold Prep (a mixture of alcohol and graphite), and another is Midway's Drop Out—a graphite product in aerosol form. A review by Al Miller recounts the discovery that Drop Out is also a topnotch bullet lube with a velocity limit of about 2,700 fps (HL 193 63-4). Midway also markets moly in powdered form (for tumbler application) and as an aerosol. In addition, the company handles a number of the most popular traditional cast bullet lubricants. Available from Midway USA, 5875 West Van Horn Tavern Rd., Columbia, MO 65203. Phone for orders (800) 243-3220.

Moly-Coated Cast Bullets — Provide excellent accuracy and no leading at relatively high velocities (HL 185 4-5). Available from Casey Charles at CMC Shooting Supplies, 420 Canyon Springs Road, Prescott, AZ 86303.

MsMoly — A molybdenum disulfide product supplied in an aerosol can which is also available in kit form including a "holey organizer," which holds the bullets while they are being coated, and an instruction book. Don Polacek's review states that "Excellent results are easy to achieve and predictable" (HL 191 58). Available from Marksman, Inc., 2018 Walburg Rd., Burlington, WI 53105.

N-2-Nd Lube — Once available from N-2-N'd, 1528 Oregon St., Oshkosh, WI 54091, but a recent letter to this address elicited no response.

MTL Lube — A favorite with some cast bullet match shooters, this is a hard lube which nonetheless will flow through a lubrisizer without being heated. Said to be good for velocities over 2000 fps; Dan Hudson reports shooting about 80 shots in

a match at velocities in the 2100-2300 fps range—often without cleaning the barrel. Available from Multi-Standard M-S, Route 1, Box 139, Butternut, WI 54514.

Natural Lube 1000 Plus — Apparently the same as Wonder Lube 1000 Plus, which see. Natural Lube is marketed by Thompson Center Arms as a replacement for their old Maxi-Ball lube (AR Jan 92 59-60). It is available from Thompson/Center Arms Co., Inc., P.O. Box 5002, Rochester, NH 03866 in several forms, including hollow sticks for use in a lubrisizer and in tubs for use in pan tubing.

NECO Products 108 Ardmore Way Benicia, CA 94510

- Taurak Lube — Apparently a Texaco industrial lubricant; probably a sodium soap grease, no longer available from NECO. It is water soluble and good for hand lubing bullets, even at low temperatures, but it does not become too soft, even at 90 degrees. Al Miller reports that its practical velocity limit is about 2,600 fps with bullets of 20 BHN or harder. Bullets lubed with Taurak and fired in .44, .41, and .357 magnums produced very good accuracy and no bore leading (HL 181 62-64). I have been unable to determine whether this Taurak is the same as the Taurak 250 that was once marketed by NEI as Hawkeye lube. Taurak is no longer listed for sale by NECO. RS

- NECO Coat — Molybdenum disulfide which is impact coated onto the surfaces of jacketed or cast bullets, then in turn coated with carnauba wax this is said to reduce the frequency of cleaning, decrease pressure, increase velocities slightly, and flatten trajectories (HL 175 63-64). The coating was available as a service from NECO or in a do-it-yourself kit form. Jacketed bullets given this coating are gaining favorable attention from the varmint hunting fraternity. See moly in section 3.

NEI Lubricants (NEI Handtools Inc., 51583 Columbia River Highway, Scappose, OR 97056). But note that NEI no longer lists bullet lubricants in its product

description sheets—but Walt Melander of NEI recommends Micro-Lube (see that entry in this-section).

• NEI 10-X -- -Apparently an Alox lube, but less sticky than others and sometimes preferred for that reason (FS 49 2). No longer available.

• NEI Hawkeye — Texaco Taurak 250 grease; a water-soluble lube, probably a sodium grease, has produced good results in both blackpowder (FS 77 5) and in smokeless powder loads (FS 74 23). Scovill states it is an excellent lube which "remains unchanged from 60 degrees below zero to well over 200 F." He found in one set of tests it produced smaller groups than Alox 50-50 (HL 134 16-17). It was once available from NEI/Tooldyne, but Walt Melander advises it is no longer available from his company. Some of it has been available from Ron Robb, owner of Sundance Fuel of Spring, Texas ((713) 353-9688). See also NECO Taurak Lube.

Perfect Lube — Properties similar to sodium grease (CB 21). Marketed by Cooper-Woodward, P.O. Box 372, Riverside, CA 92502. Said to be good at extremes of temperature.

Pyrodex Lube — Very similar to Wonder Lube 1000 Plus (which see), but with an unspecified ingredient added to improve its results with Pyrodex powder (AR Jan 92 59-60).

Radix Magnum Dry Film Bullet Lubricant — Contains molybdenum disulphide in a methylene chloride solvent, and apparently other ingredients as well. Dennis Marshall found Radix lube to be the best dry film lube yet to come on the market (FS 61 14-17). Available from Radix Research and Marketing, Box 247, Woodland Park, CO 80860.

RCBS Bullet Lubricants (available from the Sporting Equipment Division of Blount, Inc., RCBS Operations, 605 Oro Dam Blvd., Oroville, CA 95965):

- Bullet Lubricant — A non-toxic (non-Alox?) lube said by RCBS to be resistant to temperatures—presumably this means it is suitable for use over a wide range of temperatures.

- Rifle Bullet Lubricant — An Alox 50-50 lube.

Puff-Lon -- A dry lubricant placed between powder and bullet, this is claimed to reduce bore fouling, reduce chamber pressure, lubricate the bore, and to have other beneficial effects. Available from Puff-Lon, Rt. 2, Box 220, Grosbeck, TX 76642.

Rooster Laboratories Bullet Lubes (1740 Townsend Street Cincinnati, OH 45223) WWW.roosterlabs.com As of 2005 Rooster Laboratories is no longer making bullet lubricants. Rooster lubricants turn up regularly at gun shows.

- J-2 Bullet Lube — somewhat hard, must be heated to work in a lubrisizer, Matthews did not find it gave good results (FS 64 28-29).

- SL-4 Bullet Lube — a somewhat softer lube, which Matthews found did everything Alox 50-50 does, and perhaps a bit more (FS 64 28-29).

- Rooster Red C-3 — A hard lube which melts at 250° F. A Lubrisizer being used to apply C-3 must be heated. Scovill refers to it as one of the best of the improvements on Alox 50-50 (HL 134 16). Tests by Andy Barniskis indicate it is hard to get a lubrisizer hot enough to make the stuff flow, and it was necessary for him to lube each bullet twice, turning it 90 degrees to fully lube each groove. In accuracy tests, he found first it was excellent, then it was as good as other lubes but not better (HL 11169-70). One shooter found it gave less accurate results than other lubes (FS 93 14), but another reported, on hot days, the relatively hard Rooster Red gave significantly better results than the softer Alox 50-50 (TCB 105 15).

- Zambini — An improved version of C-3 which melts at 220 ° F. Requires heating the lubrisizer (HL 134 16). Zambini is intended primarily as a pistol bullet lubricant.

- Rooster Jacket — Recommended for velocities under 1,000 fps; this liquid lube dries to a clear, hard, glossy finish, and it may be used on copper-plated bullets or in the manufacture of swaged bullets. (HL 134 48). Ross Seyfried found it works very well as a paper patch lube (Guns & Amino April 1990 70). It is designed for lower velocity pistol bullets, but it has been used at 1400 fps in rifle loads.

- HVR — This has a 220° F melt point and is intended for high velocity rifle. It is said to be softer than Zambini, but it still requires some heating of the lubrisizer.

- Minie — Intended as a black powder lube, this is a general purpose lubricant which can be applied by hand.

- BP-7 — A black powder lube which can be used on the bullet and also to form grease wads to be used under the bullet. It has a 110° melting point and flows in a lubrisizer at room temperatures.

SAECO Bullet Lubricants (available from Redding-Hunter Incorporated, 1089 Starr Road, Courtland, NY 13045):

- SAECO Gold — An Alox-free pistol bullet lubricant which is said to work well in rifle loads—and to be an excellent fluxing agent.

- SAECO Traditional — An NRA-formula Alox 50-50 lubricant.

- SAECO Green — A reintroduced rifle and pistol lube which is slightly harder than other SAECO lubes, and which contains no Alox.

- SPG Black Powder Lube — See the SPG listing in this section.

Sharps Rifle Co., 1878: 1 beeswax, 3 sperm oil (CB 43).

Silver Eagle Graphite Wax Wads — An apparent resurrection of IPCO graphite wads, these are 3/4" x 4" x .035". Al Miller found them to be effective in reducing leading, and accuracy was unchanged (HL 160 52-54). Once available from

Silver Eagle Machining, 18007 N. 69th Ave., Glendale, AZ 85308, but a recent letter to address was not answered.

SPG Black Powder Bullet Lube — Developed and marketed by Steven Paul Garbe (SPG), this lube is one black powder lube which can be used in lubrisizers. Mike Venturino's review mentions it can also be used in smokeless powder loads and it has good temperature stability—for sub-2,000 fps loads, he now uses it in preference to Alox 50-50 (HL 130 59-51). Ken Waters reports using it in the .416 express in fast loads without barrel leading (HL 167 18-23, 60). Dave Twigg writes it enabled him to go back to using black powder (after having been seduced by Pyrodex) because of its ability to "keep black powder soft!' (HL 174 30). William C. Davis, Jr. writes his experience indicates it is the best lube for black powder and Pyrodex, and it is also excellent in the .308 (TCB 105 16). Garbe writes it is thought of as a black powder lube, but it is intended as a general-purpose bullet lubricant. He also notes it is supplied in hollow stick for use in lubrisizers, but it can also be melted in a double boiler and poured directly into the reservoir or used for pan lubing; these two methods produce a harder lube which is suitable for a wider range of temperatures. Available from SPG Lubricants, Box 761, Livingston, MT 59047. Steve Garbe, developer of SPG, reports while he has received several requests for a harder version of the lube (for use in higher ambient temperatures), he has not done so. But he does write that putting the lube through a lubrisizer does make it somewhat soft—though melting it in a double boiler and pan-lubing produces a harder temper (Black Powder Cartridge News, Number 14, page 31). SPG continues to be a favorite of many BPCR shooters. It is now available from SPG, LLC, P.O. Box 1625, Cody, WY, 82414. Phone (307) 587-7621.

Tamarack Bullet Lubricants (available from Tamarack Products Inc., P.O. Box 625, Wauconda, IL 60084):

- NRA Developed Formula — An Alox 50-50 blend using commercial blend A-1 beeswax.

- High Temp Formula -- This is made from 50% Alox 2138F and 50% microcrystalline wax, producing a lubricant which has a melting temperature of

200° but which does not require heating the lubrisizer. Otherwise it is said to have the characteristics of regular Alox 50-50.

Thompson Bullet Lubes — including a series of wax-base lubes for lubrisizer application, and one liquid lube. Available from the Thompson Bullet Lube Company, P.O. Box 472343, Garland, TX 75047-2343. John Zemanek's extensive review of several of these lubes appears in HL 145 24-26, 52; the evaluations below come from that source. Generally, Zemanek found the Thompson lubes tested work better with high velocity loads than with moderate or light target loads, and they work best with alloys as hard as Lyman #2 or harder, and they work best with gas check bullets loaded to maximum pressures and velocities in handguns. Despite the colors indicated, most of these lubes are available in a choice of colors.

- Bear Lube Cold — Flow temperature 90°. Not evaluated by Zemanek.
- Bear Lube Heat — Flow temperature 110°. Not good with wheelweight alloy; does better with a 50-50 wheelweight-linotype alloy. With full magnum loads, it is the equal of Alox 50-50.
- Blue Angel — Flow temperature 125°; heating is necessary. Better than Alox 50-50 in the .44 magnum. This lube is used by many commercial casters, including R&R, Bull-X, National, and Bullseye.
- Red Angel — Flow temperature 145°-180°; heating is necessary. With full loads in the .357 magnum; this is better than Alox 50-50.
- Angel Coat — A liquid lube, not evaluated by Zemanek. No longer listed in Thompson's product description sheet.
- PS Black Powder Cartridge Lube — Said in the product description to work with both black powder and modern rifles and to not affect the powder charge.

Thompson Center Natural Lube 1000 Plus Bore Butter — Mustafa Curtess calls this the "absolute best" bullet lube he has used; he also mentions it is an excellent paper patch lube.

Ultra Score Bullet and Patch Lube — Odorless, and workable in a wide range of temperatures, this works as a patch and conical bullet lube. It is waterproof and enables easy clean up. Accuracy not tested (HL 174 56-57). Once available from Big Bore Express, Ltd., 5435 N. Hertford Way, Boise, ID 83703, but a recent letter to that address was not answered.

White Label Lubes — www.lsstuff.com 364 Indian Point Road Ward, Arkansas 72176

- 50/50 Bees Wax Xlox
- X-lox 2500 plus
- BAC Lube
- Carnauba Red
- X-lox 350 (Alox 350)
- Commercial 160,190 Hard commercial lubes
- Liquid X-lox and 45-45-10

Wilson Bullet Lubricants — Developed by and available from Wayne Wilson, 701 Friar Tuck Ct., Miamisburg, OH 45342:

- Soft — Formulated to flow in a lubricator like Alox 50-50, and like that lube it will get runny in a hot gun on a summer day. Also used to grease patches in muzzle loaders and in black powder cartridge guns.
- Hard — This lube is similar to Soft, but it has a higher melting point and requires the lubrisizer be heated.

Wonder Lube 1000 Plus — A blackpowder/muzzleloader lube which derives part of its name from the fact in a test it was fired in a .50 cal. muzzleloader more than 1,000 times (90 gr. FFg behind a patched ball lubed with Wonder Lube) without being cleaned and without any increase in group size (AR Jan 92 59-60). This is

a remarkable performance, and the lube might find use in other applications as well. Available from Ox-Yoke Originals, Inc., 34 W. Main St., Milo, ME Also sold by Thompson/Center Arms as Natural Lube 1000 Plus.

Voodoo Red Synthetic Bullet Lube — Voodoo Lube
24337 Champaign St. Taylor, MI 48180
http://www.voodoo-lube.com

PART 2: HOMEMADE CAST BULLET LUBRICANTS (entries alphabetized)

Beeswax — Usually an ingredient in other lubricants, but Gil Sengel reports it was once used by itself as a lubricant for bullets in the .455 Webley (HL 169 8). It has also been used in this fashion as a lube over lead balls in the .256 Winchester (TCB 106 7).

Bill's Red Lube (aka Mac's Red) -- 1 oz. beeswax, 1/2 fluid oz. Dextron II automatic transmission fluid; 2.5 cc (Lee measure) Ivory Snow; heat and mix. Bill McGraw's description of this lube also mentions using Ivory bar soap. He uses this as a lube to coat the bullets and to make grease cookies (TCB 122 14-15). See the note in Ivory Snow in part 3.

Ben’s Red aka Red n Tacky -- 50% beeswax, 30% Red Tacky Lucas High Temp Grease, 10% Johnson's Paste Wax, 5% Dexron II or Dexron III Trans. Fluid, 5% STP Oil Treatment. High heat is need to mix. Filter through an old T shirt to remove any solid clumps. (Boolets)

Bowker-Lammers Lube — One pound beeswax, one pound beef tallow, and one tablespoon of STP (TCB 123 6).

Chapman Lube — Ken Chapman reports good results from using a lube of his own concoction in the 44 S&W Russian: 1 oz. castor oil, 4 oz. beeswax. This produces good groups with black, Pyrodex, or smokeless powders (HL 172 45).

Charlie Montana –- Beeswax 3 parts, chicken fat one part. A deadly hunting lube reputed to kill game by salmonella poisoning. (Boolets)

Cream of Wheat and other fillers—See Part 3.

Darr Lube — A 50-50 mix of Vaseline and paraffin. This was popular with some schuetzen shooters, but Wayne Schwartz had better luck with Emmert lube (FS 70 3).

Darr #2 Lube — A pound of Vaseline, a pound of paraffin, and a teaspoonful of RCBS case lube (TCB 123 6).

Dell #36 — 2 oz. beeswax, 2 oz. spermaceti, 2 oz. 600W worm gear lube, 2 oz. lithium stearate, 1 oz. anhydrous lanolin. Dell describes this as an excellent lube under all different weather conditions, but one which can no longer be made because several of the ingredients are now unavailable (CD/ASSRN).

Dell #47-M — Ingredients by weight: 40% beeswax, 24% castor oil, 16% anhydrous lanolin, 20% Ivory Snow (TCB 122 14).

Dell #48 — 10 parts beeswax (by weight), 5 parts peanut oil, 4 parts anhydrous lanolin, 5 parts lithium stearate. Dell advises the following mixing procedure: "The waxes and oils are melted together and allowed to cool until they just start to harden, when the lithium stearate is mixed in. It will look like tan mud at this point. Reheat and keep raising the temperature, stirring at frequent intervals.

First it will start to gel and turn translucent instead of muddy and finally when the temperature gets around 400 F, it will all melt. It must be poured into molds at this point because when the temperature drops slightly, it will gel again (CD/ASSRN).

Dell # 53 — 20 gm. beeswax, 5 gm. anhydrous lanolin, 2 gm. Castile soap (Kirk's), 5 gm. castor oil. Designed for pan lubrication, with a melting point of about 260° F (CD/ASSRN).

Dell's #47 (Modified)— Bill McGraw has created several versions of this:

	M-1	M-2	M-3	M-4
Beeswax	40	50	50	60
Castor Oil	24	10	20	10
Anhydrous Lanolin	16	10	28	25
Ivory Snow (grated bar)	20	30	2	5

Figures indicate % by weight. McGraw reports M-1 is rather soft, and M-2 is harder, but they both tend to dry on the bullet after several months.

El Gato Bullet Lube—see cat hair in Part II.

Emmert Lube — 8 oz. beeswax, 7 oz. Crisco (white only!), 1.5 oz. Wesson oil. Messy but effective. Do not use the yellow butter-flavored Crisco since it contains salt (FS 70 3). Another formula calls for 1760 gr. beeswax, 1368 gr. Crisco, 382 gr. Crisco oil. Another formula for this make-it-yourself lube is as follows: 12 oz. beeswax, 9 oz. white Crisco shortening, 2 1/4 oz. Crisco or Wesson oil. Jim Luke warns overheating the mix will ruin the lube; he uses it via pan lubing (Single Shot Exchange Compendium 2, page 266).

Gilligan's Lube #1— An experimental lube composed of these ingredients in the indicated proportions: beeswax, 20 grams; lanolin, 5 grams; Castile soap, 2 grams; castor oil, 5 grams. Jim Gilligan reports this lube performed well, but the Castile soap required heating over 100° C, which created a fire hazard (FS 144 25-26).

Gilligan's Lube #2—a replacement for #1 which worked well. Proportions are % by weight. Formulas are provided for both hard and soft versions (FS 144 25-26):

	Hard	Soft
beeswax	30	30
ozokerite wax	30	20
petroleum jelly	40	50

Donaldson lube — 6 oz. beef tallow, 4 oz. beeswax, 2 oz. rosin Apparently the rosin in this formula must be first dissolved in alcohol in order to enable it to blend with the melted waxes (CD/ASSRN).

Felix Lube — 2 Tablespoons mineral oil, 1 Tablespoon castor oil,1 Tablespoon Ivory, or homemade soap (grated),1 Tablespoon Lanolin, Beeswax - piece approximately 3 1/2" X 3 1/2" X 1 ".The amount of beeswax can be changed to adjust hardness. One teaspoon of carnuba wax can be added to give a shiny bore.

Heat mineral (baby) oil until it starts to smoke. Add castor oil, and stir continuously for 1/2 hour. Sliver the soap, and stir into the mixture a little at a time, until melted. Add the beeswax when it is melted reduce remove the heat and add the lanolin, thus not running any risk of burning or scorching the lanolin. (Boolets)

Frankenlube — Made by Ralph Schneider by combining all his stocks of the highest performing lubricants in his extensive collection. Excellent performance in target velocity pistol loads (TCBF).

Harris Lubricant — In the context of a discussion about the smoke produced by bullet lubes, C. E. Harris suggested the following flexible formula: equal parts of beeswax, paraffin, and petrolatum, plus a tablespoon of non-detergent motor or gear oil or RCBS Case Lube II or anhydrous lanolin. Melt and mix in a double boiler (FS 90 3).

- Equal parts by melted volume of Crisco, paraffin, and Vaseline, with 2 oz. melted anhydrous lanolin per pound of lube. Recommended by C. E. Harris for high velocity handgun and rifle loads. After the bullet grooves are filled, he coats the bullets with Lee Liquid Alox thinned 50-50 with mineral spirits (AR Apr 96 31).
- A version of the above lube for muzzleloaders or for cold weather use calls for a softer lube with two parts of Crisco (AR Apr 96 31)

Henry Beverage Lube — 2 oz. yellow Vaseline, 4 oz. mutton tallow, 10 oz. Japan wax, 6 oz. beeswax, 6 oz. crude ozocerite, plus one tube of Gunslick for each 6 oz, of mixture. Dell notes this formula was attributed to Leopold (CD/ASSRN).

Herrick Lube — Equal parts of beeswax and Japan wax, with a small quantity of cylinder oil or castor oil as a softener; use as little oil as possible, since it tends to "sweat out" over time (CGH 83-4).

Home Made Bullet Lubes — There are quite a number of these, and there is no clear distinction between the lubricants listed under this subheading and some of those listed elsewhere. Generally, these lubes are those which seemed to be developed and used by a single experimenter. They are presented here in no particular order.

- Graphite Lube—W.B. Learned used a mixture of carnuba wax and vaseline (proportions unspecified) as a satisfactory pistol bullet lube. Wanting to thin some

which was too stiff, he added some ARCO 10-40 graphite motor oil. Apparently, it worked, but details are sketchy (FS 52 10).

- 1 pound beeswax, one 15-oz. can of STP (FS 36 15).

- 5 parts paraffin, 1 part beeswax (2 parts in hot weather), 1 part pine rosin (no less), 1 part castor oil, 1 part "MPG Plus" (a "SILOO" automobile product—stir well before adding). Mix all ingredients together hot, This lube was compounded to prevent leading in .44 magnum loads with wheelweight bullets. (FS 65 30)

- 50-50 blend of beeswax and beef fat, used in pan-lubing bullets (FS 82 16, TCB 102 15).

- 4 oz. paraffin, 4 oz. beeswax, 2 oz. Kerr-McGee Blue Velvet Ride multi-purpose grease. Said to be good in rough, fouled bores (FS 95 26).

- 4 parts (volume) beeswax, 1 part multipurpose lithium grease, 50 milliliters STP per pound of lube. When making this, constant stirring is advised.

- Lube E-1 — 50% (volume) paraffin, 25% petroleum jelly, 25% lithium grease. A bit gooey.

- Lube E-2 — 53% (volume) paraffin, 27% petroleum jelly, 20% lithium grease. Better consistency, good accuracy.

- Lube E-3 — 25% (volume) paraffin, 25% beeswax, 25% petroleum jelly, 5% RCBS Case Lube II, 20% lithium grease. (The E-lube formulas were contributed by Ian Foran of Queensland, Australia.)

- 10% by weight Ivory Snow, 10% by weight peanut oil, 80% beeswax; this can be made slightly harder by increasing the amount of Ivory Snow, or softer by adding more peanut oil (TCB 99 12-13). Bill McGraw Mentions he added a small amount of water to aid the mixing, then heated it until the water evaporated. He remarks it's a low temperature lube. See note on Ivory Snow in part 3.

- 40% (by volume) virgin yellow beeswax and 60% pure neat's-foot oil (not neat's-foot oil compound). Used successfully in black powder cartridge shooting. Bullets were pan lubed and fired without sizing (TCB 106 8-9).

- Graphite Wads—Four parts beeswax, three parts Japan wax, two parts tallow; melt and add two parts graphite and stir until stiff or the graphite will settle out (TCB 108 5).

- Dip-and-Dry Lubricant—Three parts of Acheson Graphite (Grade #38) and one part water-clear lacquer. After affixing gas checks and sizing, the bullets are dipped in the mixture and allowed to dry (TCB 108 10).

- 3 oz. crude ozocerite, 2 oz. Vaseline. An old formula, but one perhaps best used in low velocity loads. (CD/ASSRN: Attributed to Horace Kephart and N. H. Roberts in Sharpe's Complete Guide to Handloading)

- Beeswax, paraffin, and petroleum jelly, in equal parts by volume. Recommended by shooter Fredrick Cook, who advises this lube is stable in summer and winter, will flow in an unheated lubrisizer, and is suitable for velocities up to 2200 feet per second.

- 50% paraffin or candles, 30% petrolatum, 20% mineral oil. Experimenters may want to add a small quantity of STP or RCBS case lube, and those with an aesthetic turn of mind can add old crayons for color.

- Pine resin (liquid) and beeswax in a 1:1 or 1:2 ratio. Bill McGraw notes this "shoots clean as if fluxing the barrel each time." (But see Steve Hurst's comments about bullet lubes behaving like "anti-fluxes"—referred to in Part III.)

- Homemade Lube-50% beeswax and 50% Penns-Oil (Pennzoil?) moly auto-chassis lube, used to lubricate bullets in .45 ACP target and plinking loads (TCB 129 16).

Hurst Lubricants – Developed by Steve Hurst. The beeswax/jojoba oil lube was better than LBT Blue in magnum pistol loads and equal to LBT Blue and Alox 50-50 in rifle loads. The Beeswax/ Dextron III ATF mix was tested in revolvers with excellent results. The lithium grease/beeswax lube is an outstanding lube for standard and magnum pistol loads.

- Hurst, Beeswax/Jojoba oil and Beeswax/ Dextron III ATF Melt the beeswax and add the Jojoba oil or Dextron III. 10-20% by weight oil is about right for use in a lube-sizer, 30-40% by weight gives a very soft sticky lube for hand lubing. You can use more or less oil depending on the hardness of the beeswax, the

temperature range of use and the hardness you want. There is no magic percentage. TFS (153 17)

- Hurst Lithium Grease/Beeswax — Made with Sta-Lube General Purpose lithium grease, this grease has no extreme pressure additives. A 50/50 by weight mix makes a soft lube. You can vary the proportions depending on the hardness of the beeswax and the consistency you desire. Heat the beeswax and grease together, 350° F is needed to achieve mixing, and risk of fire is high. Do this outdoors on an electric hot plate, do not use a gas burner!

Jim Vaughn — One toilet bowl wax ring, and one cake of Gulf paraffin. The wax ring is a rather sticky and soft material which is hardened by the paraffin. Ralph Schneider used a similar mix (but with half this amount of paraffin) to make grease cookie material which extrudes well from a JRW extruder.

Johnson Lithium Grease/Beeswax Lube — 75% all-purpose white lithium base grease, 25% pure refined beeswax, with 2 tablespoons trichlorphosphate per pound of the lithium grease. Carl Johnson reports this to be an excellent lube which enables shooting groups in a shorter time than permitted by Alox 50-50 (ABC 178).

Lanolin, Anhydrous — John Zemanek reports good results eliminating leading by putting a moderate amount of this on bullet bearing surfaces, but it is not clear whether the bullet grooves had already been filled by some other lubricant (HL149 30). It has also been used successfully as a paper patch lubricant (TCB 109 6).

Leopold No. 245 — 4.5 oz. Japan wax, 9.0 oz. tallow, 1.5 oz. ozocerite, 0.5 oz lye, 0.5 oz. rosin, 8 oz. water (CD/ASSRN). Charlie Dell suggests the following procedure: mix ingredients, boil with water until froth disappears, cool, remove lubricant cake from water, wash, and form into sticks to fit a lubricant pump. This

would be a high melting point lube, one not suitable for pan tubing. See also the Leopold lubricant listed under Roberts.

Lithium Grease-Graphite/Molybdenum Disulfide — Described as a "good basic formula" with some good results (CB 20).

Lithium Multipurpose Grease — Very effective, but difficult to apply and use because of its softness (CB 37, 86). Used by EHH in initial successful heavy cast bullet loads (before alox) as a grease wad under the bullet separated from the powder by kapok. (CB 40). I tried this method using Dacron instead of kapok in 30.06 and found the loads specified in CB worked excellently. In old military rifles the accuracy was as good as ball ammo. The only problem is the likely short storage time. SH

Lithium Grease/Paraffin/Beeswax — Mixed in equal parts (by volume), this is said to have good temperature characteristics, to be a good anti-leading grease, and to feed well through a lubrisizer. Provides accuracy equal to Alox 50-50. Mix by melting the paraffin and beeswax together and stirring the grease in. Care should be taken not to let the mixture get too hot (AR Aug 70 88).

Lithium Grease/Beeswax — Made by several experimenters with varying % grease and different commercial greases. Unfortunately the exact type of lithium grease is sometimes not specified, there are dozens of types of grease. Lithium grease is available with moly or graphite or both. Glen Fryxell recommends Sta-Lube Extreme Pressure Moly-Graph Multi-Purpose Grease, a commonly available lithium grease with both graphite and moly. This grease makes a good Beeswax/Lithium grease lubricant if you want moly and graphite. He reports excellent results in standard and magnum revolvers. (LASC)

Manny, Hill, and Metzler Lube — 1 oz. tallow, 2 oz. ozocerite, 2 oz. Japan wax, 5 oz. beeswax, 1 oz. steam cylinder oil. Described as an excellent lube for pan lubrication, this would probably be temperature sensitive (CD/ASSRN).

Marlin Firearms Co., 1891 — 1 beeswax, 4 tallow (CB 43).

Massachusetts Arms Co. (Maynard Rifle), 1890 — 1 beeswax, 3 tallow (CB 43). A similar lubricant was listed by Roberts, which see.

Matthews' B/V Paper Patch Lube — Recommended by Paul Matthews (in The Practical Paper Patched Bullet 43-44), this formula of 45% beeswax and 55% Vaseline is an excellent patch lube; it keeps the bore clean (even cleaning out some of any previous fouling), and seems to permit good accuracy.

Mattern Lube — A mixture of mobilubricant or cup grease, with 10% (by weight) graphite, and a small quantity of beeswax, Japan wax, or paraffin added as a stiffener (CGH 84).

Matthews' Black Powder Cartridge Rifle Bullet Lube — Described in Paul Matthews' book “How To's for the Black Powder Cartridge Rifle Shooter”, this is a mixture of two parts yellow beeswax (ounce by weight), one part pure neat's-foot oil (fluid ounces), and one part Murphy's Oil Soap (fluid ounces). Paul's directions say to "Melt the beeswax first and then add the neat's-foot oil followed by the Murphy's Oil Soap. Don't get the beeswax too hot, just barely melted. And heat the two oils before mixing up to about 140° no hotter." He reports this soft lube freezes hard in winter, but it works well the year around, giving better accuracy than any other lube he has tried.

Matthews' Black Powder Bullet Lube — Paul Matthews offers this lube formula. Melt 1/2 pound of yellow beeswax, and mix with it 4 fluid ounces of pure

neatsfoot oil (not neatsfoot compound) and 3.5 ounces of thin shavings from a bar of Neutrogena Facial Soap. This produces a somewhat sticky lube which shows excellent promise. PS

Meyers' Best Lube # 2.1 — George Arledge and Jim Meyers contribute this improved formula: Powdered Rosin 8 oz., 10-10-80* 6 oz., Beeswax 9 oz., Paraffin15 oz., Mica 2 oz.

*10-10-80 is described as a general lubricant and penetrant; make it by mixing one part STP, one part Marvel Mystery Oil, and eight parts Dexron ATF (parts by volume). Mix the #2.1 as follows: heat the 10-10-80 to about 250° F (be alert to possible fire danger), turn off the heat and stir in the rosin; add beeswax (temperature will drop); add paraffin & stir to 170°; add mica & stir as temperature drops to 140°. Pour quickly into a mold to keep the mica from settling out.

Meyer's Best Lube #2-16 oz. paraffin wax, 8 oz. beeswax, 7 oz. jojoba oil, 7 oz. pine rosin, 2 oz. motor mica; melt and mix, stirring until cooled to keep the motor mica in suspension. Reportedly produces good accuracy without leading in both rifle and pistol (FS 91 20).

Mixtures of Lubricants — a number of shooters have experimented with mixtures of commercial lubricants, sometimes with good success. Some shooters report using mixtures of lubricants in CBA competition.

- 25% Alox 50-50, 75% Bore Butter—this apparently makes lubed bullets less sticky to handle than straight Bore Butter and gives leading-free shooting and good accuracy.

- Dale Reifsnyder reports creating a "witch's brew" of lubes, consisting of Lyman Ideal, Mirro, Alox 50-50, Ipco, and several others (unidentified). He notes the mix is nonduplicatable, but it is the "best damned lube" he's tried. I note there may be at least two lessons here: keep experimenting, and keep records. RS

Motor Mica — A so-called "white graphite" sometimes used to dust lubed bullets and make them less tacky, but also used as a paper patch lubricant; reportedly successful in this application, but second to Teflon spray (CB 103).

Niedner Lube — To a half-pound of melted Japan wax add four heaping tablespoons of Acheson's graphite #1340; when mixing, continue stirring as long as possible or the graphite will settle out (CGH 83).

Police Department, 1962 — 1 beeswax, 1 paraffin wax, 1 cosmoline (CB 43).

Pope, H. M., about 1900 — 3 mutton tallow, 2 bay wax, 1 beeswax, 1 steam cylinder oil, 0.2 of 1 Acheson graphite; the bay wax could be omitted (CB 43). Another similar formula was described by Roberts, which see.

Rich Hoch Formula Lube — 1 lb. paraffin, 1 lb. Vaseline, 2 tablespoons of RCBS case lube. (This is similar to Darr #2, but with more case lube.) The mix can be colored by substituting colored candles for the paraffin. Melt the ingredients together and pour into a lubrisizer (TCB 10214).

Roberts-Listed Lubricants — Major Ned Roberts, writing in The Breech-Loading Single-Shot Rifle, lists the best of the lubricants he knows of. The lubricants are numbered here as they are in chapter 9 of the publication. Generally, the lubricants were made by combining the ingredients in a double boiler. (maximum temperature 212° F)

- 1. — 4 parts bayberry wax, 1 part beeswax, 1 or 2 parts cosmoline. The cosmoline is a softener; the lubricant should be made softer in cold weather.
- 2. — Beeswax and deer tallow in equal parts.
- 3. — 3 parts beeswax, one part cosmoline.

- 4.-- 8 ounces cosmoline, 3 ounces paraffin, 1 ounce beeswax; use a higher proportion of beeswax in hot weather.

- 5. — 6 ounces beef tallow, 4 ounces beeswax, 2 ounces pulverized rosin. H. A. Donaldson's favorite lubricant.

- 6. — 4 parts beeswax, 1 part steam-engine cylinder oil; a favorite of rifleman F. J. Rabbeth.

- 7. — 6 parts beef tallow, 1 part cosmoline—a lubricant adopted by riflemen G. H. Wentworth and H. Simpson.

- 8. — 3 parts beef tallow, 1 part beeswax, 1 part fine graphite—recommended by the Massachusetts Arms company.

- 9. — 2 ounces beeswax, 4 ounces bayberry wax, 6 ounces mutton tallow, 2 ounces (by weight) steam engine cylinder oil, 170 grains (or 2 heaping tablespoons) finest Acheson graphite. This lubricant was developed and used by Harry M. Pope, who recommended the following mixing procedure: melt the waxes and tallows, add the cylinder oil, then stir in the graphite, which will tend to settle out. If this is too soft for the weather, use more bayberry wax or less tallow.

- 10. — 3 parts crude ozocerite, 2 parts (by weight) yellow Vaseline—referred to as the Kephart lubricant.

- 11. — 1 pound Japan wax, 1/2 pound mutton tallow, 1/2 pound yellow Vaseline this is Dr. Hudson's lubricant.

- Leopold's No. 97 — 16 ounces beeswax, 12 ounces bayberry wax, 5 ounces anhydrous lanolin, 2.5 ounces white Castile soap; melt the first 3 ingredients in a double boiler and melt the soap separately over a hot fire, then pour the soap slowly into the other ingredients and stir well.

Roberts, N. H., lube No. 1 — 6 oz. beeswax, 2 oz. beef tallow, 3 teaspoons steam cylinder oil (CD/ASSRN).

Roberts, N. H., lube No. 2 — 25% crude ozocerite, 25% yellow beeswax, 25% Japan wax, 25% mutton tallow (CD/ASSRN).

Roderick Formula #1 — A hard formula for use when the temperature is 80 degrees and above: 50% pure beeswax, 40% pure mutton tallow, 10% Mobil 600W steam cylinder oil (FS 9 9, CD/ASSRN).

Roderick Formula #2 — A medium formula for use when the temperature is from 55 to 80 degrees: 40% pure beeswax, 50% pure mutton tallow, 10% Mobil 600W steam cylinder oil (FS 9 9, CD/ASSRN).

Roderick Formula #3 — A soft formula for use when the temperature is below 55 degrees: 30% pure beeswax, 60% pure mutton tallow, 10% Mobil 600W steam cylinder oil. Do not store bullets lubed with these formulas for more than two weeks (FS 9 9, CD/ASSRN).

Simpson-Listed Recipes for Pan-Lubing — Layne Simpson provided a number of formulas for pan-lubing unsized cast bullets (HL 108 36):

- Formula Number One (high velocities) — 6 ounces NEI Ten-X lube (4 sticks), 1 ounce paraffin, 1 ounce petroleum jelly, 2 tablespoons Break Free-CLP.
- Formula Number Two (medium velocities) — 6 ounces NEI Ten-X lube, 3 ounces paraffin, 6 ounces petroleum jelly, 2 tablespoons Break Free-CLP.
- Formula Number Three (low velocities) — 6 ounces paraffin, 6 ounces petroleum jelly, 3 tablespoons Break Free-CLP.

Simpson-Listed Recipes for Schuetzen Rifles — Layne Simpson writes these are from Bud Welsh's bullet mould and gunsmithing catalog, available from 137 Tremaine Ave., Kenmore, NY 14217 (HL 108 36):

- 1. Vaseline and paraffin proportioned approximately one to one by weight plus two tablespoons Arco graphite motor oil per pound of mix.
- 2. Vaseline and paraffin proportioned approximately one part Vaseline to two and a half parts paraffin.
- 3. Equal portions of beeswax and Vaseline.
- 4.65% beeswax and 35% beef tallow with a little oildag.

- 5. Pure beef tallow (for cold weather shooting).
- 6. 80% beef tallow and 20% beeswax.
- 7. One part Vaseline, four parts bay (or Japan) wax.
- 8. Two parts Japan wax, nine parts beef tallow, two parts crude ozocerite, five parts beeswax, one part steam cylinder oil or cosmoline.

Smith & Wesson, 1831— tallow (CB 43).

Sodium Grease — Heavy & sticky stuff once used on the side rods of steam locomotives (CB 21). May be the same as Taurak and Hawkeye. Used by some competitors in CBA matches (TFS 330-239) Available from locomotive lubricant suppliers.

Teflon Spray — excellent results when used as a paper patch lubricant. After being sprayed, the patched bullet is sized in a lubrisizer (CB 95). Also used to lube bare bullets. For commentary on this application, see Al Miller's article (ABC 42-45).

Teflon Tape — the stuff used as a pipe sealant in plumbing operations. Although this technique verges on patching rather than lubricating, it seems to deserve mention (ABC 179-181).

Texaco Hot Box Coolant — a heavy, sticky product intended for railroad use, this was used (apparently successfully) for a time as a bullet lube by Paul Matthews (FS 64 28).

Texaco Taurak Grease — reportedly very good with black powder applications, and other areas as well. Apparently water soluble, possibly a sodium grease. Once marketed by NEI/Tooldyne as Hawkeye Lube. See sodium grease.

U.S. Army Lubricants

- 1855 — 1 beeswax, 3 tallow (CB 43).
- 1861-8 beeswax, 1 tallow (CB 43).
- 1873 — 8 bayberry wax, 1 graphite (CB 43).
- 1880 and thereafter — Japan wax (CB 43).
- Blackpowder era — 3 mutton tallow, 1 beeswax (FS 90 3).

Whitehead Experimental Lubricants — Duane Whitehead embarked on a series of experiments in order to find a bullet lubricant which would be superior to Alox 50-50 in production barrels. He reports he was less than successful, but the information is presented here in order to prevent needless duplication of his investigations. One of the results he sought was longevity, which he defines as the ability of a lubricant to run long strings of shots accurately without cleaning. All percentages are by weight.

- #1 — 46% beeswax, 46% Crisco, 8% STP oil additive. This provides accurate shooting up to 90° F; velocity limit 1400 fps; longevity 10 rounds.
- #2 — 50% candle wax, 50% lithium grease. Provides good, accurate shooting up to 95° F; velocity limit 1450-1500 fps; good cold weather lube at low velocity; longevity 7 rounds.
- #3 — 33% beeswax, 67% lanolin. This is a very good, very accurate lube up to 94° F; velocity limit 1500 fps; longevity 15 rounds.
- #4 — 40% beeswax, 60% Crisco, 1.5 teaspoons STP. This is a fair lube up to 90° F; velocity limit 1400 fps; longevity 10 rounds.

- #5 — 67% Javelina Alox lube, 33% lithium grease. This is better than the regular Alox 50-50 lube at cooler temperatures; velocity limit 1600 fps; longevity 15 rounds.

- #6 — 50% beeswax, 50% Vaseline. This is an old standby of the pre-Alox era (see Darr Lube). Limited to 86° F and 1600 fps; longevity 12 rounds.

- #7 — 33% zinc oxide ointment, 33% beeswax, 33% lanolin, mixed hot. This is an unusual combination which greatly helps rough production bores. The usual temperature and velocity restrictions apply; longevity 15 rounds.

- #8 — Apache Blue Lube, which is occasionally too hard for a lubrisizer, but which may be softened by melting with up to 10% linseed oil as a plasticizer. This also improves texture. Longevity 15 rounds.

Whitehead also provided some information on paper patch lubes, which are often applied in a two-layer treatment: a primer and a top coat. His system is to heat each coat enough to soak it into the paper—either in a 170° oven, or in Texas sunshine.

- #1 — Teflon spray; probably the best primer available, but expensive and sometimes scarce.

- #2 — Lithium grease; some use it straight, others combine it 50-50 with graphite or molybdenum disulphide as a primer coat.

- #3 — Extreme Pressure Grease; furnished by some oil companies; has a high percentage of powdered moly, graphite and extreme pressure additives Used as a primer coat.

- #4 — NRA Alox Lube (Alox 50-50); the Lee liquid form is very convenient to handle; the solid form is best applied by a lubrisizer.

PART 2: CAST BULLET LUBRICANT INGREDIENTS (entries alphabetized)

Alcohols, Solid—Such as lauryl and stearyl alcohols; gave mixed results (CB 44).

Alox 350 — Too soft, with a too-low melting point (CB 45). Alox products are now produced by Lubrizole. Bullet lubricant makers add ~7% microcrystalline wax to Alox 350 to increase the hardness and melting point to match 2138F.

Alox 606 — Made by reacting an Alox product with calcium hydroxide to give a calcium soap. This increases both the water resistance and melting point. The increased water resistance makes it valuable as an industrial rust preventative.

Alox 2138F— Used in the NRA formula with 50% beeswax (CB 45). The Alox Corporation did not sell it in anything less than five-gallon pails, but it used be available in smaller amounts from GAR, 139 Park Lane, Wayne, NJ 07470.

Alox, Liquid — This was available in bulk as "Alox 606-55, which is 55% Alox 606 calcium soap in an aliphatic mineral spirits carrier." from Alox Corporation. Alox products are now produced by Lubrizole. Lubrizole Alox 2100 appears to the same as the former Alox 606-55. Available only in industrial quantities.

Aluminum Complex Auto Bearing Grease — Used by itself in black powder cartridge shooting (FS 84 6) and in Pyrodex loads (TCB 103 19).

Aquadag — Colloidal graphite suspended in water; it has been used to provide a thin coating on otherwise unlubricated bullets (CGH 93, FS 96 22).

ARCO 10-40 Graphite Motor Oil — Used in the "Graphite Lube" described in Part I. The graphite particles are so small they do not settle out—apparently a frequent problem with attempts to add graphite (FS 52 10).

Bayberry Wax — A polar wax, made from the bark and berries of the bayberry bush, Myrinca cerifera. See the U.S. Army 1873 formula in Part I. Also known as bay wax. Melting point 102° to 109° F.

Beeswax — A polar wax, melting point 145° F. Used in numerous formulas, especially the NRA formula Alox 50-50. Sometimes used by itself see Part 2. Beeswax is expensive, attempts to substitute less expensive waxes for beeswax have yielded poor results. (CB 44)

Bentonite Greases — Poor results? (CB 44, 45).

Break Free-CLP — A firearms lubricant which contains a small amount of Teflon powder.

Calcium Stearate — Can be used (via tumbling) to reduce the stickiness of lubes such as Alox 50-50 (FS 49 2).

Candle Wax — Described by Duane Whitehead as paraffin which has been treated with stearic acid, greatly raising its melting point and eliminating the coarse grain structure. He currently uses candle wax in his lube experiments.

Canola Oil (Rape Seed Oil) — A polar vegetable oil extracted from the seeds of Brassica napus.

Carbon Black — A finely divided form of carbon, much like soot. Possibly an ingredient in Apache Blue Lube.

Carbowaxes — Solid polyethylene glycols; little information given (CB 44).

Carnauba Wax — A polar South American palmtree wax, Melting point 185° F. One of the hardest of the vegetable waxes, it increases the hardness and raises melting temperatures of mixtures it is added to, but the result can be somewhat brittle (CB 43). Can be used as a hardening agent not requiring a plasticizer (FS 49 2). Used as a final coating in NECO Coat, see moly.

Castor Oil — A thick highly polar oil. Poor results? (CB 45). Also used to soften beeswax (FS 74 15). Used in one of the "Home-Made Bullet Lubes" listed in Part I, and in Charlie Dell's #47 – M.

Castor Wax — Hydrogenated castor oil, a polar wax MP 176° F with outstanding anti-flux characteristics (TCB 122 12). Lithium grease is produced by reacting castor wax with lithium hydroxide in an oil suspension.

Cat hair — the key ingredient in El Gato Bullet Lube (TCB 138 15-17) although it is claimed to have miraculous effects in many lubes in which it is an ingredient, this shooter has found frog hair works just as well.

Ceresin — A non-polar hydrocarbon wax purified from ozokerite. Most Ceresin sold is a mixture of microcrystalline waxes which duplicate the properties of the natural product.

Cosmoline — Technically a form of petrolatum, but the name has also been used for the Army's heavy rust preventive compound, a heavy grease to which rust preventive compounds such as rosin and Alox type products have been added (CB 44). See also the Police Department lube in Part I.

Crisco — A polar mixture of partly hydrogenated vegetable oils. Used in Emmert Lube, and sometimes used by itself, particularly by black powder shooters. Do not use the yellow, butter-flavored variety since it contains salt.

Cup Grease — Once used by itself as a bullet lubricant (CGH 82-3) and as an ingredient.

Crayons — Used by some experimenters to add color and as a source of “wax” Undefined composition and numerous formulas prevent duplication.

Dag 154 (Acheson's colloidal graphite) — Mixed with isopropyl alcohol, it has been used to provide a thin coating on otherwise unlubricated bullets. This mixture is said to be the same as NEI's Mold Prep, a release compound used in the cavities of bullet molds (FS 96 22).

Dextron II ATF — Automotive automatic transmission fluid, once successfully used as a substitute for sperm oil in a bore cleaner (TCB 100 9). Also used in "Bill's Red Lube" and by Steve Hurst.

Diester Synthetic Greases — Apparently gave very bad results (CB 45).

Dow Corning #321 Dry Film Lubricant — contains moly, and it can be used as a bullet lubricant (TCB 127 3 and TCB 130 6).

Ethyl Vinyl Acetate — A polymer called EVA, used to impart hardness and strength to candle waxes. Caused loss of accuracy (CB 45)

Extreme Pressure additives (EP additives) — Compounds added to lubricating greases and gear oils to increase steel-on-steel lubrication. EP additives; chlorophosphates, sulfur thio derivatives, lead, antimony, zinc compounds and others, are not commonly used in motor oils because exposing them to combustion produces corrosive products. Some of these compounds are toxic if inhaled. The tricresol chlorophosphate additives are extremely toxic.

Most EP additives have no function as lead-on-steel lubricants. Regardless, since guns involve extreme pressure, experimenters have used lubricants containing these compounds and have even purchased pure compounds to use in lubricant mixtures. See Johnson Lithium Grease/Beeswax Lube. Get the MSDS on any commercial lubricants used in bullet lubricants. Moly and graphite are the only EP additives which may be safe in bullet lubricants. SH

Graphite — See CB 19 - 20. Sometimes used as an ingredient, but can also be used to reduce the stickiness of lubes such as Alox 50-50 (FS 49 2). See also dag, aquadag and oildag. Dixon's Microfine Graphite may be available from the Joseph Dixon Crucible Co., Jersey City, NJ; it is used in the home made graphite wads described in Part 2. Also available from Acheson Colloids; see the list of sources at the end of this section. (Note: graphite, when mixed into a lubricant, may tend to settle out; this is largely a function of the fineness of the particles. "Colloidal" graphite, in theory at least, is of such a fine granulation it will remain in suspension.)

Gunslick — A firearms lubricant (see oildag). Used in the Henry Beverage lube.

Ivory Snow — A laundry detergent used in one of the home-brew lubricants described in Part I and in Charlie Dell's #47-M lube. Ivory Snow pre 1960 was granulated Ivory Soap (sodium stearate). Current Ivory Snow is a detergent primarily sodium lauryl sulfate and other ingredients.

Ivory Soap — Composed of sodium stearate, also called sodium tallowate but experimenters should check the list of ingredients, if one can be found on the

wrapper; the chemical constituents of such products have been known to change.

Japan Wax — A sumac berry "wax," it is a polar fat (glyceride) which has been used straight as a lubricant (CGH 83, CB 43) and as an ingredient in many mixes. Melting point 127°.

Johnsons Paste Wax, Johnsons Liquid wax — Commercial wax products containing carnauba wax and other ingredients. Used in several formulas and added to Liquid Alox to improve coating and reduce stickiness. (Boolets)

Jojoba Oil — A polar liquid wax from the bean of the jojoba plant, an evergreen shrub (Simmondsia chinensis) of the American southwest. It has been sold as synthetic sperm oil by Dixie Gun Works. This may be one of the mystery ingredients in Apache Blue Lube.

Lanolin, anhydrous — A soft polar wax, has been traditionally recommended as a case-sizing lube; but it may also work as a bullet lubricant by itself and as an ingredient in mixed bullet lubricants. See the "Lanolin" entry in Part I, and also the Harris lube and Charlie Dell's #47-M lube.

Linseed Oil — A polar, highly unsaturated oil sometimes used as a plasticizer, to soften other lubes which may be too hard to work through a lubrisizer. See Whitehead #8. Linseed oil oxidizes over time to a hard solid.

Lithium Grease — A polar grease containing lithium hydroxystearate and mineral oil. Used by itself as a pistol and rifle lubricant, but is too soft for most applications and may exude oil over time. Numerous commercial formulas contain additives for specific applications. Used in some commercial and many homemade lubricants.

Lithium Stearate — A lithium-based soap, used in Dell no. 48. Melting point 415° F.

Lithium Hydroxystearate — A lithium-based soap, more polar than lithium stearate. Produced from castor wax, it is the soap constituent in lithium grease.

Mica — Sometimes called white graphite, marketed as "Motor Mica" (CB 44). Like other solid additives, it is generally unsatisfactory, though its use has been recommended for paper patches and for dusting bullets lubricated with a sticky lube such as Alox 50-50 and Liquid Alox. (FS 49 2).

Microcrystalline Wax — A series of non-polar hydrocarbon waxes with fine crystal structure, available from very soft to very hard, melting point 140° - 200° F. A potentially useful ingredient compatible with other mineral and vegetable waxes (CB 44). Can be added as a hardening agent not requiring a plasticizer (FS 49 2). Often used as a replacement for beeswax or as a cheap adulterant of beeswax.

Mineral Oil — A non-polar petroleum oil sometimes used as a softener.

Molybdenum Disulfide, powdered — An EP additive often used in automotive and industrial lubricants. Often called simply "moly," this has been used alone to coat bullets (sometimes unsuccessfully) (CB 20), and in combination with other ingredients. Moly increased lubrication (decreased leading) but always decreased accuracy (CB 44) (Used in Radix Magnum lube (FS 61 14) and in NECO Coat. Harold Vaughn reported a series of carefully controlled tests showing the pressure reduction produced by moly treated jacketed bullets was not lubrication by molly, but actually caused by the carnauba wax in the coating. He noted no accuracy increase in his test rifle. (RAF 230).

Montan Wax — A polar fossilized plant wax obtained from lignite coal, but use has not led to good results (CB 44). Melting point 180° F - 203° F

MPG Plus — A "SILOO" automobile product. Used in one of the Home-Made Bullet Lubes described in Part 2.

Murphy's Oil Soap — A liquid soap usually used in cleaning furniture and wood floors. Used in Paul Matthews' Black Powder Cartridge Rifle Bullet Lube.

Neatsfoot Oil — A polar animal oil used as a softener in a number of bullet lubricants, notably those created by Paul Matthews. Be aware a product called Neatsfoot Compound is not an adequate substitute. Said to be available at saddle shops.

Oildag — Colloidal graphite suspended in oil; said to be much the same as Gunslick firearms lubricant (FS 96 22).

Orange Oil, Orange Wax — An orange liquid or soft orange wax with an odor of oranges depending on source and processing. Similar to jojoba oil with polar components. Much less expensive than jojoba because it is a by-product of commercial orange juice production. Possibly a component of Lyman Orange Magic.

Ozokerite — A non-polar mineral hydrocarbon wax called Ceresin in its fully refined form (CB 43-44). Used in the Leopold No. 245 lube and in the Manny, Hill, and Metzler lube. Also used in its unrefined form, called crude ozokerite. Melting point 144° F.

PAO oils — Synthetic polar ester oils used in refrigeration systems and other applications. Some have shown promise as lubricant additives. (Boollets)

Paraffin Wax — A series of non-polar hydrocarbon waxes with coarse crystal structure. Used with beeswax and in combination with other ingredients (CB 19, 44). Can be used to harden lubes such as Alox 50-50, but then a plasticizer (such as Vaseline) should be added to keep the product from becoming too brittle (FS 49 2). Melting point 109° to 150° F.

Peanut Oil — A cooking oil used (as a softener and probably as a lubricant) in one of the homemade lubes listed in Part 2 and in Dell No. 48.

Petrolatum — A non-polar hydrocarbon similar to paraffin but without the coarse crystalline structure. Petroleum jelly is refined petrolatum (CB 44).

Petroleum Jelly — Refined petrolatum Marketed as Vaseline or as Petrolatum USP (CB 44). See also the automobile door latch stick lube in Part l. Used in many lubricants.

Pine Rosin — Used in one of the Home-Made Bullet Lubes described in Part 2. Merrill Martin suggests any lube which is slippery shoots poorly, and using rosin as an ingredient can counter this effect (TCB 130 18).

Preparation H — I'm not sure how seriously this suggestion was made (FS 84 5), but it may have been offered in the same spirit as another respondent's suggestion the very best bullet lube is tallow rendered from the left hind leg of a Spotted Fence Lizard.

Polywax 655 — Not a wax, but a linear, low molecular weight non-polar polyethylene plastic. Used to increase the hardness of candle wax mixtures. MP 210° F. Soluble in many waxes.

RCBS Case Lube — A cartridge case sizing lubricant. Used in Darr Lube #2.

Rosin — A solid resin obtained from pine trees and other plants. Composed of resin acids, primarily abetic acid MP 210 – 250° F. When dissolved in alcohol, was used as an ingredient in Donaldson Lube, also used in the Leopold No. 245 lube.

Silicones — Apparently gave very bad results (CB 45).

Sodium Grease — A heavy lubricant sometimes used by itself as a bullet lube (see Part I) and as an ingredient. Sodium grease is water soluble, see Taurak 250

Sodium Stearate — See Ivory Soap.

Soy Wax — Hydrogenated soybean oil, a soft, polar wax used in making container candles. MP 121 – 125° F

Sperm Oil — An animal oil, rendered from the blubber of sperm whales; no longer available, but see jojoba oil. See also the Sharps Rifle Co. formula in Part I. Also see Dextron II ATF.

Steam Cylinder Oil — Used in a number of old lubricants, including the Roderick lubes, the Pope lube, the Rabbeth lube, and the Manny, Hill, and Metzler lube.

Sometimes called tallow oil, it was used in the cylinders of steam engines. Shortages of tallow during WWI caused the tallow to be replaced by rapeseed oil (canola oil), which may be a useful replacement in bullet lubricants. (TCBF) Available as cylinder oil or other product names from several companies, it is ~80% high grade mineral oil and 20% tallow or other polar additive.

Solid alcohols — Laryl and stearyl alcohols are polar waxy solids. Tests by EHH showed leading prevention and good shooting in light loads but failure in heavier loads (CB44)

Stearic Acid — A polar organic acid, a hard white waxy solid MP 158° F. Used to harden paraffin to make “tropical candles”. Despite the term acid, most organic acids are not corrosive.

STP — A product usually used to increase the viscosity of motor oils, but also used in the Bowker-Lammers lube described in Part I. Contains Zinc dithiophosphate, an EP additive.

Synthetic Beeswax — This may exist in several formulas, but one was used by Alox corporation because it approximated the properties of natural beeswax, though it is apparently somewhat harder. It is apparently composed of microcrystalline wax and paraffin (FS 18 4).

Tallow — A traditional ingredient often used because of availability and because it worked fairly well. It is polar glyceride (fat). See various U.S. Army formulas in Part I (CB 43). Tallows or animal greases come from several sources, commonly beef, pork, mutton (reputed to smell bad), venison, or bear meat. Be aware, however, tallows will usually contain some salt; prompt cleaning after using a tallow-based lube is therefore desirable (TCB 98 6-7). Melting point 88° to 106° F, more or less, but this certainly depends upon the animal from which it comes and possibly upon the area of the body from which it is taken.

Teflon — mixed results as an ingredient (CB 44).

Texaco Taurak 250 — An industrial grease, probably a sodium grease, once sold as Hawkeye Lube by NEI and sometimes as an ingredient in other lubes.

Toilet bowl sealing rings — The ones I have examined appear to be made of microcrystalline wax perhaps softened with a heavy oil. Composition may vary with manufacturer. SH

Trichlorphosphate — An extreme pressure additive used in the Johnson lithium grease/beeswax formula described in Part 2.

Vaseline — A widely used non-polar ingredient. See Petroleum Jelly, above. A component in Matthews' BN paper patch lube. Also used to soften beeswax for general use as a bullet lube (FS 74 15). Phil Sharpe notes it is not suitable as a lubricant by itself since it tends to migrate into the powder and contaminate it (CGH 82).

Vybar — A series of hyper-branched non-polar petroleum waxes, may be solid or liquid. Low ~2% by weight used in wax mixtures to bind oil additives and prevent separation and bleeding.

Water Pump Grease — A calcium soap grease which has been used by itself with some success (CB 20, 45).

Waxes — are a diverse class of organic compounds which are hydrophobic, malleable solids near room temperature. Organic waxes are polar compounds of

various types. Petroleum waxes are non-polar compounds usually simple long chain hydrocarbons. Used in many formulas (CB 19).

Wesson Oil — A brand of polar cooking oil used in Emmert Lube. Oxidizes over time to a gummy residue.

SOURCES FOR INGREDIENTS — No doubt many of these ingredients are no longer available, but the following list may provide opportunities for obtaining some of them. Some of these suppliers will sell only in large (industrial) quantities. This list is not intended to be complete; an internet search will turn up more sources of individual materials

- Filardo Products Co., 6105 S. 108th St., Hales Corners, WI 53130. www.nvcandles.com
- Frank B. Ross Co.970 New Brunswick Ave # H, Rahway, NJ 07065 Phone: (732) 669-0810 www.frankbross.com Industrial Quantities
- M. Argueso and Co., 441 Waverly Ave., Mamaroneck, NY 10543. www.paramelt.com
- Roger A. Reed, Inc., 167 Pleasant St., Reading, MA 01867. www.reedwax.com
- Strahl and Pitsch, P.O. Box 1098, West Babylon, NY 11704. www.spwax.com
- Strohmeyer and Arpe Co. Inc., 89 Milburn Ave., Milburn, NJ 07041. www.strohmeyer.com
- Acheson Colloids Co.; a division of Acheson Industries, P.O. Box 611747, Port Huron, MI 48061-1747 (graphite products, MoS2, PTFE). http://www.achesonindustries.com)
- J. D. Edwards Waxes, www.bulknaturaloils.com
- New Directions Aromatics, www.newdirectionsaromatics.com Small quantity supplier of waxes and oils.

- Steam engine lubricants, www.steamenginelube.com Sodium grease (Taurak 250) Steam cylinder oil. Small quantity supplier

PART 3: CAST BULLET LUBRICANT MISCELLANY

This section contains observations on the nature and use of cast bullet lubricants and other materials which may accomplish the same goals.

The Action of Bullet Lubricants—E. H. Harrison (CB 19) points out "The action of cast bullet lubricants is not known." I take this to mean no one knows just what cast bullets actually do; in fact, there seems to be some doubt they actually "lubricate" in the ordinary sense of the term. Ken Mollohan agrees with Col. Harrison in part, pointing out his own experiments with unlubricated bullets over a Cream of Wheat filler call into question earlier assumptions about the action of bullet lubricants (FS 88 10-12) See also the section below on the use of fillers. Veral Smith (of LBT) responded with an analysis of lubricant function and a conclusion that bullet lubricants are indeed necessary (TCB 121 12-14). We seem to have here the makings of a debate between the "traditional lubricators" school and the "unlubed-bullet-over-filler" school, I like a good debate as well as anyone, but it is worthwhile to point out there may be two (or more) different but equally acceptable and useful solutions to the problems of bore leading and accuracy. A letter (CB 86) reports an unusual method of lubing bullets shot in a .45-70: 48 gr. H4831, 1-1.5 gr. Dacron fiber, 2-3 gr. lithium grease, and an unsized, unlubricated gas check bullet. This apparently gives excellent results, both in accuracy and in keeping the bore unfouled. It might seem, based on the success of this method, the purpose or function of a lube is to prepare the bore for the NEXT shot. Tom Lafleur suggests the action of bullet lubricants involve providing a grease seal which prevents gas cutting of the bullet, and there is a logical relationship between the lubricant, the hardness of the bullet, and the chamber pressure (TCB 116 11-12). Steve Hurst points out there is a chemical basis for bullet lube function: good lubricants behave like "anti-fluxes" (TCB 122 12-13).

Overlubrication—Harrison reports Alox 50-50 lube can apparently "overlubricate" at times, and sometimes it is best to not fill all of the grease grooves in a bullet (CB 46, 55). I've also seen this recommendation in other places about other lubes—notably LBT Blue. But Glenn Latham has written, if a bullet is soft enough to be upset by firing, then it may need the support of lube in the grooves—

otherwise parts of the bullet may collapse into the empty grooves, and accuracy may be adversely affected (FS 93 3). Dave Scovill, writing in Handloaders' Bullet Making Annual (1990), says the correct amount of lubrication is provided if a lube star shows up on the muzzle after five or six shots, but a flash of bullet alloy there may be caused by insufficient lube (pages 57-63, 97-98). Overlubing can also have an effect on accuracy; Tom Gray writes, if too much lube is used, it can accumulate in the barrel and cause "lube purging fliers" every so often (TCB 116 6-8, TCB 120 5-6).

Solid Additives—EHH reported solid additives (such as graphite, molybdenum disulphide (moly), mica and Teflon often improved the lubricating quality of bullet lubes (decreased leading), but they always degraded accuracy (CB 64). It seems preventing leading is relatively easy to do; the difficult trick is to find a good lubricant which permits the best accuracy to be developed. Dennis Marshall, in a pair of articles about dry lubricants, concluded they are not effective in controlling leading, but they may warrant more research and testing. He tested Bullet Master Lube and Formula 99, both lubes containing molybdenum disulphide (FS 43 8-11, FS 44 11-17). Later, Ron Fortier found these conclusions still valid (TCB 120 4). But see the description of NECO Coat in Part I. See the results of a test in Ed Doonan's article (TCB 127 3). Robert Sears notes benefits, but suggests moly's unusual characteristics indicate it must be treated differently than other bullet lubricants (TCB 130 6). Jesse Miller concludes both velocity and group size shrink somewhat (TCB 139 9-12). Larry Jennings describes application processes and reports inconclusive results (TCB 140 5-6). Bryce Ralston discusses methods of reducing the thickness of moly coatings and reports increases in velocity (FS 144 17-20). In a review of moly coatings on jacketed bullets and loaded rounds (produced by Berger Bullets and Black Hills), Layne Simpson notes such coatings generally do not alter the basic accuracy of a rifle or load, but the moly seems to extend the length of a shot string which can continue to show good accuracy (HL 188 8-9). Another shooter notes, after seating bullets, he simply applies moly powder with a brush. Harold Vaughn reported no accuracy difference with moly coated jacketed bullets in a very accurate rail gun fired in a tunnel range. (RAF 230)

EHH tests: In the process of lubricant testing Col. Harrison tested many materials, among them Lyman Ideal lubricant, Lyman Ideal + lanolin, Lyman Ideal + sperm oil, Perfect Lube, waterpump grease (two types), Automotive greases (8 types), Transmission fluid, gear lubricants (two types), Locomotive side rod grease, cannery grease and more listed only as “others” under a type. Many of these lubricants were also tested by addition of solid additives (graphite, moly, mica and Teflon). Of the solid additives, only Teflon showed promise, but inconsistent results caused it to be dropped. Final success was achieved with Alox 350 and Alox 2138F. (CB 64)

Lubing the Bullet Nose — Frank Marshall, Jr., advises no bullet-lubing job is complete unless the nose of the bullet is lubed as well, thus preparing the barrel for the passage of the rest of the bullet. He suggests putting a dab of lube on the nose, then using a fingertip to wipe it around the rest of the nose portion (FS 38 6-7). But this might be a good use for Liquid Alox—just lube the bullets as usual, seat them in the charged cases, and then dip the noses in liquid Alox. Marshall warns, however, against using too much lube on the nose. Another shooter has concluded lubing the nose of a bullet is simply a mystic rite; his experiments indicated it produced no improvement at the target (FS 90 15). And, in some instances, lube wiped on the nose of a bullet can eventually work its way down to the case shoulder, where it effectively reduces headspace (TCB 97 3). If the nose lube works its way down to the case neck or into the neck area in the chamber, it can prevent the case neck from opening up to release the bullet, causing dangerous pressures (TCB 119 11).

Case Fillers — Some components which aren't quite lubricants deserve mention, and one of them is the class of case fillers. Many things have been used as fillers: flour, sawdust, oatmeal, cream of wheat, Teflon and other plastic powders, kapok, Dacron, a complete list would fill a book. Use of Cream of Wheat (COW) is very common. Ken Mollohan (FS 80 8-11, TCB 122 8-11) reports excellent success with COW. See also a response and additional information (FS 82 14-16). COW filler can actually clean the bore, oatmeal works, too. Some loads may leave lead rings in the throat (FS 83 23-24), or produce bore obstructions in

some conditions (TCB 125 7). Another hazard associated with COW loads was reported by a shooter who found, in one .303 load, the case necks were shot off (TCB 126 5). Several shooters report COW produces undesirable results: COW can pack into a hard mass, and corncob tumbling media may produce better results (TCB 132 5). EHH found COW prevented leading, but destroyed accuracy. He tested sawdust, oiled sawdust and kapok, finally settling on Dacron as the most effective filler (CB 39) Plastic shotshell buffers, such as Winchester's Super Grex (polyethylene) have produced some good results. Super Grex, however, seems presently to be hard to get; but other shot buffers are available from Precision Reloading, Inc., Stratford Springs, CT. Steve Hurst tested buffers and found polyethylene buffer was superior to polystyrene buffer and polyvinylchloride buffer. He notes the least amount of filler is best, too much decreases accuracy (TCB 150). Polyethylene foam backer rod for calking is available in several diameters. It is easy to cut to make filler or over-powder wads. It has very low density and actual volume when compressed is small and pressure increase is slight. Good results reported in pistol loads (TCBF)

Fillers always have the effect of reducing the case capacity and thus of raising the pressure of a given load; use caution when working up loads with fillers.

Lube Wads (grease cookies or grease wads) — Phil Sharpe provides a detailed discussion of wad formulas and manufacturing methods (CGH 84-8). Using wads made with LBT Blue Lube, one shooter reported modest increases in velocity, a reduction in velocity extreme spread, and smaller, more rounded groups (FS 84 20-21). A lubricant wad made of deer tallow and loaded under a paper patch bullet was said to be Elmer Keith's favorite. Steve Balthrop gives preparation and load details (TCB 113 18). Steve Garbe mentions he's tried strips of dental wax for this purpose; this can work well, but this wax is sometimes not compatible with black powder fouling. He also cautions a shooter should use some sort of thin paper or card wad between the lube wad and the bullet in order to keep the lube wad from adhering to the bullet's base and affecting accuracy (Black Powder Cartridge News, Number 26, page 30). Shooter Henry Rudkin reports good results with a mixture of Ox Yoke's Wonder Lube mixed with 30% beeswax to produce a .160" grease cookie sandwiched between two wads. Another

shooter recommends making lube wad "sandwiches" with thin paper on both wad surfaces. Shooters who want to know more on the subject of lube wads may want to read Chapter 3 in Paul Matthews' book “Loading the Black Powder Cartridge Rifle”. An application related to lube wads is the practice of lubricating the bullet shank when shooting a gas check design without the gas check, this was recommended by EHH. (CB 49) I have experimented with lube wads, but found they diminished accuracy somewhat in my rifle. It is possible modern lubes are so good additional lubricant in the form of a lube wad is not necessary or desirable; it may cause overlubrication and "lube-purging fliers." I've tried wax wads from CFVentures (509 Harvey Drive, Bloomington, IN 47401), and they do leave the bore clean, though their effect on accuracy is uncertain, and they do seem to raise pressures somewhat. RS

Lube wads reduce the case capacity and thus raise the pressure of a given load; use caution when working up loads with wads.

Making Lube Wads — It is possible to make sheets of wax by immersing a glass surface in the melted wax, removing it, then peeling the wax sheet off. One method is to immerse a jar of cold water (which might crack the jar?), and another is to immerse a sheet of glass once or several times until the proper thickness is obtained. It may be necessary to wet the glass first so removal of the sheet is easier. Shooter John Henwood provides a more detailed description of this method taken from Phil Sharpe's Complete Guide to Hand loading, 3rd ed. (1953): use rectangular, smooth-surfaced bottles which have been cleaned with mineral spirits, wet with water, and filled with ice water. After each dip, strike the wax off the bottom of the bottle. When the desired thickness is achieved, slit the wax coat down one or more corners in order to prevent the flat sheets from cracking during cooling (TCB 111 15) One shooter reports making grease cookies by melting lube in a flat-bottom pan and cutting it out with the cartridge case after it solidifies (FS 93 9-10). A black powder shooter suggests consistent grease cookies can be made by weighing a quantity of the lubricant, melting it on top of warm water in a pan. After cooling the wax layer is removed turned over and dried, and the thick section around the edge is removed. The required cookie thickness is determined by trial and error and controlled in production batches by weighing the lube before melting (TCB 106 8). This would enable a bit of experimentation without the need of investing in equipment. A wad extrusion pump can use the force provided by an ordinary reloading press to produce a

ribbon of lube which is then pressed against the case mouth to cut and insert the wad. One such pump is the JRW Wad Extrusion Pump, once made by JRW, 2424 Taffy Ct., Nampa, ID 83687 (but a recent letter to that address was not answered) An article by Paul Matthews in Rifle gives instructions on how to make a lube pump out of ordinary materials (Rifle magazine, issue 114, pages 34-35).

Overpowder Wads — Uses similar to lube wads but made of different materials. Included because some experience indicates overpowder wads may reduce lubricant needs and may in some cases make unlubricated bullets shoot well. The plastic or cardboard wad loaded immediately under the bullet. RS "Poly" wads or LDP (low density polyethylene) have also been successful, according to some reports; this material is available from M. Stenback, P.O. Box 127, Van Dyne, WI 54979. A review of the performance of different types of poly wads can be found in FS 74 23, 29-30. One shooter reports having used wads made from file folder cardboard, lubed celotex, felt, and milk cartons (FS 84 5). The Hodgdon Data Manual No. 26 suggests a felt over-powder wad should be lubed with a mixture of 8 oz. white petroleum jelly, 8 oz. paraffin wax, and two tablespoons of RCBS case lubricant (p. 722). (This is similar to Darr. #2 lube, but with a higher proportion of case lube.) One shooter reported foam checks cut from meat trays nearly always stopped leading and did not affect accuracy, whereas freechecs (aluminum gas checks cut and formed from beverage cans) improved accuracy (FS 93 14). There is some concern plastic overpowder wads may cause throat fouling in some loads (TCB 100 10). Ed Doonan has mentioned, in loads which were already producing good results, NECO P-checks increased group size (TCB 104 7). For those who wish to manufacture their own, a "Self-Ejecting Precision Wad Cutter" is described by Roger Clouser, who also provides recommendations on its use and advice on LDPE and PVC wad material (TCB 114 8-10). See also the section on grease cookie wads below. Wad cutters for use in a reloading press made to exact diameters are available from Fred Cornell RD #2-14 Stover Acres Sayer, PA 18840

Lubricant Migration — shooter August Rubrecht reports oil in the filler or lithium grease "will eventually bleed into the powder and primer, causing accuracy loss, velocity loss, hangfires, and misfires." Apparently such lubricants may show good

results initially, but storage for more than a week can create problems. Steve Hurst tested lubricants for diffusible (oil) components. (TFS 159-6)

Lubricant in the Bullet Base — A novel form of lubrication was once manifested in a S&W cartridge whose bullet was provided with a hollow base which was filled with bullet lube; upon firing, the chamber pressure forced the lube through four small passages emerging at a point ahead of the bullet's shoulder, from which position it apparently provided a layer of lube prior to the bullets passage. Though the design was claimed to be successful, it has apparently not survived (AR Jun 93 100).

Lubricant Preferences — Andy Barniskis cautions shooters some bullets may "like" one lube but not another—different lubes may be necessary for best performance of different bullets (FS 25 18, FS 37 24). A number of other shooters have expressed similar opinions, indicating bullet lube needs may vary from one rifle to another—suggesting, for example, a worn bore may prefer a particular type of lubricant.

A Lubrication Index — Dave Scovill has developed something called the Lubrication Index for cast bullets. It's a "ratio which divides the bearing surface of the driving bands (in square inches) of the bullet by the lubrication capacity (in cubic inches) of the lube grooves." Thus, bullets with high LI numbers have more lube capacity per unit of bearing surface. He points out LI numbers have only relative significance, however, other factors must be included when considering cast bullet performance. He includes a chart with various representative bullets and their LI numbers (HL 134 16-17, 48).

Paper Patch Lubricants — For lubricating and waterproofing paper patches, the various liquid lubes probably deserve more attention; see the use of Rooster Jacket mentioned in Part I. One shooter reported good results using Lee Liquid Alox thinned with enamel reducer and applied by brush to the sides of the patch while on the bullet (FS 91 17-18). Teflon spray was used successfully by EHH

and the bullets were then sized in a lubrisizer with Alox 50-50. He found lubricating the paper patch was essential in 30 caliber rifles. Full velocity loads in 30.06 and 308 Winchester produced normal accuracy. (CB 93)

Lubricant Layers — Some shooters have been experimenting with multiple layers of different lubricants: double- or triple-lubing. One shooter of an old Colt buys Hornady swaged lead bullets already lubed, then sizes and lubes with Rooster Red C-3, then dusts the bullets with Motor Mica; he reports the bullets are as accurate as jacketed, and they do not wear the barrel (HL 138 54). C. E. Harris has reported good results from double-lubing: first lube as usual with LBT Blue or Alox 50-50, then tumble on an overcoat of Lee Liquid Alox (FS 86 5). See also his similar suggestions in two of the formulas for home-made bullet lubes listed in Part 2.

Unlubricated bullets — Many experimenters have reported loads where bullet lubricant is not needed. Both plain base and gas check bullets have been fired naked with accuracy the same as the same bullet lubricated. The velocity is always on the low end, pistols ~700 fs, 30 caliber rifles ~1200 fs and 22 caliber rifles ~2200 fs, using fast powders. TCBF George Carlson describes his successful experiments shooting un-lubed bullets, but does not say whether he used a filler (TCB 114 7). Ron Fortier replicated Carlson's experiments using a rifle of known accuracy and did not get the massive leading he expected; he concluded "the results with un-lubed bullets were too good to be ignored"(TCB 115 14 and TCB 116 12). Most of the experiments with un-lubed bullets ignore the effects of the smokeless powder residue. Smokeless powders always contain graphite and may have rosin, polyester “Dacron” etc. Burning in low pressure cast loads is usually incomplete i.e. dirty. The black stuff may provide sufficient lubrication for some loads. It has even been suggested bullet lubing is simply a traditional hangover from black powder days (TCB 117 5). I note no competitors are using un-lubed bullets in CBA matches. SH

Black Powder Lubricants — Al Miller, writing of black powder loads, notes he has not found a lube which actually shrinks groups, but some lubes leave bores

cleaner. He mentions D.G.P. and SPG are designed for black powder loads and they leave bores free of fouling, but he switches to Rooster Jacket in hot weather. He also notes Alox-based lubricants and LBT Blue also work well in black powder loads (HL 147 22-25, 51). It is sometimes stated or implied water soluble lubes are preferable for black powder shooting, but there seems to be no clear reason for this—and Miller's experiences seem to cast doubt on the idea: SPG and D.G.P. are water soluble, but the other lubes he mentions are not. A Texas shooter may have identified a potential problem with water soluble lubricants; in his high humidity area, such lubes seem to attract moisture (TCB 114 16).

Is Beeswax Special? The percentage of successful lubricants which use beeswax, when dozens of other waxes could be used suggests beeswax may have special properties. However this could be general availability plus correct properties of stability, melting point and hardness. Conversely, attempts to replace expensive beeswax in good lubricants with other less expensive waxes have resulted in poorer performing lubricant. Beeswax is unique among waxes, the molecules in beeswax are 28-30 carbons long, in most plant and animal waxes the carbon chains are 18-20 carbons long. Is this important? SH

Bullet Lubricant Smoke — The issue of the amount of smoke produced by bullet lubricants has been discussed by C. E. Harris, who suggests the amount of lube used is just as important as the type of lube; a lot of lube can produce a lot of smoke (FS 90 3). See also the "Harris Lubricant" in Part 2.

Temperature Sensitivities — There seems to be a difference in the ability of lubricants to produce good accuracy at different ambient and barrel temperatures. There is little information about how lubes perform at very low temperatures, although one shooter reported good performance with LBT Blue Commercial at thirty below (TCB 115 4). But many shooters have remarked the softer lubes (often those which will flow through a lubrisizer at normal room temperatures) often do not perform very well on hot days or in hot barrels; sometimes they seem to "weep" an oily substance which may leave excessive deposits in the bore or otherwise interfere with accuracy. However, it is important

to realize the relative softness of a lubricant at room temperatures is not an absolutely reliable indicator of how well it will perform in hot range conditions.

Action of Bullet Lubes — Jeffrey Tooker and Lloyd de Vore discuss the action and limitations of bullet lubes, particularly liquid Alox. Tooker believes as temperatures caused by high velocity rise, lubes may break down permitting leading to occur. (FS 147 16, 26).

Anti-Fluxes — Steve Hurst explains some of the characteristics of the materials which keep lead bullets from tinning the barrel (TCB 138 18-19).

Black Powder Lubricants — evidence seems to be mounting that black powder shooters do better with softer lubricants, and particularly with those which are water-based rather than petroleum-based. An article by Mike Venturino (HL 199 38-43, 82) supports this contention. See also the entry under Alox 50-50 in Part I. Additional material on the requirements of black powder lubricants can be found in the relevant chapters of two books by Paul Matthews: How-To's for the Black Powder Cartridge Rifle Shooter and Loading the Black Powder Rifle Cartridge, available from Wolfe Publishing, 6471 Airpark Drive, Prescott, AZ 86301.

Cold Weather Lubes — It is often suggested softer lubricants are better choices in low temperatures, and Crisco shortening can be used as a softening agent (TCB 130 8). Generally, it is also known petroleum jelly is often successfully used as a lube softener.

Fiber Wads — Mustafa Curtess notes vegetable fiber wads do a fine job of keeping the bore clean, but like cereal fillers, they often degrade accuracy.

Lubricant Pressures — Steve Hurst has done extensive work in reviewing the causes of variations in lubricant pressures (TCB 136 8-10). Andy Barniskis finds some problems and believes further work needs to be done (TCB 137 4-5).

Lubricating the Bullet Nose — Henry Schmid reports using a mix of paraffin wax, Alox 50-50, and moly (amounts not specified) to lubricate the noses of bullets with good effects but with some drawbacks (FS 146 16).

Plastic Powder Coating – Plastic coating is not new, Federal once offered ammunition with Nylon clad bullets and is now marketing a plastic encapsulated bullet for pistols which may be powder coated. Plastic powder coating has been used in manufacturing for many years. What is new is the availability of powder coating for home and small shop use, Plastic powder is applied to the bullet and then it is placed in an oven at a temperature where the plastic melts and fuses into a tough coating. There are questions about the best coating method. The least expensive is the “Shake n Bake” where the bullets are shaken with the powder. This is dismissed as primitive by experimenters using a powder spray gun to give a “perfect even coat” Debate rages on like the bottom pour/ladle caster discussions. Then there are the numerous different coating powders available. Possibilities are endless, like any lube experimenting. Currently low pressure, low velocity loads can be made to work well. Hunting accuracy is possible, but match accuracy has not been shown yet. (TFS 236-15) Check the TFS, TCBF and Boolets site for the latest information. SH

Steve Hurst investigated the chemical properties of lube ingredients and found they fall into several broad classes (TCBF):

Polar — An ingredient whose molecules exhibit electrically charged characteristics. Polar ingredients are used as additives in many petroleum products. Polar ingredients have a strong affinity for solid surfaces; as lubricant additives, polar ingredient plate out on metal to form a tenacious, friction-reducing, and corrosion inhibiting film. In bullet lubricants polar components inhibit the formation of lead deposits in the barrel.
Examples: Animal and vegetable waxes and oils: beeswax, castor wax, carnauba

wax, jojoba oil, canola oil. Also oxidized petroleum products: Alox 2138F and Alox 350.

Non-polar – An ingredient whose molecules exhibit electrically neutral characteristics. Examples: hydrocarbon compounds like paraffin, microcrystalline wax, petroleum oils, mineral oil and petroleum greases such as Vaseline.

Polar/Non-Polar – Ingredients which have a polar segment on one end of the molecule and a non-polar segment on the other. These dual-nature components are able to form a bridge between two dissimilar components. The most familiar are soaps and detergents, which have a non-polar oil soluble end and a polar water soluble end. Because of this, they are able to bring oil droplets into suspension in water. In lubricants, soaps and detergents act as emulsifiers, mixing normally immiscible waxes and oils. Some soap formulations have very high melting points, which can be an advantage in bullet lubricant applications. Examples: Some familiar soap containing lubes are Taurak (sodium soap), LEE Liquid Alox (calcium soap), and lithium grease/beeswax. Lithium grease is a mixture of mineral oil and lithium soap.

Solid additives – Are non-polar and maintain their particulate nature and do not dissolve in the melted lubricant. Since some are used in high temperature, high pressure steel bearing applications, they have been used in a variety of homemade and commercial lubricants. They maintain their particulate nature in the lubricant and may require constant mixing to keep them suspended as the lubricant hardens.
Examples: Motor Mica, Teflon, graphite, molybdenum disulfide and powdered polyethylene.

Solid additives are not effective. In carefully controlled experiments by EHH and others, they degrade accuracy even though they increase leading prevention. Leading prevention is easy to observe, and solid additives can give better accuracy where bullet fit and hardness is not good and leading destroys accuracy. The loss of accuracy in an otherwise good lube with well-fit bullets can be difficult to quantify without careful testing. This has led to many claims about solid additives, particularly moly. Commercial lubricants with solid additives typically contain only enough additive to color the lubricant, and not enough to

adversely affect the efficacy of the base lubricant.

Lubricants made entirely of non-polar components are only effective in light loads and loads where perfect bullet sealing is achieved. In low pressure loads, non-polar lubricants can work but may require more (all grooves filled) lube than a lube with polar components. (CB 45) In rifles using breach seated bullets, non-polar lubricants can work, but cast bullets in fixed ammunition seldom achieve perfect sealing and non-polar lubricants frequently fail.

It is remarkable all of the most effective bullet lubricants have polar components, and some of the best (Alox 50-50, Beeswax + polar oils, Emmert Lube) are 100% polar components.

It would seem compounding an excellent lube would be a simple matter of selecting polar components. Unfortunately this is not the case. EHH tested many polar compounds: solid alcohols, stearic acid, and polyethylene glycols. He found they prevented leading but gave inaccurate shooting. (CB 64).

I have tested numerous polar compounds as lubricants and additives and most would prevent leading. However only a few have allowed accurate shooting. It appears a good bullet lubricant must have some polar components in order to prevent leading. In order to help selection, I have identified polar components in the ingredients list.

The nonpolar components of a lube are obviously important, but little is presently known about the needed properties. Currently the only known way to test a bullet lubricant is to shoot it on a cast bullet. SH

Books — The experiments conducted by E. H. Harrison in the development of Alox 50-50 are still valuable today. Unfortunately, his book “Cast Bullets” cited here, was not printed in large numbers and is therefore expensive. Fortunately the chapter on lubricants was also printed in the “NRA Handloader’s Guide” of which millions of copies were sold and is quite common and inexpensive.

Harold Vaughn’s Book “Rifle Accuracy Facts” is even rarer and in such demand dealers currently want $200 a copy. The testing of various bullet defects and

bullet/bore alignment has direct application to cast bullet shooting. The description of rifle faults and correcting them is valuable to anyone trying to get maximum accuracy from a rifle. Your gunsmith has probably read it, if not find another gunsmith. Try interlibrary loan at your local library.

Final observations — despite the advances in bullet lubricant technology and research, there is no such thing as a universally excellent cast bullet lubricant. Many lubricants work quite well most of the time, but every lubricant has failed at one time or another. The variations in bullet design and alloy, the particulars of specific loads, and the requirements of individual guns combine to create a continuing need for testing and experimentation. RS

PART 5: NOTES ON EXPERIMENTATION

by Steve Hurst

Someone, someplace, sometime will put together a bullet lubricant which will surpass the utility of Alox 50-50. Careful experimentation like that done by E.H. Harrison will probably be needed, but there is a chance a product used in someone's profession may be the very thing which is needed to make a better lubricant. Only testing will tell, and the testing must be systematic.

Keep good records, the most important aspect of lubricant testing is for you to be able to duplicate the lube. A record of components, amounts and mixing is vital. Records on the gun or guns used especially over time with the lube used as a standard are also important.

Carefully record your experimental lubricant formulas. Is it parts by weight or parts by volume? Volume is OK but a tablespoon of a powder component can vary a lot in weight. Lube experimenters are all reloaders, so everyone should have precision scales, parts by weight is most useful.

Use specific components! "Candle Wax" means nothing. There are over 100 commercial formulations for candle wax. Candle wax can be paraffin, beeswax, stearic acid, and microcrystalline wax; synthetic polymers like EVA or Vybar, even hydrogenated soy bean oil "soy wax". A candle is likely is a mixture of several things. Buy the specific component from a reputable supplier. Example: if

you want hard stearin wax you can buy pure stearic acid from a candle products supply house.

Get your components from a reputable source. The “jojoba oil” sold at a local health food store is mostly mineral oil. It is used as a skin lotion and as long as it smells and works OK no one will notice. “Orange Oil” sold at the same store is 100% mineral oil with a trace of orange perfume. Beeswax is commonly adulterated, the pharmaceutical test for purity specifically detects paraffin and microcrystalline wax. Buying from a beekeeper is not the answer. He has to melt the wax and adding paraffin blocks from the grocery store is easy. Any time you have an expensive product which can be adulterated with a cheap product and there is little chance of detection, be wary.

Be careful when using commercial products. Companies can and will change formulas (Ivory Snow). Commercial products can be discontinued and companies do go out of business (Alox). Formulas for the “same” product from another company can be very different (lithium grease). Get the MSDS, it may have the components listed.

How do you mix the components? Order of mixing can be important, especially if soaps are part of the mixture. If heat is used, what temperature? If the lube cooked at a high temperature or held over the melting point for any time, specify how long and what temperature. This important because chemical reactions will happen much faster at higher temperatures. The lube may be improved by cooking at high temperature, or components may be burned and the lube ruined if the temperature is too high. Get a thermometer and use it.

An expensive custom gun is not needed, however the gun or guns chosen for lube testing should give consistent accuracy. The cast loads chosen should shoot with accuracy very close to jacketed bullets. Accuracy with a known, high quality lubricant and load must be established. Control loads must be fired at the same time as test loads.

Accuracy testing, using a Ransom Rest or a scope sight and solid rest for pistols, or a bench rest for rifles, with comparison in the pistol or rifle to another lube is necessary for any claim of a better lube. Complete removal of jacket fouling is

essential, brushing will not remove jacket fouling. Careful barrel cleaning between lubricants and the firing of sufficient fouling shots to assure a constant barrel condition is also needed.

Indoor 25 yard ranges are common and work well for pistols and revolvers. An indoor 50 yard range is preferable to the usual 100 yard outdoor range for rifles. 100 yard outdoor shooting is almost always an exercise in wind and mirage estimation. The variability introduced by the weather can hide differences in lubricants.

Blind testing, where the shooter does not know which lube is on the bullets may be required to prevent skewing the results. The shooter may unconsciously shoot more carefully when using his/her “favorite” lube. Eliminating a wild shot because “I must have thrown that one” is very common. Some lubricants shoot a small core group and a few fliers, reporting only the core group is incorrect. One of the advantages of data from CBA competitions is all shots are counted.

There are many lubes which will prevent leading, but this does not guarantee accurate shooting. Claims like “the bore was perfectly clean after 50 rounds” are worthless. I have personally tested lubes which left the bore clean, but the groups were twice as large as the lube used as a benchmark. Some very accurate lubes leave slight deposits in the barrel, especially in revolvers. As long as the deposits are minimal and do not change with continued shooting, accuracy can be excellent.

Most of the commercial lubes and many of the homemade lubes I have tested work well on 800 fps 38 revolver and 1200 fps 30 caliber rifle loads. When the pressure is increased to magnum pistol levels and higher pressure rifle loads, differences quickly became apparent. Gradually increasing the load until accuracy deteriorates will determine the pressure/velocity limit for a lubricant. The differences between lubes may only show up in maximum loads and are likely to be gun and load specific.

Poor lubricants can often be identified by one or two ten shot groups. Slow accuracy degradation may take more shooting, but seldom more than 50 rounds. A useful determination of a lubes performance usually takes at least ten groups (100 rounds). Because of the natural variability in group size, statistical analysis

may be needed.

Statistical analysis (and more shooting) may be needed for a determination of superiority between exceptional lubes. A 20% difference in average group size for 10 groups may not be significant. Modern calculators make statistical calculations easy. Get a good book, The “Idiots Guide to Statistics” works fine for me.

Be prepared to do a lot of shooting.
Good Luck!
Steve Hurst

Final observations — despite the advances in bullet lubricant technology and research, there is no such thing as a universally excellent cast bullet lubricant. Many lubricants work quite well most of the time, but every lubricant has failed at one time or another. The variations in bullet design and alloy, the particulars of specific loads, and the requirements of individual guns combine to create a continuing need for testing and experimentation. RS

PART 6: CAST BULLET POPULARITY AND/OR SUCCESS

The fundamental purposes of cast bullet lubricants are to prevent leading and to enable accuracy; as cast bullet shooters, we are not interested in just any lubes but in the best lubes: those which accomplish these purposes in the greatest degree. In order to determine which lubes are currently the most successful (and therefore the most popular among knowledgeable cast bullet shooters), I surveyed information provided in the match results section of one year's issues of The Cast Bullet—the journal of the Cast Bullet Association. The following data were taken from issues 120-125 (March 1996-February 1997).

Some description of statistical methods may be necessary. The data are essentially lubricant "frequency of use" compilations, weighted by some degree by the match success of the shooters using the lubes. In matches where the lists were ranked according to grand aggregate scores, I simply selected the lubes

used by shooters who scored in the upper half, without differentiating between rifle classes. Where there was an uneven number of shooters, I "rounded up" (if there were a total of 13 shooters, seven were selected). In the postal matches, I considered each group (class) separately, and I also included the "other scores" shooters; this sometimes led to selecting all the shooters for whom detailed data were provided. If no grand aggregate information was provided (in which case there was no easy way to arrive at a ranking) all competitors' lube data were selected. Note: because some shooters competed in more than one class, or entered data in more than one class, their lube choices may have been entered several times in a given match. An additional problem arises because of the necessarily brief entries in the match results (a lube described as "LBT" may or may not be LBT Blue Lube)—in some such instances, I had to make guesses. Clearly, since this statistical stew carries many opportunities for error, the results should be considered only generally useful; they should not be taken as indications lube "X" is precisely l5% more popular than lube "Z". Ralph Schneider

Steve Hurst’s update the frequency of use list for the year 2015.

Some shooters enter multiple matches, sometimes in different locations. This skews the data toward the lubes used by these shooters. I made every effort to count each individual only once. Only if the person changed lube they were counted again. All match entries were considered. The total number of entries is smaller, the percentages are what matter. The same caveats by Ralph Schneider still apply.

One trend was obvious when looking at the changes over time. One shooter would win using a lube, then in the next match more shooters would switch to that lube. Very soon the majority of shooters in the local match would be using the same lube. This human propensity to copy the winner may have merit, witness the success of the PPC cartridges in bench-rest shooting. However in this case I have doubts. The lube used by winner is certain to be very good in this application (carefully fitted bullets, good bores, moderate velocity). However at the top end lubes tend to be rifle and load specific and I wonder if some shooters are handicapping themselves.

It was apparent plain base and breach seating shooters favored different lubes from fixed ammunition. This is not surprising, the requirements are very different. Most of the Emmert lube was fired on plain base bullets.

In 2015 Alox 50-50 in all its iterations is still a top choice. LBT Blue is running a close second. The rest of the pack are scattered but it is a large pack. The total number of shooters not using Alox 50-50 outnumbers the Alox 50-50 group. None of these lubes should be written off, as all have been found to perform well in someone's rifle and may do so in yours.

Steve Hurst

Lube	1997	2015
Total Various Alox-Beeswax	245	74
Tamarack	74	4
Javalina	35	11
Alox (presumably Alox 50-50)	32	13
Alox-Beeswax (brand not specified)	30	5
Lee Alox	24	8
NRA	16	15
50-50	11	2
GAR Alox	7	8
Lyman Alox	6	4
RCBS (Alox)	10	4
Darr	16	1
Emmert	7	6
GAR	10	0
Gray # 24 (& only desc. as "Gray")	52	5
H&H	6	0
Hawkeye & Taurak & Texaco 250	29	7
Homemade/Own	17	24
LBT Blue (& desc. as "LBT")	106	41
LBT Soft	0	5
Lee Liquid Alox (& desc as "liquid Alox")	24	2
Lithium (Lithi-Bee? Lithium Grease?)	13	0
Lyman (Type?)	13	3
Lyman Orange Magic	8	6
Lyman Moly	0	4
M&N	8	1
Micro	8	1
MTL	26	2
Rooster HVR	13	0
Rooster Red	12	2

SPG	16	8
Star	0	1
Thompson's Blue Angel	8	8
Thompson's Red Angel	0	2
Voodoo Red	0	6
White Label 2500+ & X-Lox	0	10
White Label BAC	0	4
White Label Carnauba Red (2700+)	0	6
Saeco Green	0	1

A number of other lubes and combinations of lubes appeared in the match results but were used very infrequently; they are not listed here.

On the basis of this information, a cast bullet shooter might reach some preliminary conclusions about bullet lubricants which may work well in his gun—but he should also keep in mind certain guns (and loads) have been known to show preferences for particular lubes. One of the lubricants farther down on the list might work the best of all. And, of course, it is possible the TGTBT (Too Good To Be True) lube is just now being compounded in someone's kitchen or garage—just waiting in the wings for the opportunity to show its stuff in match competition. Which is, after all, why we experiment. Ralph Schneider