ABSTRACT

With the start of the Korean War in June 1950, the Canadian Government found itself without adequate military equipment, including binoculars. Starting in 1950, and ending in 1953, Canadian Arsenals Ltd (C.A.L.) of Long Branch, Ontario, and Beaconing Optical & Precision Materials (B.O.P.) of Granby, Quebec, were contracted to retrofit remaining or recalled WWII REL 6X30 and 7X50 binoculars. These retrofit binoculars were to provide the Canadian troops for the duration of the Korean War. Some of the 7X50s were specially modified by BOP to have internal filters (based on the British WWII 7X50 Barr & Stroud CF41): Very Dark-Dark-Yellow-Clear for both ocular columns. Further, the optics were coated during the retrofits. The external lenses at least were coated in both the BOP and CAL (retrofits) conversions. The 6X30 REL binoculars were retrofitted with coated optics by CAL, but they underwent fewer visible changes than did the 7X50 REL binoculars by BOP. The CAL and BOP refits are indicated by the printing on both prism covers. In some cases the original REL prism cover data were deleted, either by being milled out or struck out, and can no longer be read. Often the deleted data are reprinted on another location on the prism covers. The REL 6X30 binoculars may vary in weight as much as 200g, depending on the materials used (e.g., aluminum vs brass).

This is Part 2 of three articles on Canadian-made binoculars. Part 1 (Leech 2015a) discusses the WWII Research Enterprises Ltd binoculars made at Leaside, ON, and Part 3 (Leech & Kubetz 2015) discusses the 7X50 ELCAN binoculars made by Ernst Leitz Canada, of Midland, Ontario. Included is discussion of the ELCAN replacements in 1999/2000 by the 7X30 and 7X50 Fujinon binoculars which have special optical coatings and anti-laser filters for military use.

INTRODUCTION

A Precis of Canadian Military Events at the Start of the Korean War

The Korean War began on 25 June 1950 as a civil war when troops of the North Korean Army (KPA) crossed the 38th parallel. Less than a week later, Seoul, the capital of South Korea, fell. The invasion of South Korea by the North Koreans caught the United Nations off guard.

The North Korean army continued to push southward toward the port of Pusan. This was a strategic goal, as the seat of the Republic of Korea Government had moved to Pusan. All of South Korea was conquered except for the tiny enclave at the south end of the peninsula. On 15 August 1950, the 2nd Battalion of the PPCLI was created as a component of the Canadian Army.
Special Force in response to the North Korean invasion. The Battalion landed in Korea in December 1950, trained in the mountains for 8 weeks, and then participated in the war from 6 February 1951 onward.

In the early 1950s, Canada had planned for its military a changeover to US-designed weapons and equipment. The emergency in Korea caused Canada’s military to be brought back into action, and with little weaponry and other equipment, forced Canada to use its hole cards – namely, using the remaining WWII stocks of British-designed weapons and equipment, and some Canadian-made equipment. Included in the forced-to-use-in-Korea equipment were unused WWII and some used supplies, in particular the Canadian-made REL (Research Enterprises Ltd) binoculars. In the 1950 – 1953 period, many of the REL binoculars were retrofits by B.O.P. (Beaconing Optical & Precision Materials Ltd of Granby, Québec), and C.A.L. (Canadian Arsenals Ltd of Long Branch, Ontario). By the late 1950s, after the Korean War, Canada had adopted a variety of weapons and equipment of European, British and US design, and did not continue with the planned Americanization of equipment.

**CAL and BOP 1950-1953 Refits of REL Porro-Prism Type I Binoculars.**

This is Part 2 of three articles on Canadian-made binoculars. Part I (Leech 2015) discussed the 1939-1945 Research Enterprises Ltd (REL) binoculars made in Leaside, ON. Part 3 (Leech & Kubetz ) discussed the 7X50 ELCAN binoculars made by Ernst Leitz Canada, of Midland, Ontario and the eventual recall in 1999/2000 of the ELCANs to be replaced by 7X30 and 7X50 Fujinon binoculars which have anti-laser and other lens coatings.

The first binoculars made in Canada are Porro-prism Type I binoculars (Figs 1, 2). They were made by Research Enterprises Ltd (REL) of Leaside, ON. The planning was started in 1939 at the onset of WWII. The operation was ongoing in January 1940, making 6X30 IF and 7X50 IF, Porro-prism Type 1 binoculars. Operations ceased in September 1945 after WWII ended. There were no civilian models, but some came onto the surplus market.

From 1950 to 1953, BOP was contracted to modify the 7X50 REL binoculars to include internal filters and coated lenses. During the modifications, the reticle was removed from the BOP refits, perhaps because it interfered with the internal filters. At the same time (1950-1953) CAL was contracted to upgrade the REL 6X30s with coated optics, and the 7X50s with the upgrades including coated optics and the red-painted purge screws with gaskets. The CAL retrofits retained the reticle in the right eye column.

**Porro-prism Type I Binoculars Made by Research Enterprises Ltd (REL), Leaside, ON**

In 1939, the Canadian Government approved plans and funds for a factory to make binoculars. By January 1940 most of the machinery had been purchased from Bausch & Lomb (B&L) and other sources. By April 1940, samples of needed parts had been made and tested at a temporary plant of the NRC (National Research Council) in Ottawa, where workers were being trained. In June 1940, the plans for the factory had been drawn up, and by 16 July 1940, the Canadian
Government had established REL. In August 1940, it was decided to place the factory, a Crown Corporation, at Leaside, in Toronto, ON. At this point, $600,000 worth of equipment was ordered from Bausch & Lomb, Rochester, NY. Remember, those were 1940 dollars. Factory construction started on 16 September 1940, and by 5 June 1941, optical glass was in production by the NRC in Ottawa. The first goal was to produce optical/binocular glass and rangefinders of the Barr & Stroud type (and radar equipment). Dr R.J. Montgomery, formerly in charge of optical glass at B&L in Rochester, New York, was brought on board. REL was also assisted by the U.S. Bureau of Standards, and the British Admiralty. REL, from 1941 through to 1945, made 50,000 units of 6X30 binoculars, and 25,000 units of 7X50 binoculars (see Fig. 7 below for conflicting totals), along with leather carrying cases for some of them (on the prism covers, G.A. indicates that a case was issued with the binoculars, and M.A. means that no case issued). See Fig. 1 for the 6X30 with carrying case; Fig. 2 for the 7X0 with carrying case. My REL mint-condition binoculars do not have a Mil and Range scale reticule, and the lenses are not coated.

Fig. 1. REL 6X30 binocs with issued strap. Note the classic B&L shape.

Fig. 2. REL 7X50 binocs with issued case. Note 2 large purging screws in the centre, bino left.
Markings on the prism covers of both the 6X30 and 7X50 REL and BOP-REL need explanation:

6X30 Porro-prism Type I binocular, IF (Individual Focus). (Fig. 3).

Left Prism Cover:
- C.G.B. = Consignment [to] Great Britain
- 56 G.A. Indicates Series 56, and “M.A” that the binoculars were issued with a case.
- 6X30 Binocular specs., 6X magnification and 30 mm objective.
- 8974-C This is the serial number of the binoculars.

Right Prism Cover:
- R.E.L./CANADA = Made by Research Enterprises Ltd, Leaside, ON, Canada.
- 1943. Year of manufacture.
- Broad Arrow (Crow’s Foot or Trident) with Capital Letter “C” surrounding the Broad Arrow (see Fig. 3). Broad Arrow is for Military, and capital letter “C” is for Canada.

Some 6X30 binoculars weigh 0.65 kg, others 0.85 kg and with neck strap and case 1.16-1.36 kg.

Fig. 3. REL 6X30 binocs showing prism plate data.
See explanation above.

7X50 Type 1 Porro binocular, IF (Individual Focus). (Fig. 4)

Left Prism Cover: Red, hand-painted “W” indicates these binos are waterproof.
- C.G.B. = Consignment [to] Great Britain.
- 57 G.A. Indicates Series 57, and “G.A.” that the binoculars were issued with a case.
- 7X50 Binocular specs., 7X magnification and 50 mm objectives.
- 6891-C This is the serial number of the binoculars

Right Prism Cover: (Fig. 5).
- R.E.L./Canada = Made by Research Enterprises Ltd, Leaside, ON, Canada.
- 1944. Year of manufacture.

Carved into the protective covering on the upper side of the body tube covers, just above the objective lens, painted in vivid yellow, is the British Broad Arrow (Fig.2). The 7X50 binoculars weigh 1.45 kg, and with neck strap and case 2.20 kg.
None of the lenses or prisms in either the 6X30 or 7X50 (non-refitted) binoculars of the RELs I own or have seen is coated. As far as I can determine, none of the RELs had coated lenses for WWII use, and that those with coated optics were coated post-WWII, most often as part of the BOP or CAL refits.

Fig. 4. REL 7x50 binos, left prism cover data. See explanation above. This is Series 57. The large red-painted “W” indicates the binos are waterproof.

Fig. 5. REL 7X50 binos, right prism cover data. Note the 2 large purging screws with gaskets. Even for Series 57 it is unusual to have both purging screws on the prism plate. The other is usually on the body near the objective lens (see Fig. 8). The Series 40 also has purging screws, one on the prism plate, and one on the body.
Though REL ceased operations in September 1945, BOP and CAL were contracted at the beginning of the Korean War to retrofit the 6X30 (Prismatic, No. 2, Mk 2/5) (Fig. 6), including the 7X50 (No.5 CDN Mk 2/4 (Fig. 7). The contracts ran from 1950 - 1953. Both companies provided MgF2 lens coatings, or had the lenses coated by Bausch & Lomb (no data at present to confirm either way).

BOP was incorporated on 19 April 1948, and dissolved by Corporations Canada on 16 December 1980. For more details: https://www.ic.gc.ca/app/scr/cc/CorporationsCanada/fdrlCrpDtls.html?corpid=0361887

Beginning 1 January 1946, operations continued as the Small Arms Division, Canadian Arsenals Limited (CAL) (Hardy 1946). The factory closed 30 June 1976. It was official closed by an Act of Parliament (Canadian Arsenals Limited Divestiture Authorization Act, 1986).

The modifications by BOP of the 7X50s (Series 40 and 57) were specially modified to have internal filters: Very Dark – Dark – Yellow – Clear. These are on both binocular columns (Figs 9, 10). The filter system is similar to that used by the British 7X50 Barr & Stroud CF41.

Fig. 6. Retrofit of REL 6X30 by CAL. Note date changes: 1945 to 1950. Data on right prism cover relate to the reticle. Left side: Ser. # 44064-C, No.2 CDN.Mk 2/5, and the Broad Arrow inside the Capital “C” all confirm Canadian Army use.
Fig. 7. Retrofit of REL 7X50 by CAL. Note the red-painted purge screw on each side. Right side prism cover is date changed from 1945 to 1950. There is a reticule, but the data have been struck. Note serial #: 30319-C. This indicates that more than 25,000 7X50s were issued.

Fig. 8. REL 7X50 retrofit by CAL, viewed from the objective end. Note the red purge screws.
Fig. 9. BOP retrofit of an REL 7X50 (left) with a WWII REL 7X50 as issued (right). The 2 knobs next to the oculars, on the BOP prism plates, are for changing the filter being used: clear; yellow; light dark; very dark. Note the difference in body heights. The optics in the BOP binos have also been changed to accommodate these changes.

Fig. 10. Ocular-end view of a 7X50 REL bino retrofitted by BOP. Note the left prism cover data: BOP/CANADA; and the left prism cover data: G.C.B.40 M.A., MOD – O, and Ser. # UT-6395-C. There is no reticle in BOP retrofits, as their use was for navies.
Fig. 9 compares a BOP retrofit with a standard WWII REL 7X50 bino. For Fig. 10, on the left prism plate in a doublet lens-like logo frame, is the acronym BOP and CANADA. On the right prism plate, in another doublet, lens-like logo frame, the following REL factory data are given: C.G.B.40 MA; MOD - O; and Ser. # UT-6395-C. See above for interpretation of the letters and numbers. The Kit Modification, Can. Mod. O., by BOP is dated 1953 (Fig. 11). The BOP-REL 7X50 modified binoculars have coated lenses. As binocular lens coating was not done in Canada during or immediately after WWII, it is most likely that the lens coatings were done by Bausch & Lomb, Rochester, NY.

It is too bad that, while these improvements were being made, no one thought to make one of the filter pairs, for example the Very Dark filters, to be rotating polarizing filters. The polarizing filters would have been superior for the military in land, sea and air use, and much more useful for identification questionable objects being examined.

![Fig. 11. BOP Kit Modification for the REL 7X50 to include the housed filters, dated 1953. See Figs 9 & 10 above](image)

Further, only a select few of these binoculars is water-proof (see Figs 4. 7 & 8). They have the nitrogen-purging screws and gaskets commonly seen as red-painted screws or a large red-painted “W” on the lower left prism plate.

The REL 7X50s have the usual leatherette material to protect the bodies of the binoculars. The bodies of the BOP 7X50 retrofits do not have leatherette – they have a flat-black paint. In contrast, the bodies of the REL 6X30s are coated with a black, thin, reticulated or textured paint (crinkle finish?) that covers the metal. The prism covers and the objective ends of the bodies stick out from and around the bodies. This indicates that though the original plan was to have the
bodies covered with a leatherette protective layer, there may have been a reduction of production costs invoked.

As would be expected, the outline image of both of these REL binoculars is identical to those for the equivalent B&L binoculars. The reason for this is that Canadian Government had purchased from B&L the equipment needed for binocular making, and gave the equipment to REL for making the 6X30 and 7X50 sizes of binoculars. There were also about 6 experimental 20X72 units made. REL made other optical equipment for military purposes. Other optical equipment included predictors (used on naval guns), tank periscopes, rifle scopes, and sighting telescopes (Rohan 2001). Optical research work was done at the NRC in Ottawa, and included improving the aerial photography lenses. As night photography was impossible during WWII in the UK, these improvements were also done in Ottawa.

Bausch & Lomb had been applying its own special Balcote since 1939 for commercial purpose optics, and during WWII, for the military-use binoculars. Balcote is a thin, transparent film (of MgF2) that was applied to all air-to-glass surfaces, and which resulted in cutting light loss by as much as 50% (Bausch & Lomb 1950: 13). Application of Balcote to binocular lenses increased both the contrast and apparent resolution, giving clearer, sharper vision. The American lens-coating technology may have been passed on to the UK and Canada, but it was not applied to REL-made binoculars until after WWII.

A comment offered by several Canadian soldiers, who fought in Europe during WWII, is that when German soldiers were captured, their German-made binoculars were taken as they were lighter, better (with better eye pieces especially) and more convenient to use. A few German binocular lenses were coated, which added to the image contrast and apparent resolution (Cicala 2011: 3). They were also good German war booty. Most were 6X30s, but some were 8X30s. Though some of these captured binoculars had coated lenses, they were not nitrogen-purged.

There are several other articles regarding binoculars I have written that may be of interest: Leech 2014a; Leech 2014b; Leech 2014c; 2014d; Leech 2014e; Leech 2915a; and Leech & Kubetz 2015). Electronic copies are available for the asking from: releech@telus.net. There are two books that contain more information on REL binoculars (Rohan 2001: 156-157; Seeger 1996/2002: 60, 331).

**Are There Advantages of Porro Type Prism Binoculars over Roof-Prism Type Binoculars?**

There used to be distinctive advantages of Porro-prismType binoculars over roof-prism Type binoculars, but not since 2005 when new kinds of lens coatings (e.g., phase-coating and dielectric-coating) were developed (Leech 2014d; 2015). Smaller roof-prism binoculars (e.g., 8X20) can be folded to fit into a pocket, and they may handle more easily than do Porro-prism binoculars. But, Porro-prism Types I & II binoculars offer one distinct advantage over roof-prism binoculars: Porro prism binoculars have the objective lenses farther apart than are the oculars, which are set at your inter-pupillary (I-P) distance. This gives the Porro-prism binoculars a distinct edge for stereo or 3-D interpretation for objects and distance up to about 100
or so metres. In comparison, the roof-prism binoculars have the same I-P distance for both the ocular and objective lenses.

Conclusions

The REL binoculars are of interest from the historical military equipment perspective, and during WWII, they certainly met the military needs of Canada, the UK and a few other Commonwealth countries. But they are nothing special for use today, and do not offer as much as can be had with many modern-day binoculars with coated optics. The comment from WWII users of the REL binoculars is that the German equivalents are better, mainly because some of the German binoculars had coated optics. RELs were swapped for Leitz or Zeiss, or other German binoculars, as opportunities arose. Until 2005, Porro-prism binoculars inherently offered better resolution, contrast and brightness because the roof-prism binoculars employ silvered surfaces that reduce light transmission by 12-15%. Further, roof-prism binoculars require tighter tolerances for alignment of their optical elements (collimation)(Binoculars 2014).

Except Fig.11, which is an internet download (courtesy of the late John Garnham and Frank Lagorio (flagorio@shaw.ca), all figures were taken by the author, and are of binoculars in his collection or of those on loan from H. Allan Kerr, owner of the Milarm Museum, Edmonton.

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References

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