Reprinted from the American Society of Arms Collectors Bulletin 115:42-50
Additional articles available at http://americansocietyofarmscollectors.org/resources/articles/

Great War Galilean 'Optical' Sniping sights – Past and Present

(1915 use and 2015 Trials)

By Bob Maze

The tactical form of sniping, as we understand it today, came to fruition during the Great War (1914-1918). Before, this application of tactics was simply termed 'Sharpshooting', targeting officers and NCOs that lead the troops, so that their removal from the field of battle would lead to the common soldiery, without leadership, to run amok. The antecedents of this trade date back at least as far as the American Revolutionary War, when colonial riflemen wielding long Kentucky and Pennsylvania rifles engaged the British. Then this form of fighting came into prominence during the Napoleonic wars where the riflemen of the British 60th and 95th Rifle Regiments of Foot, using Baker rifles, exacted a heavy toll on the French. Later in our American Civil War, the first use of telescopically-sighted rifles, by both sides, was applied to accomplish the same end.

The term 'sniping' arose from the British nomenclature, referring to a marksman, so keen-eyed, that he could hit a rapidly flying and erratically maneuvering long-billed wading bird in flight, the snipe. Though used throughout the 19th Century, the term 'Sniper' wasn't lastingly added to our dictionary until the Great War.

As so frequently has happened in the past, a nation fighting a new war was only prepared for fighting the last. At the beginning of the Great War, the British were still fighting a South African campaign. On the marksmanship front, the British in the 2nd [South African] Boer War (1899-1902) were severely outclassed by the Boers, farmers mostly, of Dutch ancestry. Unfortunately for the British, the Boers had largely been equipped with the latest charger-loading Model 1896 7x57mm Mauser rifles from Germany. These far out-classed the top-loading 'Long' Magazine Lee-Metfords and Lee-Enfields of the British and Commonwealth forces, in both rapidity of loading and in accuracy. Also, the low standard of regulation (sighting) at the time from the British rifle manufactories left much to be desired, and in fact it ultimately became scandalous to the nation.

Arising from the martial debacle in South Africa the British learned, through pain of endeavor, a way of countering the threat of formidable troops in open warfare. Their battle rifle was redesigned into a shorter, more versatile weapon that could be assigned to both infantry and cavalry, the Short, Magazine Lee-Enfield (SMLE). Furthermore it now had the facility of charger-loading into its 10-round magazine, a reservoir that held more per rifle than any other European Army's rifle at that time. From the SMLE's introduction in 1903, the British musketry training would never be the same as before, it would demand accurate fire at the rate of 15 rounds a minute on a target at 200 yards distance.

In late 1914, after the initial open warfare following the German invasion of Belgium and France, the lines stagnated, and began to be consolidated, with troops going subterranean, in trench lines some 450 miles long, though with some no more than 50 yards apart, from the North Sea in Flanders to the Swiss border. From this point until 1918, there was no further significant open warfare, and for the British and Commonwealth troops their 15 aimed shots per minute was a part of the past. Enemy artillery barrages and sniping became the order of the day.

During the first winter of the Great War, on the average a British battalion would lose 12-18 men per day to German sniping, most of the men being shot through the head. With this threat, morale began to plummet, those alive would wonder when they too would next receive a gruesome head wound. The British response was not rapid, but ultimately it was effective.

Commonly behind a hardened loophole plate, hidden in the opposing parapet, the enemy sniper was a tough nut to crack. The Germans employed select men from their Jäger (Hunter) troops, those men who had been forest wardens and hunters, who could shoot well and stalk. The British and Commonwealth opposition also had talent, employing hunters from Canada, Australia, Africa and India, Scottish ghillies renowned for their stalking ability, and match rifle shooters from every corner of the Empire. The German and British schools of strategy ultimately played out differently, with the British finally winning the day.

The overriding problem at the beginning of the War, for the British, was that they had no significant optical industry, whereas the Germans did. In Germany, at the beginning of the war, there was a wealth of scoped rifles, mostly in the hands of civilians that were soon requisitioned by the Army. In the early days of

Reprinted from the American Society of Arms Collectors Bulletin 115:42-50
Additional articles available at http://americansocietyofarmscollectors.org/resources/articles/

Figure 1 - A no-nonsense German officer with a telescopically sighted hunting rifle early in WWI. The rifle appears to be a commercial Mauser with double set triggers. For at least the first year of the War, rifles such as these were pressed into service for sniping. (Martin Pegler)

the war, the German Jäger was armed with a hunting rifle (Fig. 1), before scoped military Gewehr 98 rifles became commonplace (Fig. 2). With these rifles, the

Figure 2 - Receiver and scope of a purpose-built Mauser Gewehr 1898 sniping rifle. (Martin Pegler)

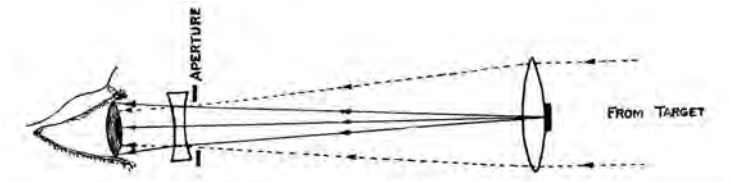
Germans initially exacted a heavy toll on the British.

To initially counter this devastating German threat, the British and Commonwealth troops put up keen-eyed riflemen over iron sights, and learned to employ spotters to assist in identifying the targets, observing through telescopes, or over the parapet with periscopes. The spotter and shooter would occasionally

Figure 3 - British sniper and spotter in the shell of what used to be an attic in Flanders, c. 1915. (IWM Q_050690)

trade off tasks to reduce the strain of each other's job, aiding the alertness levels of both. This combination of shooter and spotter, initiated in 1915 (Fig.3), was to last to the present day. It may have started in Gallipoli or maybe in Flanders, but it persists today among our elite snipers in the mud brick hovels, city streets, and rock outcroppings of Iraq and Afghanistan. Germany never fully appreciated the advantages of using a sniper team and, to their detriment, and commonly employed only 'lone wolves' without backup.

For the British at the beginning of the war, conventional telescopic sights were in short supply to go to the 'Front'. Officers, when at home for leave, often took back to their troops what telescopically sighted rifles that they could, but this wasn't nearly enough to be effective. In 1915, the Galilean 'optical' sights, as they were known in the official nomenclature, were just beginning to come into British service, primarily as a stop-gap measure in the period before more conventional telescopically sighted sniping rifles became abundant. The Galilean telescope was invented in the 16th century by the Italian astronomer/scientist Galileo Galilei. It consists of only 2 lenses, a large convex objective (1"-1.5") and a much smaller concave ocular (Fig. 4), without the absolute need for a tube



THE GALILEAN TELESCOPIC SIGHT.
The continuous lines represent the rays from the aiming mark, the dotted lines those from the target.

Figure 4 - Diagram of a Galilean telescopic sight showing its 2 lens simplicity. (Textbook of Small Arms 1929, HMSO)

enclosing them. At the time of the First World War Galilean telescopes were often found in low-powered binoculars. In England, Dr. A.A. Common had adapted this sort of optic for sighting rifles, subsequently, the renowned Irish shot and bronze medalist in the 1908 Olympics, Maurice Blood, perfected Galilean sights for competition on back position rifles. So, this type of sight was well known on the target ranges before WWI, and this bulls-eye familiarity, for better or for worse, influenced its design for military use.

When employed for aiming a rifle, the operating principles of the Galilean optical sight diverge considerably from those of a conventional telescopic sight. With the Galilean telescope images from the target and the objective (containing the aiming point: dot, post, etc.) simultaneously enter the eye. This is a compromise situation where only the target or only the aiming point may be in crisp focus, both will never be in perfect focus simultaneously. This depends primarily on the focal length of the convex objective lens, the longer the focal length (sight radius) the better the image quality. Curiously, under bright light conditions, with the pupil constricted, the concave ocular lens may actually be done away with, relying only on a small aperture to form an image, much the same way a pinhole camera operates. A conventional telescope (Fig. 5) requires more lenses and lens

THE TERRESTRIAL TELESCOPIC SIGHT.
The "cross wires" are situated at G.

Figure 5 - Diagram of a much more complicated conventional [Terrestrial] telescopic sight for comparison with the Galilean. (Textbook of Small Arms 1929, HMSO)

groups. Because the objective lens initially inverts the image, 2 subsequent lens groups must re-erect the image and focus it to enter the eye. The target's image is focused on the erector cell which re-erects it and where the sighting device (e.g. reticle) is also contained. This combined image of target and reticle in the erector cell, is then focused by the eyepiece lens to enter the eye together. Due to the large number of lenses and lens groups, their complex arrangement, and the movement necessary to focus them, a tube is always required.

Though simple in design, Galilean sights had their fair share of idiosyncrasies.

Figure 6 - Receiver area of an SMLE Mk.III fitted with a Periscopic Prism Co. telescopic sight. The magnification of this sight was the same as that of the Galilean sights, and both were in service in 1915. (Author)

i. They have a narrow field of view (1-1.25 degrees = 5-7 feet at 100 yards).

ii. They are dim due to the necessity of using a tiny rear aperture.

iii. They have low magnification of 2-2.5X, though in 1915 this was no different than that of the most common conventional British sniping sight: the Periscopic Prism Co. telescope mounted on Short, Magazine Lee-Enfield (SMLE) rifles also had only a 2X magnification (Fig. 6).

iv. The sights used in service weren't enclosed in a tube, so the lenses, especially the large objective, were prone to collect debris and mist. Worse, possibly, was the glare from direct or incident sunlight hitting the unshaded objective lens.

But for several good reasons, their drawbacks weren't insurmountable. There were in fact many perceived advantages to Galilean sights:

i. A low cost of manufacture, thus ease of replacement in case of damage.

ii. The ease of mounting them to a rifle without changing the battle sights.

iii. Most of these sights were mounted over the bore, as compared to the off-set mounting of conventional telescopes on all other contemporary British service sniping rifles, thus they could be fired through a narrower loophole slit (as most sniping was done in 1915-17), without increasing the width of the slit to accommodate the offset scope. This arrangement gave the sniper a greater margin of safety in his hide. Firing through a narrow loop hole slit, also, negated the need for a wide field of view, besides, the spotter was there identifying targets.

iv. Due to their low weight[1], Galilean sights were thought to be more rigid in their mountings, and thus less likely to be affected by recoil than heavier conventional telescopic sights, that were inclined to shoot loose because of their larger masses[2].

In 1915 the British War Department adopted 3 patterns of optical sights: the Lattey[3], Ulster/Neill[4], and the Martin[5] (Figs. 7-9). A further 2 types: the Gibbs[6] and B.S.A[7]. (Birmingham Small Arms Co.) were also acquired in some quantity[8] (Figs. 10-11). Ultimately, 14,125 optical sights were to be purchased by the War Department, with 9,000 of these the Lattey. Curiously, this figure is roughly twice the number of conventional telescopic sights fitted to British sniping rifles during WWI[9].

Figure 7. a. The fore-end of a SMLE Mk.III rifle showing attachment of both front and rear elements of the Lattey sight. (Author)

Figure 7. b. Close-up of the Latty's ocular lens holder attached the standing leaf of an SMLE Mk.III. The radius of the handguard behind the sight needed to be relieved slightly to allow full depression of the elevator, otherwise its graduations are useless. (Author)

Figure 7 c. Close-up of the Lattey's objective. Note the clamping arrangement engaging the lightening cut in the muzzle cap. (Author)

Figure 8.a. The Ulster/Neill rear sight, fitted to the dumbbell spring at the rear of the receiver. It is graduated from 200-600 yards; the earlier variants were only marked to 200 yards. (Author)

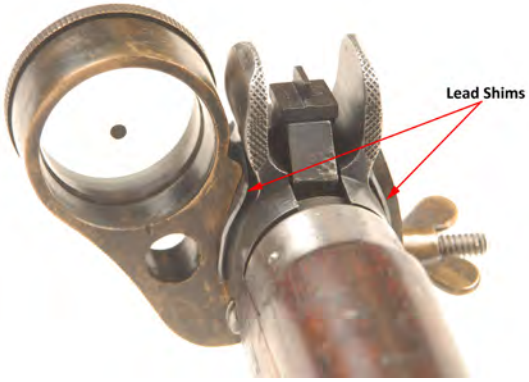


Figure 8 b. The offset Ulster/Neill objective with its prominent 4 MOA dot, a vestige from Bull's Eye shooting. Note the lead shims that were employed (today as in WWI) to stabilize the clamping of the sight in the muzzle cap's lightening grooves. (Author)

Figure 9.a. The ubiquitous No.9 micrometer adjustable target rear sight. Note the tiny ocular lens for the Martin sight inserted at the front of the windage arm. The No.9 rear sight was used for both the Martin and B.S.A. Galilean optical sights. (Author)

Figure 9 b. The Martin sight's objective fixed to the muzzle cap of an SMLE. Note the prominent 4 MOA dot aiming point. (Author)

Figure 10.a. The proprietary micrometer-adjustable rear sight for the Gibbs optical sight. Note the secondary aperture underneath the windage arm that could also be used if lighting conditions were appropriate. (Author)

Figure 10.b. The objective of the Gibbs sight, with probably the most precise aiming point. (Author)

Figure 11. The B.S.A. sight was patented in 1912 and thus was already in use on target ranges before WWI. It also used a No.9 micrometer rear sight. (Author)

Though all patterns of these sights used the Galilean optical principle, they varied considerably in the way it was applied to aiming. In most instances the aiming point was incorporated into the large objective lens: the Ulster/Neill and Martin both used a central 4 minute of angle (MOA) dot, the BSA had 3 vertically arrayed dots (Fig. 12), and the Gibbs a familiar post and crosswire. However, the Lattey's objective contained no aiming point, but instead the sight relied on the SMLE's fore-sight blade to serve that function. Their rear sights too differed. In most cases the small ocular lens was held in place by the eyepiece of a micrometer-adjustable target sight mounted at the left rear of the receiver, attached there by the dumbbell spring or a plate. The Martin and the BSA both utilized the common No.9 target sight whereas Geo. Gibbs produced a proprietary adjustable design that also incorporated an auxiliary aperture. The Neill's ocular had the same rearward point of attachment, but was a proprietary design marked to 600 yards[10]

Figure 12. The 3-dot vertical array of the B.S.A. sight was probably useful for Bull's Eye targets at different distances, but caused some confusion in our sniping trial. (Author)

in 100 yard increments. Always different, the Lattey's ocular lens holder simply clamped onto the standing leaf of the SMLE's rear sight, and used the windage and elevation settings of the sight for aiming.

Once these sights were in service very little is known of their actual use and effectiveness, we have only mere glimpses from contemporary documentation and photographs, and the occasional artifact. Only 3 solid pieces of evidence have yet surfaced that tell of, show, or suggest their use during the Great War.

Much has been researched and written on the ill-fated 1915 campaign in the Dardanelles, commonly referred to as 'Gallipoli'. A blow attempting to knock Turkey swiftly out of the war tuned into a nightmare, with British, French, and largely ANZAC troops mired down and hemmed in for 8 months near the very beaches where they had landed at in April. The only real success of the operation was the ultimate evacuation of forces in December 1915. During this quagmire, in rough trenches Empire soldiers fought for yards at a time against a well dug-in enemy, sometimes no more than a few yards away. The art and science of sniping was advanced considerably then with the use of spotters, periscopic rifles and optically-sighted SMLEs. From these battles on the Gallipoli peninsula have come the first documented evidence of the use of a Galilean optical sight in combat, the Martin, in the hands of Australian soldiers[11]. Its mention was only in passing, with no judgment, positive or negative, on how effective it was. Yet by its mere mention, one could assume some level of merit.

Across the Aegean from Gallipoli, in Salonika, an interesting photograph was taken sometime in 1915 showing 7 men of the 9th Battalion of THE KING"S OWN regiment ensconced behind a stone wall (Fig. 13). Immediately, the SMLE Mk.III in the foreground

Reprinted from the American Society of Arms Collectors Bulletin 115:42-50
Additional articles available at http://americansocietyofarmscollectors.org/resources/articles/

Figure 13.Salonika snipers, the 9th Battalion of THE KING'S OWN. The image demonstrating the concurrent use of both conventional and Galilean telescopically sighted rifles in 1915. (Martin Pegler)

mounted with an offset Periscopic Prism Co. telescope is noticed, but not so intriguing are the other SMLEs arrayed along the wall. On further examination of the image, the first and third rifles on the wall have optical sights attached, a Neill and a Lattey, respectively. Conservatively, the only solid deduction that can be made from this photograph, with no other information presently available, is that SMLEs fitted with both Galilean and conventional telescopic sights were fielded concurrently, at least in 1915.

In 2012 a few corroded, but more or less complete, Lattey sights quite literally surfaced near Arras, France (Fig. 14). They were found in a decaying wooden box in a farmer's field, near to where the old British trench lines had been. Why were they there? When were they last used? Could it have been during the April-May 1917 battle? Or, were they simply discarded stores, thrown in with other refuse when the trenches were filled in after the war? There are always too many questions and too few answers.

Figure 14. A corroded, but identifiable, objective lens from a Lattey sight found at Arras, France in 2012. Was it part of the 1917 battle there? Just think of the stories it could tell! (Martin Pegler)

However, there are some questions that can be answered about these sights, albeit 100 years later.

What we attempted in 2011 and in 2015 was to examine, to the best of our ability, how 6 optical sight types compared with iron sights (leaf and aperture), when shooting over ranges of 100 and 200 yards at simulated Great War 'targets of opportunity': a Hun's head, popping up over the parapet, and a loophole slit of an enemy sniper's hide, incautiously opened, allowing it to be backlit.

The questions we could effectively address within our tactical scenario are the following:

1. Whether the Galilean sights were at all advantageous over 'iron' sights?
2. Which type of sight gave the best accuracy, within the parameters of our trial?
3. What were the shooters' favorites, in terms of ease of use, confidence and ability, and out to what range?

To try to demonstrate, as realistically as possible, the actual potential of each sight in terms of the Great War trenches, the 'experiment' was structured in the following manner:

1. Ex-Special Forces snipers with 1-spotter and 1-shooter per trial.
2. Only Short, Magazine Lee-Enfield Mk.III/III*(SMLE), Charger-Loading Lee-Enfield (CLLE), and Pattern 1914 rifles that shot $\leq$ 1 MOA.
3. Open Vs. Galilean sights that were evaluated at both 100 and 200 yards.
    a. Galilean sights used were the Neill/Ulster, BSA, Gibbs, Lattey, and Martin (for both CLLE (Fig. 15) and SMLE)

Figure 15. An Alex Martin fore-sight fitted to a Charger-Loading Lee-Enfield. (Author)

    b. Open 'iron' sights used: Leaf – SMLE Mk.III*; Aperture – Pattern 1914 (Winchester) with a fine adjustable rear sight
4. Mk. VII .303" British ammunition chosen for precision:
    a. FNM (Portuguese) – best
    b. PMP (South African)
    c. HXP (Greek) – worst

Time was allowed at the beginning of each trial day to let the shooters zero and familiarize themselves with their rifles.

Attempting to replicate the types of targets probably engaged by British snipers during the early years of the Great War, we utilized the British Army's Figure 14 'Huns Head' sniper training target and a simulated 'paper' loophole plate, having a central white oval with the exact specifications of a German WWI aperture, on a camouflaged background. These targets were displayed from behind sandbags by a remotely

Reprinted from the American Society of Arms Collectors Bulletin 115:42-50
Additional articles available at http://americansocietyofarmscollectors.org/resources/articles/

Figure 16 a. The target trap used in our trial containing the British Army's Figure 14 'Hun's Head' target. (Holly Marcus)

Figure 16 b. The target trap used in our trial containing a simulated backlit loophole aperture. (Holly Marcus)

operated trap (Fig. 16) at random intervals, and engaged by our shooters with a single shot per 3 second exposure.

For the sake of efficiency, each 'Sniper' was given the use of 3 Galilean equipped rifles and 1 iron sighted rifle during the trial.

Sniper 1:

a. BSA, Neill, and Gibbs optical sights
b. Pattern 1914 aperture (iron) sight

Sniper 2:

a. Martin (SMLE), Martin (CLLE), and Lattey optical sights
b. SMLE Mk.III* leaf (iron) sight

Following the shoot, questionnaires were handed out to our 'Snipers' in an attempt to tap into their practical knowledge for a better assessment of the usefulness of the sights and the rifles employed in the trial. Below are our experts' responses summarized:

Are Galilean sights better than open sights?

Unequivocally, the magnification helped accurate shooting at both distances under all conditions (e.g. bright sun, fog, and overcast; we had all three). Magnification helped define the target, its edges and any movement. With open sights the shooter would need to look over them to identify the target with the 'naked eye,' then re-acquire both sight picture and cheek-weld before firing; all of these actions are time-consuming.

How would the shooters rank the sights that they used?

The confidence each shooter displayed in a specific sight for a first shot hit is prioritized below from most to least:

Sniper 1: Gibbs / Neill / BSA / Pattern 1914 (aperture sight)

Sniper 2: Martin (both types) / Lattey / SMLE (leaf sight)

As it relates to confidence, was there a favorite sight?

Sniper 1's favorite was, understandably, the Gibbs with its familiar post and crosswire 'reticle'. He was satisfied that hits could be made with the Gibbs out to 300 yards. He also put some confidence in the Neill and BSA sights to distances exceeding 200 yards, using an appropriate hold on the 4 MOA dot, allowing the target to be seen.

Sniper 2's favorite sight, of those he used, was the Martin, feeling that the 'dot' was better than the Lattey's blade for rapid target acquisition out to 150 yards.

Problems encountered concerning aiming devices (i.e. dot, post, or front sight blade):

1. As was the case 100 years ago, the 4 MOA aiming dots of the Neill, BSA, and Martin sights were less than perfect for sniping purposes. While somewhat useful at 100 yards shooting at 'center of mass,' the dot still covered most of the Hun's head and the loophole. To be able to visualize/identify the target at 200 yards, rifles needed to be zeroed using a 6 o'clock hold, by placing the 12 o'clock position of the dot beneath the target. Though this hold eliminated a fine aiming point, both shooters felt confident about making accurate hits by using this technique.
2. When recovering from recoil, the vertical array of 3 dots on the BSA's objective lens made it difficult to quickly reacquire the correct dot for aiming.
3. The Lattey sight reduced the definition of the fore-sight blade, and any light reflection off the blade diminished it even further; these factors made it hard to rapidly acquire it for aiming. However this would not be as critical if the sniper was in a hide, or if the fore-sight blade was more effectively blackened. Army veterans interviewed have mentioned using candle smoke to blacken their rifle's foresights[12].
4. For the SMLE and the Pattern 1914, their battle sight front blades were problematic in sunlight, unless well blackened. Again, this would not be a problem in the shaded environment of a hide.

Other problems:

Manipulation of the bolt between shots was time consuming, and the shooter had to re-acquire the cheek-weld anew for each shot. However, that's the nature of the bolt-action rifle.

Surprises:

Sniper 1 preferred the left-offset Neill sight if a quick second shot was needed. He found working the rifle's bolt didn't interfere as much in follow-up shots, since he was able to better maintain his cheek-weld (although an improvised cheek rest was necessary to increase the height of the butt).

Is a spotter necessary?

A nearby spotter is absolutely necessary to assist the sniper in finding targets for rapid engagement, primarily due to his greater field of view. Also, a spotter is in the best position to tell if the shot was effective; the shooter would be busy at the moment of impact recovering from the rifle's recoil.

The rifles?

The shooters felt confident with their rifles, be it a SMLE, CLLE, or Pattern 1914. However, more time could have been spent on familiarization, of the rifles and of the rifle/optic combinations. Given more time, all of the participants should have shot all of these combinations, as well, to obtain as many practical and experienced views as possible.

Evaluating the Trial

Following the trial, targets were evaluated, groups were measured, and a scoring system was employed to rank the relative performance of each Galilean sight. The scores for each sight were established by the following, rudimentary, criteria:

Hun's Head (Figure 14)	Loophole
Head (anywhere, neck incl.) – 5	Slit – 5
Helmet (head, peripheral) – 4	'Magpie[13]' (slit margin) – 4
Body (e.g. shoulder) – 3	'Plate' – 3
Paper – 2	Paper[14] – 2

This scoring system appears to have worked within the parameters for our trial and generally reflects our shooters' questionnaire responses. A perfect score is 25 as an average between the 100 and 200 yard engagements. Below are our rankings:

Scores	Optical Sight Radii
Gibbs – 25	30.0"
Martin (CLLE) – 25	33.0"
Neill – 24	31.0"
BSA – 24	31.5"
P'14 (iron) – 24	31.75"
Martin (SMLE) – 23	29.4"
Lattey – 20	20.13"
SMLE (iron) – 20	20.13"

The physical attributes of the resolving power of the Galilean telescope may have had some influence on the above scores. As previously mentioned, the longer the sight radius, the better the sight's definition (i.e. resolving power). Maybe this is why the Lattey and SMLE demonstrated the lowest scores? Those sights with longer radii, their ocular lenses mounted to the rear of their rifle's receiver, generally produced better scores in the hands of a competent shooter. The slight outlier in these data is the Gibbs sight. One can't dismiss the possibility that its more 'user friendly' post and cross wire aiming point allowed for greater precision, and thus ultimately higher scores.

So what has this trial shown us on the efficacy of the Galilean sight, in terms of the past, viewed from a present day perspective? Ultimately, the Galilean sights were probably an asset for the British Army coming to grips with the intense early German sniping threat. The static, close aligned trenches of the Western Front and Gallipoli, some not more than 50 yards apart in 1915, must have allowed even these low powered 'optical' sights a distinct advantage for a Tommy sniper, over the battle sights of the service rifles for identifying and engaging targets of opportunity with a higher degree of accuracy.

Endnotes

1 *THE TEXT BOOK OF SMALL ARMS – 1929*; Pgs. 60-61.

2 In the book '*A Rifleman Went to War*' by Herbert McBride, the problem with his Warner & Swazey scope, mounted on a Ross Mk.III rifle, shooting-loose was partially rectified chemically; he applied liberal quantities of urine to corrode its mountings in place. He also used safety razor blades as shims to tighten the scope/mount engagement. When he returned the rifle to stores, the armorer wasn't pleased.

3 Designed by Captain Lattey of the School of Musketry at Bisley Camp, Surrey.

4 Called the 'Ulster Division Sight', it was produced by: Sharman D. Neill, Ltd., Optician, Belfast, Ireland.

5 Patented (1915) and produced by the gunmaker Alexander Martin of Edinburgh, Scotland.

6 Patented (1915) and produced by the gunmaker George Gibbs of Bristol and London.

7 Patented in 1912.

8 Numbers purchased by the British War Department – Lattey: 9,000; Ulster/Neill: 4,250; Martin: 695; Gibbs: 100; B.S.A.: 80.

9 This calculation doesn't include the 2,080 Periscopic Prism Co. Pattern 1918 scopes fitted to Winchester Pattern 1914 rifles that were too late for service in WWI.

10 Early sights were only marked for 100 and 200 yards.

11 Hamilton, John (2008); *Gallipoli Sniper: The Life of Billy Sing*; Pan Macmillan Australia Pty Limited, Sydney.

12 Edit by Martin Pegler. Martin has extensively interviewed large numbers of WWI veterans in the 1960s and 1970s.

13 In bull's eye target shooting, a 'Magpie' refers to a hit that

cuts the margin of the bull, half in the black and half in the white; its name coming from the black and white crow-like bird.

14 The deduction in points is for the shot being very wide. There were no wide shots.

References:

Anonymous (1929); Textbook of Small Arms 1929; His Majesty's Stationary Office, London; Pgs. 60-61.

Hamilton, John (2008); Gallipoli Sniper: The Life of Billy Sing; Pan Macmillan Australia Pty Limited, Sydney.

Hesketh-Prichard, H. (1993); Sniping in France; Lancer Militaria, Mt. Ida, AR.

Pegler, Martin (2008); Sniping in the Great War; Pen & Sword Ltd, Barnsley, UK.

Pegler, Martin and Ramiro Bujeiro (2001); The Military Sniper Since 1914; Osprey Publishing, Oxford, UK.

Skennerton, Ian D. (1998); List of Changes in British War Material in Relation to Edged Weapons, Firearms and Associated Ammunition and Accoutrements, Volume V 1918-1926; Ian D. Skennerton, Labrador, Australia.

Skennerton, Ian D. (1993); List of Changes in British War Material in Relation to Edged Weapons, Firearms and Associated Ammunition and Accoutrements, Volume IV 1910-1918; Ian D. Skennerton, Ashmore City, Australia.

Skennerton, Ian D. (1984); The British Sniper: British & Commonwealth Sniping and Equipments, 1915-1983; Ian D. Skennerton, Margate, Australia.

Acknowledgements :

✯ A few of the Galilean sights were initially missing their ocular lenses prior to our trial. These lenses were made by:

B. Jones Sighting Systems
5115 Edgemont
Phoenix, AZ 85008

✯ Range photography was provided by Holly Marcus Photography, Harrisonburg, VA. www.hollymarcus.com

✯ Mr. Martin Pegler, for his continuing support, and tireless efforts, and good humor during this project…and for pulling the string on the trap.