

Ground surveillance and target acquisition system in the Royal Artillery

GÉZA GULYÁS

National University of Public Service, Budapest, Hungary

In the past our surveillance and target acquisition system (later only STA system) was similar to other Soviet-client country's system. Those important elements which were able to provide the target information to the field artillery were mainly and directly organized into artillery units or subunits. But now due to the concept of approach of army's leaders and the transformation of our Army the reality is that we have lost a lot of very important capabilities in the Hungarian Army. I think one of them is the artillery STA capabilities. Even so I am convinced the STA system is a very important and profitable part of every average army of the World. In this article I try to interpret the right of the previous sentence across examples of the British Regular and Territorial Army. I will introduce history, structures, current roles and equipments of two British STA regiments.

Introduction

In the past the Hungarian Army belonged to Warsaw Pact so naturally our STAⁱ system was similar to other Soviet-client country's system. Those important elements which were able to provide the target information to the field artillery were mainly and directly organized into artillery units or subunits. On artillery brigade and regiment level there were located the bigger self-propelled surveillance radars and sound ranging systems, and below on artillery battalion level were organized the smaller, man-portable surveillance radars together with the battalion and battery observation posts. It was a huge, multiply and well deliberated system, which was able to provide the necessary information to the maneuver and artillery commanders and firing units as well, suitable for the requirements. This system was built particularly on Soviet equipments for instance SNAR-10 surveillance radars, AZK-5 sound-ranging systems, 1D11 laser range finders and stereo range finders of various types, and so on...

During the transformation the Hungarian Army's number of personnel had become less and less. But number in our soldiers' foreign missions is rising continuously. And

ⁱ Surveillance and Target Acquisition

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Address for correspondence:

GÉZA GULYÁS

E-mail: gezu99@freemail.hu

obviously, this process is working nowadays. Due to the approach of army's leaders and the mentioned process, currently, the reality is that we have lost – completely or nearly completely – a lot of very important capabilities in the Hungarian Army. I think one of them is nearly total artillery target acquisition and surveillance capabilities. With the reduction of number of personnel a lot of specific units were disbanded. Firstly our artillery brigades and regiments were reduced then disbanded with STA units and then battery observation posts were relocated into the maneuver companies as fire support teams. Some years ago the last artillery battalions were disbanded and the fire support teams disappeared (firstly from tank and than infantry companies) as well.

Consequently we can declare that the very small Hungarian artillery has not any useful STA capability. Is it necessary for us at all? Or rather would it be necessary for the Hungarian maneuver and artillery units in foreign missions or at home? The answer is absolutely yes!

Why? In our army the most important task is to accomplish foreign missions. In our foreign missions, typically, companies or platoons operate and conduct mission and not battalions or brigades. And I must emphasize, it commonly means real missions (with weapons, nowadays not rarely under fire) in connection with other NATO members.

I am convinced that in a foreign mission the most important and sensitive aspect is self-protection. Nevertheless we do not think to participate in a real big war in the immediate future, I reckon that we have to provide in every possibilities for self-protection of maneuver units and subunits in smaller combats as well. The STA is such a possibility.

Because of this a lot of allied army think in this way and continuously develop their STA equipments and principles and apply various STA capabilities in a non-war conflict as well.

In this article – shortly – I try to emphasize the ground STA system's importance, and introduce its ground units and main equipments in the British Army.

1. Units

In the British Army there is a field artillery brigade. This brigade commands all the MLRⁱⁱ systems with surveillance and target acquisition and support logistic elements.

This brigade consists of the following major units:

- 5 Regiment of Royal Artillery (STA unit);
- 32 Regiment of Royal Artillery (UAVⁱⁱⁱ unit);
- 39 Regiment of Royal Artillery (MLRS unit);

ⁱⁱ Multirole Rocket

ⁱⁱⁱ Unmanned Aerial Vehicles

- Honourable Artillery Company (Special Operations and TA unit);
- 101. Regiment of Royal Artillery (MLRS unit).¹

1.1. 5 Regiment Royal Artillery^{iv}

The unit was founded in 1939 as horse artillery regiment with two batteries (the K and G) and in 1940 it formed part of the British Expeditionary Force. After Dunkirk massacre it moved to North Africa and joined the 7th Armoured Division. It took part in the Western Desert fights and – in a limited period – Italian Campaign. After this they took part in the Normandy landings and fought in North West Europe.

Due to the reorganization of the Royal Artillery in 1958, the organization, the role, and the name of this regiment were changed and the regiment became the 5th Field Regiment of Royal Artillery. From this moment there were a lot of changes in the life of regiment as well. They were light and heavy regiment with various kinds of towed and self propelled guns and mortars. After the World War II the units of this regiment served in Hong Kong, Germany and North Ireland.

In 1990 the 73 (Sphinx) Battery was formed an observation battery from the observation posts of 5 and 32 Regiments. During the first Gulf War a lot of soldiers were attached to 32 Regiment RA^v and the complete 73 (Sphinx) OP Battery joined the 16/5th Lancers. These soldiers and units organized many fire support elements and mobile OPs.^{vi}

After the mentioned war the gun units of regiment were transform again, from SP^{vii} guns to MLRS and the 73 (Sphinx) OP Battery became 4/73 (Sphinx) special OP Battery. In 1993 Q (Sanna's Post) and Headquarters Battery were combined to became Q (Sanna's Post) Headquarters Battery.

After some abroad tour in Northern Ireland, Bosnia and Cyprus the regiment was transformed again. In mid-January 1998 the MLRS regiment became Surveillance and Target Acquisition Regiment in the Royal Artillery. So due to the mentioned change nowadays the regiment consists of 5 batteries. These are the following:

- 53 (Louisburg) Battery;
- K (Hondeghe) Battery – weapon locating role;
- P Battery (The Dragoon Troop) – weapon locating role;
- Z Battery;

^{iv} This chapter is founded upon the www.army.mod.uk/artillery/units/6797.aspx and www.arrse.co.uk/wiki/5th_Regiment_Royal_Artillery websites.

^v Royal Artillery

^{vi} Observation Posts

^{vii} Self-propelled

- Q (Sanna's) HQ Battery – command and control, survey and meteorological roles;
- 4/73 (Sphinx) Special OP Battery.²

Nowadays this regiment is the main centre of surveillance and target acquisition in the Royal Artillery. Thus mainly in this regiment are founded the weapon (artillery and mortar) locating radar and sound ranging capabilities. The accommodation of regiment is a part of Catterick Garrison, in which the 19 Mechanized Brigade is located as well.

1.2. Honorable Artillery Company^{vii}

This unit is the oldest regiment in the British Army. It was known by a variety of names until 1656, when the unit was first mentioned as the Artillery Company. Since 1685 we could use the Honorable Artillery Company denomination, but it was confirmed by Queen Victoria in 1860. In this age the company moved to the current site of Bunhill Fields Burial Ground on City Road.

In the beginning of the previous century the first overseas mission was the South African War (1900–1902) for almost two hundred members of the company. They took part in that conflict as infantry and mounted infantry men. In 1907 the HAC^{viii} became part of the newly formed Territorial Force as the “26th Battalion”. Nevertheless it was a real infantry battalion but it managed to retain its own identity as the “Honorable Artillery Company Infantry Battalion” by a special act in 1908.

During the First World War the unit was raised. At that time it contained three infantry battalions and seven field artillery batteries. From these units the 2nd Battalion fought in the Italian Campaign. In 1918 in the Battle of Vittorio Veneto this unit led Italian, American and British units fight heroically. Due to the significant role members of HAC got a lot of different honours but unfortunately 1600 of them were killed.

In 1939 the infantry battalion became an Officer Cadet Training Unit, while four artillery regiments were provided. The 11th and 12th regiment served in North Africa and Italy with M7 Priest self-propelled guns, but the 13th regiment used Sexton self-propelled guns in fights of Normandy, Netherland and Germany. Moreover more or less – as a British specialty – they provided a heavy anti-aircraft regiment and two heavy anti-aircraft batteries for the allied forces.

After the war the HAC was reorganized into an Infantry Battalion, a Royal Horse Artillery Regiment of self-propelled artillery, a regiment of mobile heavy Anti-Aircraft Artillery (which was disbanded in 1955) and a locating battery (which was disbanded in 1961). The next and maybe the biggest transformation was in 1973 when the unit got its

^{vii} This chapter is founded upon the www.hac.org.uk/html/about-the-hac/hac-history and www.arrse.co.uk/wiki/Honourable_Artillery_Company and websites.

^{viii} Honorable Artillery Company

present role and facade. It became “Stay Behind” Observation Posts unit for the British Army of the Rhine. At that age the new structure was developed: 1, 2, 3 patrol squadrons, HQ^{ix} squadron (including Training Wing), gun troop (six 25 pounder guns), band and corps of drums.

In 1992 there were the next transformations. The unit got a signal squadron and 105mm light guns. The obsolete 25 pounder guns continued to be fired ceremonially. Since 1996 the regiment has always had soldiers and equipments on operational service overseas. And finally in 2005 the guns were withdrawn from Gun Troop and later it was renamed Liaison Troop and the 3rd squadron was redesigned as the Training Squadron.

Nowadays the regiment has a ceremonial and an operational role. It is providing guards in the City of London during state visits, and since 1924 has provided the saluting battery at the London of Tower. Although the HAC is operationally a target acquisition artillery regiment, it is not part of the Royal Regiment of Artillery, being a separate regiment with his own uniform, insignia and colors. The regiment consists of the following sub-units:

- 1, 2 Squadron;
- 3 (training) Squadron;
- Signal Squadron;
- L (liaison) Troop;
- HQ Squadron;
- The Corps of Drums;
- The Regimental Band.³

During full mobilization of HAC, this unit gets the 4th patrol squadron from the regular army. It would be the 4/73 (Sphinx) Special OP Battery from the 5th Regiment Royal Artillery. Since 1996 the sub-units of HAC has served in North Ireland, Bosnia, Kosovo, Iraq and Afghanistan.

2. Equipments

MAMBA^x

As a matter of fact this is the British abbreviation of the Swedish ARTHUR^{xi} system. It is an air portable and very accurate medium weapon locating system, a real “killing” artillery hunting radar. This radar system is able to automatically detect, locate and

^{ix} Head Quarters

^x Mobile Artillery Monitoring Battlefield Radar

^{xi} Artillery Hunting Radar

classify the hostile and friendly artillery, mortar and rocket weapons and units and the probable impact positions of enemy shells as well. In the British Army this radar was deployed operationally for the first time in April 2002, and currently is serving in the 5 Regt RA.



Figure 1. MAMBA in position

Radar is mounted on an Alvis Hagglands BV206 tracked vehicle so the system has high mobility even in extremely difficult terrain. Due to this vehicle and the dimensions of the radar the complete system is easily transportable by C-130 or similar capabilities aircraft or heavy lift helicopter such as a Chinook as well.⁴

The main tactical capabilities of the radar are superb. The MAMBA requires only a crew of 7 (1 commander and 6 persons in two shifts).⁵ The time into action is less than 5 minutes. During an operation simultaneously the radar can search in 90° sector which is divided into 16 sub-sectors. MAMBA can operate as a stand-alone medium weapons locating radar until its maximum detection range however when 3 or 4 radars working in coordination the level of its capabilities is growing immediately. Its (one unit) detection range in case of guns and howitzers are 20–25 km and in case of rockets and mortars are 35–40 km. The CEP^{xii} is not too high at extreme range yet. In case of guns and howitzers this value is 0.35%⁶ of range to target but in case of mortars is only 0.15%. Thus this system is able to provide accurate target dates (70 m) for counter-battery fire.

It can be operated in Location Determination and Fire Control modes. In the first mode radar focuses its calculations on the up-going trajectory of shells however in the second mode on the down-going trajectory of shells. During the Location Determination

^{xii} Circular Error Probable

the system can determine the position of firing hostile artillery units and identify its type and able to calculate the impact point of enemy shells as well, so can alert friendly troops very rapidly. When it is used Fire Control mode the location of friendly artillery is sent to the radar operator who – after the firing – searches the own shell and calculates the probable impact point of it. Due to the rapid and accurate dates a fire direction centre can exactly correct the fire – maybe before the hit – for instance during an adjust fire.

Radar can locate a maximum of eight targets simultaneously and the target capacity is 100 per minute and can make a distinction between birds and shells as well.

COBRA^{xiii}

The system is high-mobility weapon location radar with 3D Phased array antenna. It can very rapidly and precisely locate firing artillery units – with analysis of its trajectories – and distinguish the units as mortars, howitzers and rockets. Moreover the radar can provide the prediction of shell impact locations, adjustment of friendly firing and battlefield intelligence. In addition the system determines jamming data and communicate with own troops. It came into service with 5 Regt RA in middle of 1999.

COBRA consists of radar, processing system and command, control and communication system. It also has an inertial navigation system which provides accurate position of system and antenna attitude in 3 dimensions. Its error is less than 10 meters in 20 kilometers only. In the operation cabin it is situated radar system receiver, signal processor, data processing subsystem, operator's console, C³ console, vehicle intercom. The cabin protects small arms fire and shell fragments and provides nuclear, biological, chemical and electromagnetic pulse protection for radar operators. All of the mentioned main parts are mounted on the same 10t cross-country wheeled carrier vehicle.

In spite of that this is a bigger system than MAMBA or mainly MSTAR it has some unique capabilities. Only a crew of 3 (max 2 operators) is able to work the whole system. With these 3 soldiers the COBRA can be ready to operate in less than 10 minutes and moving in just 3 minutes.

The detection coverage – in a 90° sector – is more than 40 km, which corresponds approximately 1200 km² however radar operator may select Range Modes between 20 and 50 kilometers as well.⁷ In operation it can locate and report to a higher commander more than 40 six-gun batteries less than 2 minutes.⁸

Likewise MAMBA this system can distinguish shells and birds.

^{xiii} Counter Battery Radar



Figure 2. COBRA in position

Mark 2 HALO^{xiv}

It is an acoustic weapon location locator. HALO can detect and locate the accurate position of wide range of firing weapons types including artillery, mortars, tank guns and shell bursts. It works only with detection of sounds so this is an absolutely passive and covert system. This system is accepted into service with 5 Regt RA in March of 2003.

The system is transported by either Armored Fighting Vehicle (AFV 432) for the heavy section or in Pinzgaur trucks for the light and air mobile sections.

In operation there are up to 12 sensor posts inside the system. Each sensor position consists of 3 microphones, a processor unit, a meteorological sub-system and a data link. Sensitive microphones of sensor posts are able to detect the sound of enemy fire (all other sounds are ignored) and send data on acoustic events and meteorological (temperature, wind) conditions to the command post of HALO where a special software computes the location of weapons. Microphones are positioned on a maximum 12 km wide line⁹ near the FLOT.^{xv} HALO can identify a hostile position of firing weapons from 50 meters to 10 kilometers and locate guns and mortars out to a distance of 30 kilometers, night and day. In this way the locator system can monitor and provide pinpoint dates approximately area of 6500 km² in 360° and its maximum identifying capacity is 8 rounds per second. Its accuracy is typically 1% of range at 15 kilometres.¹⁰

^{xiv} Hostile Artillery Location

^{xv} Forward Line of Our Troops



Figure 3. HALO

MSTAR^{xvi}

The radar is high-versatile, small and light-weight, low-power, all-weather (-40° to $+50^{\circ}$ C), ground surveillance radar. It is able to locate moving targets and classifies them as people or troop, tracked or wheeled vehicles and also can detect helicopters, slow moving fixed-wing aircraft and can observe and adjust the fall of shot as well. The radar entered in service in early 1991 in the British Army.

The system has an electro-luminescent 12.1" and 800×600 pixel resolution SVGA display (which is only 7.4 kg) that can be overlaid with the map grid. It can show the areas of ground visible and the dead ground as well. The target location can be presented map coordinates or polar coordinates.

This system is very easy-handleable heavy-duty (according to DRS Technologies the demonstrated fixed site application is more than 12000 hours between two repairs). The total weight of system is only 37.4 kg (unpacked) or 55.5 kg (bagged) thus it is transportable by only 2 soldiers¹¹ and can be put into action in less than 5 minutes. Tactical capabilities of this system are more than enough for artillery observation

^{xvi} Man-portable Surveillance and Target Acquisition Radar

parties as it can provide area surveillance to a maximum range of 30 km, day or night.¹² Moving targets detection performance of is smaller a bit but highly remarkable. The detection range is 11 km on walking man, 11–12 km on aircraft, 15 km on artillery shells, 24 km on wheel vehicles and 36 km on tracked vehicles. The target location accuracy is ± 10 m in range and ± 5 mils in azimuth thus the system is able to provide the appropriate dates to artillery or any other kind of fire and commanders as well.



Figure 4. An MSTAR in Afghanistan

3. Conclusion

I hope that I could show clearly the major units and equipments of artillery STA system in the British Army. It is possible to say there are a lot of different kinds of units, equipments and capabilities nowadays as well. Moreover, equipments and theories are developing permanently. I think it is enough to mention sound ranging systems or units, what we abolished a long time ago, as obsolete equipments with obsolete theory. For example in the British Army military leaders do not think in this way.

Fortunately our environment became more secure since the collapse of the bipolar world so the Hungarian Army – especially as a NATO member – does not have to outbrave a real and concrete military threat. However we have to or rather we should have to retain any kind of useful capabilities because it is very hard to “reanimate” a system and culture immediately if it is necessary. Maybe it is impossible as well, and the world is changing, continuously.

And there is another reason why the artillery STA system is important. Hazard of big war was ended but in contrast in the world there are a lot of (more than formerly) smaller conflict zones. In some conflict zones there are NATO troops and naturally

more or less opposition forces. Many times these are only non-war conflicts but for those units (battalions, companies, or only platoons) who take part, that may be very serious when for example an insurgent group uses small artillery weapons or mortars with indirect fires against NATO base, convoys, patrols, and so on. I am convinced that we have to give the possibilities of calm environment and effective self protection for these units. STA units and their capabilities can provide it.

And last but not least STA units have much kind of useful equipments against hostile artillery and heavier weapons but those soldiers and NCO's^{xvii} and officers who are serving these units are simply warriors as well. They have small arms, machine guns, man pack radios, grenade launchers and, not rarely, armored personnel carriers, and so on. So they have every general capability infantrymen or infantry units have. Moreover – like in the British Army – a lot of STA units are elite, well trained. I introduced for example the HAC has own uniform, insignia, colors and – as a privileged and special unit – training system and possibilities for own recruits. So one of the two shown unit is STA centre of Royal Regiment of Artillery and the other one is one of the oldest elite unit in Britain. I think these facts are conversational. Why?

When it is required, for instance in a non-war conflict, this kind of STA unit (squad or platoon) is able to achieve as mission as simply infantry squad or platoon can as well. But in this situation the accomplishment of STA units has a large benefit. On the operational terrain soldiers of STA units can patrol, escort convoys or deploy and operate check points, but if it is necessary – with their special equipments – they can locate the hostile artillery positions and, with artillery assets, can destroy them. Especially in a non-war conflict it is very important and useful capability. It gives the elite character for the STA units.

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