COAST ARTILLERY JOURNAL

FOUNDED IN 1892 AS THE JOURNAL OF THE UNITED STATES ARTILLERY

VOLUME LXXXIX MARCH-APRIL, 1946 NUMBER 2

CONTENTS

PUBLICATION DATE: April 1, 1946

Published bimonthly by the United States Coast Artillery Association. Editorial and executive offices, 631 Pennsylvania Avenue, N.W., Washington 4, D. C. Terms: $3.00 per year. Foreign subscriptions, $4.00 per year. Single copies, 75c. Entered as second-class matter at Washington, D. C.; additional entry at Richmond, Va., under the Act of March 3, 1879.

Radar Against Ground Targets

Most antiaircraft personnel are familiar with the capabilities of radar in the detection of aircraft and are justly proud of its accuracy of twenty yards in range and one-third degree in azimuth (direction). Because of its uncanny faculty of being able to track all aircraft in the area covered by the radar beam, few doubt the radar's ability to track ground targets equally as well.

Actually, it does. The radar has made possible the sensationally accurate spotting of enemy gun positions at ranges of more than five miles through detection of artillery and mortar projectiles in flight and the detection of moving troops and vehicles on enemy-held roads at night. But this faculty was not always so.

When an ordinary radar "scanned" a stretch of enemy-held road, it detected every object along that stretch of road, and the operators were unable to distinguish the enemy targets from trees, hills, and other features of the landscape. For this reason it was necessary to modify radars so they would present data only on moving objects.

This modification was based upon what physicists call the "Doppler effect." This effect may be compared to the periodic bouncing of rubber balls. If a man throws rubber balls at a stationary wall at one-second intervals, the balls bounce back to him once a second. If the wall is not stationary, however, but moves toward the man, the balls return to him more often than once a second. If the wall moves away from him, the balls return less often.

On the basis of the Doppler effect, Signal Corps scientists knew that radar echoes would be reflected back at a different frequency from a moving object than from a stationary object. They modified their radars, therefore, to filter out echoes from stationary objects and present only data from moving objects.

With this modification, the radars could be operated much as they were in the tracking of enemy aircraft. Precise data on the range, azimuth, and direction of movement of the enemy vehicle were supplied by the radar operators to friendly artillery units, which used that data to aim their guns. The radar could also spot the burst of the friendly shells in relation to the target and tell the artillerymen how to correct their aim.

Combat troops found this use of radar particularly valuable for night harassing fire of enemy supply routes. The accurate location of targets by radar resulted in a substantial saving of ammunition during the Battle of the Bulge, when ammunition supplies were critically short, and German prisoners reported that on several occasions the enemy had to abandon the use of his main supply routes.

Vehicular targets were detected by radar at ranges up to sixteen miles. Individual troops were detected at ranges up to three miles, and the radar technicians became so proficient they could estimate the number of enemy soldiers in a group and the type and speed of enemy vehicles by analysis of their oscilloscope data.

Some astonishing results were obtained during the French and German campaigns. On one occasion radar data was used to inform an American patrol of the presence of a German patrol about two hundred yards to their right, with the result that the enemy patrol was ambushed.

On another occasion, the radar picked up three self-propelled guns moving toward our lines. A battalion concentration dispersed them. Again, a convoy of some forty vehicles was picked up and artillery fire was placed on the area until all movement ceased.

During the month of February, 1945, nine per cent of the total artillery missions fired by our forces in Germany were on targets located by radar.

Signal Corps scientists first learned that radar could detect shells in flight when they built and tested the first American radar in 1937. Studying the ability of the radar to automatically aim antiaircraft guns at target planes, they noticed that the projectiles appeared as echoes on the oscilloscope when they exploded near the targets.

This fact was considered of only casual interest until the Italian campaign, when combat units reported that enemy mortars were causing more casualties than any other one type of weapon. The Army desperately needed a counter-mortar device, and the Signal Corps suggested radar as the answer to this problem.

Radar Sets SCR-584 and AN/TPS-3 were first tested for this function. The SCR-584, an antiaircraft gunlaying set which had already proven very effective in the detection of enemy vehicles, afforded exceedingly accurate data on shell trajectories but was too big for practical front-line use. The Signal Corps turned to its AN/TPS-3, a lightweight search radar which could be transported by plane or carried by troops to a front-line position.

Equipment modifications to make this set more suitable for counter-mortar use were developed at the Evans Signal Laboratory, Belmar, New Jersey, where the first radar observations of the moon were later made. The modified radar was designated AN/TPQ-3.

A large tract of wasteland at Island Beach, New Jersey, was set aside for experimentation and testing of the equipment. Combat Infantrymen with extensive mortar experience were detailed to coöperate in the tests. Actual combat conditions were simulated as closely as possible.

When development work was completed, a squad of Infantrymen was directed to simulate a mortar attack, with live ammunition. Their orders were to select a position, fire one round, and then "move out on the double." The first time this routine was followed their position was located by the radar within two minutes and counter fire was directed with such accuracy that the first round landed within twenty yards of the mortar position.

The modification kit which changed the search radar to a counter-mortar radar was so designed that it could be installed or removed in a matter of minutes. Changes to the equipment involve restricting the scan to sectors of twenty, forty, or sixty degrees instead of a circle, separation of the console from the antenna so it may be installed in a foxhole to protect the operator, elimination of one oscilloscope, and conversion of the remaining Plan Position Indicator oscilloscope so that the center of the sweep is dropped from the center of the scope face to the bottom and the full width of the face can be used in the range spread.

So modified, the radar is a formidable weapon against ground targets.