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Radar Use of Submarines in The Defense Technologies

1. Introduction

Radar technology has greatly evolved over more than seven decades of development, now serving many different commercial and military applications on the ground, in the air, and at sea. Radar has been a significant RF/microwave technology since the days of World War II. During that time, radar (a shortening of "radio detection and ranging") proved an invaluable military tool for locating threats and targets and providing advanced warnings of an adversary's position and direction. The basic operation of a radar system involves transmitting a high-frequency signal (usually a pulsed signal) towards the location of an expected target and receiving signals reflected from said target. By performing signal processing on these radar returns, information can be extracted regarding the target, its position, and its speed.
Military systems still represent the most plentiful source of radar applications, with military radar systems found on land, at sea, and in the air (and in lesser numbers, in space-borne systems).

Recently, threats to the sea route between our country and other countries have come to the fore. In this research, we chose the topic of using radar in submarine vehicles in the defense industry to raise awareness and contribute to the literature. Our goals are to ensure that people who are interested in the subject or who want to become conscious have more resources and contribute to the development of our country in the defense industry.

The submarine is used to determine its geographic location or the position of targets. It interrupts and cuts electromagnetic for a very short time at an acute angle to a certain area. If you are reflected from the environment, the waves are evaluated by the radar and discovery is made.

Radar works on the principle that the radio waves emitted by a transmitter in pulses (SUPLE) are reflected back from objects on their path and captured by a receiver. The receiver can determine the direction and distance of the target from the returning echo, and its velocity from the time elapsed between the two echoes. In this research, we will investigate the use of submarine Radars in the defense industry by scanning articles.

2. Literature Survey

Submarines have to be vehicles with advanced navigation systems, since they are both underwater and their secrecy is important. The tools that enable the submarine to see and recognize the navigation and other friendly / enemy vehicles are called submarine receivers.

2.1 Some Submarine Receivers

- Radar

  The submarine is used to detect its geographic location or position of targets. It makes an electromagnetic landing at a certain area at a narrow angle for a very short time and cuts it. Reflected waves from the environment are evaluated by the radar and thus the discovery is made. Although rarely, it is used to determine the target's route-speed distance parameters before firing a torpedo at the target.

- Active Sonar

  Working on the same principle as radar, sonars send sound waves instead of electromagnetic waves. As the frequency of the "Ping" sent increases, the distance to hit the target and return becomes shorter.

This frequency has a high "Precision" and takes up little space for devices. The effectiveness of high frequency decreases in seas with more layers due to the diversity of concentration, such as the Sea of Marmara. A low frequency can travel long distances, but this frequency has low selectivity and takes up a lot of space for devices. It is a device that should be used carefully for a classic submarine. It can be heard from "Very long distances" depending on the "Ambient Conditions" examined in the Submarine Operations section.

2.2 Applications of Submarines:

Submarines played an important role in the navy of our country. They form part of naval vessels. Submarines are effective in our military, and as other countries expand their navies to include submarines, it is a necessity for Turkey to have submarines to counter as well.

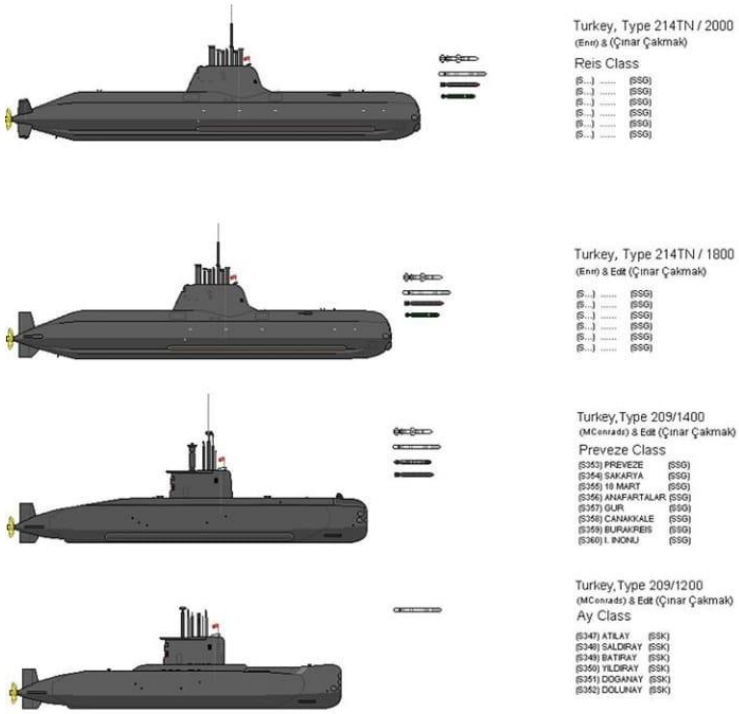
Submarines are most commonly used in navies; but they are also used in other fields. In recent years, they have also been widely used as a research tool. They allow scientists to travel deep and study deep-water marine life. In the past, the depths of the oceans were a mystery. However, with submarines, researchers are given a safe way to study the deep sea.

Submarines have also become popular in tourism. In mostly temperate climates, these ships will take tourists close to the ocean floor in a dry and safe environment. These submarines use the same concepts as those used in the navy, but are built on a much smaller scale without some of the cool vehicles like torpedoes.

Submarines are important tools that can be used for different areas. They are used by the navy, researchers and tourism companies to explore and navigate areas inaccessible with scuba tanks and wetsuits.

2.3 Some Submarines in Turkey

1. Ay-Class Submarine
   -TCG Atılay (S-347)
   -TCG Saldıray (S-348)
   - TCG Batıray (S-349)
   -TCG Yıldıray (S-350)
   -TCG Doğanay (S-351)
   -TCG Dolunay (S-352)
2. Gür-Class Submarine
   - TCG Gür (S-357)
   -TCG Çanakkale (S-358)
   -TCG Burakreis (S-359)
   -TCG 1. İnönü (S-360)
3. Preveze-Class Submarine
   -TCG Preveze (S-353)
   -TCG Sakarya (S-354)
   -TCG 18 Mart (S-355)
   -TCG Anafartalar (S-356)
4. TCG Piri Reis (S-330)



3. Work Performed (Problems about Submarine Radars and Solutions about They)

Radar Transmissions Get Absorbed Under Water

Radar works best when smaller antennas are used to send out narrow beams and the wavelengths of 1 cm suit this purpose. This process makes Radar units send out waves quickly and receive the reflections in short times.

However, this principle, while functioning well over land, runs into trouble under the water. Microwave wavelengths get easily absorbed under the water long before they hit any target object. Most waves emitted from the Radar unit are thus, lost in the vast ocean.

Radar is an Active-Only System

A Radar system must send out waves to get anything reflected. This property makes it an active system. While accuracy can be good with an active system, in warfare, it can be dangerous. Enemy warships might have sensors located on their ships that detect the presence of an active Radar transmission unit.

A Sonar system, on the other hand, can be both active as well as passive. This means that if a submarine just chooses to listen to sound waves without transmitting any, it can do that, too. In this way, a submarine can detect the presence of other underwater objects without giving its position away. This property is helpful not just in warfare but also in marine research.

Lack of Power on Radar to Reach Longer Distances

It is difficult for the electromagnetic waves emitted by the radar to reach a distant object. This requires a powerful radar with larger antennas.

However, if a submarine were to use such a large and powerful antenna, it would have to place the antenna above sea level. This will increase the chances of the submarine being detected from afar by enemy ships.

As a solution, sound waves emitted from a Sonar unit can travel long distances underwater without being absorbed. It is impossible for an enemy ship to locate the source of the Sonar unit as it is completely hidden under the ocean's surface.

The Importance of Using The Right Color

Using the wrong color on a submarine can cause a major safety issue. For this, colors suitable for the environment, the depth of the sea and the purpose of use should be used.

If you plan to manufacture a submarine and use it to do reconnaissance missions and/or attack enemy vessels in the open ocean, you should consider painting your sub black, as that’s just an added layer of security for the submarine.

Some other countries, such as Iran and Israel, are also painted green, as they mostly function in clear, shallow and coastal waters. In such contexts, the green color blends in well.

Also, not all submarines are used for military operations. Subs may also be used for deep-sea exploration and search and rescue missions. In these scenarios, camouflage is not a priority, so you may see submarines of different colors.

4. Future Work

What Kind of Technological Developments Can Occur about Submarines in The Future?

With the development of technology, submarines are expected to have instant and clear information with new technology satellites from space in order to minimize the use of periscopes used in surface exploration for exploration purposes.

It has created a great revolution when the sound of motor vehicles used until this time has decreased to almost zero after the discovery and production of electric vehicles. Another future expectation is that with a new technological development designed for war, submarines that will never reveal their own voice are expected to be designed.

Also, although submarines are painted black to hide, they are partially visible when viewed from above the water. If enough support is given to chemical and material metallurgical engineers, it would be quite logical for them to make a submarine color system whose color changes according to the environment with different chemicals instead of finding a new color. Just like a chameleon.

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