SOSUS

From Wikipedia:

SOSUS, an acronym for **Sound Surveillance System**, is a chain of underwater listening posts across the northern Atlantic Ocean near Greenland, Iceland and the United Kingdom — the GIUK gap. It was originally operated by the United States Navy for tracking Soviet submarines, which had to pass through the gap to attack targets further west. Other locations in the Atlantic and Pacific Ocean also had SOSUS stations. It was later supplemented by mobile assets such as the Surveillance Towed Array Sensor System (SURTASS), and became part of the Integrated Undersea Surveillance System (IUSS). Many other listening posts are still in operation around the world.

History

SOSUS development was started in 1949 when the US Navy formed the Committee for Undersea Warfare to research anti-submarine warfare. The panel allocated $10 million annually to develop systems to counter the Soviet submarine threat consisting primarily of a large fleet of diesel submarines. They decided on a system to monitor low-frequency sound in the SOFAR channel using multiple listening sites equipped with hydrophones and a processing facility that could detect submarine positions by triangulation over hundreds of miles.

Research Phase

At MIT in 1950, the committee sponsored **Project Hartwell**, named after the director of the committee, Dr. G.P. Hartwell, physics professor and president of the University of Pennsylvania. In November, they selected Western Electric to build a demonstration system, and the first six element hydrophone array was installed on the island of Eleuthera in the Bahamas. Meanwhile **Project Jezebel** at Bell Labs and **Project Michael** at Columbia University focused on studying long range acoustics in the ocean.

By 1952, enough progress resulted in top secret plans to deploy six arrays in the North Atlantic basin, and the classified name SOSUS was used. The number of arrays was increased to nine later in the year, and Royal Navy and USN ships, including USS *Neptune* and USS *Peregrine*, started laying the cabling under the cover of **Project Caesar**. In 1953, Jezebel's research had developed an additional high-frequency system for direct plotting of ships passing over the stations, intended to be installed in narrows and straits, called **Project Colossus**.

SOSUS goes operational

In 1961, SOSUS tracked the USS *George Washington* (SSBN-598) from the United States to the United Kingdom. The next year SOSUS detected and tracked its first Soviet diesel submarine. Later that year the SOSUS test system in the Bahamas tracked a Soviet Foxtrot class submarine during the Cuban Missile Crisis. SOSUS was upgraded a number of times as submarines became quieter.

SOSUS systems consisted of bottom mounted hydrophone arrays connected by underwater cables to facilities ashore. The individual arrays were installed primarily on continental slopes and seamounts at locations optimized for undistorted long range acoustic propagation. The combination of location within the ocean and the sensitivity of arrays allowed the system to detect acoustic power of less than a watt at ranges of several hundred kilometers.

SOSUS monitoring stations were known as Naval Facilities (NAVFAC - not to be confused with the Naval Facilities Engineering Command that has the same acronym.) NAVFACs existed in the west at Adak, Alaska; Pacific Beach, Washington; Coos Bay, Oregon; NAVFAC Centerville Beach near Eel River, California; NAVFAC Point Sur near Monterey, California; San Nicolas Island, California; and Naval Air Station Whidbey Island, Washington (1987). In the east, they were deployed at Tom Nevers Naval Facility Nantucket; Lewes, Delaware; Cape Hatteras; and Naval Facility Punta Borinquen, Puerto Rico.

Other NAVFACs were located in the Pacific at Barber's Point, Hawaii, Midway Island; and Naval Base Guam. Also, they were located in the Atlantic at Keflavik, Iceland; CFS Shelburne, Nova Scotia and Naval Station Argentia, Newfoundland (both later removed to CFB Halifax, Nova Scotia); Brawdy, Wales; Antigua; Barbados; Eluthera, Bermuda; Grand Turks; and San Salvador. Data Evaluation Centers were set up at Whidbey Island, Washington and Dam Neck, Virginia in the early 1980’s.

LOFAR (frequency analysis) was carried out on the signals from the arrays and paper outputs (lofargrams) were produced which were used to help detect and classify contacts. When the USS *Thresher* (SSN-593) sank in 1963, SOSUS helped determine its location. In 1968 the first detections of Victor and Charlie class Soviet submarines were made, while in 1974 the first Delta class submarine was observed.

In 1985, the Fixed Distributed System (FDS) test array became operational and the first SURTASS patrol began. The name for the overall system became Integrated Undersea Surveillance System (IUSS). In 1991, the system mission was declassified and the next year it began reporting whale detections and SOSUS work stations began replacing paper lofargrams. The Advanced Deployable System became operational as part of IUSS in 1996.

Current status

SOSUS was gradually condensed into a smaller number of monitoring stations during the 1970s and 80s. However, the SOSUS arrays themselves were based upon technology that could only be upgraded irregularly. With the ending of the Cold War in the 1990s, the immediate need for SOSUS decreased, and the focus of the US Navy also turned toward a system that was deployable on a theatre basis. The SOSUS components are now used for scientific projects, such as tracking the vocalizations of whales and other ocean mammals in various study projects, as a data network for undersea instrumentation packages, and for acoustic thermometry. The SOSUS system was declassified in 1991, although by that time it had long been an open secret.

Commander Undersea Surveillance (CUS), head of the IUSS, was elevated to an echelon IV command 28 February 2007. [1] CUS at NAS Oceana Dam Neck Annex operates under the operational guidance of COMPACFLT. Naval Ocean Processing Facilities in Oak Harbor, Washington, and Virginia Beach, Virginia, still monitor SOSUS and FDS, and they provide SURTASS connectivity around the world.

Intelligence Encyclopedia:

SOSUS (Sound Surveillance System)

Utilizing the unique properties of sound transmission in water, during the 1950s, the United States Navy developed the Sound Surveillance System (SOSUS). Code named "Jezebel" the SOSUS system provided critical monitoring of Soviet submarine and ship movements, especially through the critical ocean gaps between Greenland, Iceland, and the United Kingdom (the GI-UK gap). SOSUS systems were so sensitive that trained observers could determine ship type—and in some cases, identify specific ships.

SOSUS used arrays of hydrophones (underwater microphones) strategically placed along the ocean bottom. The hydrophones were connected by cables to onshore monitoring stations.

In addition to localized sound readings (i.e., sounds detected within the expected range of the hydrophones), SOSUS also picked up sounds channeled through specific conditions of state (i.e., pressure, temperature) or salinity that create channels though which sound waves propagate over long distances with minimal resistance and minimal loss of strength. This sound fixing and ranging channel (SOFAR channel) was discovered independently by American and Soviet scientists in 1943 during World War II.

SOFAR channels are capable of transmitting the low frequency, long wavelength sound waves produced by an explosion. Sound waves can be trapped effectively in SOFAR channels and propagate with little loss of energy over distances in excess of 15,500 miles (25,0000 km).

Naval communication systems utilize low frequency, long wavelength signals to enhance communications with submerged submarines. Prior to the widespread use of Global Positioning System (GPS) equipment, the SOFAR channel was also used for navigation and the location of marine craft. Evidence gathered by marine biologists indicates that certain species of whales utilize the SOFAR channel to communicate mating calls over long distances.

In general, the speed of sound depends upon the medium through which the sound waves propagate and the properties of the medium (e.g., state, temperature, pressure, salinity, etc.) Accordingly, the speed of sound differs in air, fresh water, and oceanic saltwater.

Within the ocean, the speed of sound varies with changes in temperature and pressure. When the near-surface layer is well mixed by currents and surface action, the resulting isothermal layer provides uniform propagation of sound. When a temperature gradient exists (e.g., a temperature decrease with increasing depth), the resulting thermocline shows a characteristic decrease in the speed of sound with decreasing temperature. At some depth (approximately 420 fathoms or 750 meters), the variations in temperature become so slight that the water becomes isothermal. As depth increases, so does the pressure. Because pressure is directly proportional to sound wave transmission speeds, as the pressure increases with depth so does the speed of sound.

Specific combinations of temperature, pressure, and salinity may act to create "shadow zones" that are resistant to the propagation of sound waves or that act as reflectors of sound waves. Soviet submarine captains attempted to use this zone or layer to conceal their ships from detection by surface SONAR arrays. The layers could also "bend" signals detected by the SOSUS array in order to attempt to conceal ship movements. In practice, staying within such layers proved impossible to maintain for extended periods, and intermittent SOSUS plots could be used to track ship movements or provide a probable position to explore with the use of sonar buoys dropped by airplane.

Surface sonar buoys were also used to fill gaps in the SOSUS listening network.