

Loran and shoran essay sample



**ASSIGN
BUSTER**

Is a terrestrial radio navigation system using low frequency radio transmitters in multiple deployment (multilateration) to determine the location and speed of the receiver. - The most recent version of LORAN in use is LORAN-C, which operates in the low frequency portion of the electromagnetic spectrum from 90 to 110 Kilohertz. ♦ History

-LORAN was an American development, advancing the technology of the British GEE radio navigation system that was used early in World War II. While GEE had a range of about 400 miles (644 km), initial LORAN systems had a range of 1, 200 miles (1, 930 km). -It originally was known as " LRN" for Loomis Radio Navigation, after Alfred Lee Loomis, who invented the longer range system and played a crucial role in military research and development during World War II, but later was renamed to the abbreviation for the more descriptive term. - LORAN systems were built during World War II after development at the Massachusetts Institute of Technology (MIT) Radiation Laboratory and were used extensively by the US Navy and Royal Navy.

♦ Principle

" Diagram of the LORAN principle "

The difference between the time of reception of synchronized signals from radio stations A and B is constant along each hyperbolic curve; when demarcated on a map, such curves are known as " TD lines"

The navigational method provided by LORAN is based on the principle of the time difference between the receipt of signals from a pair of radio transmitters.

A given constant time difference between the signals from the two stations can be represented by a Hyperbolic Line of Position (LOP).

If the positions of the two synchronized stations are known, then the position of the receiver can be determined as being somewhere on a particular hyperbolic curve where the time difference between the received signals is constant.

In ideal conditions, this is proportionally equivalent to the difference of the distances from the receiver to each of the two stations.

A LORAN network with only two stations cannot provide meaningful navigation information as the 2-dimensional position of the receiver cannot be fixed due to the phase ambiguities in the system and lack of an outside phase reference.

A second application of the same principle must be used, based on the time difference of a different pair of stations.

In practice, one of the stations in the second pair also may be and frequently is in the first pair.

In simple terms, this means signals must be received from at least three transmitters to pinpoint the receiver's location. By determining the intersection of the two hyperbolic curves identified by this method, a geographic fix can be determined.

◆ LORAN Pulse

◆ LORAN Method

– In the case of LORAN, one station remains constant in each application of the principle, the master, being paired up separately with two other slave, or secondary stations. – Given two secondary stations, the time difference (TD) between the master and first secondary identifies one curve, and the time difference between the master and second secondary identifies another curve, the intersections of which will determine a geographic point in relation to the position of the three stations.

These curves are referred to as TD lines. – In practice, LORAN is implemented in integrated regional arrays, or chains consisting of one master station and at least two (but often more) secondary (slave) stations, with a uniform Group Repetition Interval (GRI) defined in microseconds. The master station transmits a series of pulses, then pauses for that amount of time before transmitting the next set of pulses. – The secondary stations receive this pulse signal from the master, then wait a preset amount of milliseconds, known as the Secondary Coding Delay, to transmit a response signal. – In a given chain, each secondary's coding delay is different, allowing for separate identification of each secondary's signal. (In practice, however, modern LORAN receivers do not rely on this for secondary identification.)

◆ Limitations

LORAN suffers from electronic effects of weather and the ionospheric effects of sunrise and sunset. The most accurate signal is the groundwave that follows the Earth's surface, ideally over seawater. At night the

indirect skywave, bent back to the surface by the ionosphere, is a problem as multiple signals may arrive via different paths (multipath interference).

The ionosphere's reaction to sunrise and sunset accounts for the particular disturbance during those periods. Magnetic storms have serious effects as with any radio based system.

LORAN uses ground based transmitters that only cover certain regions.

Coverage is quite good in North America, Europe, and the Pacific Rim.

The absolute accuracy of LORAN-C varies from 0.10-0.25-nautical-mile (185-463 m). Repeatable accuracy is much greater, typically from 60-300-foot (18-91 m).

◆ SHORAN (SHORt RANge Navigation)

- a type of electronic navigation and bombing system with a precision radar beacon used in the B-26 and B-29

bomber aircraft during the Korean War.

◆ Origin

- In 1938 RCA engineer Stuart William Seeley, while attempting to remove "ghost" signals from an experimental television system, realized that he could measure distances by time differences in radio reception. In summer 1940, Seeley proposed building SHORAN for the Army Air Force. Contract was awarded 9 months later, and SHORAN given its first military flight tests in August 1942. First procurement was spring 1944, with initial combat operations in northern Italy on December 11, 1944.

◆ Structure

SHORAN, which operates at 300 MHz, requires an airborne AN/APN-3 set and two AN/CPN-2 or 2A ground stations. The equipment onboard the aircraft includes a transmitter, a receiver, an operator's console and a K-1A model bombing computer. ■ The transmitter sends pulses to one of the ground stations and the system calculates the range in statute miles by clocking the elapsed time between transmitter pulse and the returned signal.

The system was intended for use in navigation, but it became obvious that it would work well for blind targeting during bombing runs in poor visibility. The setup made up of the K-1A bombing computer combined with the navigation system was the first SHORAN. The SHORAN system is designed so that as the aircraft faces the target, the low-frequency station should be on the left, and the high-frequency station is on the right. This allows the computer to triangulate the two stations and the target. ◆ Limitations

A maximum range of 300 statute miles (480 km) and a clear radio path

No more than 20 aircraft may contact a pair of stations at once

Complex parameter calculations made prior to flight cannot be changed during the bomb run

Station angle must be between 30 degrees and 150 degrees, and the exact geographical position of each of the two ground stations and the target must be known

The 100-statute mile (160 km) ambiguity must be recognized and taken into account

There are only four possible approaches to any one target, all predefined by the geometry of the system

Because the system is line-of-sight limited, the plane must fly at altitudes above 14, 000 feet (4, 300 m) and sometimes as high as 16, 000 feet (4, 900 m), depending on local geography. These altitudes are not easily made by a fully loaded bomber. The engines are worked to capacity.

Only stationary targets can be attacked

The use of statute miles instead of nautical miles may be confusing in some situations