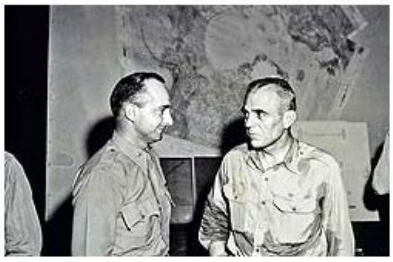
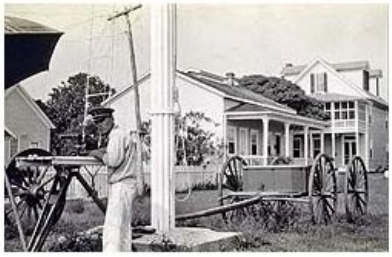
CARL ASLAKSON AND THE VELOCITY OF LIGHT

The Making of an Earth Measurer





In the April 2009 issue of Hydrointernational, Carl Aslakson was mentioned as having devised a method of determining the velocity of light by using Shoran (short-range navigation). This article traces Aslakson's professional career from his beginnings as "a farm boy in South Dakota, working in the fields with barley beards inside my clothing and dust and perspiration covering my face and hands" to becoming one of the most accomplished surveyors of his era.

The name Carl Aslakson is not recognised by the general public and is little known by the community of surveyors. His accomplishments and work influence the surveyors of today almost as much as they had during the mid-twentieth century. Aslakson joined the US Coast and Geodetic Survey (C&GS) in 1924 aged 27. He spent the next 32 years surveying in far corners, both for the C&GS and the US Army Air Forces. Aslakson's relatively advanced age as a newly minted officer was the result of being raised on a South Dakota farm, then serving as a marine in the First World War, and going on to college following the war. Armed with a degree in Civil Engineering, he joined the C&GS directly out of college. However, he was indefatigable, had great curiosity and possessed a talent for both mathematics and electronics. Fortunately, he also shared his life and times through his autobiography, which was passed on to the National Oceanic and Atmospheric Administration (NOAA) Central Library.

Initially, Aslakson followed a normal career path for a C&GS officer in the 1920s. He served five straight years on US C&GS ships, starting with theBacheon the Atlantic coast of the USA, then on theNatoma, which worked in south-east Alaska and on the coast of Washington state, and finally out to the Philippine Islands where he served on theMarinduqueprior to transfer to the USA in 1929. Aslakson survived a stingray barb in his ankle during his Philippine tour, acquired while conducting plane table mapping in shallow waters. He also survived being stung by a poisonous cone shell. While surveying off a mangrove swamp, he was even almost attacked by a very large salt-water crocodile, but his Philippine Constabulary guard shot it not more than 20 feet from his plane-table setup. Aslakson then showed just a glimmer of the talent that would make him one of the greatest "earth measurers" of his era. For surveying in mangrove swamps, and particularly where there were nooks and crannies that were difficult to observe with a plane-table setup, he devised the "sextometer", a 15-foot rod with targets at each end that could be observed by sextant.

Basically, the angle sub-tended by the sextant angle would be directly convertible to a distance.
Returning to the USA in 1929, Aslakson was transferred to Geodesy. His first assignment was to a triangulation party working from Nebraska eastward – from there moving to New Orleans. Before finishing the triangulation work in New Orleans, Aslakson was detached to take over a first-order baseline measuring party, measuring eight baselines throughout various parts of Louisiana and Texas. During this period, Carl Aslakson found his true vocation. He had an affinity for working with precision instruments and precision work. The baseline work required taping with "four different [invar] tapes, all standardised by the Bureau of Standards. Splitting the base roughly into three sections, we obtained a comparison between different pairs of tapes on each section, re-taping any kilometre if the check between the forward and backward taping exceeded five mm or less than 0.2 inches. That was half the allowable check but I used it because our results were so consistent."

Over the next few years, Aslakson headed various triangulation parties working throughout the interior of the USA and on one occasion a levelling party. No bureaucrat but a through-and-through field engineer, Aslakson twice used tornadoes hitting his party's camping ground as an excuse for "cleaning up my inventory." In these five years, he had been responsible for executing over 8,000 miles of triangulation as well as measuring the previously mentioned 36 first-order bases. In the late 1930s, he was made chief of a gravity party introducing him to time measurements in the order of 1/10,000,000 of a second. Between gravity jobs he was also acting as a consultant on various difficult geodetic problems. The most remarkable was the measurement of a first-order baseline in New York City that had end-points on a six-

story and a 16-story building.

On the eve of the Second World War, Aslakson was working on an international assignment conducting gravity observations throughout Peru and Colombia. Upon entry of the USA into the war, he was transferred to the Army Air Forces and conducted mapping operations in China and South America before returning to the USA. At this point, he was introduced to the electronic navigation system Shoran (short-range navigation). The Army Air Forces wished to use Shoran for positioning photogrammetric aircraft, but Aslakson came up with another idea: “I reasoned that if the distance between two ground stations could be measured simultaneously, we could actually measure the distance between two points on the ground by establishing a Shoran ground station there andfly across the line between the two stations. Then if a recorder could be made which would automatically record the distances to each station at all times, the two distances could be added and the minimum sum distance would be when the aircraft was exactly on the line joining the two stations. Then the minimum distance sum, corrected for height of the aircraft and certain other corrections, could be reduced to an accurate distance. Thus, instead of mapping by triangulation or measuring all the angles of triangles we could measure all the sides of triangles. The process would be *trilateration* not *triangulation*.”

Field tests of this technique showed systematic differences between Shoran-measured distances and those measured by classical geodetic techniques. He obtained an article by Louis Essen of the UK Physical Laboratory that led him to try Essen’s published value of 299,792±9km/second for the velocity of light in lieu of the then-accepted value. Using Essen’s value, he obtained much better results. After checking all additional possible sources of error, Aslakson concluded that the then-accepted velocity of light was incorrect: it was 16km/s too slow. He published his results of 299,792.3±2.4km/s in *Nature* in 1949. His methods were totally independent of a parallel effort by Erik Bergstrand, inventor of the geodimeter, who obtained a value of 299,796±2km/s in 1949. All three came up with essentially the same result by using totally different methods. However, Aslakson was the first to use electronic distance-measuring techniques for large-scale geodetic operations.

His work with Shoran and other defence-related needs kept Aslakson in the Army Air Forces until the summer of 1947. He was then detached from the Army and returned to the C&GS. Except for short assignments to the shipsLydoniaand thenHydrographeras executive officer, he spent the remainder of his career in geodesy helping launch the space age as the first C&GS officer assigned to work with the US Air Force at missile launching and missile tracking sites. He retired from the C&GS in 1955 as a captain. Despite being 59 years of age, he was recruited by Virgil Kaufmann, the founder of Aero Service Corp., and spent the next 14 years roaming the globe. His knowledge helped survey the Saudi Arabia–Bahrain boundary, and helped provide countries such as Saudi Arabia, Iran, Angola and Guatemala with base maps. He was instrumental in establishing the geodetic control for tracking stations for both John Glenn’s orbit of the Earth and for the Project Gemini launches. In 1969 he retired for good. He and his wife Marian continued travelling the world, spending considerable time overseas. On all of these trips, he always had time for his beloved shell collecting. If not on the coast, he would look for land species. The only continent that seems to have escaped his footprints is Antarctica, perhaps because of the poor shells.

Aslakson wrote his autobiography, aged 83, and reflected: “Had I chosen a different career I might have ended up with more of the worldly goods but I never have regretted remaining with the C&GS. At the conclusion of one’s professional career it is a source of satisfaction to be able to say that even if the opportunity presented itself that career would not be changed.”

Carl Aslakson’s work was recognised in a modest way: by the Department of Commerce with an Exceptional Service Award and by the Franklin Institute of Philadelphia. In 1960, the Franklin Institute awarded him the Boyden Premium, set up by a physicist in the 1800s who was concerned with studies of the velocity of light. Carl Aslakson passed away on 11 March 1982. The Earth had lost one of its great measurers.

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