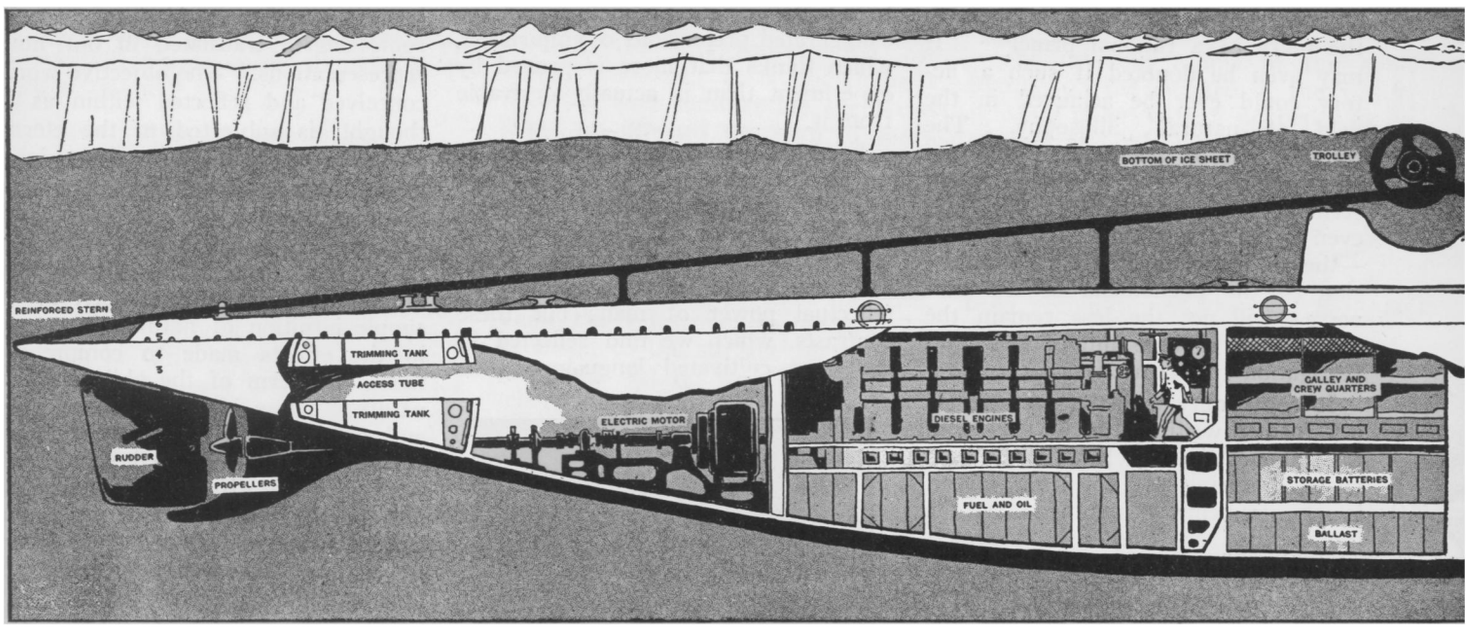


Under the Top of the World By Submarine

Exploration

THERE IS far more significance to a submarine voyage across the Arctic Ocean than the thrilling satisfaction of beating Jules Verne at his own game. Next year's expedition will increase the scientific knowledge of the North Polar region as could be done in no other way. In an interview given for this article, a veteran explorer tells how this will be done.

By J. W. YOUNG

A Scientist in the Arctic

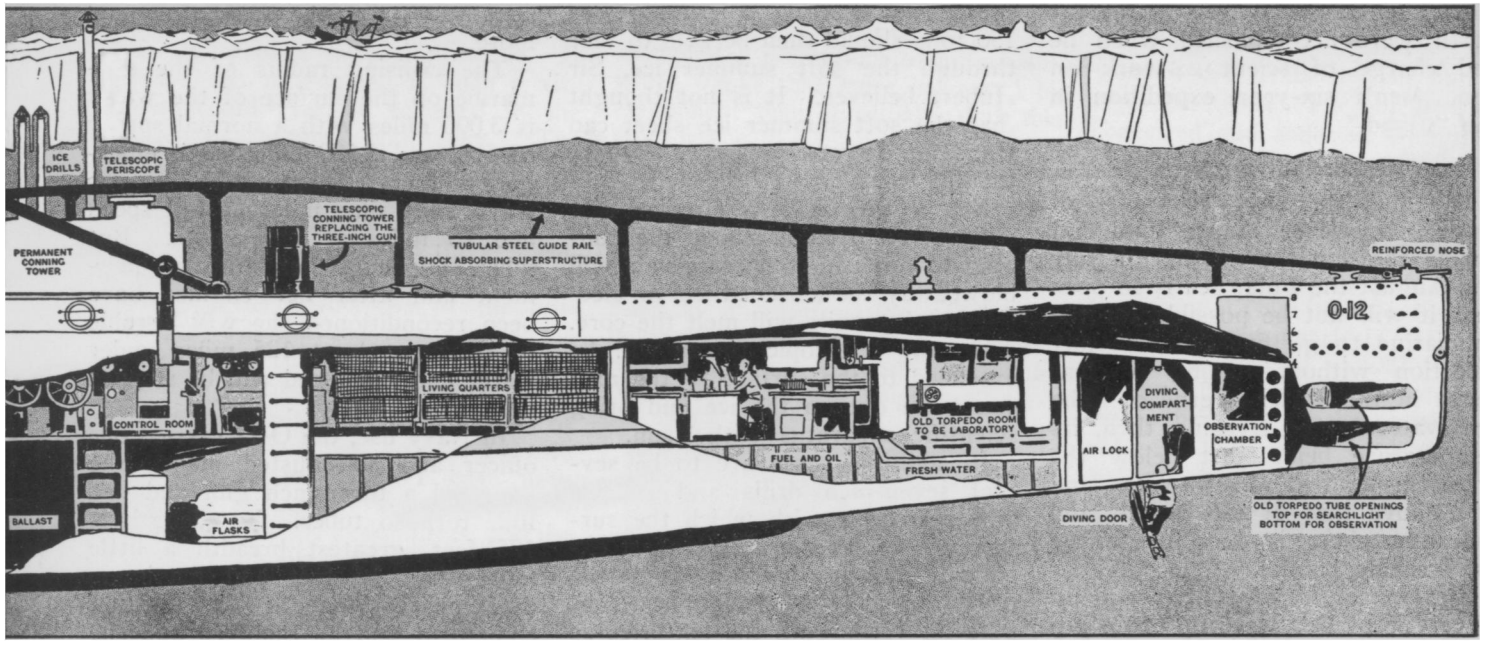
DISTANT, cold and unmapped is the Arctic ocean. Yet it is very likely that by the end of next summer scientists will know more about this bleak sea than about any of the other great bodies of water in the more favored climates of the world.

This knowledge will come from the first submarine expedition into the Polar regions now being definitely planned for July and August of 1931 by the intrepid British explorer, Captain Sir George Hubert Wilkins. Sir Hubert has distinguished himself by Polar exploration afoot, he has flown far into the Antarctic and across North Polar regions, and now he is daring to penetrate the third dimension of discovery

Lincoln Ellsworth, American, who has spent much of his life in the Arctic, will be associated with the venture, which is called the Wilkins-Ellsworth Transpolar Submarine Expedition, Sir Hubert has announced. But it is not known yet whether Mr. Ellsworth will actually make the trip. He will decide next month after he returns from exploring the unknown headwaters of the Hamilton river in Labrador.

While the mind of the layman immediately visions insurmountable difficulties and final disaster to a submarine traveling beneath the Arctic ice, many leading scientists and authorities on this region have commended the proposed expedition as being entirely safe and practicable and promising princely returns of scientific knowledge.

It is said that the expedition will be safe because Sir Hubert plans to use a submarine especially adapted for navigation beneath the ice. It will be equipped with devices for traveling safely under the ice and for



As the submarine Nautilus, now the O-12 of the U. S. Navy, will appear when reconditioned for a voyage of scientific exploration across the Arctic ocean next July and August

coming to the surface through the thick floes. Moreover, the Arctic is not as cold and as dangerous in the summer as popular imagination pictures it.

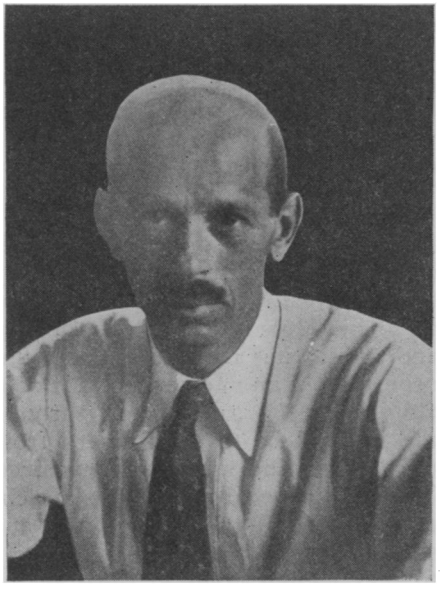
An immensely valuable store of scientific knowledge will be gathered because a submarine is large enough to carry to inaccessible regions many scientific instruments, and remain there in safety for days while observations are being made.

The project is not at all new, for a submarine was successfully operated under the ice years ago. The chief proponent of this form of navigation is Simon Lake, the famous submarine inventor.

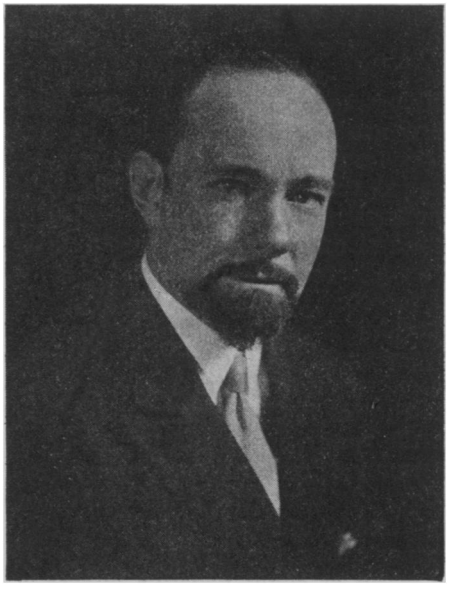
Early Under-Ice Craft

As early as 1897 Lake read a paper on the advisability of such a trip before a group of scientists at Johns Hopkins University. Later, during the Russo-Japanese War, he built several successful under-ice submarines for Russia and navigated similar vessels under ice in this country.

The submarine of the present expedition will be mastered by the experienced Lieut. Comm. Sloan Danenhower, a graduate of the U. S. Naval Academy and a former officer in the Naval Reserves. Comm. Danenhower has had no Arctic experience but he knows the sea and underwater craft. He was with the Navy a few years after graduation from Annapolis and during the World War, and even in civilian life his activities have concerned submarines and salvaging vessels from the sea bottom. Last summer, as trial captain for inventor Lake, Comm. Danenhower conducted tests on the "Defender" for the U. S. Navy to find ways of making submarines safer.



Dr. Harald U. Sverdrup, to direct the scientific work



Sir George Hubert Wilkins, leader of the expedition

It may be that the call of the North he is answering now comes from father to son; for the father, Lt. J. W. Danenhower, also of the U. S. Navy, was one of the few survivors of the disastrous yet important De Long expedition in 1879-1881. This expedition drifted with the pack ice in the "Jeanette" north of Wrangell Island off the coast of Siberia thereby exploding the theory of a continent being in that part of the Arctic.

On the other hand, Dr. Harald U. Sverdrup, who is expected to direct the scientific studies of the expedition, is a veteran of the Arctic. His

most important activities in the far north were accomplished when he had charge of scientific work on Amundsen's six-year expedition in the "Maud."

Open Summer Seas

Dr. Sverdrup says his years of Arctic experience assure him that during the summer months of July and August the Polar sea is so open that it will not be possible for the submarine to go five miles in any direction without finding a clear space in the water overhead. The sea water is not freezing then, its temperature being just below the freezing point of fresh water and just above that of salt water, and the atmosphere is also just above the freezing point.

Sir Hubert is, of course, equally as certain as Dr. Sverdrup of finding plenty of places where his submarine can rise to the surface. When he appeared before the American Geophysical Union recently, to explain his plans and ask the opinion of the American scientists, he said:

"My experience of 15,000 miles of Arctic flying and 5,000 miles of walking over ice shows me that there are patches of water in the Arctic even in winter. It will be recalled that Amundsen landed two seaplanes only 90 miles from the Pole and dragged one up on a cake of ice and took off in it."

Protected from above by a shock-absorbing super-structure and by reinforcements on the bow and stern, the submarine will travel slowly below the ice held against the bottom of the pack by a slight positive buoyancy, Comm. Danenhower explains. In his submarine work he has already operated vessels in this manner along the irregular floor of the ocean at slight negative buoyancy to keep them down.

A trolley-like apparatus attached to the top of the submarine will fly up through very thin ice or in open water to indicate where the vessel can rise between the floes. But if this indicates no open space, a thin spot will be picked out by the amount of light that comes through the ice into the water below.

The exact thickness of the ice above the submarine can be determined instantly by comparing the position of the trolley with the depth indicator reading.

When all the water ballast is pumped out, the upward force of the submarine exerting a pressure of 150 tons should then be able to tear through the soft summer ice, Sir Hubert believes. It is not thought that the soft summer ice sheet can stand an upward pressure of more than 25 tons.

But if this fails, a circular saw will cut an opening above the conning tower, and compressed air will blow away the loosened ice, or electric heating units will melt the core. Then the telescopic tower will be extended to the surface so the men can come out on the ice and bring scientific apparatus with them.

In addition, there are to be several seven-inch drills and smaller two-inch drills with which the surface can be reached, Sir Hubert explains. Through holes made by the drills air will be brought the engine for recharging the batteries so the submarine can begin another trip of more than 100 miles without coming up. But if it is desired to take observations at that point, the holes will be filled with chemicals which will quickly melt the ice and bring the vessel to the surface. Men will be able to come to the surface through 10 feet of ice while holes for air can be driven through as much as 50 feet.

Dynamiting Through

"If engineers can drill thousands of feet into the ground for oil, why can't we drill through a few feet of ice?" Sir Hubert asks. But drilling and ice sawing may be entirely unnecessary, even in emergency. Probably the best way to break through the ice will be to send divers from the submarine with explosives. These heavy charges will be attached to the bottom of the sheet and set off from a distance by electricity to tear gaping holes in the thickest floes.

The submarine O-12 of the U. S. Navy, rechristened the Nautilus, which has been on the de-commission list for four years, is being remodeled for the expedition. This work is being done by Lake and Danenhower, Inc., to whom the vessel has been chartered for one dollar a year. The first named partner is the inventor Lake, whose firm built the O-12 in 1916 and 1917.

The Nautilus is a small vessel as modern submarines go, having a surface displacement of only 485 tons and a submerged displacement of 566 tons. Most submarines built in recent years displace 2,000 tons and more.

The cruising radius of the submarine on the surface of the water is 3,000 miles with a normal supply of fuel and 5,500 miles with emergency fuel. Submerged she can travel only nine miles at full speed and 75 miles at two knots. But when stripped of her fighting equipment and after her engines have been reconditioned she will be able to travel at least 125 miles under water and her speed will be stepped up.

In Navy use, the O-12 carried one officer and 30 enlisted men. She mounted a three-inch gun and had four torpedo tubes. Her length is 175 feet, greatest breadth a little more than 16 feet and maximum draft nearly 14 feet. The fighting equipment will be removed and she will be completely rebuilt and fitted with novel apparatus for the expedition.

For the North Pole trip there will be an operating staff of 12 and a scientific staff of six. Two of the submarine's four torpedo tubes will be turned into powerful focusing search lights and the other two will be used as observation windows. She will also have a decompression chamber from which men can emerge in diving suits even though the vessel is far under water. A television transmitter as well as the usual radio sending and receiving sets will be carried.

Little danger is anticipated from ice projecting down into the water. There are no icebergs of any great size in the Arctic. Large pressure ridges have been observed only near the coast and the deepest of these extend not more than 100 feet beneath the sea.

Bottom Like The Top

If they are encountered the submarine can easily descend to that depth and pass under them. Even if they are not observed in time and are hit full on, the reinforced bow will protect the ship from damage.

Dr. Sverdrup says the bottom of the ice field is very much like its surface. It is rough but only to the extent of small irregularities beneath which the submarine will be able to slide easily. The deepest projections of ice along the route of the submarine are not expected to exceed 30 feet, while their average depth is thought to be only 10 feet.

Unlike all other Arctic explorers, it will be the problem of the men in the submarine to keep cool rather than warm. The electric motors and Diesel engine will run up the temperature of the close atmosphere well above that of the water outside.

The ship will cover the least known part of the Arctic traveling in a straight line from Spitsbergen to Alaska. The distance is 2,200 miles but it may be that only 2,000 miles will lie through ice fields. Two hundred miles north of Spitsbergen is well within the eighty-second parallel of latitude and only about 500 miles from the Pole. The great unknown territory to be explored lies on the other side of the Pole, toward Alaska.

This route is the same that Amundsen took with the airship "Norge," but far more valuable information will be collected on the two-month under-water trip than Amundsen could gather on his short air dash of a few hours' duration.

Some scientific work can be carried on while the submarine is actually in motion under the ice. Most of it, however, will be accomplished when the vessel comes to the surface at approximately 50-mile intervals. Let Dr. Sverdrup, himself, tell what is to be done:

Deep Sea Work

"The most important of the scientific studies to be made is the deep sea work. Temperatures will be measured and samples of sea water will be taken at different depths to be analyzed for its salt and chemical content.

"All we know about the currents of the Arctic ocean comes from observations made by Nansen when instruments were by no means as accurate as they are now. We need definite information about the Polar sea to understand the currents of the North Atlantic. One branch of the Gulf stream enters the Arctic north of Spitsbergen as a deep sea current, and a surface current comes out of the Arctic along the coast of Greenland and joins the Labrador current. Scientists want to know what happens to these currents in the Arctic ocean.

"These are the only currents of any consequence that enter or leave the Arctic. Elsewhere the entrances to this ocean are too shallow to permit the passage of much water.

"To collect plant and animal life of the cold waters the submarine will probably carry an inverted mast on her bottom. Nets will be attached to it and allowed to trail in the water. Results of these findings should help to clear up the great differences of opinion that exist as to plant and animal life in Arctic waters.

"Some explorers think that seals and polar bears are abundant all over the Arctic sea while others believe these animals exist in quantity only near the coasts and are

Lieut. Comm. Sloan Danenhower, captain of the Nautilus

scarce in the central part of the region. In my opinion lack of sufficient light in the Polar sea is unfavorable to the development of plant organisms, and where there are no plants animals will not find nourishment. Definite conclusions will undoubtedly be reached as a result of this expedition.

"Collection of samples of ooze and mud from the bottom can be carried on better from a submarine in the Arctic than from a surface craft in other waters, because the submarine remains absolutely still. The wire will not be snapped by the roll of the vessel as often happens in other cases.

"An apparatus is dropped overboard and it falls rapidly to the bottom and penetrates it three or four feet. When withdrawn it brings up a core several inches in diameter which shows bottom deposits layer by layer. From them scientists can delve into the history of the ocean for many thousands of years, because these deposits are made extremely slowly.

To Measure Gravity

"Another observation to which the submarine is especially well adapted is that of measuring the force of attraction of the earth's gravity. This is a very delicate measurement made by accurately timing the strokes of a pendulum. The pendulum swings fastest where gravity is strongest and will indicate a very slight change of its force. Of course, the rolling of a ship keeps the pendulum strokes from being uniform, but in a submarine there will be no trouble from this source.

"In fact, the observations can be made best while the ship is submerged. This has been done in other parts of the world by scientists in search of an almost stationary position on the ocean.

"Gravity readings taken elsewhere show that the material under the oceans is apparently more dense than that of which the continents are made. The great density of the ocean bottom probably balances the lighter water above. These readings from the Arctic are anxiously awaited by the scientific world to see if they will verify this theory.

"Magnetic observations must be made at a distance of at least 100 yards from the submarine so they will not be affected by its iron and steel. They will show the deviation of the compass needle from its true direction, a knowledge that is important in all kinds of navigation. It will be essential to know these deviations if commercial aviation across the Arctic between America and Europe ever becomes a reality.

Magnetic Observations

"Magnetic observations of the Polar region are just as important to the scientists as those of any other part of the world, and now there is a big gap across the Arctic ocean. It can be filled by observations of the submarine. This is the same kind of information the ill-fated "Carnegie" gathered from all oceans. The "Carnegie," however, was a non-magnetic ship and accurate readings could be taken aboard her.

"Of course, the first observation to be made at any stop is that of position. This is necessary both for navigation and (*Turn to page* 159)

Top of World—Continued

for the application of all scientific data. Although it will be very foggy in the Arctic in July and August, my experience shows that the sun will be seen enough for observing purposes. This fog, which is a great menace to aerial navigation and handicapped Amundsen in the "Norge," will have no effect on the submarine.

"Soundings will also be made on the trip by the sonic depth finder, and this can be done while the vessel is in motion. Wilkins has already made the deepest sounding in the Polar sea, nearly three and a half miles, measured in 1927. Sir Hubert also hopes to carry an observation balloon which can be sent up with a camera so that pictures of the ice fields can be taken.

"This opportunity is so unique and possesses such splendid possibilities for systematic observation that it cannot fail to add enormously to the store of information about the Arctic. The one great advantage of the submarine is that it can go in the summer to any place in the Arctic ocean carrying all necessary scientific apparatus. An ice breaker is its nearest rival, but the ice breaker cannot go far because its radius of operation is greatly limited by its big engines and small fuel capacity."

Science News-Letter, September 6, 1930

Indians of California had organized school systems with elementary and higher instruction in ceremonial and religious matters, long before white men came into their country, is the finding of an anthropologist at the University of California.

Wood alcohol, or methanol, is poisonous regardless of whether it enters the body by the mouth, the lungs, or skin.