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Title: Kon-Tiki Communications--Well Done!

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Kon-Tiki Communications – Well Done!

THE most unusual expedition ever to place reliance on amateur radio for communication departed from Callao, Peru, last April 28th. Known as Expedition Kon-Tiki, a group of Scandinavian scientists set sail in a 45-foot balsalog raft of primitive construction. It was the theory of Thor Heyerdahl, Norwegian ethnologist and leader of the venture, that the settlement of the Pacific Islands resulted from a migration of American peoples who had sailed there many hundreds of years ago, rather than a trek from Asia as claimed by other scientists. To prove that such a migration was possible, Mr. Heyerdahl decided to attempt the trip in a raft of the type preserved in Inca legends and early Spanish historical accounts. He named the expedition in honor of the ancient pre-Inca sun god. Secondary objective of the undertaking was to make any observations during the voyage that could be useful to science.

The Kon-Tiki raft was fashioned of logs of the lightest wood in existence and lashed together with native-made hemp rope. Its only sources of locomotion would be the Pacific trade winds and the Humboldt Current which sweeps northward along the west coast of South America and thence in the direction of the Tuomotu Archipelago.

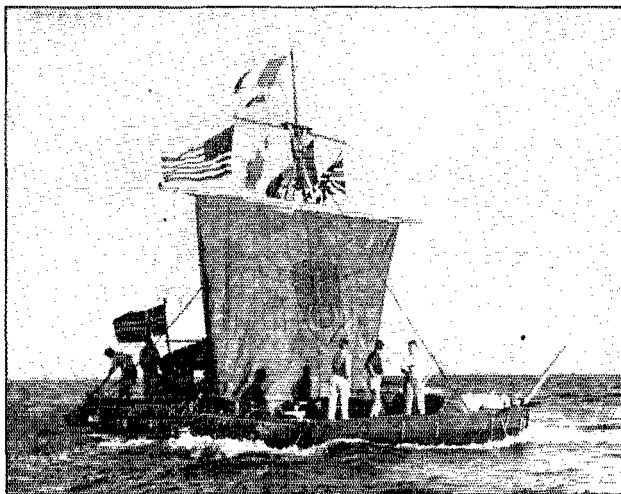
Needless to say, Kon-Tiki faced countless dangers. Amateur radio can feel flattered that it was asked to assist in such an unusual undertaking. In late 1946 ARRL was approached by Captain Bjorn A. Rorholt, LA1GA, Assistant Military Attaché on the Norwegian Embassy staff in Washington, who requested amateur cooperation. LA1GA had received the assignment of organizing radio communications for the expedition. He had worked out a communication plan which entailed use of normal marine channels for emergency purposes and the 7-, 14-, 28- and 50-Mc. bands for contacts with amateurs. Authority had been received for Kon-Tiki to use the call LI2B. After numerous discussions of amateur requirements, ARRL alerted a group of amateurs to

assist. The following were among those initially selected: W3ECP, W3FNG, W3LVY, W3YA, W6CIS, W6RBQ, W6WB, KH6DD.

The expedition carried two radio operators without previous amateur experience, Torstein Raaby and Knut Haugland. Both were eminently well qualified to go along on such a hazardous voyage. The former operated clandestine radio stations from occupied Norway during World War II, sent vital information to England and received instructions for the Norwegian underground. He also took part as radio operator in the action that resulted in total destruction of Germany's production and stock of heavy water, essential in atomic-energy research. Raaby, as the radio operator of a special intelligence unit under British command, transmitted to England from Norway essential information about the

German battleship *Tirpitz* which ultimately led to her sinking by British bombers.


The conditions under which the radio equipment aboard the raft was to operate presented many unusual problems. Proximity of the craft's deck to the sea and the relatively small protection afforded by the thatched bamboo cabin meant that the gear would have



to withstand the effects of moisture. It was desired to have transmitter units light and tight enough so that if they should fall overboard they could be fished out and put to work again immediately. Operation was required on maritime as well as amateur frequencies. Both 'phone and c.w. were specified. The transmitters were to be tuned, closed up and remain watertight unless something went wrong. It must be possible to load them up on antennas of whatever length could be erected on available supports. With these requirements in mind, W1CTW and W1EHT of the National Company engineering staff designed and constructed the needed rigs. One transmitter was built to operate on 7 and 14 Mc., another for 28 Mc. and a third for 50 Mc. The circuit for the 7-14 Mc. rig was taken

(Continued on page 148)

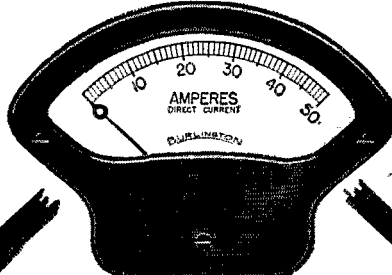
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WWV Schedules

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Mc.	EST	Power Output (kw.)	Audio Freq. (Cycles)
2.5	7:00 P.M.-9:00 A.M.	1.0	440
5.0	7:00 P.M.-7:00 A.M.	10.0	440
5.0	7:00 A.M.-7:00 P.M.	10.0	400 and 4000
10.0	continuously	10.0	440 and 4000
15.0	continuously	10.0	440 and 4000
20.0	continuously	0.1	440 and 4000
25.0	continuously	0.1	440 and 4000
30.0	continuously	0.1	440
35.0	continuously	0.1	440

A 0.005-second pulse may be heard as a faint tick every second, except the 59th second of each minute. These pulses may be used for accurate time signals, and their one-second spacing provides an accurate time interval for physical measurements.

The audio frequencies are interrupted precisely on the hour and each five minutes thereafter, resuming after an interval of precisely one minute. This one-minute interval is provided to give Eastern Standard Time in telegraphic code and to afford an interval for the checking of radio-frequency measurements free from the presence of the audio frequencies. Ionospheric-disturbance warnings applicable to the North Atlantic path are given at 20 and 50 minutes past each hour. If a disturbance is in progress or is anticipated within 24 hours, the time announcement is followed by 6 Ws; if conditions are quiet or normal, the time announcement is followed by 8 Ns. The announcement of the station's services and of the station's call (WWV) is given by voice at the hour and half hour.

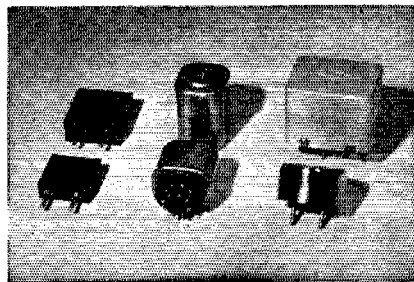
The accuracy of all the frequencies, radio and audio, as transmitted, is now better than a part in 50,000,000. Transmission effects in the medium may result in slight fluctuations in the audio frequencies as received at a particular place; the average frequency received, however, is as accurate as that transmitted. The time interval marked by the pulse every second is accurate to 0.000001 second. The beginnings of the periods when the audio frequencies are off are synchronized with the basic time service of the U. S. Naval Observatory.

Operating News

(Continued from page 69)

from the article "A Versatile Portable-Emergency Transmitter," published in July 1941 QST, the 28- and 50-Mc. units patterned after the circuit of W1HDQ's "Mobile Rig for 50 and 28 Mc." which appeared in the June 1946 issue. The Kon-Tiki versions of these transmitters employed 2E30 tubes in all stages and ran about 10 watts input. The modulator used three 2E30s. An antenna tuning unit utilizing a pi-network was used. Each of the units was built into its own watertight aluminum box with power input and output connectors made leakproof by use of

(Continued on page 144)



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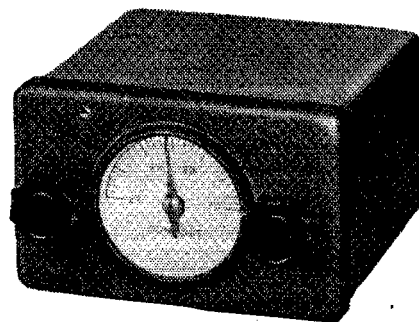
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rubber gaskets. Specifications called for omission of meters in all equipment since it was thought that they might become useless after continued use under such severe conditions. All tuning up was done by the familiar amateur procedure of using neon bulbs and lamp loops.

The type of power supply was much discussed beforehand. Storage batteries with a charger of some kind would probably have been a good solution. But taking a lesson from their experiences during the war, the operators decided against their use. Such batteries often broke, spilled acid and damaged vital equipment. It was regarded as a great risk to have acid anywhere near the ropes which held the nine logs of the raft together. Wind-driven generators were considered but discarded as being too large. It was finally decided that the power supply be dry batteries and hand generators. The batteries were encased in a box similar to that used for the other transmitter units.

The main receiver chosen for LI2B was an NC-173. Other equipment carried included a hand-cranked emergency set of the Gibson Girl type for 500 and 8280 kc., a special v.h.f. set for contacting aircraft, both provided by the U. S. War Department, and two of the famous British 3-16 Mc. Mark II transmitters (dropped by the hundreds in all occupied countries during the war). After early trials of various antennas, including balloon- and kite-supported types, the antenna chosen for all operation was an end-fed wire supported at the far end by the raft's 40-foot mast.

For the first twenty-two days following departure from Callao, Kon-Tiki's only radio contact was with OBE, station of the Peruvian Naval School. WHD, the *New York Times* station, had warned the expedition beforehand about a dead spot off the coast of Peru. The operators later agreed that such a dead spot does exist. LI2B called its amateur key stations according to plan on specified frequencies during this early period but without success. Then on May 20th at 9:44 p.m. PST, Harold Kempel, W6EVM, heard and worked the raft on 14,142 kc., providing the first North American contact. By mid-June LI2B had worked numerous amateur stations including W1CWX, W1DQH, W3YA, W5FNA, W6AOA, W6CIS, W6EVM, W6ICP, W7GXA, W8PCS, W8UJ, W9TB, W9UKO, VE3ACL, VE3OZA, KH6DD, OA4AE, ZL4DD on 14 Mc. and W4KXV, W6GAL, KZ5AW, KZ5AZ, KZ5ND on 28 Mc. For work with 28-Mc. stations Kon-Tiki, by special authorization, used the frequency 27,980 kc. to avoid the possibility of QRM.

As the weeks rolled by a smoothly-working long-haul network of amateur stations developed. Stations in North America, Canal Zone and Norway coöperated in handling the flow of information from the raft. On the West Coast W6EVM and W6AOA were the mainstays. EVM kept nightly schedules with LI2B and W3FNG, Washington, D. C., on 14 Mc., relayed

(Continued on page 148)

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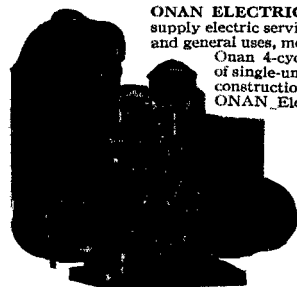
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messages to and from the Norwegian Embassy and transmitted meteorological data to the U. S. Weather Bureau. On at least two occasions urgent traffic was exchanged between the Embassy and the raft via this circuit. In one instance a message was relayed from the raft to W3FNG, delivered by telephone to the Embassy, an answer procured and relayed in the reverse direction to Kon-Tiki—all in a matter of thirty-five minutes elapsed time!


Another reliable circuit from LI2B to Washington was provided by W3YA, State College, Pa. Students and faculty members kept the college station in regular direct touch with the expedition. Schedules were maintained nightly to expedite delivery of traffic. W3YA also assisted in relaying information from LI2B to Norway, in some cases direct to LA1C, at other times via schedules with W1AW and other stations.

The expedition personnel were of course anxious to keep in touch with Norway. Prior arrangements had been made to have LA1C, headquarters station of the Norwegian Radio Relay League, serve as end link in a relay route. W6AOA became the very important link from LI2B. He relayed reports during the first several weeks to W1CWX, who in turn passed them on to LA1C via direct schedule. When other factors interfered with his schedules CWX turned the job over to various other stations. Among those who assisted in this manner were W1AW, W1DX, W1LYL, W3GAU, W3YA, W4KXV, KZ5AW, KZ5AZ, KZ5ND, LA3GA.

One of the highlights of the voyage was a contact between LI2B and LA7Y on August 5th. The Kon-Tiki operators radioed this statement about the event: "It was a great day for us. While in contact with W6EVM, he told us that LA7Y, whom he had just contacted, had heard LI2B. After completing schedule with W6EVM, LI2B called LA7Y and contact was established with RST 559 reports both ways. This happened at 0630 GCT when Kon-Tiki had the position South 15 degrees 50 minutes and West 141 degrees 25 minutes. The distance would be about 10,000 English miles." Subsequently LA7Y was worked several times and messages exchanged.

In spite of careful advance planning to reduce technical troubles, the LI2B operators had difficulty with certain elements of their equipment. The supply of dry batteries arrived in Peru so late that there was no opportunity to pack them in watertight cases. Heavy seas were encountered during the first few days and part of the heater battery reserve was damaged by exposure to water. Humidity was also so great that the capacity of the tells fell considerably even when not in use. After two months at sea all heater-batteries were down to 4 volts. Fortunately the plate batteries with their light drain were holding up well. Resourcefully, the operators disassembled some of the latter, rewired the cells in parallel and thus provided heater supplies of adequate capacity to keep LI2B on the air.

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During the last month of the voyage much time was spent repairing batteries as the supply dwindled. After being used one month the crystal of the 14-Mc. transmitter was fractured. New crystals were installed but also became defective. The only alternative left was to tune the ten-meter rig to 14 Mc., the resulting frequency forcing LI2B to 13,990 kc. These equipment difficulties were not more serious than to keep LI2B off the air four days.

The mission of Kon-Tiki was successfully completed August 7th, 101 days after departure from Peru, when waves deposited the raft on a reef off Ratora Island. But the safety of the courageous crew which had made the venture a success was still at stake. Half an hour after being stranded LI2B was fortunate in making contact with ZK1AB on Raratonga, who was asked to stand a listening watch and communicate with the Norwegian Embassy at Washington if LI2B was not heard at the end of a 36-hour period. Just before the specified period ended, contact was established with W0MNU and word of the landing passed along, thus avoiding the necessity of sending out any rescue parties.

After being taken off the reef by natives, the Kon-Tiki crew set up their radio gear ashore and were on the air for five days. Again from a little village at Raro the station was active for five days. French authorities allowed LI2B to open up once more aboard the government ship *Tamara* which took the men to Tahiti where the station was operated ashore and made its final contact with amateurs. The expedition crew then returned to the United States by ship.

In addition to those already mentioned, other amateurs assisted in various ways. W3AMS, W3JDQ and W3ECP aided W3FNG in handling schedules with W6EVM. W3ECP was instrumental in making advance arrangements for contact with Washington. W6CIS, W6RBQ and W6WB assisted in covering LI2B transmissions.

Amateur radio can be justifiably proud of its record in providing service for which the Kon-Tiki crew, the agencies served and the Norwegian Radio Relay League have expressed their unqualified praise and gratitude. Hearty congratulations to all who took part.

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