5. 한자 NAVTEX 시스템의 설계에 관한 연구

A Study on the Design of Chinese Character Code for NAVTEX system

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International NAVTEX messages are broadcast at fixed time on 518 kHz in English. But in many areas there is great interest in transmitting similar information in a second language. Important messages may be transmitted in national language on another frequency, 490 kHz, assigned by ITU and in some areas messages are also sent out on the 4 MHz. NAVTEX can also be of great value to smaller craft, such as fishing vessels and pleasure crafts.

First of all, this thesis gives the technical standard for broadcasting and receiving Chinese character NAVTEX information. This standard is suitable not only for the usage and management of the marine communication service but also for the design and manufacture of Chinese character NAVTEX equipment.

Then it gives the equivalent idea. Although correcting one bit error in a symbol or code block, the error ratio decreased rapidly. The result is that equivalent BER decreases two order of magnitudes after correcting one bit error in the code block than no error code control.

The Chinese character NAVTEX information processor is designed for the existing equipment in the coastal stations. The transmitter can switch, tune and control output power by the remote controller on 518 and 490 kHz. This processor is compatible with Chinese and English.

A receiver is designed to provide a Chinese/English NAVTEX receiver that tunes at 490/518 kHz, automatically receives and prints navigational warning, meteorological information and urgent information either in Chinese or in English.

In order to transmit Chinese characters, they must be coded by the telegraphic code in the traditional radio communication system, which every 4-digit expresses one Chinese character. The Set of 4-digit has 10,000 kind of combinations. One space between two 4-digits must be needed in the transmitting procedure, so every five-symbol expresses one Chinese character in practice. One symbol consists of 7-bit, 4B/3Y mode, and the transmission rate is 50 bauds in the general NAVTEX system. It means that 1.43 Chinese characters will only be transmitted per second.

This thesis puts forward an innovative method for broadcasting Chinese character NAVTEX information. Every Chinese character is expressed by 3-English alphabet, and the space between two 3-English alphabets is no need. The Set of 3-English alphabet has 17,576 kind of combinations and it is larger than ones of 4-digit. For transmitting Chinese character

this method is less two symbols than the traditional ones, so the transmission efficiency is improved by 40%. Now the new NAVTEX system can transmit 2.38 Chinese characters in one second.

For ease addressing, the alphabet of English and Chinese character is arranged in the special order. The total is 8,320 sites. There are 8,178 sites from the Area 1 to Area 87 in GB2312-80, so it is enough to express all Chinese characters, symbols and some empty sites in this standard.

In normal condition such as the limited amplitude of RF signal and the test method, the symbol error rate of NAVTEX receiver is about 1%. If by means of the present NAVTEX system to transmit Chinese character, the character error rate will be 4% to 5%, so it is no acceptable.

In this thesis the special horizontal-vertical parity-check code is adopted. 3-English alphabet expresses one Chinese character, and every English alphabet is coded in 4B/3Y mode, which can check the symbol error but cannot find the bit error. An additional code block is used to check the situation of error bits in one error symbol. When the error bit is found, we can correct it. This kind of Error Control Code, horizontal-vertical parity-check code, not only corrects single-error bit, but also does all odd and part even error bits in same symbol.

Under the same external condition, Chinese character error rates in new NAVTEX system decreases two orders of magnitudes than ones in the present system.

In order to keep the data in RAM, the backup battery always needs. The time for holding data in the traditional NAVTEX receiver is about 6 hours after the power shutting off. For holding more data and longer time, the capacity of battery is larger. The lifetime of battery is about two or three years, and easily rust the Printed Circuit Board along with the electrolyte flowing out from battery.

There is no any backup battery in Chinese character NAVTEX receiver. An EEPROM fully replaces RAM and backup battery. It can keep the stored data for ten years and the endurance, read-in time, is 10,000 to 100,000 cycles. If we suppose that the mean times of read-in to EEPROM are 50,000, twenty times every day, then the endurance will be 2,500 days or 6.85 years.

The price of EEPROM is inexpensive, similar to RAM and battery.

In other hand, Chinese character NAVTEX receiver of no use battery is in favor of protecting the entironment.

Now the general NAVTEX receiver is a direct printing installation. As the condition of the most fishery vessels is poor, such as the extreme temperature (high or low), heavy moisture and salt in air, unstable power supply, NAVTEX receiver printing on paper may be not suitable for the practical condition of China. In this thesis a new idea of LCD NAVTEX receiver is provided, as it can greatly reduce the price, save power, operate simple and maintenance ease.