

USS COD SS-224 RADIO OPERATIONS

The boat, the radios and their
general operation aboard the
World War Two Fleet Submarine
USS COD.

Presented to WRECS
Western Reserve Emergency Communications Service

January 22, 2009



USS COD SS-224

THE USS COD IS A WW2 GATO CLASS FLEET SUBMARINE.



NAMED AFTER THE FISH, THE COD WAS LAUNCHED ON MARCH 21, 1943 AND COMMISSIONED ON JUNE 21, 1943.

LENGTH: 312-FEET BEAM: 27-FEET

DISPLACEMENT:

SURFACED: 1,800-TONS

SUBMERGED: 2,400-TONS

SPEED:

SURFACED: 24-MPH

SUBMERGED; 9-MPH

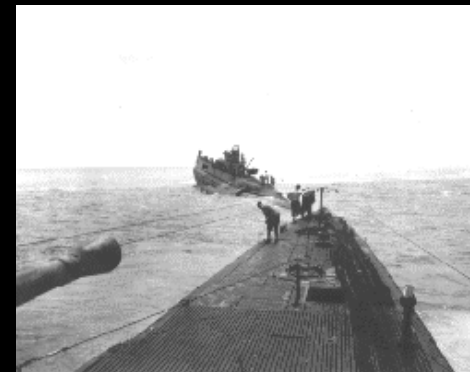
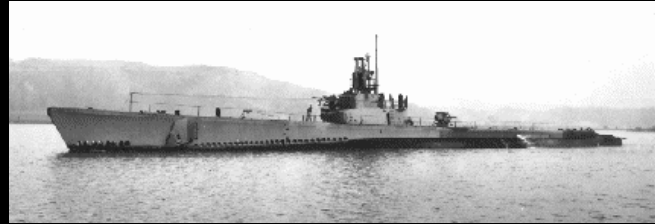
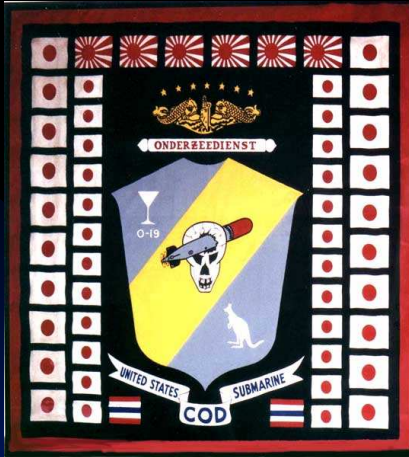
NAVY CALLSIGN:

"NECO"

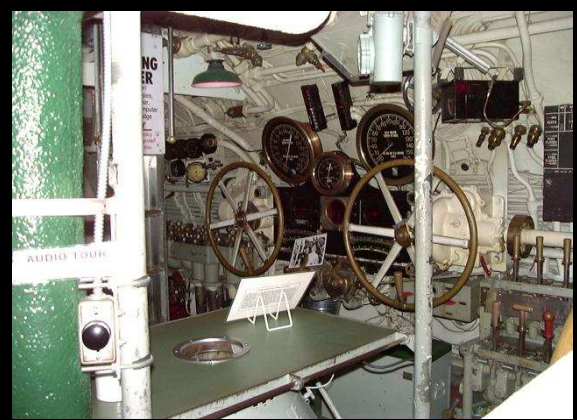
USS COD STATISTICS

- *COD* SAILED 88,254 MILES DURING HER SEVEN PATROLS (EXCLUSIVE OF MILES SAILED TO AND FROM THE USA).
- *COD* BURNED 1,023,963 GALLONS OF DIESEL FUEL.
- TOTAL PATROL DAYS WERE 415, WITH 108 OF THEM SUBMERGED FROM DAWN TO DUSK.
- DURING HER SEVEN WW-II WAR PATROLS *COD* FIRED 122 TORPEDOES RECORDING 39 HITS.
- HER SKIPPERS CLAIMED 10 SHIPS SUNK AND 5 DAMAGED BY TORPEDO. THIS IS THE SAME AVERAGE TORPEDO/SHIP SINKING RATIO AS FOR ALL US SUBS DURING WW2, ONE SHIP SUNK FOR EVERY 12 TORPEDOES FIRED. (IN COMPARISON, THE GERMAN U-BOATS SANK ONE SHIP FOR EVERY FOUR TORPEDOES FIRED).
- *COD* ALSO DESTROYED ANOTHER FIVE SHIPS, 24 JUNKS AND 11 FLOATING MINES AS "SUNK BY GUN FIRE".
- *COD*'S DECK GUNS FIRED 117 ROUNDS OF 4-INCH, 50-CALIBER; 117 ROUNDS OF 5-INCH, 25-CALIBER, 1,404 ROUNDS OF 40 MM, 200 ROUNDS OF 20 MM, AND 1,450 ROUNDS OF .50-CALIBER MACHINE GUN AMMO.

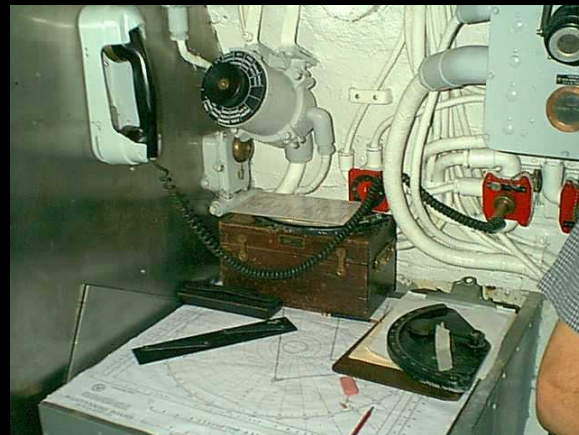
SOME PICTURES



MORE PICTURES



AND EVEN MORE PICTURES



THE RADIO ROOM

THE RADIO ROOM IS A L-SHAPED AREA LOCATED ON THE PORT SIDE OF THE BOAT JUST AFT OF THE CONTROL ROOM AND IS ACCESSED THROUGH A SLIDING METAL DOOR. IT IS VERY CRAMPED QUARTERS WITH BARLEY ENOUGH ROOM FOR TWO MEN TO SIT SIDE BY SIDE.



BESIDES THE RADIOS THE RADIO ROOM ALSO HOLDS THE ECM MARK 2 CIPHER MACHINE WHICH WAS USED TO ENCRYPT AND DECRYPT "BIMEK" RADIO MESSAGES.

IN THE ARMY THIS MACHINE WAS KNOWN AS SIGABA.

A PAPER STRIP CIPHER KNOWN AS "FEMYH" WAS ALSO USED.

RADIO RECEIVERS

THE MAIN RECEIVERS ABOARD THE WW2 SUBMARINES LIKE THE COD ARE THE RAK/RAL COMBINATION.

THIS SERIES OF RADIOS ARE USED AS COMMUNICATION RECEIVERS FOR CW, MCW, AND VOICE.

BOTH TYPES OF RECEIVERS WERE IDENTICAL IN APPEARANCE, WITH THE DIFFERENCE BEING IN THE TUNING RANGE.

THEIR PHYSICAL SIZE WAS APPROXIMATELY A 15 X 18 X 24 INCH CUBE, AS WERE THEIR RESPECTIVE POWER SUPPLIES.

THE UNITS WERE DESIGNED TO OPERATE FROM THE SUBMARINE'S 115 VOLT, 60 CYCLE AC SUPPLY LINES OR IN THE CASE OF AN EMERGENCY THEY COULD BE SUPPLIED POWER BY THE SUBMARINE'S BATTERIES.

THE RAK/RAL'S WERE MOSTLY MANUFACTURED BY THE RADIO CORPORATION OF AMERICA.

RAL / RAK RECEIVERS

FREQUENCY RANGE:

RAK - 15 TO 600 KCS IN SIX BANDS

RAL - 300 TO 23,000 KCS IN SIX BANDS

NEITHER TYPE RECEIVER HAS A CALIBRATED TUNING DIAL AND REQUIRED THE USE OF A SEPARATE FREQUENCY STANDARD TO SET THE DESIRED FREQUENCY.

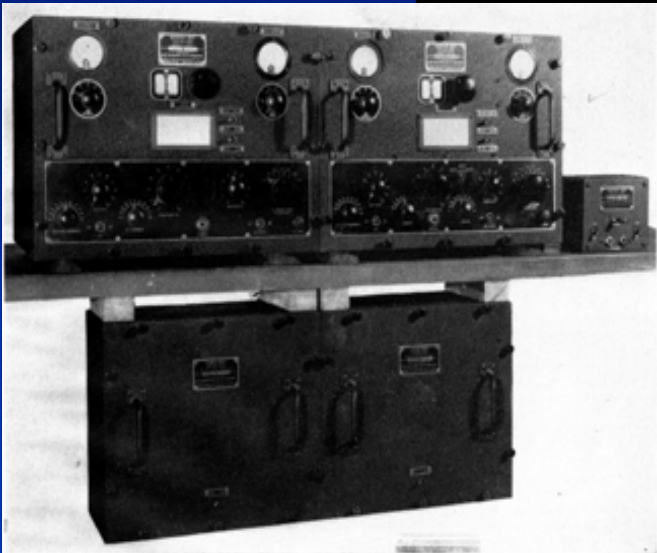
THE COD'S TWO SETS OF RAK / RAL COMBINATIONS



RAL / RAK CONTINUED

THESE RADIOS EMPLOYED TWO STAGES OF TRF, ONE REGENERATIVE DETECTOR, LOW PASS FILTER, FIRST AF AND AUDIO OUTPUT CONNECTED TO A TUBE SOMETIMES REFERRED TO AS AN AVC BUT MORE PROPERLY CALLED A LIMITER.

THE POWER UNITS ARE VERY CAREFULLY DESIGNED TO MAINTAIN AN ACCURATE CALIBRATION OF THE RECEIVER UNITS WITH A HIGH DEGREE OF FREQUENCY STABILITY.



THE POWER SUPPLY CIRCUIT INCLUDES RF FILTERS ON THE A-C SUPPLY LINE, A CURRENT REGULATING BALLAST LAMP, ELECTROSTATICALLY SHIELDED POWER TRANSFORMER, RECTIFIER TUBE, TWO-STAGE FILTER, VOLTAGE REGULATOR, AND A PROTECTIVE BLEEDER.

THE UNITS ARE COMPLETELY SHIELDED BOTH INTERNALLY AND EXTERNALLY TO MINIMIZE CROSS TALK BETWEEN RECEIVERS.

RBO RECEIVERS CONTINUED

THE RBO IS PROVIDED WITH A SELF-CONTAINED RECTIFIER TYPE POWER UNIT WHICH SUPPLIES ALL REQUIRED OPERATING VOLTAGES UPON CONNECTION TO A SUITABLE A-C SOURCE.

THE COD HAS TWO RBO RECEIVERS. ONE IN THE RADIO ROOM AND THE OTHER IN THE OFFICER'S WARD ROOM.

BAND SWITCHING AND TUNING ARE ACCOMPLISHED BY CONVENTIONAL METHODS.



THE MAIN TRANSMITTER



TBL TRANSMITTER

THE MAIN TRANSMITTER ABOARD THE BOAT IS THE TBL WHICH WERE DESIGNED AND BUILT BY THE WESTINGHOUSE CORPORATION.

THE TRANSMITTER WAS ACTUALLY TWO TRANSMITTERS HOUSED IN ONE CABINET THAT MEASURED SIX FEET HIGH BY ALMOST THREE FEET WIDE AND WEIGHED OVER 804 POUNDS.

FREQUENCY RANGE: 175 - 600 KC. AND 2,000 - 18,100 KC.

POWER OUTPUT AND EMISSION: 200 WATTS A1 (CW), 100 WATTS A2 (MCW) (MF BAND ONLY) AND 50 WATTS A3 AM.

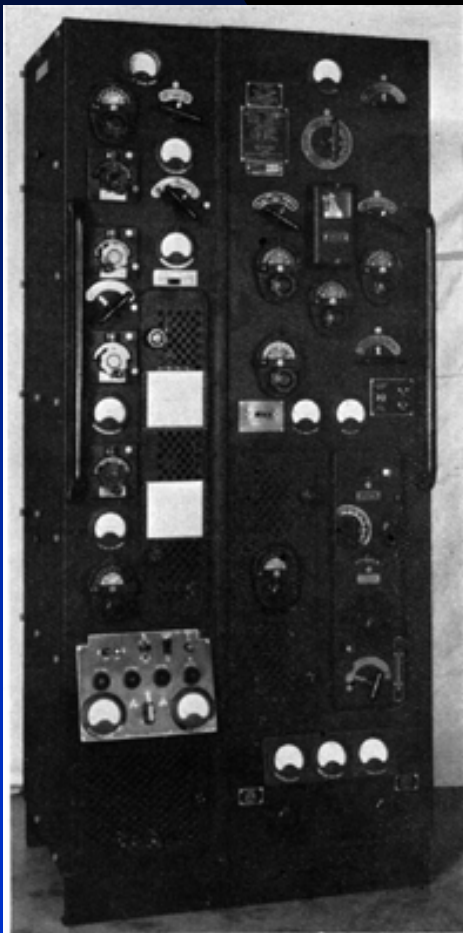
POWER FOR THE TRANSMITTER WAS PROVIDED BY A MOTOR-GENERATOR USUALLY LOCATED IN THE PUMP ROOM.

TBL TRANSMITTER

THE GENERATOR WAS POWERED DIRECTLY FROM THE SUBMARINE'S 250 VOLT DIRECT CURRENT POWER BUSS.

GENERATOR OUTPUTS WERE 2,000 VOLTS DC, 1,000 VOLTS DC, 250 VOLTS DC AND 220 VOLTS, 60 CYCLE ALTERNATING CURRENT (AC).

THE LATTER FOR THE FILAMENTS OF THE TBL.



THE COD'S TBL-7

LM FREQUENCY METER

NEITHER THE RECEIVERS NOR THE TBL HAD CALIBRATED TUNING DIALS.

THE USE OF A SEPARATE FREQUENCY STANDARD WAS NEEDED TO SET THE DESIRED FREQUENCY.

KNOWN AS THE LM FREQUENCY METER (AND THE BC-221 BY THE ARMY) IT PROVIDS A VERY ACCURATELY CALIBRATED AND STABLE RADIO FREQUENCY SIGNAL FOR TUNING THE RADIOS AND TRANSMITTERS.

THE LM WAS DESIGNED AND FIRST PRODUCED BY THE BENDIX CORPORATION.



THE COD'S LM-18 AND POWER SUPPLY

VHF / UHF TRANSCEIVERS

LATER ON IN WWII THE SCR522 AND SCR624 VHF AND UHF TRANSCEIVERS WERE ADDED TO THE RADIO ROOM.

THESE WERE MULTI CHANNEL CRYSTAL CONTROLLED TRANSCEIVERS USED PRIMARILY TO COMMUNICATE WITH AIRCRAFT, PARTICULARLY DURING LIFE GUARD OPERATIONS.



THESE RADIOS WERE ALSO USED FOR SHORT RANGE COMMUNICATIONS WITH OTHER SUBMARINES AND SHIPS.

ON 02-SEP-1944 THEN LT. JG. GEORGE H.W. BUSH WAS RESCUED BY THE USS FINBACK SS-230 AFTER SPENDING FOURS HOURS IN THE WATER AFTER HE BAILED OUT OF HIS DAMAGED PLANE.

THE ANTENNAS

HARD TO SEE IN THE PHOTO BELOW ARE THE VARIOUS ANTENNAS ON THE COD.

FOR HF THERE ARE TWO WIRE ANTENNAS AND A VERTICAL ANTENNA ALONG WITH ANTENNA FOR VHF, UHF AND THE VARIOUS

ANTENNAS FOR THE SD AND SJ RADARS.

WHEN WE OPERATE HF FROM THE BOAT WE USE THE WIRE ANTENNA ON THE STARBOARD SIDE.

IT IS 85-FEET LONG AND ABOUT EIGHT FEET ABOVE THE DECK.

THE HULL ITSELF IS USED AS A COUNTERPOISE.

FED WITH A TUNER THIS ANTENNA WORKED WELL.



FOX BROADCASTS

THE ONLY MEANS OF GETTING INFORMATION SUCH AS CHANGES IN ORDERS AND LETTING OTHER SUBMARINE CREWS KNOW WHAT WAS HAPPENING AROUND THEM WAS BY MEANS OF THE RADIO FOX SCHEDULES.

NAVY BASE RADIO STATIONS LOCATED IN HONOLULU AND AUSTRALIA, ALONG WITH OTHER LOCATIONS, WOULD TRANSMIT THESE FOX SCHEDULES WHICH CONSISTED OF ENCODED FIVE LETTER CODE GROUPS.

THESE SCHEDULES WERE USUALLY TRANSMITTED 24-HOURS A DAY. TO FILL ANY VOID IN TRANSMISSION TIME, PREVIOUS MESSAGES WOULD BE REPEATED.

THEREFORE, NO INCREASE OR DECREASE IN SUBMARINE ACTIVITY WOULD BE REVEALED TO THE ENEMY BY AN INCREASE OR DECREASE IN FOX SCHEDULE ACTIVITY.

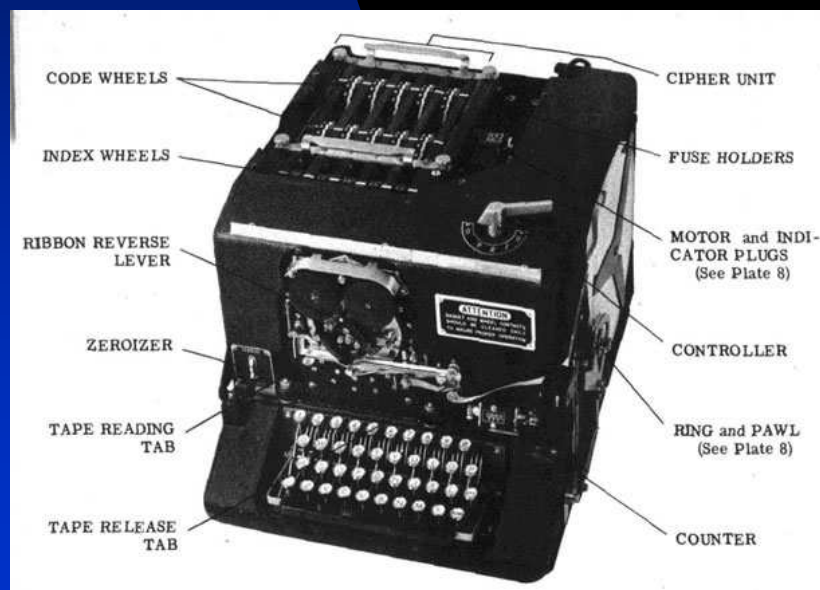
SUBMARINES USED TWO SECRET CODES, ONE BEING THE BIMEK CODE AND THE OTHER WAS THE FEMYH CODE.

THE DIFFERENCE BETWEEN THE TWO IS THAT THE BIMEK CODE WAS ENCODED AND DECODED ON THE ECM (ELECTRONIC CODING MACHINE) LOCATED IN THE RADIO ROOM AND THE FEMYH CODE WAS ENCODED AND DECODED ON A SLOTTED ALUMINUM BOARD ALONG WITH LETTERED PAPER STRIPS.

CODED MESSAGES

ONLY QUALIFIED OFFICERS ONLY WERE AUTHORIZED TO ENCODE AND DECODE THESE CODES, BUT RADIO OPERATORS WERE TAUGHT THE USE OF THE FEMYH CODE WHEN ATTENDING THE ADVANCED RADIO SCHOOL AT NEW LONDON. CT.

IN BOTH CASES, BIMEK OR FEMYH, RECEIVED MESSAGES AND THE TRANSMITTED MESSAGES WOULD HAVE THE FIRST AND LAST FIVE LETTER GROUPS OF THE MESSAGE START AND END WITH EITHER THE WORD BIMEK OR FEMYH.



THE SECOND AND NEXT TO LAST WORD OF THE MESSAGE WOULD BE A SPECIAL FIVE LETTER GROUP SELECTED BY THE ENCODING OFFICER.

THIS GROUP WAS USED AS PART OF THE KEY USED FOR SETTING THE ECM MARK 2 AND THE PAPER STRIPS FOR ENCODING AND DECODING.

ECM MARK II CIPHER MACHINE

MESSAGE FORMAT

THE MESSAGE HEADINGS WERE PRETTY WELL GENERIC IN STRUCTURE.

THE HEADING WOULD START OUT WITH NR FOLLOWED BY THE NUMERICAL NUMBER FOR THE MESSAGE TRANSMITTED THAT MONTH, SUCH AS NR102.

AT THE BEGINNING OF EACH MONTH THE NUMBERING SYSTEM WOULD REVERT TO THE NR1.

EACH MONTH THE RADIO OPERATOR WOULD START A NEW PRE-NUMBERED SHEET WITH NUMBERS GOING FROM 1 TO 1000 AND AS THE NUMBERED FOX SCHEDULE MESSAGES WERE RECEIVED THE OPERATOR WOULD DRAW A LINE THROUGH THAT RECEIVED NUMBER.



ANY MISSING NUMBERED MESSAGE WOULD BE EASILY NOTICED BY MERELY BY LOOKING AT THE NUMBERED SHEET.

A MESSAGE COULD HAVE BEEN MISSED DUE TO THE SUBMARINE BEING SUBMERGED, BUT THE SHEET WOULD INDICATE THAT THE MISSED MESSAGE AND IT COULD THEN BE COPIED DURING A REPEATED SESSION.

USS COD AMATEUR RADIO CLUB

THE USS COD AMATEUR RADIO CLUB IS A LOOSE KNIT GROUP OF HAMS WHO LOVE THE OLD BOAT AS MUCH AS WE DO RADIO.

BESIDES OPERATING THE RADIOS, MEMBERS ALSO ASSIST WITH MAINTENANCE OF THE BOAT, LEARN ABOUT HER OPERATION, HER SYSTEMS, HER HISTORY AND THAT OF THE SUBMARINE SERVICE AND SHARE THIS WITH VISITORS TO THE BOAT. (THERE IS NO REQUIREMENT TO DO SO OR TO OPERATE THOUGH).

THE CLUB CALLSIGN IS W8COD.

FOR AMATEUR RADIO OPERATIONS ABOARD THE SUB WE HAVE AN OLD DRAKE TR-7A AND TUNER STUFFED AMONG THE ORIGINAL RADIO EQUIPMENT IN THE RADIO ROOM AND FEED THESE TO ONE OF THE ORIGINAL WIRE ANTENNAS ON THE BOAT.

OPERATIONS ARE MOSTLY CW AND SSB ON 20 AND 40-METERS AT UP TO 100-WATTS.

BESIDES SPECIAL EVENTS AND FIELD DAY, WE TRY TO KEEP THE BOAT ON THE AIR AS MUCH AS POSSIBLE.

AMATEUR RADIO PICTURES



OPERATING W8COD

IF YOU ARE INTERESTED IN VISITING THE BOAT AND OPERATING W8COD OR WOULD LIKE MORE INFORMATION ABOUT THE CLUB, PLEASE CONTACT ME AT ONE OF THE PLACES LISTED BELOW.

Bill Chaikin KA8VIT

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2-Meters 145.410 (- offset with 110.9 PL)