

# **ULTRA IN THE ATLANTIC**

## **Volume 1**

### **ALLIED COMMUNICATION INTELLIGENCE AND THE BATTLE OF THE ATLANTIC**

**An Edited Version of SRH-009**

- Brief Review of War in the Atlantic up to the Reading of U-boat Traffic in December 1942.
- The U-boat and Allied Naval Communication Intelligence.
- Winter/Spring U-boat Offensive and the U-boat's Defeat, 1943.
- U-boat Restoratives.
- New U-boat Fleet and the Schnorkel.
- Compromise of Allied Codes and Ciphers by German Naval Communications Intelligence.

Edited  
By  
Jeffrey K. Bray



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Jeffrey K. Bray

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# ULTRA IN THE ATLANTIC

## VOLUME I

### ALLIED COMMUNICATION INTELLIGENCE AND THE BATTLE OF THE ATLANTIC

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## Acknowledgments

This effort was originally intended to correct the quality of the copies that are currently on file at the National Archives and Records Administration in Washington, D.C. Throughout the process of retyping and editing the manuscript many individuals contributed to the overall success and the open disclosure of the "Battle of the Atlantic History."

Specifically I would like to thank Vice Admiral John M. McConnell, Director of the National Security Agency and his outstanding staff in the Freedom of Information Office; Mr. Bernard Calvacante and Mrs. Kathy Lloyd at the Operational Archives, Naval Historical Center; Mr. John Taylor and Mr. Barry Zerby at the Military Reference Branch, National Archives and Records Administration; Mr. Dennis Vetock at the U.S. Army Military History Institute; Mr. Grady Lewis and Irv Newman at the Naval Cryptologic Veteran's Association; Mrs. Alice Creighton at the Special Collections Division, Nimitz Library, U. S. Naval Academy; and Lt. Patrick Padgett and LN1 Steve Neal at the Staff Judge Advocate Office, Naval Security Group Command.

I would also like to thank Dr. Carl Boyd, at Old Dominion University, for his assistance and encouragement provided throughout the whole effort. The assistance provided by the many cryptologic veterans of the Second World War who have also given their time is greatly appreciated.

Every attempt has been made to correct any errors in the manuscript. The original copy was in draft form and never went into production. The intent has been made to keep the history in the same format as drafted. Several corrections are included and, in some instances, clarification is offered to benefit the reader's understanding. Any oversights are those of the editor.

## Preface

The Battle of the Atlantic series was an official internal history of the activities of Director of Naval Communications (OP-20-GI-A). The history comprised of five volumes. In the original draft version appendices appeared in between individual chapters. This format can result to confusion and interrupts the normal flow of the text. All of the appendices have been combined into a single group and comprise the contents of volume six.

**Specifically, the contents of each volume are as follows:**

- |            |                                                                  |
|------------|------------------------------------------------------------------|
| Volume I   | Allied Communication Intelligence and the Battle of the Atlantic |
| Volume II  | U-Boat Operations                                                |
| Volume III | German Naval Communication Intelligence                          |
| Volume IV  | Technical Intelligence from Allied Communications Intelligence   |
| Volume V   | German Naval Grid and its Cipher                                 |
| Volume VI  | Appendices                                                       |

Volume one of the U.S. Navy's "Battle of the Atlantic" history serves as a brief review of the conflict from a communications intelligence perspective. Volume one is a full disclosure edition of Special Research History-009 (SRH-009) of the Records of the National Security Agency (Record Group 457) presently held at the National Archives and Records Administration. While the actual authors have remained anonymous it is known that the draft version was proof read and annotated by Captain Joseph N. Wenger.<sup>1</sup> The work was so closely guarded that even the senior officers assigned within the Atlantic Section were not aware of its development or

<sup>1</sup>The annotations have been verified by the Editor's interview with Admiral Wenger's son Jeffrey Wenger on 2 January 1994. Wenger was then the head of OP-20-G.



existence.<sup>2</sup> The study is most likely the product of Lieutenant John V. Connorton who was Captain Wenger's staff historian for OP-20-G.

The American "Battle of the Atlantic" history is not an all encompassing document. The series was written near the end of the war. The project was started around November 1944 and was not completed until after V-J Day. Since the American history was completed as the war was ending it only uses sources available at the time in the offices of the Atlantic Section. However, unknown to many, the British at GC&CS were able to accomplish a more comprehensive study. A twenty-four volume naval history of communications intelligence in the Second World War was completed following the end of the war. This series exclusively covers the naval conflict in the Atlantic and European theaters. A good portion of this history was the product of several American naval officers assigned to Bletchley Park.<sup>3</sup> The British effort was able to utilize all sources, Allied and Axis, in documenting the war from the perspective of communications intelligence and as such presents a more comprehensive study.

The American study does provide a detailed view of the struggle for the Atlantic. The problems of Allied collaboration continuously plagued the communications intelligence effort. The increasing levels of intercepted message traffic, especially following the Normandy landings, placed a heavy strain on the whole apparatus. Nevertheless, as it is demonstrated, the priority of eliminating the U-boat threat with this new form of special intelligence reconciled many differences.

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<sup>2</sup>Editor's interviews with Van Quine on 18 September 1993, Knight McMahan on 5 October 1993, and Allan Moltzen on 2 November 1993.

<sup>3</sup>Editor's interview with Knight McMahan on 5 October 1993.

## Introduction

No single aspect of the Second World War is full of mysticism and speculation as much as ULTRA. Just the mere mention of ULTRA with a campaign brings mythical overtones. As the word implies, ULTRA means something beyond or on the other side of moderation. Yet ULTRA was not a weapon system with phenomenal power. It simply was the code-word for the information obtained through communications intelligence during the war. Like other forms of intelligence its significance depended on its timeliness, reliability, and appreciation by commanders. As it will be shown in this volume and its companions, the mere possession of ULTRA intelligence would not be a sole factor in deciding any engagement. This was especially true in the Battle of the Atlantic.

The invention and subsequent advancements of radio communications at the turn of the century was especially important for the navies of the world. This new technology allowed naval authorities to maintain command and control of their fleets operating in distant locations. However, this new development could be as much a hindrance as a benefit. As early as the Russo-Japanese War in 1904 it was discovered that monitoring the enemy's radio transmissions could provide indications of its intentions.<sup>1</sup> Systems of codes and ciphers were developed as a safeguard to disguise the meanings of the radio messages. Thus, by the First World War the majority of the world's navies employed cryptographic systems to protect their communications from disclosure to their adversaries. Likewise, each navy was motivated to break the security measures to gain advance knowledge of the opposition's intentions.

The extensive operations of the world's fleets during the First World War saw increased reliance on radio for control. This increase in usage allowed one's adversary the opportunity to develop intelligence on naval operations. The British had set the standard in the field of communications intelligence in the naval realm. They had developed an elaborate system of radio direction finding and code breaking forming a reliable source of

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<sup>1</sup>Mario de Arcangelis, *Electronic Warfare: From the Battle of Tsushima to the Falklands and Lebanon Conflicts* (Dorset, England: Blandford Press, 1985), 11-12.



intelligence on the enemy. This development of communications intelligence enabled the British to monitor German naval radio traffic with considerable success.

The achievements of the British during the First World War were well noticed by the American navy. In a 1931 review of the decrypting activities of other governments the Americans considered the British navy as the standard to follow.<sup>2</sup> The British were successful in breaking German naval codes, had top radio security procedures which defeated German efforts of attack, and, above all, possessed the integrity to preserve the secret of their work during the war. Additional attributes included new methods of communicating with operational units without disclosing their location. Also, the British were the first to develop an office for specifically disseminating codes and ciphers, and they had the administrative capacity to maintain fifty-nine active codes simultaneously. By 1937 the American admiration expanded to the area of recruitment and training of personnel.<sup>3</sup> The British methods of attracting high quality personnel was chosen for emulation. Thus, in a somewhat distant manner British efforts in communications intelligence inspired the direction of the American effort in the inter-war period.

Prior to addressing the role of communications intelligence in the Battle of the Atlantic, it would be helpful to review its development in the U.S. Navy. The importance of the Atlantic prior to the Second World War was overshadowed by the threat of the Japanese in the Pacific. The suddenness of war in Europe in 1939 caught the American naval communications intelligence organization off guard. Nevertheless, the American naval organization was able to begin world-wide collection, direction finding and evaluation of communications intelligence as intercepts were obtained. The origin of ULTRA as a concept was not of American origin and was not adopted until collaboration with the British during the war.

The code-word ULTRA was of British origin. The word was used to identify the source of intelligence for those who

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<sup>2</sup>Records of the National Security Agency, J. S. Holtwick, Jr., "Naval Security Group History to World War II: Appendices," SRH-355, Part 2, 22-28, National Archives, Washington, D.C., Record Group 457, (hereafter cited as NSA, RG 457, with filing designations).

<sup>3</sup>Ibid., 264-66.

had access and need to know. By using this identifying caveat the recipients of the intelligence would immediately appreciate the source as highly reliable. Specifically, ULTRA intercepts were decoded Enigma-generated German military and diplomatic messages sent by radio. Yet this special intelligence had a series of code-words for its designation.<sup>4</sup> HYDRO was the first code-word associated with this form of intelligence used by the Royal Navy. Throughout the war Winston Churchill preferred to use the code-word BONIFACE as his designated source of communications intelligence instead of the military-inspired terms. The Royal Navy replaced HYDRO with the word HUSH and by mid-1941 adopted ULTRA as the final caveat.<sup>5</sup> The increased collaboration between the British and U.S. navies in the field of communications intelligence necessitated complementary security measures.<sup>6</sup>

The incorporation of security measures for this special intelligence in the U.S. Navy lacked specific guidance. While the U.S. Navy was involved in communications intelligence since the end of the First World War it did not have formal security measures like the British. There was no adoption of caveats to the security classification until June of 1942.<sup>7</sup> The June 1942 a Chief of Naval Operations (CNO) directive established that there should not be any mention as to the origin of the intelligence in correspondence and that either the code-word ULTRA or ZEAL should be used at the beginning of a message.

The incorporation of the new security measures failed to be employed as envisaged by the CNO. The American office

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<sup>4</sup>Warren F. Kimball, ed. *Churchill & Roosevelt: The Complete Correspondence*, Volume I, *Alliance Emerging*. (Princeton: Princeton University Press, 1984), 214-15.

<sup>5</sup>Ibid.; Patrick Beesly, *Very Special Intelligence*. (Garden City, NY: Doubleday and Co., 1978), 105. HUSH seems to have prevailed longer in the U.S. This may be due to the somewhat sluggish collaboration effort. Examples of "HUSH Secret" can be seen in U.S. documents in 1943.

<sup>6</sup>For more information on the cooperation between the two navies in communications intelligence, see Bradley F. Smith, *The Ultra-Magic Deals and the Most Secret Special Relationship* (Novato, CA: Presidio Press, 1993).

<sup>7</sup>Records of the Secretary of the Navy/Chief of Naval Operations (Secret-Confidential), Admiral King letter to Commander in Chief, U.S. Atlantic and Pacific Fleets and Commander Southwest Pacific Force, Folder A6-2/A8, Box 287 (A6-2--A6-2(12)), National Archives, Washington, D.C., Record Group 80, (hereafter cited as SECNAV/CNO (SC), RG 80, with filing designations).

responsible for the origin of much of ULTRA intelligence did not always follow the directive. Correspondingly, Admiralty messages to the U.S. did not begin to receive ULTRA designations until late 1942.<sup>8</sup> U.S. naval messages to the Admiralty did not receive ULTRA caveats until January 1943.<sup>9</sup> This lackluster employment of the security criteria required more attention within the American navy.

In March 1943 the CNO reaffirmed the needs of security and special handling of communications intelligence. The earlier security directive was superseded and the new policy required all material derived from cryptanalytical means to be stamped either as ULTRA or SUPER in addition to the usual security classification.<sup>10</sup> Cryptanalytical means was the method used to break the cryptographic security of enemy radio messages. Any hint of this type of work would naturally cause the enemy to change codes and setback the codebreaking efforts. Inner office correspondence by OP-20-G did not adopt the ULTRA caveat until the spring of 1944.<sup>11</sup> Once the formalities of classification management were settled, U.S. and British naval correspondence followed similar guidelines.

The U.S. Navy was deeply involved in the field of communications intelligence since the mid-1920's. This effort was under the supervision of the Director of Naval Communications (OP-20) who oversaw all aspects of collection, evaluation, and dissemination of communications intelligence for the U.S. Navy. The office directly responsible was the "Communication Security Section" (OP-20-G).<sup>12</sup> As tensions

<sup>8</sup>NSA, RG 457, SRH-236, Part 1, "U.S. Navy Submarine Warfare Message Reports: Admiralty to COMINCH 24 May 1942-31 December 1942," 215.

<sup>9</sup>NSA, RG 457, SRH-208, "U.S. Navy Submarine Warfare Message Reports: COMINCH to Admiralty 3 June 1942-31 May 1943," 37.

<sup>10</sup>NSA, RG 457, SRMN-018, "U.S. Navy (OP-20-G) West Coast Communications Intelligence Activities, Policies and Procedures 20 June 1942-26 December 1943," 7.

<sup>11</sup>Apparently the U.S. Navy did not begin classifying its documents "Ultra Top Secret" until April 1944. "Top Secret" as a security classification was not employed in the U.S. until March 1944. See NSA, RG 457, SRMN-054, Part 1, "OP-20-GI Special Studies relating to U-Boat Activities 1943-1945," 95-108.

<sup>12</sup>Designations for OP-20-G were:

| <u>From</u>  | <u>To</u>     | <u>Title</u>                   |
|--------------|---------------|--------------------------------|
| October 1917 | March 1935    | Code and Signal Section        |
| March 1935   | March 1939    | Communication Security Group   |
| March 1939   | October 1939  | Radio Intelligence Section     |
| October 1939 | February 1942 | Communication Security Section |



began to rise during the late 1930's, OP-20-G was faced with two threats on opposite sides of the globe. The predominant emphasis of cryptanalytical work was directed towards the solution of encrypted Japanese traffic. This reflected the dominance that War Plan Orange had in the navy. The technical advances of the Germans in the Atlantic had reduced the efforts of OP-20-G to that of traffic analysis.<sup>13</sup> Up to the reorganization of OP-20-G, following the Pearl Harbor attack, communications intelligence in the Atlantic theater received a low priority.

American naval interest with signal intelligence in the Atlantic theater dates from 1918. In October the Navy installed a rotating loop radio direction finder (D/F) at the Naval Radio Station, Bar Harbor, Maine.<sup>14</sup> Five other D/F stations were established along the eastern coast shortly afterwards. Originally intended for tracking German U-boats during the First World War, these stations came too late. With less than thirty days after commissioning the Bar Harbor unit the armistice was signed in 1918. A newly established New York station was in operation in time for use in the location and guidance of American battleships returning from Europe.<sup>15</sup> However, these D/F units were relegated to support duties to aid in the navigation of naval and merchant vessels and not for intelligence activity.

Time and the lack of attention had a degrading effect on the shore based naval radio direction finders. In 1924 the Navy had 52 medium frequency D/F stations in operation on both coasts. By 1941, 22 remained in commission of which only six or seven were in effective operating condition.<sup>16</sup> Most of the sites had deteriorated due to poor maintenance, fire, storm damage and other unexplainable acts. In July 1941, the navy formally transferred custody of these original D/F stations to the U.S. Coast Guard.

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February 1942 July 1946

Communication Intelligence Section

<sup>13</sup>NSA, RG 457, SRH-264, Joseph N. Wenger, "A Lecture on Communications Intelligence," 14 August 1946, 12.

<sup>14</sup>NSA, RG 457, SRH-355, Part 1, 77.

<sup>15</sup>Ibid., 77n.; L. S. Howeth, *History of Communications-Electronics in the United States Navy*. (Washington: Government Printing Office, 1963), 265.

<sup>16</sup>NSA, RG 457, SRH-355, Part 1, 79.

The development of high frequency direction finding (HF/DF) operations began in the early 1930's. Originally envisaged in 1933 and amended in 1935, the development of strategic HF/DF sites world-wide was proposed.<sup>17</sup> Of the eleven chosen locations, four were to be situated on the Atlantic coast.<sup>18</sup> Winter Harbor, Maine received the highest priority of the Atlantic sites and was operational in early 1935. Yet the first American fix on a foreign vessel by HF/DF came from the Cavite site in the Philippines in late July 1936.<sup>19</sup> Despite this accomplishment, the reliability of the HF/DF equipment was poor and an extensive development program was initiated to identify an ideal apparatus for naval service. By June 1938 an advanced HF/DF unit had been installed at Winter Harbor. Despite the placement of new equipment at the East Coast locations, the Atlantic HF/DF group would have only the primary mission of "training" and would be manned "intermittently."<sup>20</sup> Finally, by July 1939, the new Direction Finder Policy was promulgated and officially established the Strategic Tracking Organization.<sup>21</sup>

The end of 1940 saw dramatic improvements to the American naval communications intelligence organization. By December OP-20-G had successfully tracked by HF/DF both German submarines and surface raiders in the Atlantic.<sup>22</sup> Training of both enlisted and officer personnel was progressing rapidly. Technical innovations were also being rapidly incorporated into communications intelligence efforts. There was also the strengthening of collaboration with the British against adversaries in the field of communications intelligence.

Organization of the Atlantic intercept and HF/DF capabilities received considerable attention in the spring of 1941. In April the British Admiralty supplied the U.S. Navy with one of their latest Marconi Adcock HF/DF sets for test and evaluation.<sup>23</sup> In May it was decided that all remaining Naval Navigational Direction Finder Stations would be transferred to

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<sup>17</sup>Ibid., 174.

<sup>18</sup>These were to be Winter Harbor, Maine; Jupiter, Florida; Cheltenham, Maryland; and either Puerto Rico or the Virgin Islands.

<sup>19</sup>NSA, RG 457, SRH-355, Part 1, 186-87.

<sup>20</sup>Ibid., 303.

<sup>21</sup>Ibid., 333-35.

<sup>22</sup>Ibid., 409.

<sup>23</sup>Ibid., 424.

the U.S. Coast Guard. The transfer of these sites would provide new opportunities for OP-20-G.

The growth of HF/DF sites required additional OP-20-G personnel. The maneuver with the U.S. Coast Guard helped ease the personnel crunch at OP-20-G. New sites in 1941 included Greenland; Charleston, South Carolina; and Toro Point, Canal Zone. Two additional sites were projected for 1942 at Cabo Rojo, Puerto Rico and another to be located at either Trinidad or Brazil. Additionally, in May, a continuous watch officer for control of the Atlantic Strategic HF/DF net was initiated. By December 1941 the U.S. Navy had a global strategic HF/DF system in place with centralized control. It consisted of three net control stations (Atlantic, Pacific, and West Coast) that controlled 20 HF/DF sites.

Radio interception gradually supplemented HF/DF as a form of communication intelligence. Site selection for interception operations was similar to that for the HF/DF stations. Bar Harbor, Maine was involved in intercept activities as early as November 1931. The station was subsequently relocated across Frenchman Bay at Winter Harbor in early 1935.<sup>24</sup> While the primary concentration of its activities had been diplomatic traffic between Europe and Tokyo it was also well situated for other forms of radio interception.

At some point in 1931, interest was taken to intercepting Russian radio traffic. Eight special Underwood typewriters were ordered to be made with Russian (Cyrillic) type-set keys.<sup>25</sup> In 1933 Bar Harbor's activities had "been diverted" from its normal diplomatic interests to concentrate on other topics. At the time the Soviets were becoming more active both militarily and diplomatically. They had been experiencing difficulties with the Japanese in the Far East and were engaged in collaboration in naval affairs with the Germans and Italians. In diplomatic affairs the Soviets had begun treaty negotiations with France, Germany, and several other countries.<sup>26</sup>

The onset of war in Europe in September 1939 brought about a declaration of national emergency in the United States and a new view of priorities. Intercept reorganization came during the first week of September. Winter Harbor was

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<sup>24</sup>Ibid., 124, 139.

<sup>25</sup>Ibid., 100. Two were initially ordered in 1931 and another six in 1933.

<sup>26</sup>John Erickson, *The Soviet High Command: A Military-Political History 1918-1941*. (Boulder, CO: Westview Press, 1984), 332-33.



relegated to HF/DF only. Interception for the Atlantic theater during this time frame fell upon stations at Jupiter, Florida and Cheltenham, Maryland.<sup>27</sup> The missions of these shore based stations would change later in the war with Chatham, Massachusetts replacing Cheltenham as the primary interception site.

Interception of radio communications was also accomplished by American naval vessels. As early as February 1937 American naval vessels assisted in the collection of communications intelligence in Europe. The U.S.S. *Hatfield* (DD 231), under the guidance of the Director of Naval Intelligence, began intercepting communications and forwarding the material to Washington.<sup>28</sup> The *Hatfield* was anchored at La Rochelle-Pallice and was well situated for intercept operations. However, the radio division personnel lacked formal training in this type of operation. The Commanding Officer requested further guidance in June to ensure proper methods were being employed in the collection effort.<sup>29</sup> The Director of Naval Communications responded by establishing the priorities of interception and the required formats of future reports.<sup>30</sup> The *Hatfield* established the standard for European communications intelligence collection that would be followed by others.

The European Squadron, Squadron 40-T, had been in operation since September 1936.<sup>31</sup> Both the Director of Naval Communications and the Director of Naval Intelligence appreciated the significance of this new source of intelligence.

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<sup>27</sup>NSA, RG 457, SRH-355, Part 1, 337.

<sup>28</sup>Records of the Office of Naval Intelligence (1929-1942), Commanding Officer (DD231) letter to Chief of Naval Operations (Director of Naval Intelligence), DD231/A8(C-187), dated 1 March 1937, Folder A6-1/EF, Box 124 (A6-1/EF13--A6-2/EF13), National Archives, Washington, D.C., Record Group 38, (hereafter cited as ONI, RG 38, with filing designations).

<sup>29</sup>ONI, RG 38, Commanding Officer (DD231) letter to Chief of Naval Operations (Director of Naval Intelligence), DD231/A8(C-187), dated 8 June 1937, Folder A6-1/EF, Box 124 (A6-1/EF13--A6-2/EF13).

<sup>30</sup>The primary target was German naval communications and a secondary target was Italian naval communications. See ONI, RG 38, Director of Naval Communications letter to Director of Naval Intelligence, OP-20-GX, (SC)A6-2/A8, serial 2815, dated 23 June 1937, Folder A6-1/EF, Box 124 (A6-1/EF13--A6-2/EF13).

<sup>31</sup>Samuel Eliot Morison, *History of United States Naval Operations in World War II*, Volume 1, *The Battle of the Atlantic, 1939-1943*. (Boston: Little, Brown and Co., 1964), 16.

The prospective flagship for Squadron 40-T, USS *Raleigh* (CL 7), was given copies of the work of the USS *Hatfield* and the guidance furnished by OP-20-G.<sup>32</sup> The original purpose of the squadron was to evacuate Americans during the Spanish Civil War. The close proximity of an intercept unit in Europe would ensure more accurate reception of local naval radio communications.

An intercept unit was established with Squadron 40-T with the permission of the Commander, European Squadron.<sup>33</sup> The unit and its four radio specialists were established on board the USS *Omaha* (CL 4) and was designated as Station F by OP-20-G. Operations of Station F commenced on 12 December 1938 with the primary coverage was of German and Italian naval communications.<sup>34</sup> The *Omaha* departed for the Mediterranean in late April 1939 and that Station F would increase the amount of information available on German radio procedures and schedules. Coincidentally, the German naval fleet was deployed to the same area as the European Squadron.

The progress of Station F was steadily increasing but its future was in question. In May 1939 it was decided to let the station exist for one more year. As a result, when the *Omaha* was relieved by the USS *Trenton* (CL 11) on 19 June 1939 Station F accompanied the Flag staff. Radio intercept coverage resumed on 10 July aboard the new flagship. The monitoring of German communications had documented the routine procedures and practices of the naval traffic. An abrupt change in the routine was noticed on 28 August 1939, two days prior to the invasion of Poland.<sup>35</sup> It was observed that the format of messages changed, transmitter power increased, and a noticeable restriction was enforced on radio procedures. All of the intercepted traffic of Station F was forwarded to Washington for evaluation.

The opening of hostilities in Europe had a dramatic impact on American communications intelligence. By 24 October 1939 it was acknowledged that the Atlantic area had been neglected. OP-20-G declared that the Atlantic Ocean and

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<sup>32</sup>ONI, RG 38, Chief of Naval Operations letter to Commander Squadron 40-T (USS *Raleigh*), OP-16-B12, A6-1/EF(6-23), serial 1733, dated 13 July 1937, Folder A6-1/EF, Box 124 (A6-1/EF13--A6-2/EF13).

<sup>33</sup>NSA, RG 457, SRH-355, Part 1, 310.

<sup>34</sup>Ibid., 327.

<sup>35</sup>Ibid., 338.

the East Coast would now be considered the number one priority.<sup>36</sup> Commander Laurance F. Safford, then head of OP-20-G, speculated that Japan might even become a U.S. ally in the oncoming war.<sup>37</sup> However, his view would be short lived and not shared by other officers. An American communications intelligence officer in the Pacific observed, in the spring of 1940, that the Japanese had been operating without any fear of opposition at sea.<sup>38</sup>

Interest by American communications intelligence in the Atlantic and European areas continued to mount. The first indicated liaison of American and British communications intelligence personnel came in the spring of 1940. Two American naval representatives visited the British HF/DF station on the island of Bermuda.<sup>39</sup> They had observed British operations, net procedures and the employment of fixed antenna equipment.

A formal, and highly secret, agreement concerning naval communications had been made between the British and American governments in 1937.<sup>40</sup> The agreement had been made at the instigation of the British Admiralty and was so secret that only one American officer active duty was aware of its existence. Three hundred fifty copies of a publication covering the complete description of the American communications organizations and procedures were held in the Europe.<sup>41</sup> In the event of war the American naval communications representative would provide the publications to the British.

In October 1940, the Special Naval Observer (SPECNAVO), London, was approached by an Admiralty representative concerning further collaboration in communications

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<sup>36</sup>Ibid., 343.

<sup>37</sup>Ibid.

<sup>38</sup>Ibid., 356.

<sup>39</sup>Ibid., 368. These were Lieutenant (Junior Grade) J. M. Lietwiler and Chief Radioman H. Kidder.

<sup>40</sup>SECNAV/CNO (SC), RG 80, OP-20-G letter to Director of Naval Intelligence, serial 040620, dated 16 January 1940, Folder A6--A6/A1-1(Oct 40), Box 223 (A4-3/QSI-A6-2).

<sup>41</sup>One hundred fifty copies were kept with the Naval Attaché in London and 200 copies were kept with the Commander, European Squadron.



intelligence.<sup>42</sup> The British provided information concerning positions, frequency coverage, control stations, and linkages of these stations with the Admiralty. The British requested that the Americans reciprocate the exchange of information. This request was granted and similar information on American communications intelligence activities was sent to London on 20 November.<sup>43</sup>

Afloat communications intelligence continued to contribute to the European effort. The transfer of Station F was accomplished once more with the arrival of the new commander and his flagship, the USS *Omaha*. In fact, the new commander of the squadron, Rear Admiral Charles E. Courtney, recently relieved as Director of Naval Communications (OP-20) and aware of the importance of Station F. The transfer of Station F occurred after 5 July 1940 and returned to its collection duties. Primary coverage would now center on Italian naval circuits in the Mediterranean. The ensuing naval battles throughout the summer were covered by Station F and relayed on to Washington. Early in October 1940 Squadron 40-T was recalled from duty in Europe due to the increased risk of conflict with the belligerents.

The need for more accurate communications intelligence in Europe was being felt by OP-20-G. Previously, the majority of intelligence gained from communications had come from HF/DF and traffic analysis. The rapid growth of intercepts of European messages allowed the Americans to begin a dedicated attack on decrypting this traffic.<sup>44</sup> The incorporation of attacking European generated intelligence into OP-20-G seems to have begun around July 1940. A two-person European branch was added to the cryptanalytical section.<sup>45</sup>

The interest in European traffic intensified by October 1940. Losses of merchant shipping to U-boats reached a new high in October. The continued reliance of radio communications by the U-boats represented a weakness that

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<sup>42</sup>SECNAV/CNO (SC), RG 80, SPECNAVO, London letter to CNO, serial 31 dated 17 October 1940, Folder A8-3/EF13(Sep-Oct 40), Box 230 (A8-3-A8-3/EF13).

<sup>43</sup>SECNAV/CNO (SC), RG 80, Director of Naval Communications letter to Director of Naval Intelligence, serial 084720, dated 20 November 1940, Folder A8-3/EF13(Sep-Oct 40), Box 230 (A8-3-A8-3/EF13).

<sup>44</sup>The higher the volume of messages of a particular code or cipher system the greater the likelihood of breaking that system.

<sup>45</sup>NSA, RG 457, SRH-355, Part 1, 375-76.

could be exploited. The communications intelligence situation was made worse when the Japanese made drastic changes to their main naval cipher systems in December.<sup>46</sup> OP-20-G had no immediate solution to the Japanese changes and recovery was not near. At the time there were only five officers and two civilians working in the cryptanalytical section.<sup>47</sup> The threat from the U-boats seemed to be increasing as the months passed. Thus, OP-20-G was forced to address European cipher system. Work was divided up in the office with the hope that a break would be possible.

Two separate sections for attacking European traffic were created.<sup>48</sup> The first, headed by Agnes Driscoll, centered on German naval systems. The second, headed by Lieutenant Lee W. Parke, concentrated on Italian naval systems. There was some prior work on German systems, but it was of no avail. Commander Safford hoped that the employment of Mrs. Driscoll in the effort would produce favorable results.<sup>49</sup>

In early 1941 the collaboration between American and British navies intensified. In January the United States decided to give the British one of the PURPLE machines for breaking Japanese diplomatic message traffic. The machine was escorted by four military officers; two were from OP-20-G.<sup>50</sup> The Americans hoped the British would reciprocate the offer by giving a copy of the German ENIGMA machine cipher. Instead the British exhibited their efforts against the ENIGMA and presented them with all the keys that had been recovered and

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<sup>46</sup>Edwin T. Layton, *"And I was there"* (New York: William Morrow and Co., 1985), 78.

<sup>47</sup>Ibid. At the time of the Japanese change the office had to attack the German ENIGMA, the Japanese Naval Attaché machine cipher, continued work on JN-25 operational code, and also provide assistance to the Army with its attack on the Japanese diplomatic code.

<sup>48</sup>NSA, RG 457, SRH-355, Part 1, 400.

<sup>49</sup>Agnes Driscoll was most noted for her work on Japanese code and cipher systems. She had been working on the JN-25 code since November 1939. Once assigned to the German section she had no further involvement with Japanese systems. Editor's interview with Albert J. Pelletier on 16 March 1994.

<sup>50</sup>In addition to escorting the PURPLE machine the naval officers had an additional mission. They were to observe, in detail, the British HF/DF organization and equipment. This had been by the direction of Commander Safford. Upon the officers' return to American only Safford was briefed about the British HF/DF efforts. Editor's interview with Robert Weeks on 28 February 1994.

a paper analog of the cipher.<sup>51</sup> The American mission also was given a copy of the latest British HF/DF unit for evaluation.<sup>52</sup>

The American contingent returned and applied what they had learned from the British to their work against the European ciphers. However, the work was time consuming and showing little progress. Further collaboration continued on the only truly dependable intelligence resource available at the time: HF/DF. By July the reproduction of British codes and ciphers for HF/DF reporting was being carried out for joint use.<sup>53</sup>

In the spring of 1941 sought to improve the interception effort with the Atlantic sites. In March direct commercial teletype service was authorized for the Winter Harbor and Amagansett radio intercept facilities.<sup>54</sup> This development allowed the stations to forward intercepts immediately to Washington upon receipt. While the primary emphasis was on Japanese diplomatic traffic other "messages of unusual nature appearing to be of sufficient importance to warrant attention" would also be forwarded.<sup>55</sup> The result was improving coverage of radio circuits and minimizing delays in getting the intercepts to the cryptanalysts.

Establishment of coverage by the radio intercept stations was promulgated in the fall of 1941. Atlantic stations served as four of the five major intercept facilities on the continental United States.<sup>56</sup> The primary and secondary missions of the Atlantic stations were:

| <u>Station</u>    | <u>Primary</u> <sup>57</sup> | <u>Secondary</u> |
|-------------------|------------------------------|------------------|
| W (Winter Harbor) | Italian Naval                | Axis Diplomatic  |
| M (Cheltenham)    | German Naval                 | Axis Diplomatic  |
| G (Amagansett)    | Diplomatic                   | None             |
| J (Jupiter)       | Diplomatic                   | None             |

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<sup>51</sup>Editor's interview with Prescott H. Currier on 10 February 1994; David Kahn, *Seizing the Enigma: The Race to Break the German U-Boat Codes, 1939-1943* (Boston: Houghton Mifflin Co., 1991), 235-37.

<sup>52</sup>Smith, 58.

<sup>53</sup>NSA, RG 457, SRH-355, Part 1, 430.

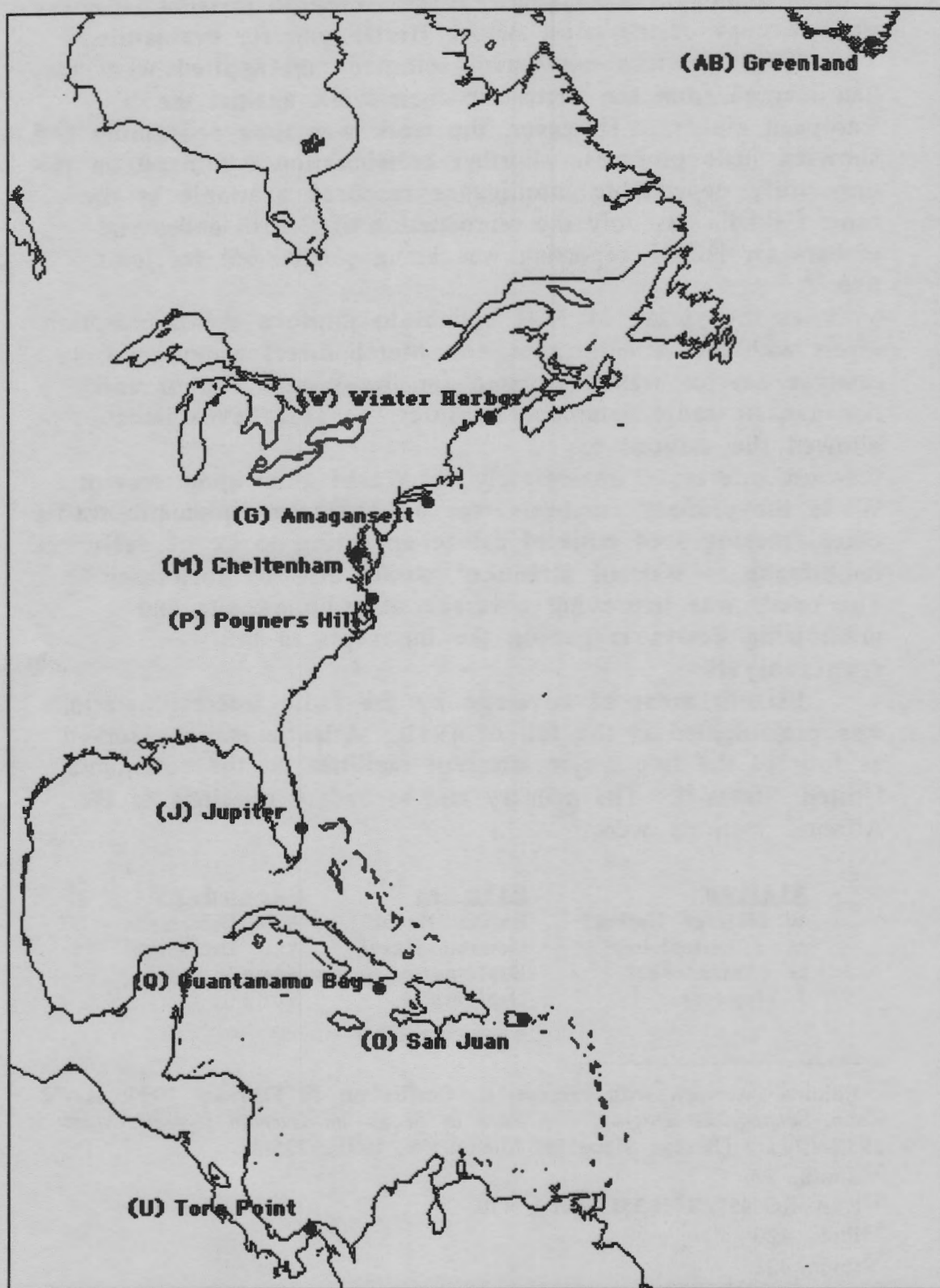
<sup>54</sup>Ibid., 420.

<sup>55</sup>Ibid., 421.

<sup>56</sup>Ibid., 430.

<sup>57</sup>Stations G and J were covering only the Rome, Berlin, Tokyo circuits transmitting to each other and to South American capitals.





Atlantic Strategic HF/DF Net by December 1941

Within two months of the Pearl Harbor attack the first major reorganization of the Code and Signal section of the U.S. Navy was made since its beginning in First World War. What followed was the complete detachment of communications intelligence and communications security from one another.<sup>58</sup> It was determined, following a comprehensive study by Commander Joseph N. Wenger, assigned to the war plans section of OP-20-G, that a more centralized and highly coordinated control authority be established for communications intelligence.<sup>59</sup> An additional emphasis on increased communications was stressed for information correlation and interpretation. The proposals of Wenger were accepted and adopted following a reorganization conference with the Director of Naval Communications, Admiral Leigh Noyes. The reorganizations was as follows:

| <u>Office</u> | <u>Mission</u>                             | <u>Officer in Charge</u> |
|---------------|--------------------------------------------|--------------------------|
| OP-20-G       | Communication Cryptanalytical Intelligence | Cdr. J. N. Wenger        |
| OP-20-K       | Communication Combat Intelligence          | Lcdr. L. W. Parke        |
| OP-20-Q       | Cryptography                               | Capt. L. F. Safford      |
| OP-20-U       | Security Section                           | Lcdr. R. L. Densford     |

By 24 June 1942 OP-20-G had evolved into an efficient and well organized office. When a break finally came with the German ciphers in December 1942 a further reorganization took place within OP-20-G.<sup>60</sup> The need existed for a separate division for handling intelligence acquired on the Pacific and Atlantic theaters.

The creation of the "Atlantic Section" within OP-20-G did not develop until January 1943.<sup>61</sup> Prior to this Atlantic communications intelligence correlation was conducted by the office primarily concerned with Pacific theater matters. It is known that the Atlantic Section was functioning well prior to

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<sup>58</sup>NSA, RG 457, SRH-279, "Communications Intelligence Organization 1942-1946," 1-2. The new sections were designated OP-20-G and OP-20-Q respectively.

<sup>59</sup>Ibid., 4-14; NSA, RG 457, SRH-403, "Selections from the Cryptologic Papers Collection of Rear Admiral J. N. Wenger, USN," 4; NSA, RG 457, SRH-355, Part 1, 461.

<sup>60</sup>NSA, RG 457, SRH-355, Part 1, 463.

<sup>61</sup>The OP-20-G "Atlantic Section" should not be confused with the COMINCH "Atlantic Section" which was the primary consumer of OP-20-GI-A's efforts.

the *Torch* landings in North Africa in November 1942.<sup>62</sup> A small section was established in early 1942, but the increase of traffic overwhelmed the limited staff. Two officers from the Pacific Section of OP-20-G were reassigned to the Atlantic section to assume watch over non-German Atlantic activities.<sup>63</sup> Due to the delays, involved in processing the intercepts, the Atlantic Section was not a key element in direct support for the *Torch* landings. Nevertheless, the experience obtained aided in the clarification of organizing the office to support current operations.

While the need existed for proper correlation of Atlantic communications intelligence the development of such a unit was slow in going. The initial head of the informal Atlantic Section was Lieutenant Willard "Van" O. Quine in the fall of 1942. The Atlantic Section, formally known as OP-20-GI-2, was officially established when its designated officer in charge, Lieutenant Commander Bernard F. Roeder, assumed his duties after returning from the Pacific in January 1943. From that point on, the Atlantic Section served as the correlation and dissemination branch for all Atlantic related communications intelligence.

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<sup>62</sup>Jeffrey K. Bray, ed., *Ultra in the Atlantic*, Volume VI, *Appendices*. (Laguna Hills, CA: Aegean Park Press, forthcoming), Appendix 17.

<sup>63</sup>The two officers were Allan R. Molten and John S. Adams.



## List of Abbreviations

|          |                                                 |
|----------|-------------------------------------------------|
| A/C      | Aircraft                                        |
| A/S      | Anti-submarine                                  |
| ASDIC    | Underwater sound location device                |
| BAMS     | Broadcasts for Allied Merchant Ships            |
| CBM      | Cubic meter                                     |
| CINCCNA  | Commander in Chief, Canadian Northwest Atlantic |
| CINCWA   | Commander in Chief, Western Approaches          |
| CESF     | Commander, Eastern Sea Frontier                 |
| CMSF     | Commander, Moroccan Sea Frontier                |
| CNO      | Chief of Naval Operations                       |
| COMINCH  | Commander in Chief                              |
| COMNAVEU | Commander, Naval Forces Europe                  |
| CRT      | Cathode Ray Tube, television screen             |
| CSP      | Code and Signal Publication                     |
| CVE      | Escort aircraft carrier                         |
| D/D      | Destroyer                                       |
| D/F      | Direction Finding                               |
| FOIC     | Flag Officer in Charge                          |
| GAF      | German Air Force                                |
| GC&CS    | Government Code and Cypher School               |
| GNA      | German Naval Attaché                            |
| GNAT     | German Naval Acoustic Torpedo                   |
| GSR      | German Search Receiver                          |
| H/F      | High Frequency                                  |
| JNA      | Japanese Naval Attaché                          |
| KCS      | Kilocycles                                      |
| MCS      | Megacycles                                      |
| M/F      | Medium Frequency                                |
| MPA      | German naval D/F divisions                      |
| MPHS     | German naval D/F main stations                  |
| MPNS     | German naval D/F subsidiary stations            |
| M/V      | Merchant Vessel                                 |
| NEMO     | American code name for captured U-505           |
| NOIC     | Naval Officer in Charge                         |

|          |                                                        |
|----------|--------------------------------------------------------|
| ONI      | Office of Naval Intelligence                           |
| RAF      | Royal Air Force                                        |
| RIP      | Radio Intelligence Publication                         |
| RFP      | Radio Finger Printing                                  |
| R/V      | Rendezvous                                             |
| SIS      | Italian Naval Communications Intelligence Organization |
| SKL      | German Naval High Command                              |
| SPECNAVO | Special Naval Observer                                 |
| TINA     | Radio Transmission Characteristics Intelligence        |
| T-V      | Zaunkönig acoustic torpedo                             |
| U/B      | U-boat                                                 |
| VL/F     | Very Low Frequency                                     |
| WW       | German Weather Messages                                |

**Foreword concerning  
The Atlantic Correlation and Dissemination Section  
of  
U.S. Navy Communications Intelligence (OP-20-G)  
(OP-20-3-GI-A, hereinafter referred to as the Atlantic Section)**

**1. Organization.**

The organization of the Atlantic Section was completed in January 1943 with the appointment of LCDR Roeder, USN, as GI-2 (later GI-A). Personnel numbered 12 male officers and 5 enlisted men. The section combined the following functions:

(a) Translation (German U-boat traffic).

(b) TINA, RFP, D/F correlation (U-Boat).

(Functions (a) and (b) had been brought together as one section in December when current U-boat traffic was first read.)

(c) Non-U-boat traffic intelligence pertaining to the Atlantic theater, previously handled in GI (Pacific Intelligence Center).

On 31 December 1943, the Atlantic Section consisted of 15 male officers, 10 WAVE officers, 3 male enlisted and 5 WAVE enlisted.

**2. Sources of intelligence (decryption).**

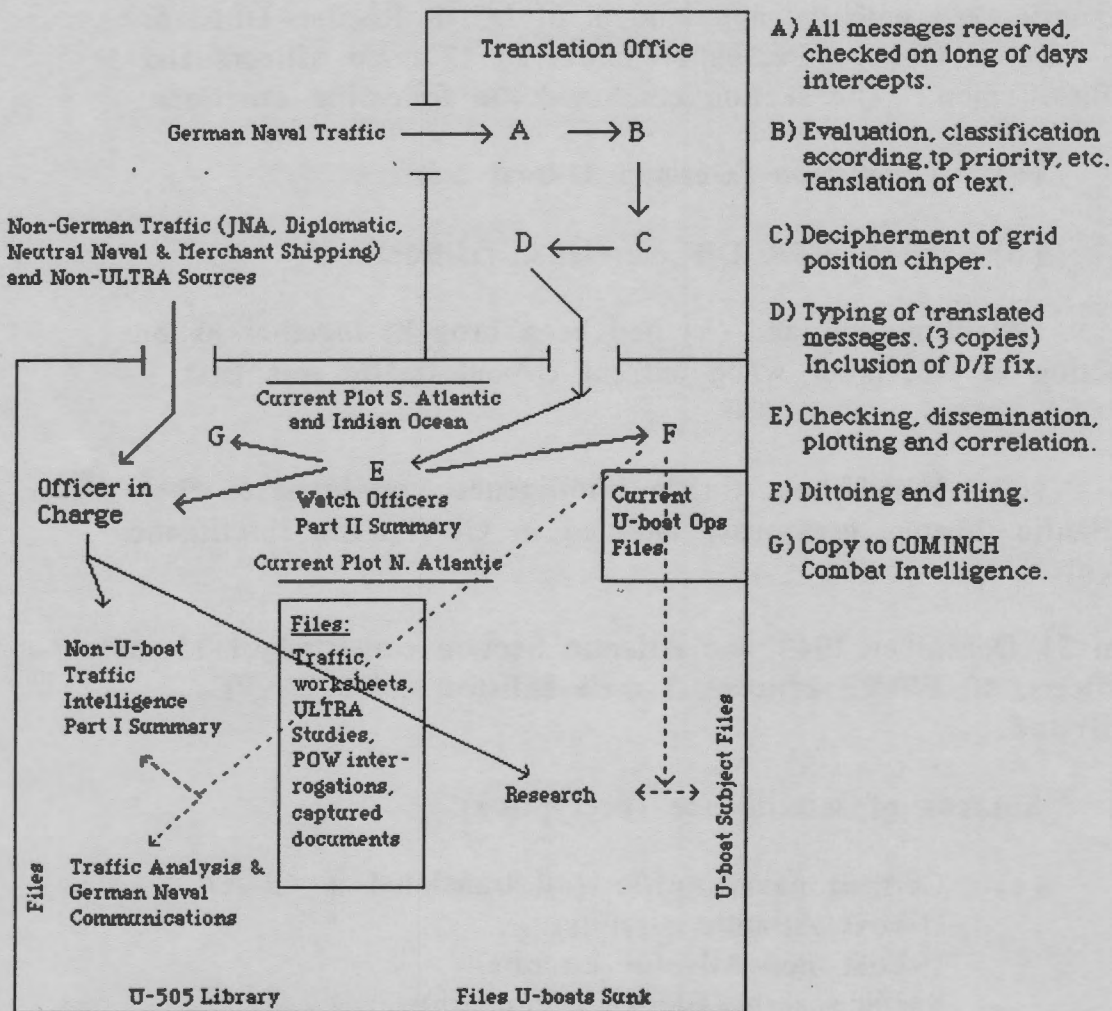
(a) German naval traffic. (all translated in GI-A)  
U-boat Atlantic circuits.  
U-boat non-Atlantic circuits.  
Surface ship (Blockade runners).  
Naval Attaché (Berlin-Tokyo).

(b) Japanese Naval Attaché traffic (beginning spring 1944).

(c) German clandestine traffic.



# Office Diagram for OP-20-3-GI-A Atlantic Correlation and Dissemination Section



U.S. Navy dispatches, D/F reports, and Traffic Analysis  
[Chatham Reports] arrive via tube.

- (d) Miscellaneous: Vichy French, Italian and other naval related traffic.

In addition to the above traffic sources decrypted in OP-20-G, enemy diplomatic traffic was made available by the Army.

3. Dissemination of ULTRA intelligence.

- (a) F-21 (COMINCH Combat Intelligence Antisubmarine).

Copy of every translated German message.

Memoranda on interpretation and problems in ULTRA. (650)

Daily Summaries (Part I - non-U-boat ULTRA)  
(Part II - U-boat ULTRA)

Special studies and monthly reports (on compromise of Allied codes and ciphers, torpedoes, radar and search receivers, etc., including monthly summary charts of U-boat operations.)

- (b) Director, Naval Communications.

(Same as for F-21)

- (c) COMINCH Chart Room.

Non-U-boat ULTRA daily summary (Part I).

- (d) U.S. Navy Communication Security and Countermeasures (OP-20-K and S)

Results of all studies pertaining to respective interests of those sections.

- (e) CINCLANT

ULTRA intelligence on surface blockade runners.

(f) OPNAV Central Division.

Martinique and other Vichy French possessions in Western Hemisphere.

(g) Army Special Intelligence.

ULTRA intelligence on German cargo carrying submarines in the Far East; German Naval Attaché traffic.

4. Miscellaneous.

(a) CSP 1774 on enemy U-boat communications procedures and radio circuits was supplied with current corrections to forces at sea.

(b) Neutral shipping: to OP-16-FT, FX-37, Ottawa.

Neutral call signs were furnished to the Atlantic Fleet.

(c) Translations of captured U-505 (NEMO) documents.

5. Interpretation and Research.

The Atlantic Section's primary responsibility was to furnish COMINCH Combat Intelligence (F-21) with a correct interpretation of each German message. Chief among the problems of interpretation was that presented by the German practice of enciphering U-boat positions. The decrypted text of the message gave the U-boat's position not directly in terms of the German Naval Grid, but in terms of a changing system of arbitrary bigram equivalents and numerical additions or subtractions applied to the naval grid. The decipherment of U-boat positions required the closest correlation of all information available from past U-boat traffic as well as from D/F fixes and from hints in present U-boat traffic as to U-boat Command's intentions. The problem was currently and successfully met by the Atlantic Section, but not until a copy of the grid cipher was obtained from U-505 in June 1944 did it cease to exact constant and special attention.



In addition to maintaining a current plot of the U-boat situation, the Atlantic Section conducted research on every aspect of the U-boat revealed in traffic.

6. Exchange with GC&CS.

After the summer of 1943, there was considerable exchange of intelligence results with GC&CS through which the Atlantic Section benefited from the larger British background on U-boats and from the British coverage of local German naval circuits.

7. Qualification.

The Atlantic Section of OP-20-G did not have access to COMINCH Combat Intelligence antisubmarine files during the course of the war.

The operational use of U-boat ULTRA intelligence was of course the responsibility of COMINCH (F-21). It must be understood throughout the following report that F-21 had his own system for further analysis and study of the ULTRA intelligence supplied by OP-20-G, as well as for correlating this intelligence with information from other sources. It was OP-20-3-GI-A's duty to furnish F-21 all available ULTRA with the least possible delay and to be prepared at all times to follow up with any examinations, correlations, and studies which F-21 might request in the course of his own study. Very close contact was maintained between F-21 and OP-20-G, resulting in a double check on all traffic processed.

## **Chapter I**

### **Brief Review of War in the Atlantic Up to Reading of U-boat Traffic in December 1942**

**\* \* \***

1. Before U.S. Entrance.
2. From U.S. Entrance to the beginning of Special Intelligence on U-boats. December 1941-December 1942.
3. The critical nature of late fall, early winter 1942. Allied invasion of North Africa and the beginning of the all-out U-boat counter offensive.





## Brief Review of War in the Atlantic up to Reading of U-boat Traffic in December 1942

### 1. Before U.S. Entrance.

The chart of monthly merchant shipping losses with comments which appears at the end of this chapter will suffice as a review of the major periods of the U-boat war from September 1939 to November 1941. In addition the following comments should be made:

(a) It was a primitive U-boat fleet which began the blockade of England on 3 September 1939, in a manner reminiscent of World War I. 250-tonners constituted the majority of a fleet that did not exceed 50 operational subs.

(b) Ocean going types were ready when it became advisable to move out into areas of weaker defense, but the U-boat operating fleet remained small.

(c) The introduction of the group attack ("wolfpack") against convoys was inevitable once off-shore areas were denied to individual U-boats.

(d) The marked improvement of the summer of 1941 was due to the combination of evasive routing and the use of Iceland as a base for escorts and aircraft. The "evasive routing" presumably represents the results of British decryption of U-boat traffic during this period.

(e) On the eve of U.S. entrance into the war U-boat successes had been throttled down to the lowest monthly figure since May 1940, about 60,000 tons.

(f) A major cipher change cut off British special intelligence shortly after the United States entered the war.

### 2. From U.S. Entrance to the beginning of Special Intelligence on U-boats. December 1941-December 1942.

When Germany declared war on the United States, a routine shift to the West brought the U-boat into the greenest pasture the war was ever to offer. With the assistance of

refueling stations at sea, U-boats pressed the war into harbors and river mouths of our own shores. It is not the purpose of this report to do more than remind the reader, if such reminder is necessary, that the rapid depletion of the Allied merchant fleet at the source of Allied supplies constituted the greatest single threat of defeat ever encountered in our war with Germany. Going on the high tide of Japanese conquests in the East and German conquests in Europe, Russia, and North Africa, 1942's appalling loss of shipping was a major factor in the tense gloom which awakened the U.S. to the prospect of a long and costly struggle. It is in the province of this history, however, to point out that the German Navy was achieving this victory with an operational fleet still small when compared with the fleet that launched the North Atlantic offensive of the winter of 1942-43. The sinkings of June 1942 (626,158 tons) were achieved by the efforts of 60 to 65 U-boats in operation. The following winter the German Navy could put 180 U-boats into the Atlantic, 120 of which were operating while 60 were outbound or returning.

(a) Attack on U.S. - Atlantic Seaboard. December 1941-Summer 1942.

Reaching a new high of success in March 1942 (approximately 535,000 tons), U-boats were temporarily checked in April by U.S. countermeasures. The strengthening of our own defenses with the introduction of the coastal convoy system and the mobilization of every conceivable weapon, merely diverted U-boats once more into areas of weaker defense. With the extension of the U-boat campaign to the Caribbean and Gulf of Mexico our losses piled up to establish a new record for the U-boat fleet in early summer 1942.

(b) U-boats occupy more distant areas and at the same time return in force to the North Atlantic convoy lanes. From Summer 1942 - December 1942.

U-boats moved in greater numbers into the last outposts of the Atlantic. In addition to the Caribbean and Trinidad, always a point of emphasis, U-boats gathered along the South American coast, in the St. Paul Rocks area, along the African Coast, and finally in the Capetown and Madagascar areas. 1,200 ton U-cruisers were now ready to undertake the most

distant missions. But only the larger boats could follow this natural movement into areas of weak defenses. The smaller U-boat (the 500 tonner) was built for North Atlantic operations and, as coastal areas within its reach were closed, it had to turn back to the mid-Atlantic. At the same time the renewal of interest in North Atlantic convoys had become a necessary condition for German victory. To offset the increased Allied convoy defenses in the North Atlantic, U-boats had to be massed in groups for quick and decisive kills of convoys which could be caught in the mid regions beyond land-based aircraft. This necessitated greater numbers of U-boats, a demand which the intense U-boat building program seemed adequate to meet. By November the German Navy could maintain an average of 90 U-boats operating in the Atlantic, and the Baltic was full of submarines in training.

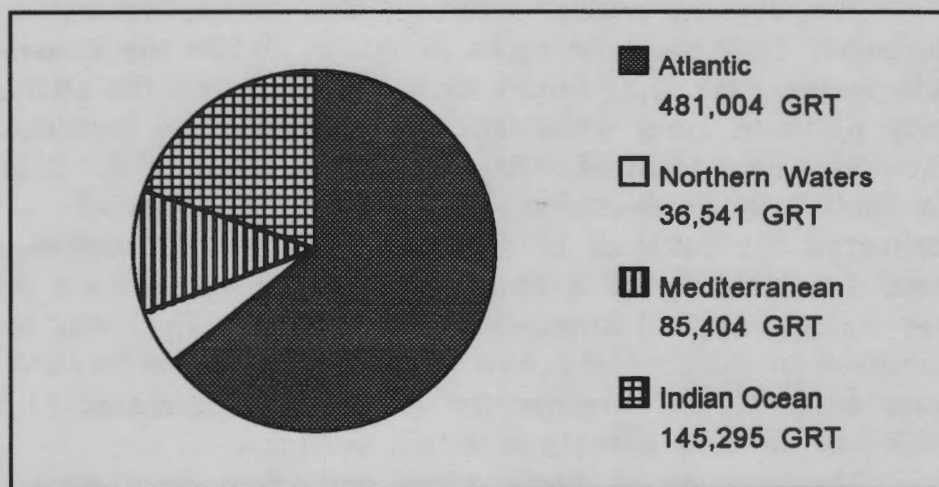
3. The critical nature of late fall, early winter 1942. Allied invasion of North Africa and the beginning of the all-out U-boat counter offensive.

The over-all critical nature of the period, November to December 1942 must be borne in mind. While the Russians held in the East, U.S. forces were just beginning the attempt to seize positions from which an offensive could be launched. There was no margin of safety. The U.S. effort in the Solomons, the landing in North Africa, the raising of the siege of Stalingrad, the battle of El Alamein, all formed a picture of one force that had reached a limit and of an opposing force that was making its first impression. Whether the field was to be stabilized or whether the Axis force was to move forward once more depended on whether the enemy was permitted to rest, re-fit and to take advantage of his conquest.

The invasion of North Africa had taken the U-boat arm by surprise and forced an alteration of plans. U-boats had to be sent in large numbers to patrol the landing coast, the Gibraltar approaches, and the New York - Gibraltar lane in the mid-Atlantic. It was really the first occasion on which the hand of the German U-boat navy was forced. Hitherto it had, in a sense, merely followed the line of least resistance. And this policy had been justified in terms of the sheer numbers of ships sunk. The U-cruiser attacks off of Capetown, although definitely pointed toward assisting a specific German battle front, were still in conformance with this past development.

The invasion of North Africa served to emphasize the principle U-boat task, namely, the destruction of the convoys bound for England and Russia, by adding still another major convoy lane - still another artery of final defeat.<sup>1</sup> The enlarged U-boat fleet was forced to undertake an intensive campaign against major convoys in the winter of 1942-1943. The importance of this campaign was clearly recognized by German High Command, and U-boat commanders were sternly reminded of their hard pressed comrades in Tunis and Russia. It was equally clear to the Allies that the one thing needed at this stage of the war was victory over the U-boat. Everything depended on maintaining our sea lanes. Could this be done, it was but a matter of time until the accumulation of materials would overwhelm the Axis. Hopeful as November may have been in view of the North African landing, Rommel's retreat, and Stalingrad, the U-boat had met the threat by its greatest single month of overall success.

**Allied and Neutral Merchant Shipping Losses  
November 1942 by U-boat Action<sup>2</sup>**



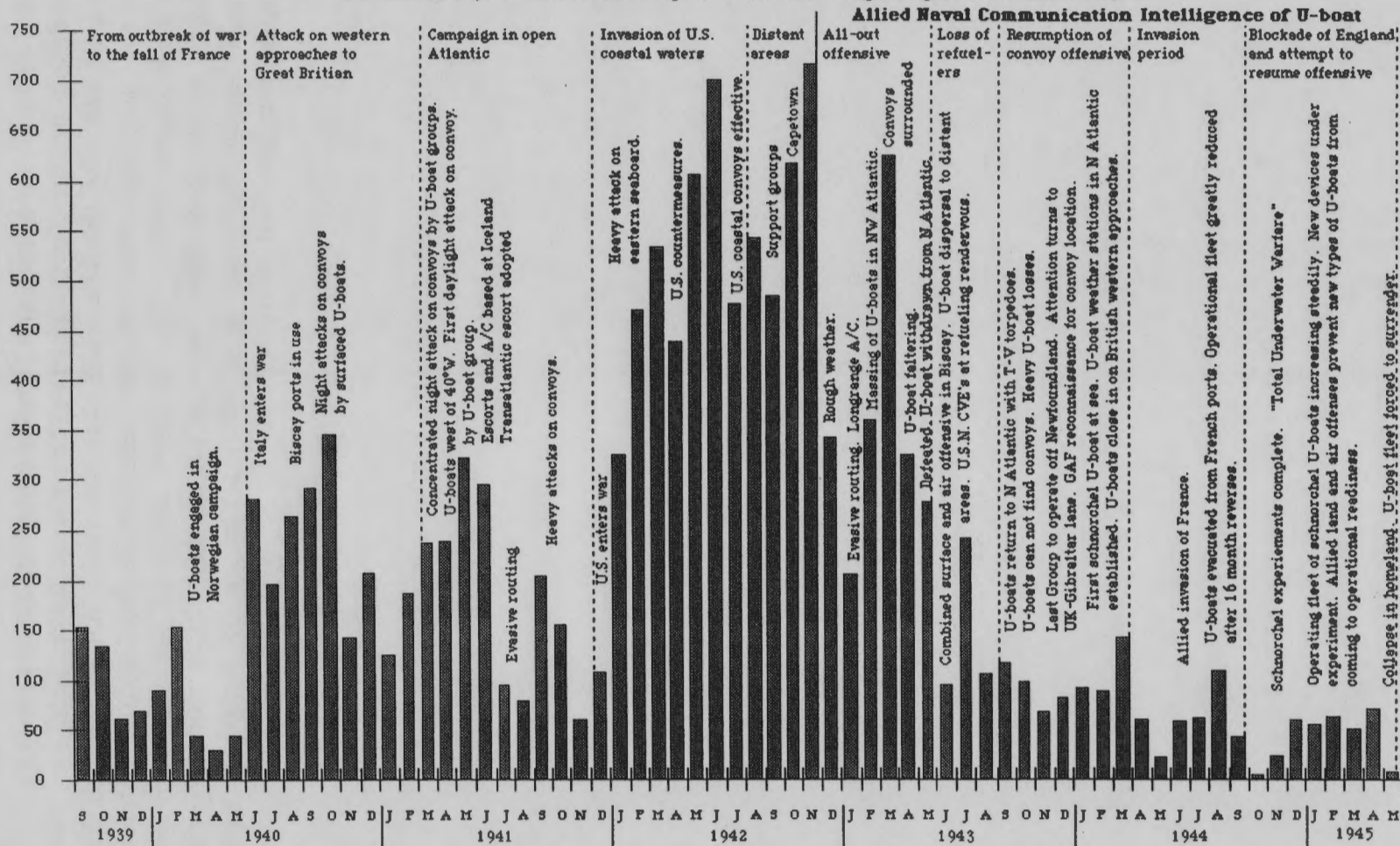
<sup>1</sup>While this may have been true from a naval perspective Hitler had other concerns. He was preoccupied with the vision that the Norwegian theater would be invaded by the Allies. His subsequent decrees moved the bulk of the German surface fleet to northern Norway for reinforcement. See *Fuehrer Conferences on Matters Dealing with the German Navy*, August-December 1942. Operational Archives, Naval Historical Center.

<sup>2</sup>The figures represented do not include an additional 85,751 GRT for combatant vessels also lost. Jürgen Rohwer, *Axis Submarine Successes 1939-1945*. (Annapolis: Naval Institute Press, 1983), passim.



If the German armies seemed stalled on land, the U-boat was in a position to wipe out the momentary Allied relief. At this critical moment, the fundamental counter-offensive launched by the Germans may be said to have been the U-boat war at sea, for the sea itself was the basic Allied vantage point. It was into this situation that decryption intelligence entered in mid-December 1942. The decisive battle of the war had been joined at sea and there was no retreat for either side. Neither could refuse challenge in a bitter exchange of torpedoes and depth charges that followed.

**Monthly Losses of Allied and Neutral Shipping by U-boat Action**  
 (Source: Admiralty, "The Anti-Submarine Report," CB 4050/Series. Figures represent thousands of GRT)



## Chapter II

### The U-Boat and Allied Naval Communication Intelligence

\* \* \*

1. The U-boats Mission. Nature of the U-boat War.
2. The U-boat.
  - (a) Its secret strength: "Invisibility."
  - (b) The U-boats weakness.
3. Communication Intelligence and Perspective on U-boat war from beginning of 1943 to end of war.
4. The contribution of decryption intelligence to the U-boats loss of invisibility.
  - (a) Record of decryption.
  - (b) Weakness of U-boat operating system which increased value of decryption intelligence: Operational bookkeeping by radio.
5. Uses of decryption intelligence in the Battle of the Atlantic.
  - (a) Accumulation of information on U-boat navy.
  - (b) The protection of Allied convoys and shipping.
  - (c) Offensive use.
  - (d) Allied decryption intelligence as countermeasure.
  - (e) Technical intelligence.

## The U-Boat and Allied Naval Communication Intelligence

### 1. The U-boats mission. Nature of the U-boat war.

The German Navy defined the U-boat as a "torpedo attack underwater boat"; its target, enemy merchant shipping. The continuous and successful use of the U-boat against this target is ". . . in the long run of strategically decisive significance for the outcome of the war, since the destruction of her sea communications means the loss of the war for a nation dependent upon sea-trade."<sup>1</sup> In theory the U-boats peculiar properties enabled it to carry out this mission despite the enemy's control of the seas. Once well launched under Admiral Dönitz, the U-boat navy was never permitted to forget her basic offensive mission nor its significance for the outcome of the war.

The peculiar nature of the U-boat war, or the Battle of the Atlantic, does not lend itself readily to the stirring descriptions which may mark the history of a series of major fleet engagements. It is not an impressive succession of majors but an attrition of minors. To the Allies this battle may have been inglorious, for it was a battle to deliver supplies. When seen as a whole, however, these minor engagements add up to a major battle upon whose outcome week by week the future prosecution of the war abroad depended. Whether striking or hiding, however the U-boat turned to or from attack it always threatened and exacted countless hours of watch and patrol. An engagement which goes on so long, is so devoid of spectators and correspondents, and is so far to the rear of the battle lines is apt to recede in memory with the passage of time, for it lacks the classical unities of the drama, being neither one in place nor in time nor in action. To the German Navy, in contrast, it may have borne a rather different, more romantic face. The Battle of the Atlantic was a front, "The U-boat front," and was recognized as the first line of battle, at first carrying the offensive to the Allies and then in defending the continental fronts. The U-boat man was a hero, in name at least, and the conduct of the war by U-boat Command made full use of colorful imagination, as in naming U-boat groups "Jaguar," "Seawolf," "Searobber," "Eagle," "Lionheart," . . . etc.

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<sup>1</sup>Handbook for U-boat Commanders, OKM 1942, p.71 (NEMO Document)



Mr. Churchill managed to convey something of this in reverse to the Allied public in his description of the Nazi beast of the sea stealing out from its caves on the Biscay coast or with drawing to lick its wounds.

## 2. The U-boat.

### (a) Its secret strength: "Invisibility."

In stressing the strategic significance of the U-boat weapon itself, namely, to destroy the sea communications of an enemy dependent on merchant shipping, the U-boat Commander's Handbook stressed the following basic principles:

(i) "...the characteristic property and greatest strength of the U-boat is its invisibility." This comes from its ability to submerge. "Invisibility" gives the U-boat its own advantage in combat: surprise. "invisibility" determines the entire theory of U-boat tactics, even in defense, which depends on escape underwater.

(ii) To keep its secret strength, the U-boat must "not be seen, not heard, not be located (geortet)" before or during an attack. If the U-boat is located by the enemy, "...it loses almost all prospect of success."<sup>2</sup>

The ULTRA history of the U-boat war is a commentary on this section of the Commander's Handbook, as part of the U-boats strength in surprise, was the intelligence of convoys which guided the wolfpacks to the right place. Insofar as the U-boat anticipated the possibility of location before attack it began to add various counter-location devices which characterized the German U-boat in World War II. As the possibility of location turned into a probability, the morale of the Commander was affected and the entire U-boat navy became engaged in developing one counter-device after another - either to restore "invisibility" and "surprise" or to enable the U-boat to defend itself.

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<sup>2</sup>Ibid., 10.

(b) The U-boats weakness.

The U-boat lost its strength upon being located because it was an offensive weapon incapable of surviving a defensive role in combat. Extremely vulnerable, its only defense was again its source of strength, namely invisibility. It could disappear and hide. Going down was a matter of seconds, but once there it was sluggish - and its time submerged limited. For it was not truly an underwater boat.

The German Navy knew the weaknesses of the U-boat. The handbook of 1942 listed and discussed them.

Low speed (principal weakness) which results from the necessity, for sake of "invisibility," of two kinds of propulsion, thus doubling the machine installation and resulting in a corresponding reduction in the performance of either one singly. This comparatively low speed "...is of fundamental significance for the U-boats tactical use."

Limited underwater cruising range.

Limited look-out.

Great vulnerability.

3. Communications Intelligence and Perspective on U-boat war from beginning of 1943 to end of war.

On the whole, U-boat traffic read in OP-20-G covers the period of U-boat weakness. It would be surprising if this were not so. The U-boat was at a distinct disadvantage throughout this period because it had lost its "invisibility." Its movements were known, whether by decryption intelligence or D/F, or radar, or sonic devices - or by a combination of all these Allied location devices. It was the U-boat that was more and more "surprised." In the fall of 1942, the U-boat had already begun the long and involved history of remedies, but not until the decisive defeat of the winter and spring offensive of 1943 did U-boat Command's search for counter-devices and restoratives become constant and urgent, finally resulting in a major change in submarine warfare.

Throughout the search for causes of the U-boats loss of "invisibility" and "its one advantage in combat: surprise," there was one Allied location measure which remained unknown to

the German's. Behind D/F and radar there was a further locating device, decryption intelligence, whose existence the Germans may have feared on occasions but in which they apparently never really believed. At least those responsible for final decisions never acted as though they believed in it; the changes which might have countered the Allied cryptanalytic attack were never introduced. Knowing that the U-boat had lost its secret strength and had become the hunted instead of the hunter, U-boat Command persisted in reducing the mystery of Allied location by radar, i.e. to something which could be seen or could be heard, given adequate CRT and receiver equipment. It was of course considered that the secret might not lie solely in Allied transmissions, but also in U-boat radiations. Every kind of U-boat radiation was studied: heat and electronic which might be picked up in special allied receivers, U-boat transmitter radiations in tuning, U-boat receiver radiations, and their own radio transmissions D/F'd by Allied intercept net. In truth, the critical radiations were the radio transmissions and the receiver was the Allied intercept net. But the Allies were not simply D/F'ing the unit transmissions, they were reading the messages - U-boat Command's as well as those from units. U-boat Command's messages were more revealing than those from individual U-boats.

4. The contribution of decryption intelligence to the U-boats loss of invisibility.

(a) Record of decryption.

Well over 115,000 individual German naval messages were decrypted in OP-20-G and read in the Atlantic section. (This figure does not include short-signals and WW's). During the first 9-1/2 months of reading, i.e. from December 1942 to mid-September 1943, U-boat traffic was not decrypted solidly nor always within the time limit for immediate operational effectiveness. 233 out of the 289 days in this period were read, 127 within 5 days, of which 61 within 2 days. Thereafter, from mid-September 1943 to the end of the war, but especially after 1 November, it is no exaggeration to say that U-boat traffic was consumed on the spot, continuously, solidly, and currently for 19-1/2 months.

# Record of U-boat Traffic Decryption (Atlantic) December 1942 - May 1945

| Month                 | No. Days<br>Not Read | No.<br>Days Read | Total No. Days<br>Read in 5<br>Days or Less | No. Days<br>Read in 2<br>Days or Less | 2 to 5<br>Days |
|-----------------------|----------------------|------------------|---------------------------------------------|---------------------------------------|----------------|
| Dec 42                | 12                   | 19               | 8                                           | 5                                     | 3              |
| Jan 43                | 3                    | 28               | 17                                          | 5                                     | 12             |
| Feb                   | 1                    | 27               | 23                                          | 18                                    | 5              |
| Mar                   | 5                    | 26               | 19                                          | 8                                     | 11             |
| Apr                   | 11                   | 19               | 19                                          | 12                                    | 7              |
| May                   | 3                    | 28               | 14                                          | 9                                     | 5              |
| Jun                   | 9                    | 21               | 7                                           | 1                                     | 6              |
| Jul                   | 2                    | 29               | 3                                           | 2                                     | 1              |
| Aug                   | 6                    | 25               | 10                                          | 1                                     | 9              |
| Sep 1-15              | 4                    | 11               | 7                                           | 0                                     | 7              |
| Total to<br>15 Sep 43 | 56                   | 233              | 127                                         | 61                                    | 66             |
| Sept 15-30            | All days read        |                  | 12                                          | 3                                     | 9              |
| Oct                   | All days read        |                  | 25                                          | 18                                    | 7              |

## Average daily delay in hours (GCT)

|        |               |      |
|--------|---------------|------|
| Nov    | All days read | 26.1 |
| Dec    | All days read | 26.0 |
| Jan 44 | All days read | 23.7 |
| Feb    | All days read | 32.6 |
| Mar    | All days read | 22.0 |
| Apr    | All days read | 18.0 |
| May    | All days read | 21.1 |
| Jun    | All days read | 21.5 |
| Jul    | All days read | 18.6 |
| Aug    | All days read | 16.2 |
| Sep    | All days read | 36.4 |
| Oct    | All days read | 45.2 |
| Nov    | All days read | 37.0 |
| Dec    | All days read | 40.3 |
| Jan 45 | All days read | 25.2 |
| Feb    | All days read | 28.1 |
| Mar    | All days read | 56.7 |
| Apr    | All days read | 33.4 |



After months of effort the German machine cipher had been mastered and the recovery of the daily keys reduced to a minimum delay.

- (b) Weakness of U-boat operating system which increased value of decryption intelligence: operational bookkeeping by radio.

The above statement on the quantity of material made available by decryption is not complete without a statement concerning certain peculiarities of the German operating system which greatly increased the value of U-boat special intelligence. The constant and close personal direction of the U-boat from the shore necessitated complete reliance on radio communications. U-boat radio traffic constituted in effect a system of operational bookkeeping which required daily posting if the U-boats were to function as Command intended. The following are some of the major points in the operating system, all dependent upon radio communications, which made available to the Allies Dönitz's (COMSUBs) own entries in his system of accounting for every U-boat at sea.

- (i) Heading points and operational plans were ordered by radio after the U-boat had put to sea. There were few exceptions to this procedure. Occasionally boats sailed with written orders for special tasks, but even they were told by radio to "Proceed according to Special Task."

- (ii) Passage reports: U-boats were required to send passage reports after clearing outer Biscay or after crossing 60°N when outbound from the Baltic or Norway for Atlantic operations.

- (iii) Complete control of operations from shore: U-boats were not only told where to go after they had put to sea but also when they were expected to arrive in their heading area. Patrol lines were formed on the hour. Every U-boat Commander who was to be in the line was addressed by name. There were to "be in line at 0800/17" at stated intervals between two points defined down to minutes by means of grid squares. There they were to expect an "eastbound convoy" beginning at dusk. From there on they continued to be told exactly what to do. It is a mistake to think of the "wolfpack" as

a kind of independent task force. There was no senior officer present who directed the operation from a flag-boat. COMSUBs decided everything, and thus demanded the most detailed descriptions of the situation from each U-boat, transmitted on frequencies that could be heard equally well on this side of the Atlantic. There was a provision for a "group circuit" to be used only when Control could not hear what was going on. If communications were entirely broken off (very rare) and the "group circuit" ordered, then COMSUBs would name other U-boats as radio relays so that he could still keep himself informed. The shadowing U-boat had to send homing signals on medium frequencies, but at the same time it had to report to Control on high frequencies.

(iv) Position reports: If a U-boat failed to append his position to a transmission or failed to transmit for several days, he usually received a special request to report position. (U-boat sinkings were judged on the basis of these reports.)

(v) Modifications: No U-boat could deviate from orders without permission requested and granted by radio.

(vi) Returning: U-boats could start their return home only after a specific order to do so or after a request with reasons had been submitted and granted - by radio. The decision to return was left up to the Commander in some cases, such as those involving a damaged U-boat, but the damage had to be reported and the return cruise announced. On their way in, U-boats had to transmit their expected time of arrival off escort points and their requests for radio beacons.

(vii) Fuel on hand had to be appended to every transmission. Refueling at sea was handled in the same detailed manner. The refueling station was announced well ahead of time. What U-boats were to be serviced, how much fuel they should have left on arrival, and how much fuel they were to be given were all sent on the air, down to the last cubic meter. And after the job was done, the supply submarine had to make his report by radio; telling what U-boats he refueled, how many cubic meters each received and when, and how much of everything the supply submarine had on board.

(viii) While mechanical details of new equipment were not always available in U-boat traffic, the essentials could be put together in short order, because here again either Command could not wait to see how the things were working out or something would come apart and the U-boat would need advice.

(ix) General orders, estimates, etc., situation reports. The German habit of bookkeeping did not stop with the details of U-boat movements, but went on to make far more information available to the Allies than was actually necessary for the U-boats day to day operations. The tempo of the war at sea, and considerations of security, may have necessitated the custom of giving the U-boat his heading orders after he put to sea. The fact that some U-boats were always at sea may have made it difficult to effect a timely delivery of general orders and estimates of the current situation without reliance on radio. But whatever the German difficulties may have been, their solution by radio kept the Atlantic Section's books posted along with those of the U-boats at sea. When the U-505 was captured, her volume of Current War Orders, for example, was already contained in the Atlantic section's files and long since in the hands of COMINCH. In fact, U-505's copy was out of date, having been superseded by additions and corrections which she had failed to intercept herself or which had been transmitted after her capture.<sup>3</sup>

(x) Communications: To carry this heavy burden of traffic the German navy developed elaborate, complex, flexible, and highly efficient radio service which is probably unique in the history of military communications. Its workings, however, were likewise revealed in U-boat traffic. The Atlantic Section translated more than a hundred corrections to "Communications War Orders" in addition to approximately 150 series of messages announcing frequency and circuit changes.

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<sup>3</sup>The Atlantic Section translated 168 corrections to Standing War Orders, 58 current orders (not operational, but estimates on anti-submarine defense, tactic, etc.), and 194 Experiences and Admonition messages, not to mention cancellations. In addition there were unnumbered "Situation Reports" for the various operational areas.

5. Uses of decryption intelligence in the Battle of the Atlantic.

The effect on the enemy of this wholesale misdirection of his own radio communications is difficult to calculate in detail. In mentioning some of the more obvious uses of intelligence emphasis should be given to the most general use, background information.

(a) Accumulation of information on U-boat navy.

As will be evident from the items already referred to, the files of processed U-boat traffic steadily gathered a vast amount of information, both general and detailed, on every aspect of the U-boat, including the edicts of the Grand Admiral and the welfare of the U-boat crews, their ailments and proxy marriages. Orders of the day and reports from those at sea could be read against a broad background. Something of the enemy's temper could be determined, his habits and character appreciated. One had considerable evidence with which to appraise his intentions and limitations, with which to judge what he could or would do - or not do.

On the basis of traffic U-boats could be identified by number and by commander. The Atlantic Section periodically issued a master list of operational U-boats. Their types could be identified, if not already known, in various ways, as, for example, by reports of fuel on hand.

From a knowledge of the enemy's communications and operating systems one could frequently fill in information that had been missed. To mention only one example: if a U-boats passage report had been missed, the order to change from "Coastal" to "Ireland" radio circuit would give the same information in another way. There were also cases in which errors made by the Germans were caught here before they were cleared up by Control.

If this background was invaluable in the interpretation of present and future U-boat movements, it was equally important in breaking into current keys, for one knew the sort of message which would accompany or come out of a given situation at sea. One waited for a message of the right length or with a D/F fix in the right area.



(b) The protection of Allied convoys and shipping.

During the first 5 months of 1943, the primary use of radio intelligence was in convoy diversion, for at this stage sufficient antisubmarine and escort forces were not available for an immediate and direct offensive.

(c) Offensive use.

The defensive use of ULTRA intelligence continued throughout the war, but with the increase of anti-submarine forces the direct offensive use became more and more characteristic. One of the first instances of the U.S. Navy offensive use of ULTRA was the attack delivered by the USS *Bogue* on U-boat group *Trutz* early in June 1943. From that time on U.S. Navy CVE forces carried out frequent attacks, giving special attention to U-boat refueling rendezvous in the Middle Atlantic. As a result of these attacks U.S. Navy contributed in a major way to the destruction of the U-boat supply fleet. In addition, U.S. Navy forces practically cut off Axis supply line to and from the Far East by intercepting the submarine cargo runners, after having played a full part in the sinkings of surface blockade runners.<sup>4</sup> Of the 489 U-boats sunk by Allied action at sea beginning in January 1943 U.S. Navy forces sank approximately 63 with direct aid of ULTRA information plus some 30 more with indirect aid of ULTRA.

(d) Allied decryption intelligence as countermeasure.

An important contribution made by the Atlantic Section on the basis of its own correlation of U-boat traffic was the detection of German cryptanalytic success with Allied codes and ciphers - principally the Anglo-U.S. combined naval cipher.

(e) Technical intelligence.

Communications intelligence correlated, evaluated and disseminated advance intelligence and currently significant details about devices and techniques under development or in use by the enemy. Such information was extensive both in variety and in volume. A related factor in the constant

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<sup>4</sup>See parts B and E of Volume II

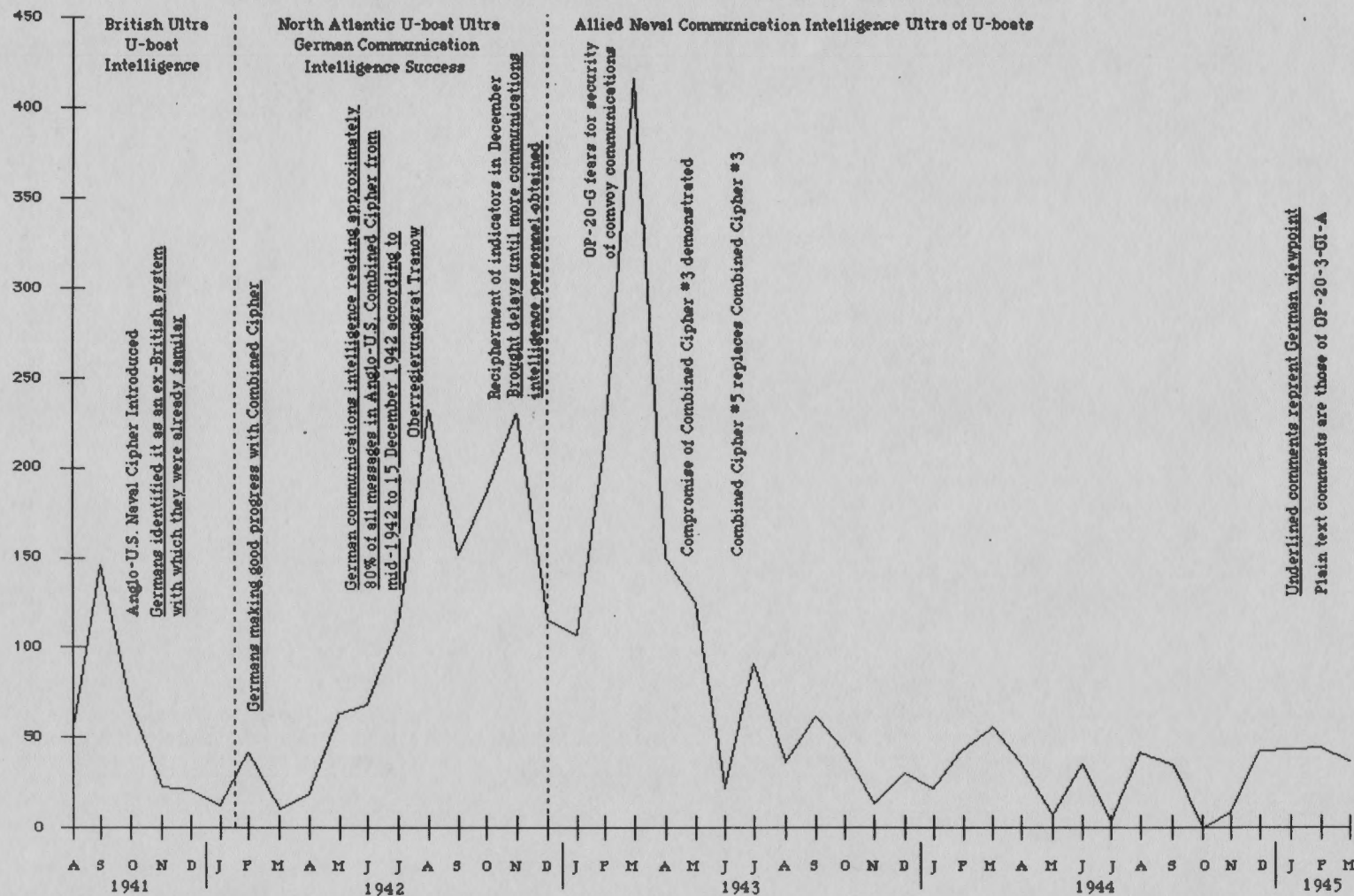
struggle for technical supremacy, namely enemy knowledge of Allied devices and procedures, was also the subject of continual attention. A review of the nature and history of the more important devices concerning which information was passed leaves no room for doubt that this aspect of the Atlantic Section's activity was of vital significance. The advantage of superior intelligence about the enemy's endeavors in the field of radar, anti-radar search receivers and deceptive devices (such as Aphrodite), weapons, underwater diesel propulsion (schnorchel) and other technical matters helped the Allies to gain and hold the initiative in the battle for superiority in technical devices.<sup>5</sup>

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<sup>5</sup>See Volume IV for details.

## Merchant Shipping Sunk in Escorted Convoys by U-boats

(Source: Admiralty, "The Anti-Submarine Report," CB 4050/Series. Figures represent thousands of GRT)



## Chapter III

### Winter/Spring U-boat Offensive and the U-boat's Defeat, 1943

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## Winter/Spring U-boat Offensive and the U-boat's Defeat, 1943

The U-boat was decisively defeated in the spring of 1943. The failure of the German winter/spring offensive can be ascribed in part to Allied communication intelligence. Decryption intelligence assisted materially in successful convoy diversion in January and February, when massed assaults might have produced shipping losses comparable to March, or worse. Delays in decryption intelligence on our side plus timely radio intelligence on the German side played an important part in such convoy successes as the U-boat did achieve, notably in March. In April and May decryption intelligence held its own, but even when U-boats made contact the strengthened surface-aircraft defense attacked with a force the U-boat could not withstand. The war was to last for two more years, but the U-boat navy could not regain the initiative. When it returned to the offensive, it was firmly mirrored in ULTRA intelligence. Unable to find and strike its main target, it moved cautiously, never freed from the constant fear of surprise attack.

### 1. General considerations on the U-boat's defeat.

#### (a) Retreat or strategic withdrawal.

Retreat from the major transatlantic convoy lanes was at all times the indication in German U-boat traffic itself of the U-boats defeat. Strategic withdrawal will be the term used by the Germans, for unlike World War I, it was the German U-boat navy that alone remained as a fighting unit at the conclusion of World War II. Its tenacity and resilience, its determination to revolutionize submarine warfare despite disasters at home will be the subject of later comment.

#### (b) U-boat navy's time-table.

Without more knowledge than is now at hand on the preceding periods of the U-boat navy's history in World War II, it is a matter for questions that the U-boat was not only so late in starting its all-out offensive against major convoys, but also not really ready even then. The U-boat building program indicates that the spring offensive of 1943 was merely the

beginning of the all-out offensive, not the real thing. The unexpected invasion of North Africa, the serious situation on the land fronts, and the astonishing productive capacity of the United States apparently forced the U-boat navy to undertake an offensive before it was really ready. The construction of the U-boats reached its peak a year later, in the winter of 1943-44, when U-boats were being commissioned at the rate of 25 per month. But the types being commissioned were the ones that had already shown themselves inadequate for the U-boat mission. In other words, the German Navy's time-table not only showed what was probably a serious underestimate of U.S. productive capacity but also a slowness in active comprehension of what happened in the Atlantic during the spring of 1943. New high speed underwater types did not reach significant production figures until the winter of 1944-45. Meanwhile the accumulation of old types had continued to rise, in spite of losses at sea, until the actual number of U-boats, including those in training, had never been larger than it was in the winter of 1943-44. Schnorchel was not ready for all these boats until the fall of 1944 - after the Allied invasion of France.

At this point the general effect of decryption intelligence should be probably be taken into account. Part of the German miscalculations, i.e. those continued after spring 1943, may have been due to the impossible situation in which the German Navy was placed without even knowing it - namely, that having its high grade operational radio communications wide open to the enemy. Long after the defeat of spring 1943, the German Navy persisted in believing that "invisibility" might be restored to the standard types. With this restoration the U-boat would again be equal to a battle that was recognized as "hard," and "growing harder." The U-boat of spring 1943 had not been prepared for strength and variety of defenses encountered, but the balance could be restored. At least, the Germans saw no reason why old types could not still hold their own.

- (c) Review in terms of merchant shipping and U-boat losses.

The decisive nature of the U-boats defeat in 1943 can be shown by a breakdown of over-all figures for the war. January 1, 1943 is taken as the point of division, thus giving the U-boat the advantage of its all-out offensive.

| <u>M/V's sunk by U-boat<sup>2</sup></u> |                  | <u>by direct Allied<br/>action at sea</u> | <u>U-boats lost<sup>1</sup><br/>by other<br/>causes</u> |
|-----------------------------------------|------------------|-------------------------------------------|---------------------------------------------------------|
| Sep 1939-<br>Dec 1942                   | 11,422,350 GRT   | 139                                       | 14                                                      |
| Jan 1943-<br>May 1945                   | 3,493,571 GRT    | 556                                       | 73                                                      |
| Total                                   | 14, 915, 921 GRT | 695                                       | 87                                                      |

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U-boat success had been achieved at a reasonable cost while the U-boat fleet was still adolescent - the greatest success, of course, (over 6,000,000 GRT) off our own coasts in 1942. But before the small-scale weapon which had accomplished so much in 1942 could be really forged as a large-scale weapon, it was already under Allied control.

- (d). World War I compared with World War II.

|                          | <u>M/V's sunk<br/>by U-boats</u> | <u>U-boats<br/>Commissioned</u> | <u>U-boats<br/>lost</u>                    | <u>% U-boats<br/>lost</u> |
|--------------------------|----------------------------------|---------------------------------|--------------------------------------------|---------------------------|
| World War I <sup>3</sup> | 12,191,966                       | 343                             | 178                                        | 52%                       |
| World War II             | 14,914,921                       | 1,200                           | 782(all<br>causes)<br>695(enemy<br>action) | 65%<br>58%                |

<sup>1</sup>These numbers represent German U-boats only. Admiralty, Historical Section, *The Defeat of the Enemy Attack on Shipping 1939-1945*.

<sup>2</sup>Jürgen Rohwer, *Axis Submarine Successes 1939-1945*.

<sup>3</sup>The figures for World War I are taken from Admiral Dönitz's book: *Die U-bootwaffe*, Berlin: Mittler & Sohn, 1942, p. 69. The figure on shipping losses, according to Admiral Dönitz, is taken from British statements. It is not clear that the figure 343 should be listed "U/B's commissioned," but Admiral Dönitz used the phrase normally translated as "commissioned" - "in Dienst gewesen."

If the above figures for merchant shipping losses are correct, there is a very marked contrast between the effectiveness of the U-boat in World War I and World War II. While the percentages of U-boats lost are in line with one another, the much greater U-boat effort of World War II did not yield anything like a result comparable to World War I. When these figures are examined together with those in paragraph 3 above, one sees that the U-boats failure in World War II lies in the last 2-1/2 years of the war, precisely during the period when the U-boat navy had reached its greatest potential. Had the U-boat been able to continue its earlier success with figures at all proportional to the increased effort the result for the Allies would have been indeed calamitous.

## 2. Pattern of the winter/spring offensive.

There were two principal types of U-boat operations:  
Group (wolfpack) operations against major convoys,  
Individual station patrol, primarily in distant coast areas.

Supplementary to the above, but in itself of unique and great importance was the U-tanker.

### (a) Independent U-boats in distant areas.

The U-boat attempted to harass the ocean edges simultaneously with the convoy offensive, although the expenditure of effort in distant areas which characterized the fall of 1942 could not be maintained. After some 23 U-boats in these areas during December, the number dropped to 7 in January, but thereafter increased month by month to 18 in May. The active fleet of 740 and 1,200 tonners, however, was too small to maintain a constant pressure comparable to that in the North Atlantic. Furthermore, these distant operations demanded a disproportionate share of U-tanker services.

### (b) U-tankers.

In December 1942, the German Navy had seven 1,600 ton supply submarines, upon which the Atlantic offensive was dependent for its full effect. By March, 2 more had sailed on their first cruises. Even though these refuelers spent half their



time at sea, U-boat supply was working on a slender margin, for it was apparently intended to maintain 3 refueling stations: one for US-UK convoy submarines, one for US-Gibraltar convoy submarines, and one for Trinidad-Caribbean and South American submarines. As a result, US-UK convoy operations suffered during the early part of the winter. Continuous stations could not be maintained. In January, for example, U-459 (Wilamowitz) had to be sent on a long haul into the South Atlantic to service the few Capetown submarines, while U-boats in the North Atlantic were being forced to drop out of groups and come home for lack of supply facilities. Not until February were continuous stations maintained off the US-UK and US-Gibraltar lanes, and the situation was still pinched. In March 3 of the 4 supply submarines that delivered fuel serviced US-UK convoy submarines. This measure of attention to the North Atlantic continued for the remainder of the spring offensive.

It was of course recognized at the time that these refueling rendezvous constituted a kind of Achilles heel, but it was months before efficient antisubmarine forces were available to act on decryption intelligence of these meetings at sea.

(c) Group pattern for US-Gibraltar lane. December 1942-April 1943.

U-boats operating on the US-Gibraltar lane formed a circuit independent of group operations farther north. There was frequent exchange with IXc (740 tons) submarines bound to or returning from middle or south Atlantic coastal areas, but not with the 500 tonners operating on US-UK lanes. Proceeding from Biscay to the Azores areas, U-boats would form for eastbound convoys and sweep out sometimes as far as 40°W. After a period of waiting, the group would turn and cruise back along the lane for westbound convoys. Having arrived in the area east of the Azores and north of Madeira, the group would break up along the Canaries and in the Gibraltar approaches for mixed group and individual station patrol tactics. As their final gesture before putting back into Biscay, the U-boats that had not been refueled for further operations would form once more off Portugal to block the UK-Gibraltar lane. Meanwhile replacements would have formed in the Azores area. It was not a very lucrative run, yet U-boat Command gave

approximately one-third as many submarines to it in the peak months of February and March as he gave to the US-UK lanes. The destruction of oil tankers in the convoy TM 1 in January had apparently impressed High Command with what these operations might achieve for the North African front, but in March Admiral Dönitz admitted that US destroyers could put up very stiff resistance. In April U-boats were withdrawn from the lane.

(d) Group operations against US-UK convoys.

It has already been suggested that the U-boat navy was not really ready to launch the convoy offensive in the winter of 1942-1943. The shift of emphasis to US-UK lanes was not noticeable in December, when independent operations sank more ships than were sunk by North Atlantic groups.

From January through May 1943 the number of U-boats at sea in the Atlantic averaged 166 per month, 179 being the top monthly figure-reached in both March and May. The average number actually operating was 108. The remaining 58 U-boats were either outbound or returning, and, although potentially operative, could not be relied upon for the operating plans at any given moment. Thus only 65% of the submarines at sea might be called immediately available. This figure was again cut down by the demands of other areas, with the result that an average of only 72, or 66% of the operating submarines, was devoted to US-UK lanes in January and again in February, but the number stalled in March, fell off in April, and then reached its highest point (81) in May, when the battle was practically over.

(1) Pattern of the US-UK group formations.

The major convoy offensive might be described as a pulsation or rhythm: first the convergence of U-boats from port (both Biscay and the Baltic or Norway) as they made for their waiting areas, then the formation of the patrol line followed by the reconnaissance sweep, and lastly contact and the vortex of operation. In practice, of course, the pulsation was irregular, the rhythm broken; at any given time there might be several distinct beats in differing degrees of completion. After the operation came disentanglement and division: some heading directly for port, others to refueling stations whence they

joined up again with another group or formed the nucleus of a new group or returned home. Forming and reforming, they traced individual patterns and group patterns in a whole whose periodicity was determined by the convoy cycle.

The group formations had to fulfill two basic requirements: maximum reconnaissance and maximum striking power once contacts had been made. Disposition for maximum reconnaissance reflected the work of German naval intelligence (largely communications intelligence) on convoy movements, but trial and error method was also used against a background of elementary deductions concerning convoy routes, such as preference for the northerly route which could be covered to a greater extent by land based aircraft. With a sufficient number of U-boats lines could be set up near the beginning of the ocean route which would cover the major arc of possible diversions. It was practically impossible for a convoy to pass through a line undetected. To obtain maximum striking power the groups had to be arranged in a pattern that would make encirclement possible - without sacrificing other favorable opportunities.

Certain of the more important conditioning factors should be mentioned:

(i) Considerations of emphasis as between eastbound and westbound convoys.

(ii) Intelligence: specific convoy intelligence, such as that gained from decryption, which recommended or necessitated changes in plans. Also, of course, the failures of intelligence represented in successful convoy diversions.

(iii) Convoy contacts not planned for, with the resulting changes made for immediate exploitation.

(iv) Allied defenses and location devices.

(v) Availability of U-boats, their condition, etc.

(vi) Availability of U-tankers at right time and place.

(vii) Weather: the phenomenally bad winter of 1942-43.

(2). The simple pattern:

December 1942 to mid-January 1943, consisted of two basic groups, one at either end of the convoy lane, shifting up and down in accordance with anticipated outbound convoy routes. Attention was divided more or less equally between east and west bound convoys by this arrangement, although, as things worked out, more attention was actually given to westbound convoys. An effective modification of this simple pattern was the planned encirclement involving a contact group backed up by a support group, an arrangement which led to the successful operation against convoy ON 154 at the end of December.

(3) Transition:

Late January. ULTRA intelligence was sufficiently current during the first part of January to be of material assistance in the successful diversion of convoys. U-boat failure to contact expected convoys at either end of the lane forced the initial pattern into a natural evolution. With its accumulation of fresh U-boats the eastern group was lengthened in an attempt to close outbound routes. When the convoys continued to evade the patrol lines, the groups were compelled to go in search of the convoys. By the end of January the long line originally intended for westbound convoys had turned into a westerly fan sweep, beginning about 30°W and covering the area from 55° to 60°N. A few days later, U-boats began to sweep the area between 50°N and 55°N in the same manner.

(4) Revised pattern:

For destruction of eastbound convoys. The transition just described was to end, of course, in the massing of U-boats in the northwestern Atlantic. The revised pattern might be reduced to four primary constituent groups:

Contact group off Newfoundland.

Westerly sweep group north of 55°N.

Westerly sweep group between 50° and 55°N.



a condition of changing visibility. At intervals the clouds would open and one could see the present situation, but not completely, for much of the present U-boat situation could be seen only in the immediate past. Unlike the analogy of visibility and cloudiness, however, the record of the immediate past was there, waiting to be read. The present might fade out but the past would open up and complete the picture of what had just been seen. And even though the present was blocked from view the past record would contain many elements known to form a part of the new situation. And thus, working back and forth, combining indirect and direct views, even at worst one had some kind of picture more accurate than any other in Allied possession, particularly when supplemented by D/F and traffic analysis.

Since ULTRA intelligence was not available for current use in December, it is of interest to note that every planned group operation met with at least the first condition of success, contact on the expected convoy. On the other hand, the scale of the German effort was small and the weather was bad. The largest number of submarines brought to bear on any one convoy was 22. (Groups *Ungestüm* and *Spitz*; ON 154).

Despite the enemy's increased effort in January and February U-boat successes on the convoy lanes did not measure up. The winter offensive was not succeeding. Ten U-boat groups or wolfpacks operated against US-UK convoys during January and February. Of the 16 convoy "expectations" for which the line were formed only 4 led to contact, and one of these 4 was probably a case of last minute German communication intelligence on the movement of a westbound convoy, ON 166. It was also the heaviest single convoy loss during this period. There were 6 additional contacts, not "expected" in U-boat traffic. Of these 6, 4 were to some extent accidental and it is not clear that radio intelligence could have prevented them. The remaining two are cases of radio intelligence failure, in which attempted evasion of one group sent the convoys to other U-boats whose movements were not currently known.

In March, the successful U-boat month, there were only 4 planned operations. Two of these expectations accounted for the greater part of the losses. Both are cases of radio intelligence failure, although it is not certain that one of them could have been prevented under the circumstances. The combined attack on SC 122 and HX 229, like the case of ON 166,

Replacement group, the fresh boats from port heading for and forming up in the area of 55°N - 27°W.

This drive against the west was designed for eastbound convoys. From the end of January to the conclusion of the spring offensive U-boat group formations were made with eastbound convoys in mind. Westbound convoys were attacked only as intelligence made these targets irresistible or as opportunity supposedly permitted within the framework of the offensive against eastbound convoys. Whether or not this shift of emphasis can be attributed to the aggressive Admiral Dönitz, who became Commander in Chief at this time, it seems evident that the German Navy could no longer afford to be primarily interested in the sinking of ships as such. It was the cargo of war supplies that had to be destroyed. By January 1943 Allied ship construction had passed total losses by U-boats.

The new pattern was highly flexible and was arranged not only to block every lane north of 50°N by the staggered sweep groups but also to make certain that once contact had been made every U-boat could be brought to bear. An increased number of U-boats was required. As against 12 new U-boats released from the north for Atlantic operations in January, 23 were released in February. U-boat losses lagged behind the accessions. To keep the requisite number at sea continuous refueling stations were necessary, for which U-boats might leave their place in line only when down to the very minimum of fuel. As COMSUBs explained to group *Haudegen* on 3 February:

Seizing of the convoys running at this time on very scattered routes is possible only with a large number of submarines.  
(1733/3 February 1943)

(5) March 1943: the pattern works.

As a result of unexpected operations in February on westbound convoys the revised pattern for eastbound convoys was not restored until March, when it proved its worth. More ships were sunk in convoy during March than in any other

month of the entire war. The difference did not lie in the number of U-boats, for as many had been there in February, but rather in the deployment of U-boats. First they were in their positions according to the pattern described above. Second, contacts were made on eastbound convoys as planned. The result was total encirclement of the convoys. The groups closed in from every direction; the convoy defense was hopelessly outnumbered. Even so, U-boat successes in March - or rather in the first three weeks of March - must be qualified. More than twice as many ships were convoyed in March as in February.

(6) Break.

The policy of massing U-boat groups in the northwestern Atlantic continued through April and May, but something had gone wrong. The precision of March could not be attained. There was evidence of increasing haste and uncertainty on the part of U-boat Command. Operations were confused by attempts to exploit contacts on westbound convoys near the end of their run. At the same time U-boats were ordered to pursue all contacts, even the most unfavorable, on eastbound convoys. Command could not concentrate his U-boats where and when needed. The arrangement of the group lines became more complex and less effective. In short, the pattern was breaking up.

3. Examination of the U-boat's defeat.

(a) ULTRA intelligence and convoy diversions.

During the winter and spring offensive of 1942-43 Allied radio intelligence was an imperfect instrument. It was of little or no immediate use in December 1942, but by the first part of January decryption was holding its own. By a combination of breaking into the present from time to time and the continual filling in of the past gaps one began to see how the U-boats worked, how their lines were set up, and what patterns were employed. Whether running even with them, a little ahead, or lagging behind, the process of piecing the whole thing together never stopped. It was like trying to watch the U-boats through

was made possible by last minute shifts in U-boat dispositions, presumably the result of German communications intelligence.

(b) Convoy defenses.

Effective convoy diversion continued in April and May, but even with contact U-boats could not mass for assault or maneuver into attack positions. The increase in convoy defenses which followed the shipping losses of March was the first step in the offensive sweep against U-boats. Joint surface-aircraft escort deprived the U-boat of his mobility. If he came up on the surface to look around or get ahead - aircraft put him down. Once down, the water rumbled with explosions, which U-boat Command interpreted as bluff depth charges, part of the Allied propaganda campaign against U-boat morale. U-boat crews and Commanders became frightened and lost their "healthy hunter instincts," despite Admiral Dönitz's exhortations and threats.

(c) Loss of experienced U-boat commanders and crews.

The U-boat arm had already lost many of its "ace" commanders<sup>4</sup>. The effort to step up the North Atlantic offensive in the spring of 1943 had necessarily bought new and inexperienced men into the most difficult battle areas. It is not possible to weigh the personal factor in the U-boat defeat but its importance can be indicated by the following figures:

During 1943, 10% of the operating U-boats accounted for 50% of the merchant shipping sunk; 40% of the operating U-boats accounted for all the merchant shipping sunk.

But even the skilled commanders were subject to surprise attack from the air.

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<sup>4</sup>A few of the top commanders and their successes include:

| <u>U-boat</u> | <u>Commander</u>  | (Number)<br><u>Tonnage GRT</u> | <u>Date of loss</u> |
|---------------|-------------------|--------------------------------|---------------------|
| 99            | Otto Kretschmer   | (44) 266,629                   | 17 March 1941       |
| 47            | Günther Prien     | (28) 164,953                   | 08 March 1941       |
| 100           | Joachim Schepke   | (39) 159,130                   | 17 March 1941       |
| 567           | Englebert Endross | (22) 128,879                   | 21 December 1941    |



(d) Surprise attacks from the air. Visibility and vulnerability.

As is pointed out in more detail in Chapter IV of Volume II, two things stand out in the course of the U-boats defeat - both of them plainly marked in U-boat traffic:

Inability of the U-boat to cope with surprise attack from the air;

Increasing intimidation of U-boat men as they began to appreciate the visibility and vulnerability of their weapon.

(1) U-boat Command's refusal to admit defeat.

U-boat Command did not anticipate the rapid expansion of Allied convoy defenses, hence he did not readily adjust himself to the facts reported from sea. A review of his reactions during the course of the winter/spring offensive shows that his concentration on the one end - attack! - relegated the difficulties encountered by the U-boats to a subordinate place where they could be handled by expedients or by psychology. In December 1942 U-boats were told to pay no attention to their own search receivers. Allied radar was ineffective. U-boats were to rely upon themselves and think only of attack. In January convoy evasion raised the fear of Allied location devices. It was not a combat of fear, but a fear that the Allies were escaping combat by means of radar. In February the SC 118 operation gave Command cause for worry. Results were not up to expectations and it was clear that very long range aircraft had been effective. His reaction, however, had been "further reports about aircraft are superfluous." If the U-boat persisted it could wear the escort out and then sink the fat merchantmen. Worries were put to one side as U-boats reported their successes against ON 166. The operation was called a "run of the mill success," but that was not true. Contact in the first place had been a matter of good fortune and the convoy had been pursued and attacked for days because it was beyond the range of land based aircraft. The appearance of aircraft carriers with convoys in March seems to have made little impression on U-boat Command. By April, however, the

combined effect of increased defenses was evident in Command's renewal of the doctrine that the U-boat must surprise if it is to succeed. Chances against convoys were narrowed down to the first night's attack. Claiming that the "aircraft situation is known here," Command saw no reason why the U-boats could not maneuver outside the range of the close aircraft escort (30-40 miles). If they were caught coming in, they could attack submerged. Encouraged by the brief success against ONS 5 in May, U-boat Command tried to dismiss aircraft by telling U-boats to stay on the surface and fire their inadequate anti-aircraft guns, "...then the plane will soon stop attacking." But trapped and defenseless, subject to surprise visitations in the difficult task of maneuvering, U-boats were less bold in pressing an attack which was sure to reveal their presence.

(2) U-boat Command accounts for the defeat.

U-boat losses did not become alarming until May and then they went up with suddenness for which the Germans were totally unprepared. When U-boats began to disappear at the rate of 1-1/3 per day, Command yielded the area in which he had already lost the initiative. He correctly judged (19 May) that "the enemy has once more gained a few lengths on us in his effort to deprive the U-boat of its most important attribute, invisibility." Allied successes were attributed to the surprise attacks from the air which radar made possible - on the outbound and returning U-boat lanes as well as on the convoy lanes. The time was to be passed in "cunning caution" until the U-boat regained its invisibility.

## Chapter IV

### U-boat Restoratives

\* \* \*

1. Course of the war.
  - (a) Summer 1943. Dispersal and U-boat diversion.
    - (1) US-Gibraltar lane. *Bogue* and U.S. Navy radio intelligence.
    - (2) Weakness of the summer campaign: unavoidable U-boat concentrations in passage areas and at refueling rendezvous'.
    - (3) Results.
  - (b) Renewal of the North Atlantic battle.
    - (1) T-V acoustic torpedo. "Offense is the best defense."
    - (2) Non-radiating search receivers will restore the balance "in the main theater of battle."
    - (3) "Thoughts on convoy fighting:" surprise the convoy.
    - (4) Sink the escorts. ("Thoughts on convoy fighting" continued).
    - (5) Results.
2. Major changes underway.
  - (a) German diagnosis of U-boat ailment.
  - (b) Plans for new types of submarines.
  - (c) Schnorchel.
3. U-boat restoratives before schnorchel.
  - (a) Against aircraft: GSR, infra-red receivers, radar, deception, anti-aircraft.
  - (b) Against destroyers.
  - (c) Tactics.
  - (d) Against the Allied intercept net.
  - (e) Failure of all countermeasures.

## U-boat Restoratives

The history of the U-boat war from May 1943 to the fall of 1944 is a repetition of German defeat. The U-boat continued to suffer heavy losses without being able to come to attack. Conviction of the U-boats defeat did not come easily. At first it seemed a matter of offsetting a temporary Allied technical advantage by devising suitable countermeasures.

After the briefest treatment of the courses of the war down to the invasion of France, this chapter will summarize the background of this period in terms of major changes started for a new U-boat warfare and in terms of various devices which were used in the attempt to keep the old U-boat alive.

### 1. Course of the war.

#### (a) Summer 1943. Dispersal and U-boat diversion.

The situation could not have seemed hopeless at first, for it was not believed that the Allies could distribute their advantage so as to cover every ocean area or every individual U-boat in the way in which U-boat groups had been covered in the North Atlantic during April and May. Meanwhile German technical genius - undisputed as ever - would produce the needed countermeasures and the U-boat could then return to the major battle.

In leaving the North Atlantic convoy lanes, it was recognized that the U-boat was withdrawing from the one area where victory was absolutely necessary. In one of his last messages to U-boats before the abandonment of the North Atlantic, Admiral Dönitz had made it plain that there were no longer substitute areas where the U-boat might fulfill its mission. U-boat commanders had been warned on 21 May: "...do not fail to understand that you must answer for your actions." (1900/21). The withdrawal three days later admitted a major and decisive defeat, although, at the time, it was presented as a strategic withdrawal.

#### (1) US-Gibraltar lane. *Bogue* and U.S. Navy radio intelligence.

That the US-Gibraltar lane was covered by carrier air power was quickly demonstrated early in June when Command



tried to contain group warfare with the U-boats salvaged out of the last North Atlantic operation in May. The USS *Bogue* attacked group *Trutz* on the basis of U.S. Navy decryption intelligence before the convoy could arrive which *Trutz* expected on the basis of German decryption intelligence. The combination of superior intelligence with the expansion of U.S. Navy air power in the Middle Atlantic, which Command did not anticipate, was to cost him dearly.

- (2) Weakness of the summer campaign:  
unavoidable U-boat concentrations in passage areas and at refueling rendezvous.

The U-boat dispersal which became marked after the *Trutz* affair was as natural and customary as it was necessary. Once dispersed, however, U-boats could find no place in the Atlantic where they might recoup their losses and reestablished their prestige. Instead, the effort led to an intensification of defeat by an alarming reduction of the operating fleet - and by the loss of the U-tankers. There were still two areas of unavoidable U-boat concentration: first, the passage areas of Biscay and Iceland-Faeroes; and second, the middle Atlantic refueling rendezvous', which were all the more necessary now that the 500-tonners were being employed in American waters. Against the first concentration the British waged a highly successful joint surface-aircraft sweep. Against the refueling rendezvous' the U.S. Navy CVE's made a lasting impression on the U-boat navy. (See Chapters VI and VII of Volume II for an overall study of the U-tanker system, the significance of its destruction, and the contribution of the U.S. Navy radio intelligence and CVE's to this destruction.)

- (3) Results.

In fulfilling the necessary conditions of attack, namely, passage and refueling, was a highly dangerous and nightmarish business for the U-boat, once in his operational area he had no escape from the problem of survival. Of those which reached American waters, more than half failed to return home.

(b) Renewal of the North Atlantic battle.

During the summer the Navy had, or though it had, developed the devices which Admiral Dönitz had promised to the U-boats in May. When U-boat groups formed on the US-UK convoy lanes in September the Admiral apparently believed that the U-boat was once more equal to its task. The hopes and ground for these hopes are best stated in the Admiral's own words. First of all, there was the acoustic torpedo, "Zaunkönig."

(1) T-V acoustic torpedo.

"Offense is the best defense." As U-boats sailed from France to await the signal for the first convoy operation, all T-V equipped submarines were instructed as follows:

To be deciphered only by Zaunkönig subs:

Offizier R

Make use of every opportunity to bring your sharp weapon into play. In Biscay on the way to your operational area, be at all times clear for a defensive or offensive shot against destroyers or corvettes. If the enemy bears down on you, do not blind yourselves by going to great depths, but in the daytime remain at periscope depth and fire. You still have enough time after firing to dive. The same applies at night, first fire, then dive. Offense is the best defense. Act accordingly.  
(1128/2 September 1943)

(2) Non-radiating search receivers will restore the balance "in the main theater of battle."

Unaware of the development in Allied centimeter radar, the Germans had become convinced in the course of the summer that Allied location successes were due to radiations from the old style search receivers. This leak had supposedly been stopped with the introduction of a new receiver, covering the old band of 120-180 cm. Hence the following general message to T-V U-boats on 13 September:

To all Zaunkönig U-Boats:

Offizier J

After an interruption of months you will resume the submarine war in the main theater of battle, the North Atlantic. New

weapons and equipment are at your disposal for that purpose. Experiences in the Bay of Biscay have shown that the situation has changed fundamentally and in your favor as regards the matter of radio locating (funkortung). The prerequisites for a successful fight have been given. I feel certain that you will take up this battle which is likewise decisive for the future of our race and take it up in the old warlike spirit of the men of the submarine corps. The Führer is following every phase of your fight. Attack. Go to it. Sink them. COMINCH and COMSUBs. (2056/13 September 1943)

- (3) "Thoughts on convoy fighting:" Surprise the convoy.

Since the U-boats invisibility had been restored by the new search receiver, it was permissible to repeat the doctrine of surprise-attack. On 14 September U-boats were sent these instructions:

To all Zaunkönig subs:

Offizier O

Lines of conduct for first operation on a convoy. 1) Approaching (the attack area). Remain absolutely out of sight when cruising in formation as well as in (attack) strips. However, make the most of favorable opportunities for attack. Contacting the enemy, defense, and successful operation depend on surprising the enemy. During the current offensive in the Mediterranean convoys in the Atlantic may be weakly guarded. An example of this was the Moroccan campaign. 2) Operating: uniform procedure in the different states in accordance with "Thoughts on Convoy Fighting," is the most important requirement. In the initial attempt make the most of the surprise technique, transition to open battle only after sending the short signal. (0837/14 September 1943)[Emphasis added]

- (4) Sink the Escorts. ("Thoughts on convoy fighting" continued.)

With the T-V the U-boat was now specifically armed against surface defense.

To all Zaunkönig subs:

Offizier Z

Thus the main goal is to decimate the escort. The destruction of even a few destroyers will have a considerable effect on morale of enemy and will in addition greatly facilitate attack on ships. When advancing on surface do not groups of more than two subs. The goal must be to surround in even distribution, in order to disperse enemy defense. . . . 3) I expect all commanding officers to make use of every opportunity for shots on destroyers. The sub is now the attacker. Shoot first, submerge afterwards. COMINCH.  
(0905/14 September 1943)

It is interesting that no reference was made in these opening messages to the U-boats anti-aircraft, on which considerable effort had been expended during the summer. With adequate warning of aircraft approach in the search receiver it was more advisable to dive.

#### (5) Results.

The renewed campaign against major convoys was, of course, a failure. In November U-boat groups again evacuated the northwestern Atlantic. Somehow or other the U-boat was still being located by "...location methods which in part we have not yet been able to pick up..." (1903/13 November 1943). Shipboard intercept and D/F of convoy voice traffic and special very long range aircraft reconnaissance found a few convoys but to no avail. There was no dispersal this time; U-boats were drawn back to the eastern North Atlantic and concentrated nearer home. The U-boat did not give up. It stayed on and worked hard to develop more counterdevices. Insofar as it tied down Allied naval forces, it was told, the U-boat kept just that much Allied strength away from the homeland. In January U-boats took up the task of reporting weather for invasion forecasts.

#### 2. Major changes underway.

Whatever confidence may have been placed in the U-boats restoration, in August 1943 German High Command decided to build a new fleet.



(a) German diagnosis of U-boat ailment.

German diagnosis concentrated on the surface U-boat as the occasion for its major weakness. The existing U-boat had depended largely on surface cruising for its mobility. To maintain its ability to maneuver as an invisible attacker it had to surface for battery charging. Since the U-boat was a visible object on the surface and since there seemed to be observers everywhere - day and night, the only final solution to the problem of restoring the U-boats power, its invisibility, was to eliminate the necessity for surfacing.

(b) Plans for new types of submarines.

By September 1943 designs were underway for a U-boat that would really be what the name says: an "underwater boat," not visible to the human eye either directly or indirectly by the aid of electronics. It was first hoped to build a turbine propelled submarine combining both underwater endurance and speed. Later a compromise of diesel-electric propulsion with short burst of high underwater speed was accepted. The new type was to depend on schnorchel. It is not known to what extent the simultaneous development of Schnorchel may have determined the acceptance of the compromise type. Plans for the new types could not be fulfilled before the fall of 1944 at the earliest, even with the use of mass-production technique.

(c) Schnorchel.

The diesel air trunk may have been under consideration for some time, though the revival of the earlier Dutch experiments was not noted in ULTRA sources (British) until December 1943, when schnorchel trials were made in the Baltic. The first schnorchel-fitted U-boat in the Atlantic appeared in January 1944 (U-539, Lauterbach-Emden). Experiments at sea were not completed until after the Allied invasion of France.

3. U-boat restoratives before schnorchel.

Thus the continuation of the U-boat war - from the spring of 1943 to the fall of 1944 - depended largely on shifts and

expedients, whose provisional character was at all times apparent. The history of the U-boat war during this period is written in the trails and hopes of these contrivances. The U-boat war had become a technical war for advantage in counterdevices. How effective in general these devices might have been, under the circumstances, cannot here be judged. It is sufficient to say that decryption intelligence furnished advance and accurate information on these devices - as well as the U-boats locations and plans.

- (a) Against aircraft: GSR, infra-red receivers, radar, deception, anti-aircraft.

GSR: Probably the most important of these restoratives, both in terms of time and energy expended, were the radar search receivers, which were to give adequate warning for submergence before aircraft could actually locate the U-boat. But the Germans were always a step behind, having the disadvantage of being on the defensive, i.e., trying to match an active instrument with a passive instrument after the fact. If they installed a receiver which covered the basic band of Allied radar frequencies, then the Allies changed their transmission tactics or their frequencies, leaving the U-boat in confusion. The Germans could never be sure of what was happening. Matters were not helped by the breakdowns of the receivers and aerials. There was never a permanent aerial for the centimeter bands. Reports from the sea were incomplete and inconsistent. Again and again U-boats were attacked without warning. They did not know how they had been spotted and U-boat Command could only guess at the means; visual, phosphorescence, infra-red search lights, U-boat radiations, new radar frequencies. U-boat Command probed and quizzed, exhorted and reprimanded. What exactly had been the state of visibility and the conditions of the sea? If any lights had been seen, what was their color? Had the U-boat been charging its batteries? Had it been tuning its radio transmitter? Was the receiver on? Was the search receiver in working order? Had nothing peculiar been heard or seen? No crackling noises in the headphones?

The state of affairs in the winter of 1943-44 is well illustrated by the following incident in which an experienced U-boat commander apparently thought he had been flown at by a planet in her lawful orbit.

From Bugs (U-629):  
Radar and light location continuously from  
0400 to 0800. Thus (location of patrol) line  
continues to be known.  
(2131/9 December 1943)

From Control:  
Bugs: before the night in over give more  
detailed account of light location.  
(0425/10 December 1943)

From Bugs:  
White, yellow to red disc, then out.  
Approached abeam flying from horizon. Not  
preceded by radar. Diving was possible  
during and after light location.  
(0540/10 December 1943)

From Blauert (U-734):  
Reference light location reported by Bugs.  
Similar observations. On the 8th, aircraft  
alarm three times. The disc, however, always  
turned out to be the planet Venus. . .  
(2043/10 December 1943)

In addition to receivers for possible Allied transmissions, both radar and infra-red, and many experiments conducted at sea in an effort to identify the locating beam, deception measures become standard procedures, particularly in the form of "Aphrodite."

U-boat radar: The use of U-boat radar offers a significant commentary on the U-boats predicament. For many months U-boat Commanders were reluctant to use it at all, for they were naturally very receiver-conscious. Knowing that a receiver's range was greater than radar range, they were afraid of giving themselves away by transmitting. After Command became reasonably sure that antisubmarine aircraft did not carry receivers, he had to wage a campaign to get his men to use their radar - not as a target locating device, but as an additional aircraft detection measure.

Anti-aircraft guns: Emphasis on the policy of staying up and fighting aircraft tended to fluctuate with the rise and fall of confidence in search receivers. Tower alterations for increased anti-aircraft were noted in U-boat traffic in the winter of 1942-43, but orders to stay up and fight did not

become pronounced until the inadequacy of the Metox GSR had been underscored by U-boat losses. None of the attempts to give the U-boat effective anti-aircraft fire succeeded. The quadruple anti-aircraft mount did not solve this problem. Flak-U-boats failed. Much was expected of the 37 mm automatic late in 1944, but it too failed. For one thing, the Allied practice of strafing before bombing tended to nullify the anti-aircraft crew. For another, the permanently installed guns (e.g. the 37 mm) were subject to too many breakdowns as a result of long immersion. Furthermore, tower alterations for extra gun mountings increased crash diving time and added one more worry for the Commander in his problem of deciding when to dive and when not to dive. Command's advice was not to dive if the Commander felt himself "surprised."

(b) Against destroyers.

T-V: The search receivers and deception devices mentioned above were employed against surface forces as well as against aircraft, but the principal counterdevice against surface forces was, in a sense, the acoustic torpedo. It is noteworthy that the only new addition to the U-boats proper armament after the spring of 1943, the T-V, should have been in effect a counterdevice. If the U-boat could not get at its real target, the merchant shipping, without being first discovered and held down or hunted down, then it had to have a torpedo designed for destroyers. Thus T-V was to Allied surface defenses what increased anti-aircraft was to aircraft defense. It was more effective probably than anti-aircraft, for aircraft did not move in the U-boats medium.

Sound: There was an interesting parallel between the use of passive and active instruments against aircraft and against surface forces. U-boats did not use Asdic but relied on hydrophones in their preference for stealth and listening. The sound and bubble device (Bold) offered a further parallel to anti-radar devices such as "Aphrodite" and "Thetis."

(c) Tactics.

Against both aircraft and destroyers, but mainly against aircraft, the U-boat was compelled to adopt every conceivable tactic as a countermeasure. It is difficult to imagine changes



which might have been tried and were not. For example, there were countless suggestions as to how surface charging of batteries could be done without an attack. Everything from phosphorescence and weather to habits of antisubmarine patrols was taken into minute consideration.

(d) Against the Allied intercept net.

Radio silence on the part of the unit was offset by the German operational system. If the U-boat kept still, Command did not, but continued to inform the Allies where the U-boat was going, what it was planning to do, and where he thought the U-boat should be. A U-boat could not really observe complete radio silence for Command's personal direction of the war required passage reports, return reports, and situation reports. In the closing weeks of the war, Command demanded such transmissions from reluctant Commanders because they were of the utmost importance for decisions concerning the future disposition of U-boats.

To enable U-boats to transmit with out fear of interception and D/F, elaborate off-frequency systems were set up in the fall of 1943. Without foreknowledge by decryption intelligence, these systems would have presented a serious obstacle to the Allies.

(e) Failure of all countermeasures.

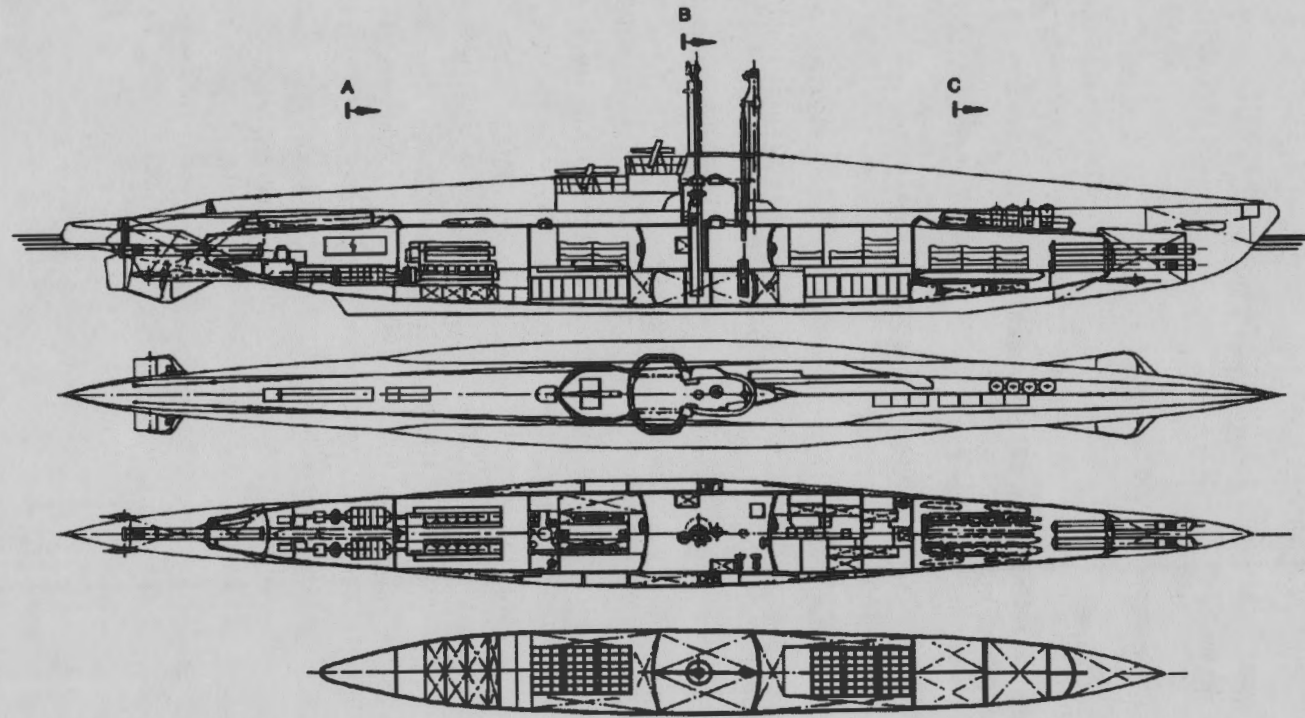
The countermeasures could not correct the fundamental difficulties. First, they did not touch decryption intelligence as a locating device. The reading of U-boat traffic, in addition to its negating tendency on German efforts, offered an absorbing study in unsuccessful attempts to work from known effects to unknown causes. Second, once the U-boat was deprived of its invisibility, its weakness in a defensive role could not be compensated. A resort to its ability to submerge, its one strength in defense, was as dangerous as staying up when surprised by aircraft. The U-boat had to be told in the summer of 1943 that "diving is death." There was no way of protecting the vessel at the moment of submerging, when it passed from one medium to another. The dual life complicated the countermeasures and interfered with their effectiveness.

## Chapter V

### The New U-boat Fleet and the Schnorchel

\* \* \*

1. The Allied invasion of France.
2. The German Navy never lost sight of its one end: Renewal of the offensive at sea.
3. The fleet of new submarines did not sail.
4. The schnorchel fleet.
  - (a) Starting the U-boat war all over again.
  - (b) Old and new problems.
  - (c) Weaknesses not corrected.
5. Surrender.



Type VIIc U-boat

## The New U-Boat Fleet and the Schnorchel

Late in determining the need for a radical change in the Fleet, the German Navy had lost time never to be made up. The issue was to be decided by circumstances beyond its control. As the German land situation went to pieces, the Navy worked with steady and undaunted determination to complete the new types, but was forced into postponement after postponement. To the one end of resuming the offensive at sea, everything was subordinated. In lieu of the fleet of new types, every available old type was fitted with schnorchel. The schnorchel fleet did well. It increased in size despite losses and increased its pressure against Allied shipping - to the very day when force to surrender because there was no longer a Germany to defend.

### 1. The Allied invasion of France.

The Allied invasion of France on 6 June 1944 confirmed the past failure of the U-boat. The men and materials that had not been stopped in the Atlantic were landed on the coast of France, depriving the U-boat of its best Atlantic bases and beginning the internal collapse that was to cut the U-boat navy off at its roots. Having refused for so long to yield the Atlantic, the U-boat navy was not prepared for an eleventh-hour stand off the invasion beaches. It could not hope to succeed with outmoded weapon in its last attempt to prevent invasion - under conditions the most unfavorable ever yet encountered. Along with the concentration of Allied antisubmarine defense in coastal waters, the Allies were benefiting from the most complete decryption intelligence of the U-boat in the entire course of the war, for the sabotage of landline communications forced all naval administrative and high command traffic into emergency radio channels - and into Allied translations. The Allies knew the war-readiness date for every U-boat as well as its operational orders days before the U-boat sailed. These orders had to be carried out in shallow water operational areas for which the 500-ton U-boat had not been built. Although hastily equipped with schnorchel, these Channel U-boats lacked experience with their new device and were helpless. Two-thirds of the U-boats that attempted to operate against the invasion armadas were lost. In return for this sacrifice U-boats were told that insofar as they inflicted any damage at all on the



landing craft they had fulfilled "their supreme task," had "justified their existence."

2. The German Navy never lost sight of its one end: Renewal of the offensive at sea.

It is remarkable that throughout this period of great trial and confusion and throughout the worse months to come, the U-boat navy did not lose sight of its one end: the renewal of the U-boat war in the Atlantic. While the Grand Admiral repeatedly addressed his men at sea with stirring promises of the future, the navy ashore subordinated everything possible to the installation of schnorchel and to the mass-production of the new types. Morale and discipline were maintained and the U-boat navy fell back to Norway and the Baltic in good order. From there no time was lost in undertaking once more the blockade of Britain.

3. The fleet of new submarines did not sail.

The new U-boat navy of high underwater speed submarines, from which so much was expected, was not to sail. Admiral Dönitz had apparently planned to release types XXI and XXIII in large numbers during the fall and winter of 1944. They were to strike *en masse*, throw the Allies into confusion, and thus hold the land fronts where they were until German counterattacks on land and in the air could restore the military balance. Throughout the last winter of the war, the Allies watched the threat anxiously through the Japanese Naval Attaché and Baltic U-boat traffic. The mass-production systems had been decentralized, but the destruction of German land transportation and the aerial bombardment of assembly yards were effective.

The new types did not reach military strength. month by month postponement was reported by the Japanese Naval Attaché - until the Allied land offensive reached the Baltic and North Sea ports. A few type XXIII submarines made cruises against England, but the only type XXI to sail was still outbound on the day of surrender.

It appears that a further attempt was underway to achieve the goal of a true underwater craft. As has been stated, the types XXI and XXIII were dependent on schnorchel. Other than burst of high underwater speed they did not offer

the desired radical solution to the U-boat problem. In the course of the winter, the Japanese Naval Attaché reported details of still another new type, type XXVI, which was to add turbine propulsion to both diesel and electric. the turbine would give the U-boat endurance in underwater cruising at high speeds.

#### 4. The schnorchel fleet.

Even without the new types, the German Navy made a strong recovery with the schnorchel-fitted older types. Unquestionably the most successful German counter-device, schnorchel came too late to alter the course of the war but did enable the existing U-boat fleet to renew its menace. It was sufficiently successful to warrant being called the remodeler of the fleet. The U-boat was still bound to the water's surface, but the area exposed had been reduced to a minimum, and even this minimum could be camouflaged. It was a half-way revolution in submarine warfare, a difference in degree but not in kind, a stage in transformation of the U-boat into something like a true underwater cruiser. Economical and relatively simple, it made possible the salvage of all existing older operational types. In face of hopeless conditions in Germany, schnorchel enabled the U-boat navy to undertake what it called "total underwater warfare." The one positive contribution of the Allied invasion of France to the U-boat navy was the speed with which it forced Germans to complete their experiments at sea and equip all standard types with schnorchel.

##### (a) Starting the U-boat war all over again.

It is sufficient evidence of the skill and pertinacity of the German Navy that schnorchel started the U-boat war all over again. Deprived of French bases, the schnorchel fleet sailed from Norway and the Baltic to take what had been abandoned years before, a close-in blockade of the British Isles. Cruising submerged for as long as 70 days and finding bottoming tactics in shallow water highly favorable to their defense, U-boats entered the channels and inland seas of Great Britain, where they increased in numbers and in effectiveness to the day when they were ordered to cease.

Nor did U-boats neglect distant areas and the open sea. More U-boats were off the U.S. and Canadian coasts in the final

weeks of the war than had been there at any one time for the past 2-1/2 years.

An attempt was made to resume group warfare against major convoys in mid-Atlantic with U-boats own passage to our coasts. It was characteristic of the U-boats general plight, however, that U.S. Navy forces, acting on decryption intelligence, went out to meet these U-boats and attacked them all the way in. Even with the advantage of decryption intelligence as to the U-boats whereabouts, it was difficult matter to home attacking craft onto a schnorchel U-boat that was in good working condition and that was handled by a Commander who had mastered his more complicated weapon.

(b) Old and new problems.

It is further indication of schnorchel's significance that U-boat Commanders had to relearn the U-boats functions and Allied antisubmarine forces to relearn the U-boats habits. Every phase of the U-boats life was affected.

U-boat seeing and hearing: Schnorchel cruising blinded and deafened the U-boat. At the same time it made the U-boat more dependent than ever upon periscope and hydrophones. It was necessary to interrupt schnorcheling for frequent periscope and hydrophone sweeps.

GSR: Since the schnorchel head could be located by radar, it had to be fitted with a permanent GSR aerial for warning purposes. A permanent aerial (round dipole) for meter wavelength radar was available, but not for centimeter radar.

Communications: Reception on very low frequency at submerged depths had long been part of regular procedure. It was transmission which constituted a continuing weakness for the schnorchel U-boat. Transmission over the schnorchel "round dipole" was tried without success. To communicate with Control, the schnorchel U-boat had to surface. Dampness from long submerged cruising tended to short the radio equipment. As the off-frequency procedure was enlarged, the future

protection against D/F and interception was being developed in "Kurier" flash transmission.<sup>1</sup>

Underwater navigation: "Avoid surfacing for astronomical fix" became a new rule to whose observance U-boat Command devoted much attention. In addition to Elektrasonne beacons, U-boats charted their progress by soundings and sonar together with painstaking dead-reckoning and an accurate knowledge of currents and of their own speeds at the various screw revolutions.

(c) Weaknesses not corrected. Schnorchel had, in part, restored the U-boat its source of strength, its invisibility in the combat area. The U-boat was thus more difficult to locate before attack even though its area was known from decryption intelligence. Certain weaknesses mentioned in the U-boat Commander's Handbook of 1942, however, remained: low speed, limited lookout, and vulnerability.

## 5. Surrender.

The German U-boat navy alone remained when the Wehrmacht disappeared in ruins. It is important to remember that on V-E Day the German U-boat navy was still a dangerous combat unit, organized, improved, and willing to continue the war.

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<sup>1</sup>"Kurier" was a high speed burst communications system. See Chapter VIII of Volume IV.



## Chapter VI

### Compromise of Allied Codes and Ciphers by German Naval Communication Intelligence

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1. German naval intelligence: "Convoy Expected;" its importance.
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3. Source acknowledged in U-boat traffic. "B-Dienst."
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12. Conclusion: Effectiveness of German naval communication  
intelligence.

## Compromise of Allied Codes and Ciphers by German Naval Communication Intelligence

1. German naval intelligence: "Convoy Expected;" its importance.

From the beginning of the Atlantic Section's reading of current U-boat traffic it was apparent that the enemy made good use of intelligence on Allied ship and convoy movements. The "convoy expected" messages soon became a familiar part of recurring pattern of U-boat groups, not only in the messages which formed the groups and ordered their patrol lines or courses for sweeping. It was not surprising that group tactics should appear in traffic to be dictated throughout by knowledge of convoy movements, for U-boat warfare in the open sea was by its nature peculiarly dependent upon convoy intelligence. From their experiences in the First World War and certain German naval authorities had long since come to the conclusion that the combination of group attack with convoy intelligence would provide an ambush in mid-ocean that could defeat the convoy system. Admiral Bauer, World War I Commander of U-boats until the summer of 1917, wrote in 1931 that:

the success of the convoys was owing essentially to the fact that they succeeded in reaching their destination for the most part unnoticed, or damaged by single submarines only moderately in proportion to the large number of ships. Here the convoy's unexpected arrival was just as important as its guard by warships, which had been the decisive factor for the convoys of earlier times. If it had been possible to determine the presence of convoys and report them early enough so that a fairly large number of submarines could join the attack, even a strong guard could not have protected the group from heavy losses.

Reconnaissance and the assembling of as large a number of U-boats as possible for the attack were the only suitable means of defeating the convoy system with respect to

both the element of surprise and the military strength of the convoys.<sup>1</sup>

As one method of preventing a convoy from entering the "combat area" unnoticed, Admiral Bauer suggested U-cruisers which could lie in wait outside ports of departure and shadow the convoy on its ocean route. He also recognized, in part, the role radio intelligence might play in convoy location, although

The whole conduct of the war so far as the use of the radio message is concerned was still primitive and harmless.<sup>2</sup>

Germany had no difficulty, he says, in reading the simple cipher which England used when she began "...to guide commercial and escort vessels by radio, in accordance with the intelligence she gained about German U-boats."<sup>3</sup>

## 2. Its effectiveness.

It was obvious that the U-boat groups were being moved with intelligence during the winter of 1942-43. The only questions were:

- (a) How accurate and timely was their information, and
- (b) What was its extent and source?

These questions could not at first be answered here with any confidence, and if the British could have done so their information was not available to the Atlantic Section. Preliminary surveys undertaken shortly after the Atlantic section began to read traffic did not permit any specific conclusions which could explain the individual "convoy expected" messages. There were cases in which U-boat Command seemed well informed up to the time of convoy diversion. The day of expected meeting with the convoy would arrive - but no sighting reports. Command would stir his boats and urge sharper lookout while ordering a change of course.

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<sup>1</sup>Hermann Bauer, *Das Unterseeboot*. Mittler & Sohn, Berlin 1931, pp. 117-19. Section translated by OP-20-GI-A.

<sup>2</sup>Ibid.

<sup>3</sup>Ibid.

Then, again there were cases in which everything worked out according to plan.

3. Source acknowledged in U-boat traffic. "B-Dienst."

Sources of intelligence disseminated to U-boats were sometimes acknowledged: agents, submarine and aircraft reconnaissance, prisoners, and the intercept net. Very little was known about the German communication intelligence organization, except that its mark appeared occasionally in U-boat traffic as "B-Dienst," tagging a repetition of plain language reports which were relevant to U-boats at sea. It was assumed that the Germans were working on our cipher systems, but nothing further was known. Had the Atlantic Section made no attempt to correlate the traffic it processed, the suspicion of compromise might have been aroused with difficulty, for the "convoy expected" messages were routine. The U-boat naturally "expected" convoys, and general information such as convoy departures, cycles, and other related matters could scarcely be kept from an industrious enemy. Furthermore, Allied North Atlantic convoys observed no such thing as radio silence. On the other hand, U-boat "expectations" were often disappointed, precisely when we began to get a good first decryption hold on U-boat traffic. If our radio intelligence was effective in convoy diversions, then it seemed that the enemy's was not effective in countering these diversions.

4. Suspicions of cipher compromise.

The sudden shifting of lines for U-boat groups *Neptun-Ritter* and the formation of *Knappen*, all ordered within the space of 30 minutes on the night of 18 February, led not only to a very successful operation against convoy ON 166 but to very definite fears here of Allied cipher compromise. It was another matter, however, to prove the insecurity of the cipher.

5. Difficulty in proving cipher compromise.

It may be difficult to demonstrate with certainty that ones own ciphers are being broken by the enemy - even when one is in turn reading part of the enemy's traffic. For, when properly used, special intelligence is sufficiently disguised so sources other than actual decryption of a specific message can



not be eliminated. The enemy is presumed to possess information whose possible sources are so varied as to come under the cognizance not of one but several different counter-agencies. Without complete knowledge of ones communications systems (including ciphers), communications habits, actual movements, and plans, it may not be possible to judge the source of the intelligence appearing in enemy traffic, unless the enemy fails to observe elementary precautions. By such failure he can yield a self-evident proof, as would be furnished by a direct quotation whose origin can be traced solely to one dispatch. Without such indubitable proof that a major cipher is compromised there is a natural reluctance to instigate and authorize the complicated changes and expenditures which would be necessary if a reading enemy is to be forestalled.

6. Compromise of Naval Cipher #3 demonstrated, May 1943.  
Naval Cipher #5 introduced 10 June 1943.

While the weakness of combined Naval Cipher #3 was appreciated in some circles it was not until May 1943 that its compromise was so thoroughly demonstrated that action could be taken. In the middle of May 1943 the Germans offered the necessary proof of combined cipher compromise in the form of three Offizier messages to groups *Rhein*, *Elbe*, and *Drossel* during the course of their patrol and action against convoys HX 237 and SC 129. Convinced that cipher compromise was involved, the Atlantic Section gained access to Commander 10th Fleet Convoy and Routing files. The compromised Allied dispatches were identified and the evidence was submitted to COMINCH. The conclusions were accepted. An exchange of signals followed between COMINCH and Admiralty involving proposals for additional security precautions, but the marked increase in similar compromise messages in German traffic toward the end of May led to the introduction of Naval Cipher #5 on 10 June.

7. Compromise of Naval Cipher #5 demonstrated, October and November 1943.

Beginning in September with convoy operations, the familiar signs of convoy intelligence were once more in evidence. After having repeatedly expressed its fears, the Atlantic Section conclusively demonstrated the compromise of

Naval Cipher #5 on one occasion in October and one in November. COMINCH and the British concurred.

8. Extent of German success with Naval Cipher #3.

(a) Tables "M" and "S".

The demonstration of compromise in May led to a thorough examination of all previously suspected cases in German traffic, an examination which was now possible with access to the convoy files.<sup>4</sup> (For a full statement of the results see Chapter IV of Volume III.) From these studies, together with conclusions which GC&CS made available at this time, it was evident that during the first half of 1943 German cryptanalysts had read extensively and with usable currency in the world-wide ("M") and the North Atlantic area ("S") tables of the combined cipher (Naval Cipher #3). From the interrogation of Italian communication intelligence officers following the capitulation of Italy it is known that the German and Italians cooperated in their attack on the combined cipher. Copies of the basic book had been obtained and were known to the enemy under the code word "Frankfurt" or "Francoforto." The reciphering tables were identified. With the aid of the basic book messages were usually readable in part on a depth of three, sometimes even on a depth of two. After the introduction of a new basic book five to seven months were necessary before good progress could be made and this depended on luck and Allied mistakes.

(b) Weakness of the combined cipher.

The combined cipher was in practice a weak system. In the first place, it was overburdened, as might be expected, for it was the main link in all dispatches concerning convoys, wherein of course the emphasis of the Atlantic lay. The North Atlantic had been turned into a vast freighting area in which the movement and protection of convoys involved a constant

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<sup>4</sup>During the course of investigations Commander 10th Fleet Convoy and Routing provided invaluable assistance by opening its past and current files to the Atlantic Section, while MCR, NCR, and Communications Security contributed by identifying the systems of dispatches which were under suspicion. The investigation was the more difficult because its nature could not be revealed for reasons of security.

exchange of dispatches by radio. Running through the whole thing was regular pattern of standard announcements: sailing telegrams, ocean route, ocean meeting point, escort relief, stragglers rendezvous, convoy position reports, etc. If any U.S. Navy command was on the address for information, as was normally the case, the combined cipher was used. In the second place, combined cipher involved use of combined call signs from which the addressees could be determined and the general nature of the content deduced.

9. The delay in Allied counter reaction.

Although the British had recorded cases of combined cipher compromise prior to May 1943, no action was taken until the demonstrations of May. It is worthwhile to list here some of the problems and difficulties which prevented an earlier demonstration on the part of the Atlantic Section.

(a) Cryptanalytic: The difficulties experienced with the Enigma general traffic during the first part of 1943 were even greater in the case of Offiziers, or messages sent in a double encipherment. Offizier messages contained the only identifiable cases of compromise.

(b) Lack of convoy dispatches: Although the Atlantic Section did receive copies of routine convoy dispatches for information, it had had to fight even for daily convoy position estimates. It did not receive the significant diversion and routing dispatches. Even with access to the convoy files, the problem was not solved, for it appeared doubtful that there was anywhere a complete file of Allied transmissions.

(c) General: A more fundamental difficulty was the system of combined communications itself. U.S. Navy-British naval communications were so complex, and often repetitious, that no one seemed to know how many times a thing might not be sent and by whom - and in what systems. It is possible that the question of cipher compromise might have been settled earlier than May had the Combined communications systems been less obscure and had there been closer cooperation between the British and the US in such matters.

## 10. Other German Cryptanalytical Successes.

In addition to Naval Cipher #3 and #5, the following systems are known to been read by the German naval Communication intelligence organization:

(a) Various British Naval and Air codes (low grade): including COFOX, MEDOX, FOXO, LOXO, SYKO, Air Force code and Aircraft Movement code.

(b) U.S. Hagelin: A Hagelin reencryption of 26 September 1943 was read by the Germans.<sup>5</sup> The compromise was noted by the British from their reading of German Mediterranean traffic.

(c) Anglo-French.

(d) Merchant signals: Supplied with the books from merchant shipping abandoned or sunk, the enemy had no difficulty with Mersigs.

(e) Russian: aircraft reporting system, weather system, and low grade naval traffic.

## 11. Failure with U.S. Navy naval ciphers and the British Type X.

There is no evidence that the Germans ever had any success with high grade machine ciphers. If the Japanese Naval Attaché's reports can be believed on this point, the German navy knew very little about U.S. Navy ciphers and needed assistance from Japanese as late as summer of 1944 in identifying U.S. Navy traffic.<sup>6</sup> Italian communications intelligence officers stated that their organization did little work on U.S. Navy ciphers since they believed that anything of importance to them in the Mediterranean area would be found in combined cipher. According to Commander Porta, neither the Germans nor the Italians had attacked British cipher Type X to any extent up to the time of the Italian armistice. The

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<sup>5</sup>See COMNAVNAW sealed Secret to CNO 171416Z Nov 43.

<sup>6</sup>See Chapter VI, Volume III, paragraphs 14-15.



Germans at that time, however, decided to work on it but as far as is known they had no success.

12. Conclusion: Effectiveness of German naval communication intelligence.

Reliable information on the German navy's successes in decryption is at present confined for the most part to what has been discovered through reading German naval traffic itself, i.e. to those messages which contain statements traceable to Allied dispatches. Some good information has been obtained from Italian captured documents and from Italian naval communication intelligence officers. The references in Japanese Naval Attaché traffic to this subject are too general to be of much assistance. It is hoped that captured German documents will eventually offer material for a complete and detailed account of German cryptanalytic successes. The importance of a full treatment cannot be over estimated as a future safeguard against complacency and ineffective organization whether at home or among Allies.

According to present information the German naval communication intelligence organization achieved only one major success against "high" grade Allied naval ciphers, namely the combined British-U.S. Navy ciphers using tables "M" (world-wide) and "S" (North Atlantic). A successful attack on combined cipher gave the German navy the kind of information they most needed for offensive operations: convoy intelligence for use of U-boats. on the other hand, their success, such as it was, in this kind of intelligence could not compensate for their lack of insight into Allied naval operational traffic such as was carried by machine cipher. In consequence there is no indication that the enemy ever had reliable advance information on any major Allied amphibious undertaking. Apparently dependent on analysis and low-grade traffic, such hints as the German Navy had of these major operational movements came too late - before adequate counteraction could be taken. Nevertheless, within the realm in which it concentrated, its successes undoubtedly increased merchant shipping losses, and thereby contributed to a lengthening of the war.





**Jeffrey K. Bray** holds a B.A. in History and M.A. in International Studies, both from Old Dominion University, Norfolk, Virginia. He is a navy veteran who specialized in naval and aviation ordnance systems and intelligence. He lives in Durham, North Carolina.

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