RADIO SPIES

— EPISODES IN THE ETHER WARS

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INTRODUCTION: TELLING THE STORY OF RADIO INTERCEPTION FOR INTELLIGENCE PURPOSES.

Radio's virtue as a broadcasting medium, that many may listen, is exactly its vice as a means of communication. From the early days of wireless telegraphy, radio's inability to avoid attentive ears has given rise to dramatic consequences.

In political, diplomatic, and especially military contexts, the senders of certain messages want to keep secret from discovery not only the content of the messages, but indeed often the existence of the message traffic itself. Conversely, and especially to those for whom it is not meant, that traffic may be a matter of life or death. [1]

The forces of good fought the forces of evil in many of the contests of the last century. It is, however, not the purpose of this paper to make those judgments, which history itself has made. Rather, this paper seeks to tell *some* of the stories of the work of radio interception through the end of the Second World War. That work, that has gone on now for nearly a century, includes startling events and some remarkable episodes, many of which are little known. Radio also played important roles in covert action and irregular warfare, especially as a source of

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[1] To use a cold war example, U.S. spy satellites monitored the automobile radio telephone traffic of Moscow for several years, gleaning much valuable intelligence from the conversations of the elite of the Soviet Union, including the Russian Premier and the Politburo. [3] In the 1990s, the "Echelon" program of the Anglo-American alliance of intelligence agencies monitors email and data traffic world wide. It was, until recently (post "9/11") illegal for American intelligence agencies (as opposed the F.B.I.), to spy on Americans domestically, so that task had long been delegated to the British, who share the take. "The more things change..."

intelligence about occupied territory, and also thereby giving rise to special intercept challenges.

Radio intercept operators, largely unsung heroes, not of combat so much as of discipline, did the work of monitoring the ether. Much of that work remains "secret." That work has been done by similarly situated Americans, British, Australians, Germans, Japanese, Russians, Poles and many others. They have tuned their radio receivers all over the world for nearly a hundred years, often subject to all the risks of war, often in appalling conditions, often for impossibly long shifts, often without relief for weeks, striving for perfect copy of enemy traffic. Inasmuch as these signals were rarely sent in plain language, the intercept operators could almost never understand the traffic they took down. They knew only that the signals came from an enemy and that they put their countrymen in deadly peril, and they did their duty.

The radiomen on both sides of many conflicts earned the respect due worthy adversaries. It is from this perspective that this paper will relate the work of the intercept corps that has been so important in this century of conflict[2] as well

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[2] For some of this country's early efforts, see Bartholomew Lee, *America's Wireless Spies* [52]; for World War Two work against Axis spies, see George Sterling, *Spies Use Radio, The Radio Intelligence Division In WW II* [92] both in Volume 5, Antique Wireless Association Review (1990).

as some of radio's roles in irregular warfare. As Winston Churchill wrote: "This was the secret war, whose battles were lost or won unknown to the public, and only with difficulty comprehended, even now, by those outside the small, high scientific circles concerned. No such warfare had ever been waged by mortal men." [25]

THE FIRST RADIO SPIES, 1900, AND THE FIRST INTERCEPT: SUEZ, 1904

As early as 1900 in the Boer War, the Royal Navy in South Africa appears to have used wireless sets inherited from the Royal Engineers to signal from the neutral port of Lourenço Marques "information relative to the enemy" albeit in violation of international law. [71] This first use of radio for intelligence purposes depended, of course, on the inability of others to intercept the signals, but in 1900, only the British in that part of the world had any wireless capability.

Alexander Popov early on (circa 1895) in Russia used a Branly-style coherer to detect lightning strikes at a distance. This worked because the electro-magnetic pulse generated by the lightning rendered the coherer's filing conductive, permitting a signal bell to announce the strike, otherwise unseen or heard. With the development of wireless communications by Marconi and others in this period, Popov quickly turned to communications circuits. He installed such a

wireless set on a grounded Russian battleship in January, 1900. The success of this and related salvage and rescue work persuaded the Russian Navy to install wireless sets on many of its ships. In early 1904, the Russian fleet prepared for war with Japan. The British then had the opportunity to intercept Russian naval wireless signals:

> "An intelligence report on signals intercepted by HMS *Diana* at Suez shows that the rate of working was extremely slow by British standards, while the Royal Navy interpreters were particularly critical of the poor standard of grammar and spelling among the Russian operators."

[71] The apparatus on HMS *Diana* in 1904 was likely not Marconi-made, but rather the work of Royal Navy wireless pioneer Captain H.B. Jackson, judging by the data on Royal Navy installations of wireless gear in this early period. [71]

THE JAPANESE ENTER THE 20TH CENTURY WITH THE FIRST WIRELESS COMBAT INTERCEPTS AND OTHERS FOLLOW THEIR LEAD

The Japanese undertook the earliest combat wireless interception in the Russo-Japanese war of 1904. Lee De Forest had equipped a news gathering vessel with his new system which was capable of working a post in China from as far

away as Nagasaki, Japan. The Japanese Navy monitored these transmissions for what information they could derive from them, but eventually shut the operation down. [30] The Japanese also monitored the then primitive wireless capabilities of the Russian Navy [32] (and probably *vice versa*). [67] The early success of the Japanese Navy in the interception of Russian messages emphasized the importance of this new technical intelligence. [32]

Jack London as a war correspondent in this conflict sent his dispatches out by wireless. [47] The San Francisco Examiner on April 17, 1904 reported that the belligerents regarded war correspondents as spies for using wireless, under the headline "Wireless is Contraband of War." [47] The Japanese earned their place in the 20th Century by way of their humiliating defeat of the Imperial Russian Fleet at the Battle of Tsushima in May, 1905, preceded by their sneak attack at Port Arthur in February, 1904. [31, 93, 73]

The German Wilhelm F. Flicke, in his 1945 WAR SECRETS IN THE ETHER [35] summarizes military intelligence use of wireless intercepts before the outbreak of World War One. Ironically, nearly a hundred years later, Bosnia and Herzegovina are still in the news.

> "During the crises which arose in 1908 between Austria and Italy in connection with the annexation by Austria of Bosnia and Herze-

> govina all Italian radio traffic on the continent and at sea was intercepted by the Austrians.... This proved of great value for Austrian foreign policy.... In 1911, when war broke out between Italy and Turkey over Tripolitania and Cyrenaica, the Austrian intercept service had an opportunity, for the first time, to prove its worth in the military as well as the political field. Since the Italians had set up several relay stations between Rome and Tripoli where the first Italian landings were made, the Austrians had a fine opportunity to intercept all transmissions more than once — and therefore very completely. ... This was the first time in history that the course of military operations ... could be followed move by move... using technical means at a distance of hundreds of kilometers....” [35]

In these Balkan and Mediterranean conflicts, Austrian intercept services provided political and military intelligence four times in five years. [35]

In France as well as Austria, intelligence operations set out to understand peacetime wireless circuits, patterns, traffic and messages, in order to be prepared for war. In France, this task fell to the *Duexieme Bureau* of the Military General Staff (*i.e.*, G-2), and in Austria to the *Evidenzbuero*, each feeding the intercepted coded messages to their respective Foreign Ministries. [35]

In 1911, a domestic interception sensitized Americans to the danger and the opportunity that wireless eavesdropping posed. The Los Angeles Polytechnic High School trained boys in wireless operations as schools today train their students in Internet use. The school had spawned some 300 young radio enthusiasts. [85] The nearby Avalon, Catalina Island to San Pedro, Los Angeles circuit was easy pickings. [Figure 1, newspaper headlines] One particular message (between the De Forest Los Angeles station, first using call letter "D" for De Forest, and the Catalina Avalon's station "PI," earlier "A" for Avalon [see Fig. 11]) evidenced a Hearst press conspiracy. [Fig. 2] Three of the boys publicized their interception to the enormous embarrassment of the Hearst interests. [Fig. 3] This was big news at the time. These particular clippings were preserved in the amateur radio logbook of Howard Seefred (6AE), and date from his early interests in radio in Los Angeles in 1911 - 1912. [85] The Hearst interests had the boys criminally prosecuted by the Los Angeles County District Attorney. This case was, however, ultimately dismissed, but wireless interception and the case received national publicity in Hugo Gernsback's *Modern Electrics*, in September and December, 1911. [37]

On the East Coast, Charles Apgar's 1915 interception from New Jersey [Fig. 4] of the German Telefunken station on Long Island at Sayville, call sign

WSL, communicating with Nauen, in Germany, call sign POZ, is well remembered in part from the work of Rexford Matlock, W3CFC (A.W.A.). [60, 53, 14] As early as 1913, Apgar recorded wireless interceptions on Edison disks. In August, 1914, he intercepted German Navy wireless transmissions from Europe using his one-Audion Armstrong regenerative radio circuit. (The low, near zero, sunspot numbers of 1914 would have favored lower frequency propagation). [94] The Navy as well as Apgar listened to the "Nauen buzz" from WSL, the Navy station from its location on Fire Island off Long Island in New York and from Station NAA in Virginia. Apgar, however, figured out how to record, and then slow the traffic down to normal speed for analysis. Two decades later the German Military attache in the Embassy to the United States at the time, Franz von Papen, told of the German code to be used in wireless messages "which made it possible to send military information in the guise of commercial messages." He gave as an example that "60,000 bales of cotton f.o.b. Alexandria" meant 60,000 British troops at Abbeville, France. He complained, however, that wireless communication with Nauen suffered from atmospherics. [70]

By 1916, the U.S. Army had used wireless interceptions inside Mexico to learn from Carranza's forces the whereabouts of Pancho Villa's rebel army. [53] [Fig. 5] The U.S. Army, from 1916 through at least 1920, employed a direction

finding station manned by three lieutenants in Mexico City to get cross bearings with the cooperation of 10 other stations on the border and one in Maine. [90]

Just before the United States listened so intently to the Mexicans, the Japanese off the West Coast of Mexico grounded their cruiser *HIMJS Asama*, accompanied by a fleet of three other cruisers and related vessels for several months ending in April, 1915. The Japanese Fleet had wireless capability and this was an ideal site for eavesdropping on the American Navy operating out of San Diego. [96]

RADIO INTELLIGENCE DEVELOPMENTS DURING WORLD WAR ONE; THE WORLD WAR ONE WIRELESS INTERCEPT SERVICES

By 1914, radio communications, or "wireless telegraphy" as these communications were then known, were used by all of the world's military and naval forces. The relationships among frequency or wavelength, power, directivity and range were not well understood. In the beginning, signals officers and commanders in the field and at headquarters rarely took into account the possibility of interception, or deception. The soldiers and sailors of the European nations soon bore the costs of such negligence. The British forced the Germans into the use of

wireless by cutting and seizing their undersea communication cables. As noted historian Barbara W. Tuchman put it:

> "... from that moment on, Germany was sealed off from direct cable communication with the overseas world, and the burden of communication fell on Nauen, the powerful German wireless station a few miles outside of Berlin. Nothing can stop an enemy from picking wireless messages out of the free air — and nothing did. In England, Room 40 was born." [96]

The British Admiralty, in its Room 40, analyzed the intercepted traffic. [8, 73]

IN 1914 BRITISH RADIO OPERATORS ORGANIZED THE ROYAL NAVY RADIO INTERCEPT SERVICE, FEEDING TRAFFIC TO ADMIRALTY ROOM 40 FOR CRYPTANALYSIS

Maurice Wright became a Marconi engineer in England in 1912 (and was later Engineer in Chief). Wright experimented with the then new triode vacuum tube in a radio receiving circuit in 1914. Two days before the outbreak of hostilities in August of 1914, he copied German Navy wireless traffic. He worked with H. J. Round, (later a colleague and supporter of Major E. H. Armstrong after America entered the war). Their circuit details are lost to time, but it was undoubt-

edly a regenerative configuration, for it "made the interception of long range communications possible for the first time." This was later reported by Peter Wright, Maurice's son, who became a high official in the British Counter Intelligence Service (MI-5). [111]

Working at his lab at Marconi at Chelmsford, Wright realized he was listening to the German Navy. He brought the intercepts to Captain William Reginald "Reggie" Hall of Naval Intelligence which was located in Room 40 of the Admiralty. [73, 111] Hall appreciated the bonanza in his hands, and put Wright to work building a chain of intercept stations for the Admiralty. Wright and Round also developed aperiodic direction finding techniques to track the German fleet. They provided sufficient warning to allow the British fleet to find and engage the Germans on the high seas. In the process, Wright established a clandestine intercept station in Norway in 1915. [111]

The intercept stations set up in this effort were known as the "Y" stations. Marconi receiving stations, British Post Office stations, and an Admiralty "police" station all provided intercepts for Hall's Room 40 code breakers. These stations were soon joined by enthusiastic amateurs. Barrister Russell Clarke and Col. Richard Hippisley had been logging intercepts of German traffic at their amateur stations in London and Wales. They reported these intercepts to, and then went to

work for Hall. New intercept stations soon went up on the coast and soon, practically all German naval wireless traffic also found its way to Room 40. [8, 107]

The German high power long wave station at Norddeich provided fodder for the code breakers through the "Y" stations, which soon turned to higher frequency interception as well. [8] In 1915 these intercepts helped the British to win the naval battle at Dogger Bank, [56] and played vital roles in later naval engagements:

> "Warned of a new German raid [on England] on the night of 23-[2]4 January, [1915] by radio intercepts, [Admiral Sir David] Beatty's force made a rendezvous off the Dogger Bank... The outnumbered Germans turned in flight.... the Kaiser, fearful of losing capital ships, ordered his navy to avoid all further risks." [56]

The direction finding stations working under Round also provided intercepts to Room 40. [8] The directionals tracked U-boats and Zeppelins as well as naval craft. [8] Both of these new weapons had major impacts on the war, but the impact of the Zeppelins was mostly psychological as countermeasures proved effective. [56] A map of Zeppelin movements over the North Sea created through the use of Marconi directionals [Fig. 6] appears nearby. [107] The "Y" station intercepts showed that the 1915 sinking of the *Lusitania* had the approval of the

German high command, despite its denials. [8] In December of 1914, Round took direction finding aerials and 70 foot masts to France for tactical work at Abbeville and Blendecques, and then at Calais and Amiens. [86]

The foremost history of the astonishing success of British intelligence in the First World War concludes: "[the] Y stations made it all possible." [107] Room 40 read more than 15,000 secret German messages. [73] The most famous intercept of all was the infamous 1917 Zimmerman Telegram that brought America into the war. Germany promised Mexico it could have back the territory it lost in the Mexican American War, if it would join Germany against the United States. [96] Snatched from the ether by intercept stations and decrypted by Room 40, it enraged Americans, and motivated America to enter the war. [8, 96, 107] Captain Reggie Hall of Room 40 claimed "Alone I did this." [8]

As early as November, 1914 there had been a call in the British press for the use of private wireless stations to monitor for spy transmissions out of England. [107] While there is no evidence of any wireless transmission of espionage out of England during that war, the demand that the amateur radio fraternity turn its expertise to the interception process was met, and the system that would become so effective in the next war was foreshadowed.

The British Navy successfully intercepted wireless messages on the high seas as well. Signal Officer Charles Stuart of the cruiser *HMS Glasgow* worked an outstanding feat of code breaking. After the late 1914 battles of Coronel and the Falkland Islands [56], he determined that the German cruiser *SMS Dresden* would coal at Juan Fernandez Island (Robinson Crusoe's old second home) off Chile. He managed to discover this solely from deciphering his intercept of one message from the Telefunken station at Nauen. [8] *HMS Glascow* was able to interdict *SMS Dresden* at Juan Fernandez.

In 1917, American Haradan Pratt (later communications advisor to Presidents Truman and Eisenhower) managed wireless communications on the West Coast for the U.S. Navy. In this capacity, he had occasion to use direction finding techniques from Los Angeles and San Diego, to locate a German wireless transmitter in Mexico, at Chapultepec near Mexico City. [76] German Telefunken engineers had escaped WSL in Long Island and set up a 100 kilowatt spark transmitter in Mexico for communications with Nauen. [1] In 1918 the British Secret Service sent two agents to destroy the German station in Mexico at Ixtapalpa. This they did by smashing its Audions, and thus putting the German agent Herr Kurt Jahnke out of business. [8] Jahnke re-appeared in German intelligence in World War Two. [73].

The success of British Army signals units in intercepting German wireless traffic convinced British commanders that wireless was too dangerous to use. The signals units thus turned almost exclusively to monitoring and intercept work. [107] German Army divisions used spark transmitters with a range of 300 kilometers (kms), and reconnaissance transmitters with ranges of 100 kms. The German field sets had a range of three kms. Their coastal fortresses had high power transmitters to reach ships at sea. The main transmitter at Nauen enjoyed a world-wide range of 11,000 kms by 1916. [86] The British, the French and later the Americans had much to listen to.

IMPERIAL GERMAN ARMY INTERCEPTION OF RUSSIAN WIRELESS TRAFFIC IN 1914 LEADS TO THE DECISIVE GERMAN VICTORY AT TANNENBERG, BLUNTING THE RUSSIAN ADVANCE WEST

Germany established an intercept corps in 1914 under the command of Captain Ludwig Voit. It consisted of a radio station and cryptography section located in general staff headquarters. He arranged to have his intercept stations attempt to copy Allied traffic. [73, 49] In 1914, the Russian Army used wireless to coordinate its campaigns. It apparently took no precautions against interception and did not encode its traffic. [35] In 1914, the Germans won the decisive battle

of Tannenberg against the Russians. Between August 26th and September 5th the Russian armies suffered massive defeats and could only escape by moving East. [56] The German wireless operators had all of the Russian traffic intercepted and readable by the German radio station at Thorn in West Prussia, and in Koenigsberg in East Prussia, about 85 miles to the North. While the Germans may not have made as much use of this traffic as its importance would dictate, Generals Paul von Hindenberg and Erich Ludendorff could, and likely did, know as much about what the Russians would do as the Russians did themselves. [49, 73]

The Battle of Tannenberg showed how important intercepts could be and the Germans set up wireless intercept stations on all fronts. The German Navy Intelligence Branch activated 24 intercept and high frequency direction finding stations along the coast. [73] The earliest intercepts were delivered directly to General Hindenberg by motorcycle entirely at the personal initiative of the chief of the Thorn station. Moreover, the whole effort began as an amateur and even sporting endeavor of the operators with time on their hands. [35]

TACTICAL INTERCEPTS BY ALL BELLIGERENT SIGNAL SERVICES PROVIDE IMPORTANT BATTLEFIELD INTELLIGENCE, AND RADIO DECEPTION BECOMES A WEAPON

In early September, 1914 the Russians intercepted a message from German Army Staff Headquarters from which the Russians inferred a threat from a new large force, and therefore they held back forces of their own in the upcoming battle. The German Eighth Army staff, however, anticipating interception, had transmitted in plain text from its station at Koenigsberg the completely false message. [35] Radio deception thus began to play its counterpoint to radio interception at the commencement of the Great War. The Germans used radio deception again successfully within weeks. [35]

The Battle of Tannenberg taught the Germans the value of their nascent intercept efforts. The Russian traffic was read from August 1914 to the close of 1915. One Russian General officer termed the Russians' use of plain text and its failure to take precautions "unpardonable negligence." [35] The Germans were not alone in listening to Russian wireless. The Austrians had also integrated their intercept service into their Chancellery cryptographic section at the beginning of the war. [35] They regularly intercepted and decrypted Russian traffic all throughout the war.

The Germans then proceeded to make in the West, the very errors from which they had profited in the East. The French, even before the war, strove to intercept relevant traffic. At the beginning of the war in the West, the Germans

sought to thrust their forces deep into France in order to defeat the French armies east of Paris. The French had discovered the whole order of battle by radio intercepts and up to the minute tactical intelligence. Just as the Russian thrust failed in the East for want of radio discipline, so too the German thrust in the West turned to defeat at the Battle of the Marne between the 5th and 10th of September, 1914 [56] for exactly the same reasons. [35] With respect to the Battle of the Marne, with the French intercepting so many important messages sent in the clear, without encryption:

> "One of the great ironies of German radio traffic in 1914 was that it helped the French far more than the unfortunate [General Helmuth von] Moltke, who, despite his radio networks, was unable to keep track of his own troops.. ." [74]

Field Marshall Alfred, Graf von Schlieffen (who died in 1913), Chief of the German General Staff, had envisioned a knock-out blow against France, and at best a stalemate against the Russians. Germany got, in large measure as a result of wireless interceptions, the opposite: the knock-out of the Russians at Tannenberg and the stalemate of Western Europe's trench warfare for four years. [56]

The French, who bore much of the burden of the Great War, had seen the value of wireless interception shortly before it began. [74] Major François Cartier

created eight intercept stations reporting to the Ministry of War. Under his direction, the French early-on initiated traffic analysis[3], aided by the simple regime of German call signs and the lack of operator discipline among the Germans .[74] His work was hampered by a lack of direction finding equipment until 1916 (although the French Navy helped in this regard), but it was advanced by success in code breaking after September, 1914. [74]

After these 1914 failures to achieve early decisive victories, the Great War degenerated into trenches, artillery and gassing, for four horrible years. The superior material and manpower of the allies, bolstered by the entrance of the United States in April, 1917, the success of the French in August, 1918, and the battles of September through November, 1918 fought in large measure by American troops, turned the tide of the war. [56]

The United States also joined the war in the ether. Strategically, in 1918, the U.S. Army Signal Corps established its first long range intercept station at Houlton, Maine, to listen to Europe, under Lt. Arthur E. Boeder. [5] American

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[3] Traffic analysis is described by the U.S Army in 1944 thus: "Although messages may be cryptographed, a systematic analysis of intercepted radio traffic may provide the enemy with much useful information. This traffic analysis is based upon: (a) Amount of traffic and length of messages. (b) Call signs. (c) Routing and relay instructions. (d) Precedence (priorities). (e) Procedure signs and operating signals. (f) Times of origin and receipt." [98] (FM 24-18).

intercept stations monitored Nauen's transmissions to German agents in Mexico and South America. [8] The U.S. Army, throughout the war, knew that German agents were able to maintain contact with Germany. The Signal Corps believed that the high powered German wireless stations, such as Nauen, were the culprits:

> "It was impossible, however, to prevent the enemy from sending from its high powered radio stations, messages which could be received in the United States and in the countries to the south. The Radio Section of the Signal Corps, therefore, systematically intercepted enemy radio cipher messages from these stations all of which were duly reported to the Military Intelligence Division." [90]

Tactically, the U.S. Army had used mobile intercept stations as well as land stations in 1916 on the Mexican border [Fig. 7], and well on into the 1920s. Marfa, Texas, Fort Sam Houston, and Fort Bliss, and Las Cruces, New Mexico hosted intercept stations, as did several other locations. [53] During the entire First World War, a full field signal battalion, the Seventh, operated on the Mexican border. [90] The Signal Corps brought its Mexican operations expertise with it to France in the American Expeditionary Force.

> "Radio intelligence firmly established itself as an Army intelligence tool in France. In addition to monitoring U.S. traffic for security

violations, Signal Corps intercept stations located all along the enemy front copied enemy traffic and pinpointed the location of enemy positions by goniometric radio direction finding. Intercepted traffic was passed to radio intelligence sections at General Headquarters and with the two field armies, where specialists analyzed message flow patterns and attempted to decrypt the messages themselves." [33]

("Goniometric" refers to direction finding by comparing the angles of the nulls of the loop antennas [see Figs. 10, 18]).

An American World War II Communications Security poster quotes the following First World War example in order to heighten security awareness among U.S. operators:

"As early as 1914 the German station at Norddeich sent out by telegraph regular weather reports in mixed text. In these, the cipher clerks had not taken the trouble to encipher the letters and numbers ordinarily used for indicating the direction and strength of the wind, etc.

"The station at Brugge, on the contrary, committed the inexcusable stupidity of transmitting the same telegram after having enciphered the said figures and letters. A comparison of the two telegrams gave an exceedingly

valuable clue to the code used, and permitted ... a gradual reconstruction of great parts of it." [33, 39]

Illustrations appear nearby of a U.S. Army Radio Direction Finding (RDF) station in France [Fig. 8] and a photo [Fig. 9] of an Army station in France with G.S. Corpe standing behind the operator. [28] "Sam" Corpe (later W6LM) had been an early (circa 1912) United Wireless Company operator at Avalon on Catalina Island off Los Angeles [Fig. 11]. This had been the first American circuit to handle paid wireless traffic about 1902 as stations "D" and "A". He captioned this photo:

"U.S. Signal Corps Army Receiving Station France, 1918. W6LM in center, standing with Head Phones. Close to where Major Armstrong developed Super Het Circuits."

Just after the war, Major General George O. Squire issued his REPORT OF THE CHIEF SIGNAL OFFICER [90] detailing the work of the Signal Corps in Europe. The Second Field Signal Battalion put up one of the first American radio intercept stations at Souilly, Meuse on November 14, 1917, taking 393 messages and 1,173 calls in its first two weeks of operation. Headquarters implemented the first intercept station, [Fig. 14] devoted to press coverage, in September, 1917. [90] Other stations followed at Toul, then "Radio Hill" near Masey. Direction

finding stations (known as the "goniometric stations" from their technique) sprang up along the front lines taking an average of 150 bearings a day. [90] Radio tractors (trucks) also took on direction finding duties. By November, 1918, at least a dozen radio intercept stations were working, along with at least eight direction finding stations. [90] [Figs. 12,13] The five main intercept stations took a total of 72,688 messages and 232,977 calls. The directionals took 177,913 bearings from 20 stations. In additions, the stations picked up 5,342 enemy aircraft transmissions and called for 102 aircraft warning alerts. [90] The Signal Corps also sent false traffic successfully in October, 1918, to deceive the Germans. [90]

The circuits used in these receiving stations did the job with a minimum of hardware. A schematic diagram for the basic English direction finding radio [Fig. 15] appears nearby. [19]

Major Edwin Howard Armstrong's superheterodyne circuit remained essentially in the developmental stages up to the end of the war. [22] During the war, according to a definitive postwar account, tuned radio frequency (TRF) amplifiers did yeoman's work at the intercept stations. They were French designs, known as R-2-bis and R-3-ter. A circuit diagram [Fig. 16] appears nearby. [52]

The full complement of French equipment in the American intercept stations included Receivers (tuners) Types A-1, No. 2 (range of 150 to 6000

meters wavelength), and No. 3 (range of 300 meters to 15,000 meters wavelength), Amplifiers Type 3-ter, R-2-bis and R-3-ter, and Wave Meter Type No. 2. Marconi equipment also gave a good account of itself. [52] Direction finding stations used a Type L-3 amplifier connected to the loop antenna and tuning 200 to 100 meters wavelength. Nearby appears a 1917 photo [Fig. 17] of a British radio station operated by a corporal in the Royal Engineers who is transcribing a message from a one tube receiver. A power panel sits to his left, as do two large receiving inductances.

The work of the American direction finding station in the American sector during an attack on the Toul front in May of 1918 stands out. Two radiomen in the station took 650 bearings (by tuning, then nulling twice, then taking a call or noting a message, and then recording and transmitting the data), over 24 hours of continuous operation. This amounted to a full bearing every two minutes without surcease. [52] Soon, other similar stations went into operation, including three very successful trucks (known as radio tractors).

The Signal Corps also operated ground effect "listening stations" to intercept enemy front line telephone and telegraph messages. This work was more dangerous than the radio work. It required ground plates to be inserted near enemy positions. The Signalmen who volunteered their way into "no man's land"

to place the grounds risked their lives every night: they "combine the duties of both the scout and the spy..." [51]

General Squire in his post war Report complimented the wireless intercept operators many times, for example:

> "Upon several occasions the efficient work of our intercept operators was cited in secret reports. During the St. Mihiel operations, messages picked up by these means enabled the General Staff to learn of a counterattack, as well as its strength, and the time and place it would occur, three hours before it took place.
>
> "In the early days of the service, a commendatory report on the operations of the radio section stated that: 'The net result has been that in this period of ... days, the information furnished by the radio section has probably saved more men than are engaged in this service. Such results would have been impossible without energetic and loyal cooperation of the Signal Corps operators. The work of the Signal Corps officers and men of the radio section deserves the highest commendation.'" [90]

RADIO INTELLIGENCE WORK BETWEEN THE WARS: THE BRITISH CONTINUE TO MONITOR AND DECRYPT, ESPECIALLY SOVIET SUB-VERSION IN THE 1920S

Downsizing was the aftermath of the Great War's end, as it is of all wars. Intercept services and intelligence functions shrank. There were, however, soon untoward "consequences of the peace" (to use Lord Keynes' phrase). As wireless and radio came to play a part in the unfolding events, so did radio interception.

At the close of the First World War, the allies turned their attention not only to the other nations of the world, but also to the subversion effected by the international communist movement (the “Commintern”). With the success of the Bolshevik Revolution in Russia in 1917, all of the Great Powers faced a new threat, that of revolution from within. In 1919, as the British sought to project its Navy into the Baltic to counter the new Soviet Union, the Bolsheviks turned to wireless to counteract English intentions. Mutiny loomed as a real threat among disaffected sailors.

> “The Bolsheviks attempted to capitalize on the sailors’ grievances by aiming wireless broadcasts at them which urged them to refuse duty and hasten the cause of World Revolution. This was the first time radio had been used for propaganda purposes.” [31]

(The British as early as 1917 had themselves broadcast a much exaggerated report, for propaganda purposes, of Germans destroying a religious site in Jerusalem). [70]

British troops fought in post revolutionary Russia after 1918. British army units supported the White Russian counter-revolutionaries. The Russians at the same time intensified their work to kindle a revolution in England. "The prospect of a revolution in Britain was frighteningly real in 1919, so real that the War Office [asked] if the troops would 'remain loyal in case of a revolution in England.'" [31]

Since 1917, the Russians had dedicated themselves to the overthrow of the United Kingdom and the English were aware of this as a result of intercepts and seized documents as early as 1919. [111]

In England in 1918, the ratio of workers to strikers was only three to one (25% striking, and the number rising). [56] (In Russia in 1917 some 60% of workers were on strike.) Demobilization mutinies welled up among British troops in France and "3000 men marched from Victoria Station to occupy the Horse Guards Parade [Grounds]." [56]

After the collapse of diplomacy (as well as British subversion of the Soviets) in Russia in 1918 - 1920, only radio provided a link between the English

and the Russian government. [31] After taking hostages, the English put one of them up to communicating with Moscow by radio to disclose the hostage-taking and to promote a trade. The ploy worked and the hostages were exchanged 11 days later. [31]

The United States, starting on September 2, 1918, projected an expeditionary force allied to British and Czech forces, into Russian Siberia. Major General William S. Graves commanded the 9,000 troops. [31] The Signal Corps "Americanized" the existing Russian telegraph lines which stretched some 2,900 miles West from Vladivostok on Russia's East Coast into the Baikal area of the interior, where the U.S. 27th Infantry was stationed. At the Vladivostok end, a line was run to an American wireless station on a nearby Russian island, "so that the press reports received by that station might be distributed throughout the entire American Expeditionary Forces." [90]

The military intelligence services in Europe after the war also monitored the communications of the communists. In 1918, the existence of the Bolshevik Free State of Bavaria, communist-led mutinies in the German Navy, general strikes and workers' takeovers [56] led to recognition of the real threat of the Bolshevik revolution spreading to Germany and all of Europe. Nearby is a photo [Fig. 19] of a U.S. mobile intercept station at work in Germany *after* the end of the war.

[33] The Germans themselves valued their military intelligence section which was re-instituted on a permanent basis as early as 1919. [49] Within Germany itself, the paramilitary Free-Corps who were determined to resist the Bolsheviks, [70] set up a monitoring station to listen to communists, [35] with a staff of 32 by 1925. [49]

The official German Military Intelligence (*Abwehr* = "shield") intercept service concentrated on the international press radio service until 1925, gradually turning its attention to diplomatic transmissions. [35] By the mid 1920s, the German *Abwehr's* three sections were Reconnaissance, Cipher and Radio Monitoring, and Counter-espionage. [73]. As early as 1926, the German intercept corps encoded its intra-corps transmissions and its target intercept frequencies to deny its adversaries intelligence about its success. [86]

In the estimation of Willhelm Flicke, the leading German expert, the English had the superior radio intercept service between the wars. It was devoted not only to military intelligence but also to diplomatic traffic. [35] By the 1930s, the Germans were, however, reading most of the important messages among their future enemies:

> " ... Hitler was receiving summaries of intercepted diplomatic messages, world wide, from a larger organization [than that of the English] ... and this

enabled Hitler to march surefootedly into the Rheinland, Austria, the Sudetenland, Czechoslovakia, completely re-assured that the French and British would not oppose him militarily, and even into Poland knowing exactly how the Allies were likely to react." [86]

By 1934 the Nazi Research Bureau (*Forschungsamt* or "FA") had two radio intercept departments, B and C, for internal and external intercepts respectively. [86] After 1931, the French had a spy who was so highly placed in the German hierarchy that the internal organizational documents of the Research Bureau (the FA), including the management of radio interception stations (*Forschungsstellen*), were in Allied hands as soon as they became available to German staff. [86] In the mid 1930s the FA made millions of interceptions to generate, for example, a 1935 intake of 34,000 internal messages and 8,500 external messages. [86] In addition to its stations in Germany, the FA set up a monitoring post in Berne, Switzerland, for Swiss, Italian and French traffic. [86] The Germans could read all neutral wireless traffic and most enemy traffic except the British and American ciphers. [70]

The French also maintained their intercept service as did other nations. By 1939, French headquarters and each of eight French armies had intercept companies. [86] The Russians maintained the best discipline and were perhaps the most

effective. The Poles more than held their own, especially in the 1930s with respect to the German "Enigma" traffic which was intercepted by three radio monitoring stations in northwest Poland (at Posnan, Starogard and near Krakow). [86] The Italians ran a lax operation, and other nations had only indifferent success. [35]

In November, 1919, the English organized the Government Code and Cipher School (GC&CS), amalgamating Room 40 of the Admiralty and Military Intelligence. [73] To support its work, the English formed the Royal Corps of Signals, which in conjunction with Admiralty monitoring, provided the messages for the code breakers. [107] The British Secret Service also took to putting its agents aboard merchant ships as Marconi wireless operators, when particular ports of call were of interest. [111]

Soviet subversion in England provided G.C. & C.S. with its first important work at a time when civil unrest was widely feared. The *London Times* ran a story that wireless intercepts had revealed the fact that the Soviets were funding subversive activity in August of 1920. This sort of security breach by the press happened all too often as the years progressed. Despite a treaty prohibiting domestic subversion, the Soviets kept it up, particularly by their support of the Comintern ("Communist International") agents. Their subversive communications were

monitored in detail by the wireless intercept stations and decrypted at GC&CS between 1917 and 1930. [107, 73] Various diplomatic initiatives suppressed the subversion for a while but they also motivated the use of one-time encoding pads, for diplomatic traffic, which were very difficult to decrypt. [107]

In 1930 an intercept station detected a circuit between Moscow and a suburb of London. [107] There is no indication that it was ever closed down, leading to an inference that the British found the existence of the circuit advantageous. Perhaps analysis of the traffic provided useful intelligence on Soviet spies in England. It now seems possible that the traffic was decrypted, permitting derivation of useful intelligence directly from message analysis. The one-time pad had come into use by diplomats in 1930, but it appears the cipher was indeed compromised by the British Secret Service; [107] moreover Comintern communications did not enjoy one-time-pad security. It was not until the Spanish Civil War in 1936 that the British turned away from their focus on the Soviets.

One can speculate why the circuit between Moscow and London was permitted to continue. It is possible that it was fully decrypted by British Intelligence and that it was left in place to monitor the success of Comintern ("Commu-

nist International") subversion at Cambridge and Oxford Universities, which led to the Philby affair many years later.[4] [3, 13]

A similar and perhaps related circuit during the Second World War, carrying the traffic of the Red agent "Sonia," [73] as early as 1941, was also not shut down. Officially, the British claimed it never existed, but its wartime existence was later verified. [111] Sonia, a woman of many names, and perhaps more than one "Sonia," spied for the Soviet Union all over the world in the 1930s. A "Sonia" was a protegee of Soviet master spy Richard Sorge in Asia. In Germany in 1938, she recruited Britons as spies. She moved to England in February, 1941, went to the Oxford area at the behest of her Soviet controllers, [111] and she began her radio transmissions to the Soviet Union that spring. [73] Kim Philby had taken the initiative to reconnect himself to the Soviets shortly before. The British, in Switzerland, learned that Sonia was a Soviet spy in 1940 but let her into England the next year. [73] She died, having been much honored in Socialist countries, in July, 2000. [106]

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[4] Many high Soviet intelligence officers always believed that H.A.R. "Kim" Philby was an English triple agent. [3, 13] Some former Soviet intelligence operatives believe that Mikhail Gorbachev was a Western agent [44] The two men were connected through Premier Yuri Andropov, earlier KGB Director, Philby's "control" and Gorbachev's mentor.

However interesting Soviet intrigue may have been, the English had first to deal with the NAZIs, who had even more immediate plans, as became clear after 1936. This was complicated all the more by Japanese expansion.

The English had maintained since 1925 a "Y" committee to coordinate the work of intercepting radio signals. The British Army had its own chain of stations throughout the Empire, as did the Navy. In the Great War, the British operated intercept companies in Turkey and Iraq. [86] In 1923, they merged into Number Two Wireless Company moving to Sarafand (near Jaffa on the Mediterranean coast) and to Palestine (near modern day Tel Aviv). Another intercept company became Number One Wireless Company and moved to Cherat in India's North West Frontier Province (now Pakistan). [86] The focus of the work of these companies was the diplomatic traffic in the Far East. In 1939, Britain targeted Red Army operations in the South of Russia. [86] The British Far East Central Bureau (Singapore Naval Dockyard) did cryptanalysis [93] and had charge of radio interception. [82] Radio intercept "Q-Team" operated on Stone Cutters Island in Hong Kong after 1935. [86, 93]

The British Post Office and the Air Ministry ran the domestic stations. [107] The listeners heard and logged the traffic, but making sense of it was another matter for the NAZIs had implemented Enigma machine encoding. With the

coming of “real” war in 1939, only the Poles had made any progress in decoding these communications. The story of the decryption of the Enigma traffic is now well known [48, 107] although for many years extending long after the war and up until 1972, it was the “ULTRA” secret.

That work may well have won the war in Europe and it certainly contributed to the war effort in amounts far beyond its cost. What is not widely known is that enemy radio operators' errors gave away the codes far more effectively than even the new electronic computers could decipher them. This was known to be a potential source of decoding clues from the earliest days of the encryption of wireless messages.

THE U.S. ARMY AND NAVY CONTINUED MONITORING IN THE 1920S AND 1930S, ESPECIALLY JAPANESE DIPLOMATIC COMMUNICATIONS

Until 1929, American military intelligence fed wireless intercepts to the "Black Chamber" of Major Herbert O. Yardley. Secretary of War Henry L. Stimson was scandalized at this spying and put an end to it, shutting down MI-8, the cryptography unit of the Military Intelligence Division of the General Staff (G-2). [38] He said later: "Gentlemen do not read each other's mail." Yardley’s success in decryption went for naught, and he went public in 1931 in the Saturday

Evening Post and in a book. [107] Yardley's disclosures resulted in much tighter Japanese communications security. [38]

American cable intercept efforts had borne fruit at the 1921 Washington Peace Conference. Army MI-8 codebreakers decrypted the Japanese diplomatic code and achieved a considerable negotiating advantage[5]. [33] As early as 1926, the United States Coast Guard intercepted occasional Japanese radio messages and turned them over to the Army. [38]

The U.S. Navy also focused on the Japanese (as to some extent had the British as well). In October, 1927 Captain (later Admiral) Ellis M. Zacharias monitored Japanese traffic from the *USS Marblehead,* [73] and then set up a monitoring station at Shanghai. It was the first of a chain of stations stretching across the Pacific. [61] Zacharias set up his receivers on the fourth floor of the American Consulate [5] and manned them with U.S. Marine radio operators. Navy monitoring of Japanese traffic began as early as 1924 in Shanghai, with self-trained radiomen, and also on board the *USS Huron*, which was the Flagship of the Pacific Fleet. [86] In 1927, the Shanghai station transferred over to the *USS General Alava* in Shanghai. In 1925, a station in Hawaii also focused its attention

[5] The U.S. also intercepted and decrypted its allies' cable messages before the 1945 U.N. Conference in San Francisco, to great advantage. [3, 42]

on Japanese Navy traffic. Beijing got a U.S. Navy intercept station manned by Marines in 1925 or 1927. In 1929, the Navy "dis-established" its Shanghai station, but put one of its radiomen to work establishing an intercept station on Guam Island. Beijing station closed in July, 1935 but waited until Shanghai was re-established as Station A under Marine Corps command. It was controlled by the Navy at Cavite, P.I. and was part of the Asiatic Group which included Guam Island. [86, 73] A 1928 Navy intercept from Shanghai station [Fig. 20] appears nearby.

By 1940 the chain of stations included the Aleutian Islands, the Philippines at Corregidor, Samoa, Guam and Hawaii [5, 61] and Bainbridge Island, Washington State; Winter Harbor, Maine; Jupiter, Florida, and Chelten on Oahu in Hawaii. [107] The Navy also established lesser monitoring stations at Imperial Beach, CA and Amagansett, L.I., NY. [5]

Station A's March, 1938 equipment list shows wide spectrum capability. Direction finding equipment included a portable Model DR for 200 kcs (kilocycles, now "kilohertz – khz") to 18 mcs (megacycles, now "megahertz – mhz"), and a Model DG covering 100 khz to 1000 khz. The low frequencies which were so favored by navies were covered by a Navy Model RAA receiver. Medium frequencies were covered by two Model RAB receivers. High frequencies were

handled by three Model RT-2 and one Model RS-1 receivers. A frequency meter, line amplifiers and generators filled out the equipment. For recording Morse Code transmissions, the station used a Boehme paper tape recorder and two Boehme tape pullers. [86] VHF capabilities came on line in November, 1938 with the addition of a National 1-10 receiver for 27+ mhz to 300 mhz (ten meters to one meter wavelengths, hence "1-10") [see Fig. 21 for a later Navy NC-110 as the RBT]. A National HRO replaced one of the model RAB receivers, extending coverage higher into the high frequency range (3 to 30 mhz). A "Telediphone" made recordings of the Moscow and Tokyo circuit for transmission to headquarters. A Telediphone is a commercial Dictaphone-like disk recorder designed to record telephone conversations and was used to record the audio of radio signals. In December, 1940, the station was "dis-established" and the personnel transferred to the Philippines. [86]

The Army, despite the closing of the Black Chamber, operated the Signal Intelligence Service (S.I.S.) from April, 1930, [73] ostensibly only for "training." The brilliant William F. Friedman ran the small group which ultimately broke the what the U.S. called the Japanese "Purple" Code and provided the MAGIC decrypts that likely won the war in the Pacific. [33, 75, 107] Friedman broke that code without any captured cipher machines or codebooks (unlike the Polish and

English successes at cracking the Enigma codes). Friedman's was an unequaled feat of mind, one that nearly cost him *his* mind. [107] By the end of the war, 10,371 officers, enlisted personnel and civilians worked for this agency, by then called the Signal Security Agency, and later called the Army Intelligence and Security Command (INSCOM). [73]

"Reading the mail" later became the euphemism for monitoring radio transmissions, particularly radio-teletype. In the 1930s, however, considerable care had to be exercised by anyone who might want to listen to someone else's radio traffic. Almost all message traffic moved as Morse code. Interception of this traffic was widely regarded as illegal [38] under the United States' Wireless Law of 1912, and immoral eavesdropping to boot. This applied even to encrypted traffic from other possibly belligerent nations. This led to the "training-only" rationale, which Army brass used to circumvent the Wireless Law and the even more explicit constraints of the Communications Act of 1934, §605. That Act was widely interpreted to criminalize interception and disclosure of radio transmissions not meant for broadcast. The example made in 1929 of Col. Yardley could not have been far out of mind. Section 605 provided:

"No person ... shall divulge the contents of any messages transmitted by such [a radio or wireless] station ... unless legally required to do so by the court ... or ... competent authority." [5]

The targeted messages were, however, encrypted. The army could argue that interception and recording of a still *encrypted* message did not, by definition, divulge its still unencrypted contents. Nonetheless, discretion was prudent. The Army, on a tactical level, also engaged in monitoring and direction finding between the wars. They also practiced monitoring for training purposes using the 1940 set pictured post [Fig. 50] which is shown being operated in Hawaii.[33]

THE SPY IN THE PRESIDIO OF SAN FRANCISCO

One "irregular" intercept station appeared in San Francisco, at its Presidio, as early as 1931. The Presidio of San Francisco, founded by the Spanish in 1776, is the oldest Army base in the country. The U.S. Army took it over in the Mexican War, circa 1846. Col. Joseph Mauborgne (1881-1971) of the Signal Corps [109] set up the intercept station on his private initiative. This is why it is properly considered an "irregular" station. He listened at home (a busman's holiday) and recorded the traffic for Friedman. [5] Colonel Mauborgne, stationed at the Presidio, presumably lived in a nice house in "officers' country." Comfortable

though his circumstances may have been, he apparently was not one to let something like Yardley's disgrace or Congressional enactments get in the way of winning a coming war.

Mauborgne had served admirably in France in the Great War. He was one of only 17 Signal Corps officers to receive the Distinguished Service Medal. [90] He knew full well the value of interceptions for intelligence purposes. In 1914, he broke the British "Playfair" cypher. During the war, he commanded the Signal Corps' Land Division Engineering Section which included all of the radio units. [90]

As a Major in the Signal Corps after World War One, he acted as the Chief of the Signal Corps Engineering and Development Division. He signed off on the design prints of the standardized Army building to be used as radio stations, including the 1920s WVY station in the Presidio. That building is still standing in the Presidio as Building 312. It housed the Presidio's first radio station after the spark era, with the military call letters WVY. Building 312 is the likely site of the later Monitoring Station Number Two which was attributed to Fort Scott in 1941 but administratively transferred to the Presidio in 1942. [97] Its first intercepts may have been made as early as 1926. [2]

War clouds from the Far East spread from Japan in 1931. Japan seized Manchuria, with obvious designs on both China and Russia. Preoccupied with the Depression, Americans focused on Europe or turned inward moving toward isolationism. The Navy counted Japan as the major threat of its next war, but the Army looked primarily to Europe and set up its first, experimental intercept station for receiving European communications. [5] Mauborgne listened to Japan.

Col. Mauborgne's monitoring station in 1931 may have employed a military receiver. As of 1922, the Presidio radio station WVY [Fig. 22] used AMRAD IP-501 (Navy SE-1420) type receivers [Fig. 23] which employed a regenerative circuit. The more complex super-heterodyne circuit was, however, the real state of the art. In 1931, the Hammarlund Company first sold its superhet "Comet" communications receiver. This evolved into the Army's favorite receiver, from Comet to Comet Pro to Super Pro to BC-779 [Fig. 24] to SP-600 etc. How advanced Col. Mauborgne's equipment was is not known, but he did make recordings of his intercepts, which were flown to Washington (probably from the Presidio's Crissy Field). Inasmuch as he used an automatic recording system, his cannot have been an entirely amateur effort by the man who just happened to be one of the nation's foremost cryptographers.

Listening to Japanese traffic in 1932 had to be a challenge. Yet, if the Japanese embassy in Washington, D.C. could copy the signals, so could a dedicated monitor in San Francisco. If the gods of propagation be willing, the Presidio is one ionospheric skip closer than Washington. Mauborgne, however, most probably tuned into the Japanese "diplomatic cables" radio telegraph traffic routed through the West Coast on commercial circuits. Tokyo Radio communicated with RCA's KPH at Marshall to the North of San Francisco, and with ITT/Mackay's KFS just South of San Francisco at Half Moon Bay. If these commercial stations took the Tokyo traffic by radio telegraphy, so could a radio spy in the Presidio. The technique of siting an intercept station near a commercial receiving station continues to this day with intercept stations being located near satellite receiving nodes. (The Army in 1936 put into place a listening post for Japanese traffic near the Presidio at a Coast Artillery fortification). [2]

Joseph Mauborgne went on to achieve the rank of Major General. [Fig. 25] He commanded the entire Signal Corps from 1937 to 1941. [66, 109] He was instrumental in the development of RADAR by the Signal Corps. As sensitive as he was to the need for interception and decryption, he established the American Army intercept corps. He activated the "Second Signal Service Company" on January 1, 1939. His formation of this intercept corps provided the foundation of

the Army's intercept work in World War Two, as well as the post-war creation of the Central Security Service which merged into the National Security Agency which continued interception and decryption of communications intelligence. Mauborgne knew that intercept work was hard, and secret, and that the operators deserved premium pay, prestige and perquisites, and that in the absence of sufficient reward and recognition, a peace-time Army could not keep them. [38]

Joseph Mauborgne was not only a good spy, he was a renaissance man: Army officer, mathematician, artist and musician. It was the British experience in the Second World War that musicians, artists and even literary types made excellent cryptologists. Perhaps their minds were quicker or more open to possibilities or patterns. The Spy in the Presidio was certainly an exemplar of such a man.

THE UNITED STATES COAST GUARD'S PROHIBITION INTERCEPT WORK

On January 29, 1920, the Prohibition of alcoholic beverages, by the 18th Amendment to the Constitution, became the law of the land. Of course, disputes with the government about liquor went back at least to the Whiskey Rebellion of 1791. Prohibition continued the tradition until its repeal by the 21st Amendment in

1933. Beer and bathtub gin was the order of the day, but the good stuff came primarily from Europe, by way of the high seas, often via Canada. Wireless coordinated the rumrunners, as well as the Prohibition agents, foremost among whom was the United States Coast Guard. [83] The Radio Inspectors of the Radio Department of the Department of Commerce also joined the fray. [7] [Figs. 29, 30

The rumrunners, whose vessels the Coast Guard called "Blacks," quickly realized that the Coast Guard was intercepting their shore to ship radio communications. The Coast Guard equally quickly realized its vulnerability to radio interception by the rumrunners. Both sides in this contest turned to radio codes to hide their intentions. [Fig. 26] The Coast Guard set up an intelligence center at Headquarters under Lt. Cmdr. Charles S. Root. Radio intercepts were an important facet of this intelligence operation. [46] The Coast Guard initially got its codes from the Navy, just as it got obsolete destroyers from World War One to use as Revenue Cutters. The Navy, however, feared that too much traffic in its codes left them open to decryption, and withdrew this support.

The Coast Guard used both coastal radio stations and its vessels to intercept the communications to and from the sloops full of whiskey that Americans' thirst drew to our coasts. A typical coastal station of the period, NPG in San Francisco,

[Fig. 27] is illustrated nearby. The rumrunners, overseas, had access to high grade marine radio equipment for their ships. In the United States, the coordinating radio stations favored R.E.L. equipment from Long Island's Radio Engineering Laboratories, but they also used the cover of amateur radio stations, complete with QSL cards on the wall and all.[Fig. 28] Amateur equipment easily sufficed to communicate for several hundred miles out to sea.

The rumrunners devised special codes to frustrate interception. Occasionally, Prohibition agents seized a codebook. New York District Radio Inspector Arthur Batcheller did so in a raid on a major radio station on Long Island. A copy of this codebook appears nearby [Fig. 26] , along with official photographs and newspaper stories of the raid [Figs 29, 30]. Without such a seized codebook, decryption posed more of a challenge. The Coast Guard turned to the then nascent Signal Intelligence Service in Washington.

It was not the SIS Director William Friedman who took on the work, but rather it was his wife, Elizabeth Smith Friedman. She became the cryptanalyst for the Coast Guard. [46, 24] On the high seas, Lt. Frank M. Meals intercepted the rumrunners from Coast Guard Cutter 210, with special equipment. The Field Intelligence Unit was established at a fixed location on shore in December, 1930, with Lt. Meals commanding it. Four specially equipped 75 foot patrol boats with

high frequency monitoring capability and experimental direction finders joined the fray. One radio which the Coast Guard employed for direction finding as well as communications, was the CGR-25A, manufactured by the Charles W. Speaker Company. It covered 69 khz to 1.050 mhz, and dated from the 1920s. A photo appears nearby. [Fig. 31] In November of 1929, Admiral F. C. Billard, Commandant of the Coast Guard, accepted the Speaker company's bid for 115 intermediate frequency receivers at $260 each and 50 low frequency receivers at the same price. His letter appears nearby. [Fig. 32] These radios went one each to 24 destroyers, and 46 patrol boats, while 28 cutters got one or two each. [11] The Speaker company made a similar radio, the LSR 101 [Figs. 33, 34, 35], for the U.S. Lighthouse Service which was part of the Department of Commerce at the time. The Coast Guard earlier used Navy SE 1420, IP 501 receivers. [7] [Fig.23]

For code breakers of the sophistication of the Friedmans, rumrunners' codes were childsplay. Nonetheless, history seems to be devoid of testimony from anyone who could not obtain alcoholic beverages during Prohibition. There can be little doubt, however, that the Rum Wars, radio interception and all, made good whiskey more expensive, although, on the other hand, it *was* free of federal tax.

As late as May, 1936, the Coast Guard still had a small seven man cryptography unit dealing with radio intercepts. At that time, the Army's seven or eight

man unit was no larger. [38] In 1941, the Navy used the Coast Guard's collection of weather observations from all ships at sea for intelligence purposes, and Fleet Radio Unit Pacific declared that it had had "... the support of at least one organization capable of intercepting on a useful scale." [72] George Sterling reports that the Federal Communications Commission Radio Intelligence Division intercepted "Hellscreiber" transmissions from the German High Command, circa 1943, and turned the print-outs over to the Coast Guard Cryptographic Laboratory in the Navy Department. (The Hellscreiber system sends a small facsimile of each letter of a message in sequence; The F.C.C. had intercept equipment for it). [92]

THE SOUNDS OF WAR FILL THE ETHER IN THE LATE 1930S

The intercepts for the Army SIS came first from stations at Battery Cove, Virginia, Fort Monmouth, New Jersey and Fort Sam Houston, Texas. The Presidio at San Francisco, California (Monitoring Station Number Two) came on line by 1940 or so, along with the Canal Zone, Fort Shafter on Oahu in Hawaii and Fort McKinley in the Philippines. The next year, a station in New York harbor at Fort Hancock, and one at Fort Hunt, Virginia joined the network. [107] The Army in the Philippines monitored the Tokyo and Berlin, and Tokyo and Moscow circuits, while the Presidio and Bainbridge Island listened to traffic on the Tokyo

and Washington circuit. [107] Panama focused on the Rome and Tokyo circuit. [5] General Mauborgne had been instrumental in setting up this intercept chain which was focused mostly on diplomatic traffic.

The Army in 1940 described its operations in formal terms:

> "47. SIGNAL INTELLIGENCE SERVICE — *a. General*. — The signal intelligence service consisting of the service chief, several officer assistants, and enlisted clerical and other assistants is charged with the handling of all matters within the province of the army signal officer regarding signal intelligence and signal security in the entire army. Among other matters, it — (1) Recommends and supervises the employment of the radio intelligence company, assigns missions thereto, and evaluates the information obtained thereby...
>
> "RADIO INTELLIGENCE COMPANY 64. COMMAND. — A radio intelligence company is an organic part of the army signal service and of the GHQ signal service.... The radio intelligence company may also be employed in coastal or other frontier defense, or in the zone of the interior.... Elements of the company are widely dispersed during operations and may be attached to units subordinate to the army.

"65. DUTIES. — The duties of the radio intelligence company include — a. The establishment, operation and maintenance of radio stations for the purpose of — (1) Obtaining signal intelligence by intercepting enemy radio transmissions, and finding positions of enemy radio stations.... (3) Obtaining information as to unauthorized radio stations by intercepting radio transmissions, and finding positions of such stations located in areas controlled by friendly forces." [102]

By December, 1941 the Army had seven working intercept posts, known by their numbers:

1 Fort Hancock, New Jersey

2 Fort Scott, Presidio of San Francisco, California

3 Fort Sam Houston, Texas

4 Post of Corozal, Panama Canal Department

5 Fort Shafter, Territory of Hawaii

6 Fort McKinley, Philippine Islands

7 Fort Hunt, Virginia [38]

RCA receivers worked in diversity [Figs. 36] at an early Army intercept post. The Army equipment list for its first, 1939, intercept station at Fort Hunt,

Virginia cites 53 receivers: ten SCR-243, twenty nine SCR-244, and fourteen diversity sets. The SCR-243 and SCR-244 equipment at work in the first Army monitoring station were Signal Corps Radios including then state-of-the-art receivers. (SCR is the designation for "Set Complete Radio" and it often includes several BC-### which is the designation for "Basic Component".) The SCR-243 used the BC-197, an early Hammarlund Superpro receiver in military dress. It covered 100 khz to 20 mhz. The SCR-244 was similar, with a BC-794 receiver. This, too was a Superpro model, covering 150 khz to 400 khz and 2.5 mhz to 20 mhz. According to contemporary documentation, some SCR-244 radio sets used variants of the Superpro such as the BC-779 (the most common [Fig. 24]), and the BC-1004. [23] Some 30 sets of recording equipment were also listed along with nine diversity antennae. [38]

The Navy had its own chain of intercept stations in the Pacific. They were identified by letters of the alphabet relating to their locations and were used for naval intelligence as well as diplomatic traffic. In Washington, D.C., the Army SIS and the Navy equivalent organization "OP-20-G" (established in 1924) shared Washington decryption duties in the period immediately before the Second World War and they cooperated well. [38] In December, 1941, OP-20-G had 730

personnel, including 75 officers. At the end of the war, it had 8,454 personnel including 1,499 officers. [73] (The Army employed comparable numbers.)

The Americans, the British and the Dutch traded intelligence information about the Japanese. In the period after the war in the Pacific began, the British had four intercept stations in Australia (one removed from Singapore) plus a Dutch station removed from Batavia in Indonesia. The Americans provided the Purple Code keys and similar high level material including two Purple Machine replicas as reconstructed by Friedman. [107] After evacuating Singapore, the British in Australia set up a naval signals intelligence center at Belconnen, and the Central Bureau near Melbourne. The Australian Special Wireless Group put up intercept stations in Darwin, Perth, Morningsby near Melbourne and in New Guinea. [86]

Tactical intercept units, including American units, moved up towards Japan as the war progressed. [86] At the Central Bureau, 4,000 personnel worked to provide General Douglas MacArthur with his own "Ultra" intelligence. [86, 32]

According to Robert Stinnett in DAY OF DECEIT, [93] the Navy in December, 1941 had eleven intercept stations in the Pacific. The main station was located at Heeia, on Oahu Island in Hawaii, and known as Station H (or "Hypo"), with 65 radiomen at eight receiving posts. [93] Others were on Corregidor Island,

P.I., called Station CAST (phonetic "C"); Sitka, Alaska was Station AE and Dutch Harbor, Alaska was Station KING. Station ITEM was sited at Imperial Beach near San Diego in Southern California to monitor the Japanese Fleet, with help from three Canadian stations at Vancouver, B.C. and North. [93] RCA Communications at KPH in Marshall, just North of San Francisco, and Mackay Radio at KFS in Half Moon Bay, just South of San Francisco also aided the Navy. [93] Guam hosted Station BAKER. Samoa was the site of Station VICTOR on Pago Pago at Vaitogi. Near San Francisco, perhaps at Scaggs Island, Station FOX supplemented the mid Pacific stations. The Navy headquarters was Station US (now Naval Security Command at Fort Meade, Maryland).

Before the outbreak of war in the Pacific, along with the British Hong Kong and Singapore stations and the Dutch Batavia, Indonesia station, this coordinated network of 22 intercept stations was known diplomatically as "The Splendid Arrangement." [6] [93 map] [Fig. 37]

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[6] According to a map of "The Splendid Arrangement" of intercept stations in DAY OF DECEIT [93] on page 68, a Midway radio station primarily used for direction finding was identified with the nomenclature "AF' (and Sitka, Alaska was "AE"). According to several sources, "AF" was the Japanese code term for Midway Island, decrypted by the U.S. Navy and confirmed by a radio hoax on the Japanese before the Battle of Midway that had been perpetrated by Navy cryptologists Jasper Holmes and Joseph Rochefort. [73] Although "there are no coin-cidences...," confusion is possible.

Close to Washington, Station M in Maryland was also detailed to intercept work. [93]. It was, however, the Navy intercept station at Bainbridge, station "SAIL," (phonetic for "S" as in Seattle), that took the communication from Tokyo to the Japanese Ambassador in Washington, D.C., which instructed him to break off negotiations at 1 PM Washington time, or just after dawn in Hawaii on December 7, 1941. [5] The critical last paragraph, with the time specified, was also intercepted at San Francisco's Presidio, at Monitoring Station Number Two, and teletyped that evening, December 6, 1941, to Washington. [93] Station S also took that traffic.

Intercept stations had been alerted to its importance by an unusual plain English special request from Radio Tokyo to both RCA (for KPH) and to Mackay Radio (for KFS) in San Francisco, to be ready to take a cable to the Japanese Ambassador. [93] On December 6, 1941, Sergeant Howard W. Martin was in charge of Station Two in the Presidio, and at 8 PM he complied with Washington's urgent request to teletype the day's intercepts (already forwarded by airmail). These teletype versions were received about Midnight, Washington D.C. local time. [26] The Navy intercepts also got to Washington about midnight; it was the Navy's responsibility to keep the President informed.

According to DAY OF DECEIT, Washington malfeasance as well as general military misfeasance prevented an adequate and timely warning to Hawaii on the morning of December 7, 1941. A rash of intercepts (at least 129, duly categorized), [93] some taken even on the *SS Lurline* at sea, showed hostile intent [93] (although many in the Military code AN-1 were not in fact decrypted until much later according to recent criticism). The Japanese shore stations had taken to communicating with the fleet on the long distance frequency of 16.620 mhz. [93] Radio direction finding at 4 mhz placing the fleet north of Hawaii [93 chart] had given the game away as surely as had the RADAR detection of the Japanese air fleet attacking from the North. The interceptions [see e.g., Fig. 54, Nov. 1941 San Francisco intercept] and decrypts, indeed the simple traffic analysis of the unusually high number of Japanese Naval messages [93] should have pointed to the coming of war, but dawn on December 7, 1941 was thought to be just another Sunday in Hawaii.

WORLD WAR TWO's ETHERIC CONFLICTS: THE SETTING OF THE RADIO WARS

U.S. counter-espionage work in the ether was initially the domain of the FBI, but the Coast Guard also made a claim to jurisdiction, based, no doubt, on its

Prohibition work. [5] The FBI enjoyed a brilliant success in operating a fake spy station on Long Island to communicate with the NAZI control station AOR, in Hamburg. It lead to the arrests of 33 spies in June, 1941. [92] The Coast Guard and the Army, as late as May, 1936, each had as few as seven or eight cryptologists working. [38] In short order, however, the Federal Communications Commission, under George Sterling, assumed domestic intercept responsibilities. [92] Sterling was a leading radio authority and later an F.C.C. Commissioner. At the beginning of the war, the F.C.C. formed the Radio Intelligence Division (R.I.D.) to intercept spy radio transmissions and other traffic. [92] [Figs. 38, 39, 40, 41] The R.I.D. claimed to have put many Axis spies out of business, perhaps as many as 200. Commissioner Sterling has told this story so well [92] that little of it will be repeated here. Herr Flicke, however, very much doubted the R.I.D.'s claims, because he was in a position to know that Germany never had anywhere near that number of agents in place. "Sixteen was more like it," he wrote after the war. [35] The American success in intercepting radio transmissions from Axis agents in South America also got all too much disclosure during the war in *TIME* magazine in November, 1942 and by the Pan American Union in 1943 (*e.g.*, four agent groups in Argentina alone). [55]

Commissioner Sterling, in telling his story, kept silent about the F.C.C.'s intercepts of Soviet signals. In 1942 it monitored Russian Embassy transmissions from Maryland. It also intercepted illicit transmissions from the Russian Consulates in San Francisco and New York. The F.C.C. also cooperated with the British in targeting Soviet clandestine stations. Sterling similarly did not reveal F.C.C. interception of British Royal Navy traffic in September, 1943, with the U.S. Navy providing the stations, frequencies and schedules. [2]

As of August, 1940, after the French armistice, a French intercept operation continued working in Vichy territory as the *Groupement des Controles Radioelectriques* for the *Duexieme Bureau*. It employed several listening stations in France and direction finding stations in France and North Africa, with about 400 people working at various tasks. Its Commandant Romon suffered arrest by the NAZIs in December, 1943, and they shot him in August, 1944. [86]

The Germans excelled in technical intelligence techniques. As early as 1940 or 1941, the Germans developed a device to unscramble the radio-telephone calls between President Roosevelt and Prime Minister Churchill. It was presumably a vacuum tube analog computer-like machine, for it was "a complicated apparatus ... constructed at great cost, based on the recognized rhythm of the known distortions," according to Flicke. [35] Telephone engineer Kurt Vetterlien

ran an intercept post (the "research post") on the Dutch Coast. It focused only on high Allied leaders' radio-telephone communications. Knowing AT&T's system, he had been working for the German Post Office on de-scrambling since the mid 1930s. His success was not expected by Allied technologists. [73] Hitler read the transcripts of these calls in near real time. However, a change in the Allied scrambling system put the device out of business.

The United States used a world-wide network of at least ten radio stations. The Germans called this the KVNA-net, after the VNA call sign of the first heard station, in Karachi, now Pakistan. Station WAR in Washington acted as net control or the central station. The Cairo station was WVNV. The Germans read most traffic on this net currently: "... it afforded information on American military measures in the Far, Middle and Near East and in Africa." [35]

Perhaps the greatest success that the Germans enjoyed in interception for intelligence purposes came in North Africa in 1942. General Irwin Rommel earned his sobriquet "The Desert Fox" with his battlefield prescience. What was actually going on was more mundane: The German General Staff (*Ober-kommando der Wehrmacht*) military radio and cipher breaking group (*OKW-Chi*) intercepted and decrypted (with the help of a secretly copied code book) the communiques of the American Military Attache in Cairo on the Cairo KNVA net.

He reported to the State Department in Washington every move and plan of the British. *OKW-Chi* at Nuremberg passed on his detailed reports to General Rommel. [35, 86]

On June 27, 1942, a German domestic station broadcast a radio drama about the war in North Africa. One of its characters was an American military attache in Cairo who sent detailed reports back home. Transmissions from the real attache, and hence intercepts, stopped two days later. A change in the American code soon deprived Rommel of the best strategic and tactical intelligence of the War. He had no advance warning of British General Montgomery's coming attack at El Ala-mein, which was the turning point of the war in North Africa and in the West. [86] The German thrust to the oil-rich Middle East was parried.

As of 1942, the U.S. Army Signal Intelligence Service set up its main European intercept station at Vint Hill Farms in Warrenton, Virginia. It was soon followed, for Pacific intercepts, by Two Rock Ranch in Northern California, and a much enlarged operation in Hawaii. These were Stations One, Two and Five. They employed Hammarlund Superpro receivers, favored for their two RF stages, and many highly directional rhombic antennas. [64] The network of Allied intercept stations was not just located in Europe and America but was spread world-wide throughout the war. For example, an intercept station in India,

(probably in New Delhi) provided valuable intelligence to MacArthur's Combined Bureau on Japanese intentions in Indochina. [55]

The warring powers filled the ether with signals. As a result of ionospheric effects, the short wave signals bounced around the world. Between 1938 and 1942, sunspot numbers were peaking, promoting long range high frequency propagation of both military and diplomatic transmissions as well as international broadcasting. [94] Sometimes, for example at Two Rock Ranch, one station could, and often, did monitor an entire theater of operations.

Most of these signals were encrypted Morse Code. Few were radio teletype using Baudot code, because propagation conditions made teletype reception very difficult. The U.S. did, however, use an IBM radiotype system on domestic military circuits, and a Baudot system overseas. [95] The Russians also used a radio-teletype circuit back to Moscow. [2] Some tactical communications used radio telephone which often operated on very high frequencies. Aircraft communications, including those from German bombers [Fig. 42] and Japanese Naval aircraft, frequently employed AM voice mode, and were duly intercepted. Roosevelt and Churchill spoke across the Atlantic on radio telephone, duly scrambled and initially, duly unscrambled. Of course, everyone was listening to everyone else, most of the time. The codes were regularly broken on all sides, except for

high level Russian communications and most but not all of the British and American codes.

The Allies also used false radio traffic to mislead the NAZIs as to their own intentions, particularly in connection with a second landing after Normandy which was codenamed Operation Bodyguard. [82] Hitler continued to withhold forces in the summer of 1944 to meet the second landing north of Normandy that never came. The British used the "double cross system" to turn almost every NAZI spy in England. When captured, each spy was given the choice to work with the British, or not. Those that did not were 1) shot and 2) replaced with British agents pretending to be that German py. Each of them then radioed the Germans false information, much of it purportedly from very high levels in the British government.

The Allies maintained false levels of traffic from the mythical First Army Group (FUSAG) to mislead the Germans who were seeking to understand allied intentions by using traffic analysis, [73] a deceptive practice begun in the North African campaigns, [86] with antecedents in World War One. The Germans ran "radio games" (*funkspiel*) to subvert Allied intentions. For example, they ran the entire British sabotage network in Holland, [108] even asking the British by radio for airdrops of chocolate. On the other hand, a British radio deception helped to

save the Normandy invasion of June, 1944. The British convinced the NAZIs that their supposed agent CATO could obtain the highest secrets by sending a message supposedly coming from CATO to Germany reporting that the Allies would indeed invade Normandy on June 6. They sent this warning just too late to be of use. It did, however, establish CATO's credibility. CATO then sent another message on June 9, that the real invasion was not at Normandy, but farther North. Hitler believed it and held his crucial Panzer divisions in reserve. [49]

There was often little difficulty in hearing signals. Ground wave often sufficed for nearby armies. Skip propagation permitted long distance technical intelligence gathering from the ether. The transmitters ranged from broadcasting stations of up to 500,000 watts and more, to spy radios of maybe five watts on a good battery. Utility services, including radio telephone, ran five to ten or more kilowatts as did naval land-based circuits.

The U.S. Army's main station, WAR, was located in Washington, DC. Military land based circuits ran at ten kilowatts for the main transmitters such as WAR and WVY. [95] Intelligence services' spy and sabotage control stations often communicated at hundreds of watts with directional antennas providing gain. Unless a broad area was to be covered, such as by a BBC broadcast, it made good security sense to limit power and use directional antennas.

Ships at sea still used long wave as well as short wave, with transmitters such as TAQ, TBA, and TBB, being used for frequencies from 200 khz to 30 mhz. [59] The Navy in Hawaii put out 500 kilowatts at 26.5 khz and 355 khz was the primary ship to shore frequency [59] The Navy also used its shortwave capability (primarily 2.716 mhz as of 1941) at lower powers. Aircraft often conducted liaison communications at a hundred watts or less, often using much less on short wave. Command communication among aircraft ran very low power transmissions of ten watts or so.

Tactical military signals ran from one hundred watts and often much less, down to the 350 milliwatts of the Handy-Talky BC-611, which was good for maybe half a mile with ideal terrain and fresh batteries. (It has been reported that these "Walkie Talkie" sets were purposely detuned to limit their range because the foot soldiers who carried them had no training in coded transmission and their plain English communications could provide too much information for the Germans.) VHF command communications worked on FM at five watts or so. Spies in the field operated at the lowest power practicable, and for the shortest time to defeat direction finding while still permitting communications.

The receivers which were used came from the general market and primarily exemplified the designs of the 1930s. The Army Signal Corps' initial intercept

efforts anticipating World War Two, circa 1939, used the early Superpro to take the traffic.

The U.S. Navy favored National Company equipment, including the HRO series [Fig. 43] and the NC-100 series [Fig. 44]. The Navy "Battleship Receivers" were specially designed in the 1930s and manufactured by Federal Telephone and Telegraph (and others including RCA). [Fig. 45] The Navy nomenclature for these was RBA for long wave, RBB for medium wave and RBC for short wave. Early Navy intercept work often used the RBA and RBC sets. The working receivers in many installations, including submarines, were the matched pair of tuned radio frequency (TRF) receivers with regenerative detectors, called RAK and RAL, for long wave and short wave. Dutch Harbor, Alaska used an RAK, an RAL, a Navy National HRO-7 known as the RAS, along with a Hallicrafters S-20-R for VHF. [27] Intercept Station King (K) is identified as being sited at Dutch Harbor. The Navy also employed the National 1-10 VHF regenerative receiver for surveillance and intercepts. [Figs. 67, 68]

The F.C.C. favored Hallicrafters equipment [see, *e.g.* Fig. 46 the SX-28 and panoramic adaptor S-35]. The Federal Bureau of Investigation used the SX-28, and the National HRO series and there is anecdotal evidence that the FBI used National NC-100s for intercepts and feeding the signals to recording systems. An

FBI photo of a NAZI spy shows his similar preference for Hallicrafters gear [Fig. 58]. The Office of Strategic Services had to make its own tactical equipment in the China-Burma-India (C-B-I) theater, and in Europe, the O.S.S. used miniaturized state-of-the-art VHF equipment (the "Joan Eleanor" system, named after developer Al Gross's wife and daughter) to avoid direction finding interception, by transmitting straight upwards to high flying aircraft with VHF receivers. (The transceiver weighed four pounds and measured 6 ½ inches long by 2 ½ inches wide by 1 ½ inches deep.) [73]

Antennas in all theaters ranged from short VHF whips and short wires, through random length long wires to complex direction finding arrays and precisely aimed rhombics and log periodics. The Army at Vint Hill Farms and Two Rock Ranch put up arrays of rhombic antennas for nearly world-wide coverage.

With so many signals in the air, all World War Two belligerents employed tactical intercept units. The U.S. Army operated tactical radio intercept and intelligence units in every theater on every level. [Figs. 47, 48, 49, 50] U.S. Navy Radio Intelligence Units did shipboard tactical intercepts for task force commanders and the Fleet Admirals.

On the strategic level, the British General Communications Headquarters, G.C.H.Q. , successor to G.C. & C.S., reported to the Foreign Office. The "Y"

network of receiving stations, many initially manned by amateur radio operators, became the Radio Security Service (R.S.S.) and ultimately the Composite Signals Organization (C.S.O.). The Royal Air Force, for example, posted its main intercept station at Cheadle with 100 receivers working. The British success, of which Winston Churchill was so proud [25], has been thoroughly documented by Nigel West in THE SIGINT SECRETS [107]; [see Figs. 58, 59, 60, 61, 62, 63]. The British even established a research and intercept post in Antarctica. [72] [Figs. 64, 65].

American intercept operations included:

1) The Federal Communications Commission (F.C.C.) Foreign Broadcast Intelligence Service (F.B.I.S.),

2) the F.C.C.'s Radio Intelligence Division (R.I.D) covering North and South America,

3) the U.S. Navy, from California and Washington State, Hawaii and Australia, for the Pacific Theater. In Hawaii, the Fleet Radio Unit Pacific (FRUPAC) handled the Pacific Fleet's communications intelligence. FRUPAC supervised Radio Intelligence Units working for fleet and task forces commanders. [73] FRUPAC and its predecessor Station HYPO handled at least 1,460,000 Japanese messages during the war. In Australia, MacArthur's unit in Melbourne

was FRUMEL in support of his Combined Bureau joint intelligence operation. [32]

4) The U.S. Army, initially by the Signal Intelligence Service, then by the Army Signal Security Agency, focused primarily on the European theater but used monitoring stations in Washington State and California. The Army's pre-war intercept stations ranged from New Jersey to Texas and Panama to California, Hawaii and the Philippine Islands. During the war, the Army also established intercept stations at:

Amchitka, Aleutian Islands, Alaska;

Asmara, Eritria, Africa;

Bellmore, L.I., New York (ex-O.S.S.);

Fairbanks, Alaska;

Guam Island;

Indian Creek (Miami Beach), Florida;

New Delhi, India;

Petaluma (Two Rock Ranch), California;

Tarzana (Reseda), California (ex-O.S.S.);

Warrenton (Vint Hill Farms), Virginia.

[64] In addition to these 17 major stations, hundreds of field and mobile stations supplemented the intake of enemy traffic. By 1945, the Signal Security Agency handled 380,000 foreign messages a month, but operated only 11 listening posts. [2]

In Australia, General Douglas MacArthur, Commander of the South West Pacific Area, enjoyed his own intercept network and decryption section. [32] Australia operated its own intercept stations. So, too did New Zealand. Both nations employed the Australian copy of the National HRO receiver, [Fig. 51] and also RCA AR-77s. [87]

The main German intercept operations were :

1) *Seehaus* "Lakeside Facility" short wave broadcast monitoring;

2) Military intelligence *OKW/Chi* [military intelligence, cypher];[7]

3) Internal security, the "Research Bureau" *Forschungsampt* (FA);

4) Secret State Police, the *Gestapo.*

The Italians also developed a number of intercept receivers for tactical and intelligence work. [Figs. 55, 56, 57] Even the NAZI-allied French (Vichy regime)

[7] Recordings are available from the U.S. National Archives and Records Administration made by Germans in France in 1944 of American radio telephone transmissions in England, which transmissions may have been designed to deceive.

intercept operations continued to December, 1943, and likely into 1944, until the Allied invasions. [86]

The Japanese operated their main intercept station at Owada outside Tokyo. It was listening to broadcasts and diplomatic traffic as well as foreign armies and navies, as detailed below. The Japanese Army and Navy also did tactical intercepts in the Pacific and in China and Burma.

The Russians operated several levels of intercept service, with much tactical monitoring on what the West called the Eastern Front during the War, and with the radio section of the N.K.V.D. (the state security committee) intercepting diplomatic circuits and monitoring foreign broadcasts, along with internal security monitoring. [Figs. 52, 53]

As of 1933, the Soviet intercept agency was the best supported in the then mostly peaceful world. Work on ciphers flourished in the late 1930s and by the early 1940s the Russians also broke the Japanese Purple Code. By then the intercept service of the G.R.U., concerned with Soviet military intelligence, had separated from the similar work of the N.K.V.D., which concentrated on diplomatic traffic. (The name of the latter became N.K.G.B. in 1943. Its Eighth Directorate handled communications intelligence and later (1968) the 16th handled SIGINT.) The Soviets filed German, Italian, Japanese and Turkish intercepts.

Their use of American and British radio receivers in large quantities permitted effective tactical radio interception by special purpose radio battalions on the Eastern Front. In London, the Soviets used radio interception to assess British surveillance of their illicit activities, a first in counter-counter-espionage. [3] Towards the end of the war, the Russians targeted Allied radio circuits, and the Allies found out that they had been targeted by decrypting a Russian radio-teleprinter circuit. [2]

RADIO INTELLIGENCE WAR WORK IN SAN FRANCISCO: THE TWO-THREE-FOUR IN THE PRESIDIO AND AT MACKAY'S STATION KFS AT HALF MOON BAY

The Japanese attack in the Pacific on December 7, 1941, was indeed all too much of a surprise. In the six months that followed, the Japanese overran American, British and Dutch cities and bases around the Pacific's Western shores. The British lost Singapore in late December, 1941. In the Philippines, first the Bataan Peninsula, and then the fortress of Corregidor fell by May, 1942. The Dutch lost Bandoeing and the rest of Indonesia, with all its oil, early on. By the end of 1942, the Japanese ruled from Manchuria to Australia, and from India's border with

Burma to the Western Aleutians in Alaska, Wake Island in the mid North Pacific, and the Solomon Islands in the South Pacific.

MacArthur escaped from the Philippines to Australia on a submarine. The last, heartbreaking message from the last Army radio operator on Corregidor, as the fortress surrendered, was copied helplessly by several stations.

Most of the information that follows comes from Professor Richard D. Kain's 1998 oral history done by the National Park Service at the Presidio, where he had served as a Sargent and intercept station "trick chief" between 1942 and 1946. [50] In this, the chaotic period of retreat and defeats, in December, 1941, and early 1942, the ether delivered a few strange short wave signals to state-side monitoring stations. They seemed to be Americans seeking contact with American Forces and transmitting Morse code in plain language. They could be heard in California. Perhaps they were some Japanese trick, the kind of "radio-game" of which the NAZIs were so fond. On the other hand, maybe they really were Americans in desperate straights.

The Army quickly established contact. Once communications links were working, the operators could determine that they were indeed talking to Americans. Only Americans could know cultural details, family matters and the minutia of overseas postings. These circuits, however, posed an unusual problem: the

overseas radio operators had no codebooks, so only plain language messages had to suffice.

The Army early-on decided to create a "cover" for these communications. All Army operators adopted amateur radio processes, procedures, call signs, nomenclature, and abbreviations (such as the Q signals, *e.g.*, QRN for noise on the circuit, QRM for interference, QSO for contact or conversation, etc.). The Army thus sought to create the impression that some "hams," willing to violate the shut-down orders of December, 1941, still talked to each other on the short wave bands in C.W. Morse Code. Fifty years later, Prof. Kain could still remember working a Navy man, Roy Tweed, on Guam after it came under Japanese control. He recalled Hammarlund receivers (one shows in a photo [Fig. 70] in the unit's History) as well as Mackay equipment, and that of the Hallicrafters and National Companies. These pseudo-ham QSOs used nothing but the best amateur radio equipment.

The Signal Corps created at least one dedicated radio company to communicate in this manner. The Presidio of San Francisco housed it. The Signal Corps called it the 234th Signal Operation Company. Its last commander was Captain William B. Inglis of Norman, Oklahoma. The 234th documented itself, consistent with war-time security constraints. It produced a company book, and recorded

some of its stories. Some photos have also been preserved. The cover of the book appears nearby. [101] [Fig. 69] On September 21, 1945, the Army awarded the 234th its Meritorious Service Unit Plaque.

It may be that the 234th was not preceded by 233 prior companies. "Two Three Four" sounds like an arbitrary but hardly random numerical sequence. Perhaps similarly, the covert and irregular Office of Strategic Services (O.S.S.) called its only operational combat regiment in the China-Burma-India theater of operations the 101st Detachment, lest it ever be known it was only the first such unit. [63]

In 1942, the Office of Strategic Services (O.S.S.) set up two intercept stations in the United States because it did not receive enough intelligence information from the Army and Navy. A front company, FBQ Corporation, established the listening posts in Reseda (Tarzana), California and in Bellmore, Long Island, New York, for foreign broadcasts; the Army soon took them over. [73] The Army used both sites in 1944 to monitor Army transmissions for security breaches. [73]

These Army security stations monitored the work of Army radio operators, such as those of the 234th. In the case of the 234th, however, the monitors did not want to hear good, secure, standard Army communications. The whole point had

been to disguise the overseas contacts as amateur radio bootleg QSOs. Hence the monitors listened for any deviation from amateur radio procedures and even vocabulary. The last thing they wanted to hear on these circuits was Army talk.

In one instance, the Army disciplined an operator (then Sgt. Kain, Professor Kain admitted) for saying in his QSO with an overseas operator that he had "just gotten out of the sack." Use of an Army term like "sack" for bed could give the game away. It was hoped that enough boring ham talk, and only ham talk, would send Japanese intercept operators elsewhere for more interesting traffic.

The 234th Signal Company operated from its own radio station on the Presidio. A site inspection of the known radio buildings as of 1998 suggested to Professor Kain that the station was the former Crissy Field aeronautical radio station. This building, with its own small generator out-building located next to it, has long been converted into a nice house. It is at the West edge of the Crissy Field homes of "officer's row" which housed the pilots and their families. In the 1920s and into the 1930s, it housed the radio transmitters and receivers used by the Army Air Corps to communicate with the biplanes and pursuit aircraft using Crissy Field on the North shore of the Presidio. The 234th's History discloses that the unit operated at Crissy Field until October 7, 1944. [101]

The World War Two radio operators of the 234th in the Presidio referred among themselves to their radio station as "the H.O.I.P." for "House of Intelligent Persons." This station, however, did not provide the only base of radio operations for the 234th. Forty miles South, International Telephone and Telegraph's Mackay Radio Company operated a radio receiving site near Half Moon Bay for its commercial and marine station KFS. The resurrected Globe Wireless Company operates this receiving site to this day for its KFS and KPH transmitters in Palo Alto utilizing marine digital communications with ships at sea. The callsign KFS dates from the Federal Telephone and Telegraph Beach Station on Ocean Beach in San Francisco, callsign FS, which was known for its 1910 arc operations. Before Pearl Harbor, the Half Moon Bay site may have been British Station X in the Splendid Arrangement. [93] On December 7, 1941, the radiomen at KFS heard, on 500 khz, the signal for submarine spotted (SSSS SSSS SSSS) then an S O S, then silence. Globe Wireless operators at KTK, at nearby Mussel Rock in Pacifica, also took the traffic. [68] The ether thus carried some of the first signals of America's Pacific war.

Mackay Radio (and now the resurrected Globe Wireless) had (and has) a wonderful network of antennas, rhombics and the like, for working the Pacific. The war shut off most of the KFS commercial and marine traffic. The Coast

Guard took the station over, and the radiomen became Coast Guardsmen. In short order, however, the Army put some or all of the antennas to good use and the receiving station was back in business.

In August of 1942, a KFS intercept started the communications between overseas operators and the West Coast. American guerillas using the old Manila army station callsign KAA called WAR, the U.S. Army's main station in Washington. They came up on the 8 mhz marine band where they were sure to be monitored. The Navy and KFS completed a circuit and verified the identity of the guerillas. The circuit stayed open until the Japanese captured the group, killing some and imprisoning the remainder of them.

Another station soon came up, using "WPI," the old U. S. Army Philippines station callsign. It, too, was vetted, and then that circuit carried considerable traffic about Japanese positions in the Islands, all in plain language. Soon a new circuit opened with a more organized group that enjoyed the benefit of an M-94 cypher machine. At this point the Army put in its own shifts of trained operators at KFS. [68]

Details of operators from the 234th at the Presidio went down to KFS for months at a time. They had no leaves or time off. The work was intense and demanding as the war progressed. More and more stations appeared in the Pacific.

Soldiers and sailors left behind, especially in the Philippines, came up on jury-rigged transmitters which they had reconstructed. Philippine partisans also put radio equipment into operation. Escaped prisoners of war did the same. Civilians in the war zone came on the air, sometimes from transmitters in ships. In the South Pacific, the "coast watchers" provided intelligence about Japanese naval movements by radio. Toward the end of the war, submarines landed commandos in the Philippines who carried good, working radios and operated on pre-planned circuits with the 234th.

On December 26, 1944, notes the History of the 234th, it received a

> "Commendation at the conclusion of special mission at Radio Station KFS at Half Moon Bay, California. It was the relay of radio traffic in a certain net designated by the Commanding General South West Pacific Area"

Radio operators at KFS also specialized in reception of weak distress signals from survivors of torpedoed ships which were transmitted on the universal distress frequency of 500 khz. KFS had a particularly good custom made marine receiver available and it was able to save many lives. [68]

The 234th also got an early taste of the Cold War. Still active at the end of World War Two, the Army called upon it to set up the first teletype circuit with

Moscow. The United Nations (and President Truman) came to San Francisco in June, 1945 for its formal post-war revival, The “United Nations Conference of International Organization” (the Allies had also used the term "United Nations" for themselves battling the Axis powers). The 234th thus played a role in the U.N.’s genesis.

There may well have been other units with equally dramatic stories. War time secrecy has, unfortunately, outlasted almost all the participants. With the ongoing declassification of World War Two documents, perhaps more of these stories will become known.

The “adventures in the ether” of the 234th emphasize that radio intelligence work knew no "front line." Getting too close to a real front line cost the lives of all too many radio intercept operators on all sides. Much of the work could be, and in many cases had to be, done thousands of miles from combat. To do it right, it often had to be done far from the dangers and distractions of the ongoing warring armies. The dedication of these intercept operators was no less intense despite their relative safety.

TWO BROTHERS IN TWO THEATERS OF THE RADIO WAR

Dick Secondari and the late Elliot Secondari, twin brothers from San Francisco, served in the U.S. Army Signal Corps in World War Two. Dick Secondari has generously made his personal archives available. He was drafted in 1943 as a 19 year old, as was his brother Elliot. Both had been amateur radio operators and knew the Morse Code. The Army sent them to the Signal Corps after Basic Training. They both qualified as Radio Intelligence Intercept Operators. Dick Secondari (K6TR) has provided the information that follows.

Dick Secondari served with the Second Signal Service Battalion (established by Gen. Maubourne in 1939) whose personnel operated all over the world. The Signal Corps assigned him as an intercept operator to stations working Japanese traffic and he was an "IO-J." The IO-Js had to learn Japanese Kana Code, with 58 different characters and two phonetic signs. They transcribed this onto typewriter-like machines, known as RIP-5s.

The Signal Corps initially posted Dick Secondari to Two Rock Ranch North West of Petaluma California and he made occasional visits to the Presidio. Later he served in Hawaii, and had been posted to Guam as the war ended. The intercept stations moved West as the Japanese retreated. The traffic consisted of operational messages and procedural messages for radio circuit operation. The Japanese used 50 word per minute Kleinschmidt perforated tape keying systems.

The intercept operators recorded the traffic on inked paper tape recorders, the BC-1016, then typed the encrypted messages out as Kana Code. Dick Secondari, still an active amateur radio operator (as K6TR), still has a paper tape recorder, and some documents and messages preserved from his IO-J days. The Waters Conley company of Rochester, Minnesota, made the tape recorder (Army BC-1016 and Navy SC-10 equipment), and an illustration of it from its manual appear nearby. [Fig. 71]

While on duty, Dick Secondari compiled a personal dictionary of Japanese radio and other terms. He used it to decypher some of the procedural circuit transmissions. For example, he could use his little-black-book dictionary to help figure out a message to change frequency. Then the IO-Js would tune the intercept receivers so they were ready and waiting for the traffic on the new frequency. The IO-Js were thus up on the new Japanese frequency before the Japanese were. A page from his circa 1944 dictionary appears nearby. [Fig. 72] He also retained some of the "end of the War" messages which he had access to and they are reproduced nearby. [Figs. 73, 74, 75]

The Japanese transmitted diplomatic as well as military messages via short wave radio. The intercept operators called the diplomatic traffic "Dip." As the Japanese conquered new territories, *e.g.*, the Dutch East Indies (Indonesia), they

incorporated surrendered radio stations into their network. They did not, however, change the call signs. They also used their own standard pre-war call signs. This made circuit analysis and traffic analysis easy. The station at Bandoeng, for example, retained its pre-war call letters, PLK1, as the Japanese continued to operate it after wresting it from the Dutch.

Dick Secondari's recollection is that the Army favored Hammarlund receivers. The Army intercept stations racked three Hammarlund Superpros as a diversity receiver with a metered combiner circuit (behind a black wrinkle-painted panel) at the bottom of the stack. Dick Secondari recalled that the Army published a photo of such a diversity set up in a wartime radio magazine (without disclosing its intercept function). He still has a copy of that picture from the magazine, and it appears nearby. [Fig. 76] The three meters to the left each correspond to one of the BC-779A receivers, the left meter shows the final combined output. The two bottom meters monitor the power supply. Each receiver worked off a different rhombic antenna, pointing in a slightly different direction in order to eliminate fading and atmospheric distortions. The output from the combiner went directly to paper tape, not earphones. The operators read the tape visually. Operators used earphones for tuning, but almost never a loudspeaker such as the one shown on top of the rack. The nearby frequency meter (BC-221) provided accurate tuning of the

system to the nearest kilocycle. As the operators read the tape from the Waters Conley machine, they typed out the Japanese Kana code characters on a RIP-5 typewriter. Others then re-encrypted these messages and used the land line teletypewriter circuits to send the messages to Washington for decryption of the Japanese text. The operator in the photo holds the same rank as Dick Secondari did at the time; he mustered out in 1946 as a "Spec. 5."

The East Coast stations to which Elliot Secondari was assigned monitored Germany primarily. Army intelligence on the East Coast also targeted Argentina, because of the heavy German influence there at the time. Elliot Secondari was assigned to stations working German traffic, and he was an "IO-G." He also served with the 3258th Signal Service Company in Europe with the U.S. 9th Army. A photo taken 50 years after this intercept work, of the two Secondari brothers (Dick on the left and Elliot on the right), as the radio operators of the *SS Jeremiah O'Brien*, (homeport San Francisco, callsign KXCH) appears nearby. [Fig. 84]

TACTICAL INTERCEPTS

In the military battles of World War Two, all belligerents communicated by radio, intercepted radio communications, and sought to deceive by radio. The best

telling of the tactical details of this intercept work is in Major Hugh Skillen's SPIES OF THE AIRWAVES (1989) supplemented by his *Enigma Symposium* (one each in 1994-99). Intercept operators all too often found themselves in combat on the ground as well as in the ether. Major Skillen lays out the whole of the Second World War from the perspective of military intelligence that had been derived from radio interception. His is the definitive if relentless work, from which only slivers will be taken for this note.

As of 1940, the U.S. Army formally described its tactical radio operations:

> "80. EFFECTS OF TACTICAL OPERATIONS. — *a. General.* — Tactical operations affect the operations of the radio intelligence company in varying degree. The effects of some of the more common tactical operations are indicated below:
>
> (1) *Intercept operations* vary but little with the tactical situation. These operations for both long and short ranges consist of searching the workable radio spectrum rapidly and intercepting all types of transmission from both enemy and friendly stations for extended periods of time. The location of the intercept station is to a large extent independent of the terrain, and all activities can be concen-

trated in one room or tent without affecting the efficiency of operation.

(2) *Position finding* operations vary markedly with the tactical situation. These operations are governed by the distance to and power of radio transmitters employed by the enemy, the extent and frequency of movement thereof, and the tactical maneuver of our forces...

(3) *Intercept and direction finding operations* are inter-related to the extent that intercept stations usually first detect enemy transmitters..." [102]

The role that tactical radio interception played in military intelligence in the North African campaign was critical on both sides. Rommel had the benefit of a superb tactical intercept and decryption unit, Radio Company 621 under the command of *Oberst Lt*. Harold Seebohm (a veteran of the Polish and French campaigns). He lost it all, including Seebohm, in combat on July 10, 1942 to an Australian Army attack. Seebohm died of his wounds. [86]

British tactical intercept units also found themselves in combat and sustained loss of life in North Africa, in the shifting tides and fogs and sands of battle.[86] Both Rommel and the British commanders frequently had the benefit of viewing intercepted, decrypted and translated tactical traffic before the intended

recipient actually received it. [86] Lax American communications security often assisted the Germans, [86] as lax British security had assisted them earlier.

Some 40 British Special Wireless Sections acted as the ears of the British Army. [Figs. 78, 79, 80] Thirty of these worked in the field with a complementary Wireless Intelligence Section. Wireless Intelligence Section 55 trained the American 128th Radio Intelligence Company, one of the Army's first, in the North African Campaign. [86].

A typical British tactical intercept unit at Corps level employed 20 National HROs, ten Hallicrafters S-27s for VHF, and three loop direction finding vans. [86] Morse code was the order of the day except for the VHF radio telephone used by German armor and some AM air communications. Both the Australians and the Polish Army in exile assisted the British intercept efforts. The Polish success was impressive, at one point sneaking into a German combat air radio telephone net and successfully commanding the aircraft to return to base. [86] A Polish intercept unit went to Palestine to monitor the Russian Front. [86]

In June, 1944, the Normandy invasion succeeded. By 1944 "radio intercept had become the most valued source of military intelligence in the German Forces" which deployed 17 Communications Reconnaissance Battalions [86] under General Fritz Boetzel. [86] Each intercept company operated 36 receivers. The

Army units used the German receivers Ln-E.a and Kw-E.a (for "short wave - ground, model 'a'"; the Kw. E. a. set is reported to be "a high-grade superhetero-dyne..." [99]; see [Fig. 81]) and the R1 V. The Navy and the *Abwehr* intelligence service favored the KST, a copy from the late 1930s of the National HRO by the Körting Radio Company. [86] The U.S. Army characterized several other German radios as intercept receivers: the Fu. H. E. c. ground receiver, the earlier Fu. H. E. u. ("a well constructed, battery-operated 9-tube superheterodyne..."), the Torn. E. b. [Fig. 114] ("nicknamed 'Bertha,'" which is the German phonetic for the letter "b") [99].

In the latter part of the European campaign, British radio intercept crews sometimes were tasked to communicate with the German radio networks on matters of prisoner treatment and possible exchange and these unusual communi-cations between enemies took place when necessary. [86]

The British units mostly operated National Company HROs, in their nomen-clature "R-106." [Fig. 82] They wanted Hammarlund Superpro receivers badly [86] because they were band switched and this eliminated the need to plug in new coil units to change surveillance bands. The Superpro receivers also provided superior sensitivity as a result of having RF amplification. Most if not all of the

American Army intercept units used the Superpro receivers and this created some envy among their British companions.

Towards the end of the war, the British began to intercept German UHF radio telephone links from the Adriatic coast. The Germans called these the Rudolf and the Michael systems and they operated between 400 mhz and 600 mhz. Little communications security hindered the intercept work because the Germans erroneously believed that the UHF links were entirely secure by reason of their high frequency and narrow beam nature. [86] They fell prey to a clever British officer who remembered an experimental UHF link at the 1936 Olympics in Berlin.

The U.S. Navy put Radio Intelligence Units aboard the flagships of most task forces. They made combat intercepts and reported to HYPO (*i.e.*, Station H, later called FRUPAC for Fleet Radio Unit Pacific). [Figs. 43, 88, 90] The Navy's coordinated communications intelligence permitted the submarine *USS Gudgeon* to sink the Japanese submarine *I-73* some 240 miles west of Midway Island in January, 1942. It was the first U.S. submarine sinking of an enemy vessel in the war. [73] The Navy had deciphered the five-number Naval Code early on. [93]

Radio intelligence won the Battle of Midway Island in June, 1942 and thus started American forces on the way to Hiroshima. The Navy radioed false information which was duly intercepted by the Japanese. It lured the Japanese into making an almost immediate radio transmission which identified their target as Midway Island. This permitted the Navy to be ready for the battle. [73] A Japanese speaking Navy officer also provided translations in near real time of AM VHF intercepts (likely made by a NC-1-10) from attacking Japanese aircraft, for great tactical advantage.

Tactical use of radio also initiated the peace. In mid August, 1945, MacArthur effected the Japanese surrender by radio traffic broadcast over the U.S. Army Air Corps Pacific meteorological radio network (500 khz and 15 other frequencies) which was regularly monitored by the Japanese. [69] The Army then followed up with direct contacts. A message retained by Dick Secondari regarding the dangers in implementing the cessation of hostilities appears nearby. [Fig. 75]

THE JAPANESE INTERCEPT SERVICE AND THE EXPLOITATION OF TRAFFIC ANALYSIS

The Japanese intercept service operated primarily from a site near Tokyo where it made military intelligence tactical intercepts in the Pacific and China and

Burma theaters and performed diplomatic monitoring of foreign broadcasts. The main intercept site was in the Tokyo suburb of Owada. The Owada Receiving Site was established in connection with Japan's war on China in 1937. The Japanese had other sites in Japan which were used for monitoring Russia as well as China, and for internal security. It is not known which site or sites took the shortwave coded messages from the Japanese in South America in the beginning of the war. [89]. A sophisticated Japanese army receiver [Fig. 83], perhaps some 60 years hidden in Southern California, has been recently found by Mike Adams, so clandestine traffic into the U.S. cannot be ruled out.

As an example of Axis cooperation, the officer who was later to become the Pearl Harbor Japanese spy of December, 1941, Takeo Yoshikawa, worked in Naval Intelligence in Tokyo at the beginning of the war in Europe. He intercepted a plain language short wave broadcast from Australia detailing a fleet of 17 transports of Australian troops passing Freetown, South Africa on its way to England. Upon forwarding this information to the German embassy, Hitler wrote him a thank-you letter. [73] Soviet spy Richard Sorge made many radio transmissions out of Japan. He was targeted by counter-intelligence, captured in 1941 and executed by the Japanese in 1944. [73] He sent out thousands of coded messages by radio from Tokyo residences. [82] Japanese domestic interception was fairly

crude; it lacked mobile radio direction finders and could only get a fix on Sorge's Tokyo radio operations within a couple of kilometers, although it first noticed his traffic in 1937. [82]

Mamoru Fujimuro (JA1FC) is on the staff of the Museum of the Japanese Amateur Radio Relay League, a member of the Antique Wireless Association, and an historian of Japanese military communications with a book on Japanese military and naval receivers forthcoming. He has generously conveyed [36] the following information about Japanese World War Two intercept work (some other sources are cited as well).

The Imperial Japanese Navy used a very heavy and very stable receiver designed in 1932, and known as the 92 Toku (The "92" came from the year 2592 in the Japanese calendar). [Figs. 85, 86] It tuned 20 khz to 1500 khz in its long wave version. The short wave version tuned 1300 khz to 20 mhz. It put a single radio frequency amplification stage before its mixer and oscillator. Next came two intermediate frequency stages of amplification, a detector and an audio stage. In its "Improvement-Four" iteration, it employed two type 78 tubes in two RF stages, a type 6A7 as its mixer-oscillator, and two type 78 tubes as IF stages. A type 77 tube acted as the detector and the audio went to a type 38 tube. On long wave, the first IF acted as a radio frequency amplifier stage, followed by another, then the

detector and the audio stage. The top left dial on the radio on “Improvement 3" was the “regenerative adjustment capacitor” suggesting a regenerative detector, at least on long wave. These sets served on board submarines. On surface ships, at least 10 could be found in the radio room. It weighed 60 kilograms (over 130 pounds).

The Navy employed it in all types of vessels and at the main intercept station outside of Tokyo which was the Owada Receiving Site. (The Japanese Navy also sited intercept operations at Jaluit in the Marshall Islands). [32] Some Japanese references suggest that as many as 300,000 of these receivers were manufactured, but Fujimuro-san doubts this number, because the number is disproportionate to the size of the Navy itself and its war time manufacturers such as Hitachi and Oki did not keep good records, or at least such records did not survive the war. Perhaps 10,000 to 30,000 is a more accurate estimate. The Japan Radio Corporation is shown as the manufacturer on one of the surviving sets.

Despite the information about this receiver noted by the U.S. Army, [100] it is not the case that it was used by the Japanese Army. It may, however, have been captured in land bases of the Japanese Navy. A few of these receivers are in private U.S. collections [45], and one is on display in the Japanese Self Defense Forces’ Communications School’s museum at Kurihama, in Yokosuka. In Yoko-

hama, Mr. Takashi Doi is opening a museum which will display two of these receivers. This receiver was still operational in 1950 on the *SS Kouei-maru*, formerly an auxiliary cruiser in the Japanese Navy. After the war, with a beat frequency oscillator added, the Model 92 served as a police radio. Every once in a while one shows up in the United States. [45] [Fig. 85]

The Japanese Army favored foreign receivers, mostly captured in China and Manchuokuo (the Japanese state of Manchuria). These included the Hallicrafters SX-28. The Army ran intercept operations in the South Pacific as well as in China and Manchuokuo (occupied Manchuria). The Army plotted direction finding bearings, as well as intercepted traffic, from its site in Kita-tama, Tanashi-city near Tokyo. The Japanese Army in Japan used the facilities of, among others, the Nakano Communications School for its intercept and decryption activities. The Army in Japan favored imported or captured Hallicrafters SX-28s, Hammarlund Superpros and National HROs. The National NC-100A was in use in the Kyoto communications center. The Army's strategic intercept target was the Soviet Union.[32] The Japanese radio direction finding radios may well have been superior to those of the British as well as those used by the Americans. [55] A Japanese tactical RDF set up appears nearby. [Fig. 98]

In 1937, another receiver appeared. It was based on the 1932 version. It was designed especially for ships. Having been designed in 1937, its nomenclature was "Type 97" (based on the Japanese calendar year 2597). It employed ten vacuum tubes, including a rectifier in a full wave power supply circuit for standard shipboard 100 volt a.c. power. It appears to have bandswitched three sets of coils for full frequency coverage.

The Pre-war Japanese Ministry of Foreign Affairs realized the importance of radio interception and monitoring. It established its Overseas Broadcast Receiving and Recording agency. For this purpose it used the HRO-inspired (PW dial and all) Yamada Denki superheterodyne. This radio, one of which Fujimuro-san has in his personal collection [Fig. 87], employs two stages of radio frequency amplification, two stages of intermediate frequency amplification and two audio stages. Its main range was 9 to 18 mhz. Its circuit made it the peer of any of the military radios of the day. The Japanese Ministry of Foreign Affairs also employed many U.S. commercial receivers of the day for interception and recording. These included four Hammarlund Superpros. The MFA operated the Ogama receiving site which was formerly that of radio station JOAK .

The Japanese government imported as many good short wave receivers as it could, before the war. It had pending orders for both Hallicrafters and National receivers when the war broke out.

Although the Type 92 and the Type 97 were original engineering efforts, the Yamada Denki superheterodyne was a one-band copy of the National HRO. The direction finder in the Mitsubishi Zero fighter aircraft was a copy by Toshiba Corporation of an American direction finding radio. The Japanese also employed a VHF aircraft transceiver for 30 to 50 mhz AM.

The Navy supplemented the work of the Owada and Jaluit sites. Japanese Naval Intelligence worked from the Third Department of the Japanese Naval General Staff. [73] The Japanese Navy sent light cruisers on pre-war radio reconnaissance voyages to waters off Hawaii or the West Coast during U.S. Navy exercises and training missions. One such was *HIMJS Yuhara* off Hawaii in 1923. [32] The use of cruisers for radio reconnaissance before World War Two is reminiscent of the *HIMJS Asama* incident off Baja California in 1915. In 1932 the tanker *SS Erimo*, equipped with intercept gear, plied Hawaii's waters during a U.S. naval exercise. [73]. Japanese "fishing ships" carried special radio equipment and intelligence officers to the waters off the West Coast as well. [73] The Japanese had a five-man radio intercept team in Mexico in 1940 tasked to listen to the U.S.

Navy on the West Coast. [32] The Japanese found decyphering U.S. Navy coded messages a formidable task, but they had some success. According to Fujimuro-san, their Navy used hundreds of reserve officers, and employed an IBM punch card tabulating machine (as did General MacArthur in Australia).

The Third Department emphasized traffic analysis because it had so little success in code breaking. Traffic analysis permitted the Japanese to predict bombing targets with an initial 70% accuracy. [73] According to a later U.S. analysis:

> " ... the most lucrative sources of information available to the Japanese became (1) analysis of Allied Communications transmissions and (2) Allied short and medium wave radio broadcasts... [73]

According to Fujimuro-san, some 50,000 people worked on communications interception, broadcasting monitoring, and intelligence analysis of the intercepts and recordings. Different groups of people did the radio work and the analytic work. The Naval General Headquarters worked on wireless telephone interception. The paucity of English speaking Japanese personnel made this a challenge. Copying Morse code was relatively easy but dealing with spoken English was very hard. A post war Japanese analysis notes:

> "Our navy was not able to break the American military's code(s); our intelligence appreciations and strategic estimates were primarily based on call-sign identification, direction finding bearings, and the interception of plain-language transmissions [aviators']. As an example, we could estimate when a strong American force sortied from port or was operating, because their air patrols in that area became intensified and expanded and many patrol planes' messages then came up on the air; we could also ascertain the general area of the enemy's attack because of their custom of stationing submarines in that general area, in advance of the planned attack." [55]

The Japanese government restricted domestic wireless and radio from the beginning by enforcing the 1915 Law of Radio Telegraphy. Only the Army Military police were permitted to do "research" with short wave radios that could receive foreign broadcasts. It was not until after the war that Japanese could freely tune the world bands (a novel circumstance of which SONY Corporation soon took advantage). As early as 1924, a few radio enthusiasts put amateur radio stations on the air, much to the displeasure of the government. The Army Shimo-shizu Aviation School amateur station used the callsign J1SK. The Navy Yoko-suka Torpedo School's Communications Section took to the air on the ham bands

as J2BB. When the Japanese Minister of Posts and telecommunications found out from the American Radio Relay League (A.R.R.L.)'s QST magazine in August, 1926 about the new Japanese Radio Relay League, he was surprised and angered and called official hearings into the matter. Official licensing of amateur radio stations began in 1927.

Before the amateur licensing, only licensing-fees-paid receivers for the broadcast band were permitted to listen to the first station JOAK (1924) and then some others between 550 khz and 1500 khz. Use of transmitters was strictly regulated, but marine and private commercial radio telegraphy and telephony was permitted. Popular demand fueled the growth of broadcasting in the 1920s but it did not have the support of the government.

The government insisted on type-acceptance of receiving equipment after inspection and testing. One can speculate that had the Japanese government been less hostile to radio knowledge in its population, it would have had more resources available to it in time of war. The Japanese militaristic regime was, however, dedicated not to technical initiative but rather to "thought control" policed by, among others, the "Thought Section of the Criminal Affairs Bureau" in the Ministry of Justice. [73]

SHORT WAVE BROADCASTING GOES TO WAR

Short wave propaganda broadcasts first flourished in the Spanish Civil War in 1936 with the advent of the technology a few years earlier. [Figs. 91. 92] This gave rise to increasingly more organized monitoring of governmental broadcasts.

> "It was in the 1930s that shortwave was first used as a propaganda weapon. 'Since the outbreak of the Spanish rebellion,' reported the *New York Times*, 'new stations have appeared on various shortwaves, sending music and speech from both Nationalist and Rebel headquarters. Stations in the Canary Islands, Spanish Morocco, the Balearic Islands, and new stations in Spain itself may be tuned almost daily by shortwave listeners who know when and where to locate these transmitters...' [10]

The NAZIs in Germany employed the Zeesen short wave broadcasting station for propaganda from 1934 forward, having specially built it for that purpose. Its image appears on a 1930s QSL card, reproduced nearby. [Fig. 93] German stations DJA through DJE broadcast in the 49, 31 and 25 meter bands as of 1933.[78] The Fascists in Italy broadcast propaganda on short wave as well. It went out on station I2RO on 11.810 mhz in the 25 meter band at up to 10 kilowatts. [Fig. 94] In 1936, news of the Fascist colonial wars in Ethiopia and

elsewhere in North Africa provided fodder for the Italian broadcasters. Japan put its short wave facilities at Nazaki to work broadcasting the virtues of the coming "Greater East Asia Co-Prosperity Sphere." This station's equipment also appeared on a QSL card, reproduced nearby. [Fig. 95] This prolonged propaganda broadcasting of the "Co-Prosperity Sphere" began with the invasion of Manchuria in 1931, and extended through the overrunning of Nanking in 1937 and into the world wide war of 1941 - 1945. [Fig. 96]

Early on, the Russians recognized the power of short wave radio for propaganda and established Radio Moscow in October, 1929 at Moscow Centre. [79] Perhaps it commenced broadcasting for the furtherance of the communist revolution in October in order to commemorate the "October Revolution" of 1917 which had occurred only 12 years prior. A photo of Joseph Stalin making a short wave radio broadcast in the mid 1930s appears nearby. [Fig. 97, *cf.* Fig. 52] During the Spanish Civil War, Russia is reported to have targeted Spain with four 100 kilowatt shortwave transmitters employing directive antennas and "radiating communist propaganda." [40] In a decade, it broadcast for the defense of Mother Russia using its station RV49 which broadcast on 6.0 mhz at between 10 and 25 kilowatts. [78]

The English used the British Broadcasting Corporation (BBC) from Daventry, England. [Fig. 99] It transmitted on short wave extensively in the 1930s on radio stations GSA through GSH in the 49, 25, 31, 19, 13 and 16 meter bands at up to 25 kilowatts. [78] The fact that the English always told the truth on the radio made it the only trusted broadcaster on the airwaves, [35] in wartime in which "truth is the first casualty." [Fig. 102] By 1938, the impact of shortwave radio propaganda was widely recognized. [110]

The Americans created the Office of War Information and broadcast from transmitters primarily on the East Coast. Their main station, WRUL (which had its own pre-Pearl Harbor anti-NAZI programming) eventually became the Voice of America. [18] The O.W.I . broadcast operations devoted themselves to truth, on the British model, to the dismay of the Office of Strategic Services (O.S.S.), which wanted to use broadcasting as a weapon of subversion. [89] The first U.S. interval music, "Yankee Doodle Dandy" is still the Voice of America signature on the air nearly 60 years later.

During the war, short wave radio built and maintained the morale of the troops. Many civilian radios, usually with a short wave band as well as the medium wave AM band, were transformed by the manufacturers into "morale receivers." Some were specially designed as such. A 1944 Associated Press

wirephoto of a Hallicrafters S-29 hard at work presenting a baseball game to American soldiers in Panama [Fig. 100] appears nearby.[8] The German receiver WR 1 played the same role, covering 0.15 to 15.8 mhz. The Germans adapted a pre-war commercial short wave set for morale use, but warned:

> "Use of this radio for foreign station reception is a crime against the national safety. By order of Our Leader (*der fuhrer*) such use will be punished with the severest penalty. Soldiers, beware!"

This warning is noted in the U.S. Army Field Manual description of this set. [99]

MONITORING SHORT WAVE BROADCASTING FOR INTELLIGENCE IN THE EARLY YEARS OF THE SECOND WORLD WAR

In 1939, U.S. news organizations begin short wave monitoring of the war in Europe. CBS, working in the New York area, was perhaps the first to do this. [Fig. 101] In 1940, the Federal Communications Commission created the United States Foreign Broadcast Information Service to gather intelligence from foreign short wave government broadcasting. [80, 54]

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[8] The F.C.C. also used the S-29 as a close-in mobile surveillance receiver, according to George Sterling [92]; compare the disguised RDF set [Fig. 103].

Listening to Second World War short wave broadcasts can send chills up the spine, fifty years later. It was a nightmare world that the NAZIs had in mind, and before the Allies won that war, 70 million people had died in the conflagration. Intelligence as well as armaments prevailed. The intelligence operation of the Foreign Broadcast Intelligence Service (F.B.I.S.) of the Federal Communications Commission played a role. [Figs. 104, 105, 106] These short wave listeners, for example, brought Americans the first news of the surrender of France. In the darkest moments of the Pacific war in April, 1942, they monitored the first news of the success of General James Doolittle's air raids on Tokyo and other Japanese cities. They were the first to know that the strains of war had provoked the resignations of Japanese Chiefs of Staff.[9]

Short wave radio had become a major source of international information around the civilized world in the 1930s. The radio fad that flourished with the rise of broadcasting in the 1920s, revived again in the 1930s with the coming of long distance short wave broadcasting. Where it had once been a triumph to get a nearby city on the broadcast band, by 1934 distant foreign capitals were calling loud and clear. [Figs. 91, 92] Holland started in 1927 and Moscow in 1929. The

[9] The National Archives and Records Administration (NARA) in Washington, D.C., has preserved many of the recordings that were made, and cassette tape copies are available.

British Broadcasting Corporation's early experiments with short wave had grown into the Empire Service by 1935. The NAZIs took to the air from the specially built Zeesen propaganda station in 1934, and the Japanese militarists did their own propaganda broadcasting in Asia. By 1939, the airwaves were full of arguments soon to be resolved by war and bloodshed.

In 1939, the first formal American monitoring began. It was sponsored by the Columbia Broadcasting System (CBS). A photo from *Radio Craft* showing that modest station in Queens, New York, [Fig. 101] appears nearby. [34] CBS also devoted its Studio Nine to the analysis and broadcast of war news derived from short wave monitoring. CBS monitored broadcasts from as many as 24 countries and provided linguists for translations. At its 10 by 12 foot radio "shack" in Forest Hills (Queens, New York), CBS employed commercial receivers whose performance had been enhanced by CBS engineers. (It was also CBS, in San Francisco, that took the first Japanese acknowledgment of surrender in August, 1945, by shortwave monitoring of the Domei News Agency's Morse code press broadcast, which announced: "Flash – Emperor Accepts Potsdam Declaration" and then went off the air. CBS carried the story on this basis for 16 hours before an official announcement.) [20]

Although the war had started in 1939, it was at first "the phoney war," until 1940 when Europe felt the *blitzkreig* (although the Japanese had been on the march in China since 1937). All of the combatant nations intensified their short wave broadcasting and, propaganda broadcasts became a weapon of total war.

After Pearl Harbor, the Office of War Information (O.W.I.) quickly put nearly 30 short wave stations on the air in the United States. They were directed toward other nations as well as American service personnel. By 1942, the National Broadcasting Company (NBC) had established an elaborate monitoring post at Bellmore, Long Island, New York, to log the broadcasts of other nations. Several graphics of this station in operation, with obvious wartime dramatization, [Figs. 108, 109] appear nearby. These theatrical scenes come from an article about official monitoring in the Mechanics Illustrated RADIO MANUAL dating from the first year or so of the war and intended for home front morale boosting purposes. [104] NBC apparently favored Hammarlund Superpro receivers.

Overseas, the British Broadcasting Corporation also operated its own listening posts. The Political Intelligence Department of the British Foreign Office sifted through whatever emanated from Germany. A German then-refugee working for the English as a young lady, summarized it:

> "We analyzed what came out of Germany — press agency stuff and broadcasts. We all knew that Goebbels [propaganda chief] lied, but one could learn a lot about German thinking by watching the daily news releases." [41]

Princeton University in November of 1939 had set up the Princeton Listening Center in its School of Public Affairs. Lloyd Free of Princeton became the first Director of the Foreign Broadcast Monitoring Service in 1941after the Federal Communications Commission set up that official agency. Harold Graves of Princeton was its Assistant Director. The agency's second Director was President Robert D. Leigh of Bennington College. After Pearl Harbor, the F.C.C. changed the name of the agency to the Foreign Broadcast Intelligence Service. With initially four posts in Oregon, Texas, Maryland and Puerto Rico, this Service set out to record significant broadcasts and to analyze enemy broadcasting for useful intelligence. The nature of its work can be gathered from the sorts of reports that it issued:

> Underground Movements and Morale in Japan
>
> Berlin's Claims of United Nations' Shipping Losses
>
> Reactions to the First Bombing of Japan
>
> New NAZI portrait of the American Soldier

Despite the importance of its work, the F.B.I.S. earned the enmity of powerful forces in Congress. Some of them thought it to be the "Nastiest nest of Reds." The House Un-American Activities Committee went after its chief analyst, Goodwin Watson, and the assistant news editor, William E. Dodd, Jr. A rider on the war appropriations bill cut their salaries. It was all just an attack on the F.C.C.'s Chairman, Lawrence Fly. He would not knuckle under to Congressional potentates. As it happened, a new F.C.C. Commissioner, Clifford J. Durr from Alabama, was Supreme Court Justice Hugo L. Black's brother-in-law. When the attack on the F.B.I.S. personnel reached the Supreme Court, Justice Black ruled against the Congress and in favor of the F.C.C. men. He wrote a ringing opinion for the court in which he applied the Constitutional prohibition of Bills of Attaint passed by Congress against individuals. [103]

During the war, the F.B.I.S. monitored millions of words a day which were received at listening posts in the United States at San Francisco, Portland and Silver Hill, Maryland, and in London, Stockholm and Algiers. Additional stations monitored the airwaves from the island of Kauai in Hawaii, and eventually Guam and Iwo Jima. The U.S. posts took in 1.2 million words a day, and the foreign posts received another million more. The recordings were made on site, or in

Washington, D.C., from land-line audio from Silver Hill. The analysis was done in Washington. Information went out by teletype to 19 Government agencies, the O.W.I., the British Ministry of Information, and to the Army Provost Marshall with prisoner of war information. The teletype circuits handled some 150,000 words a day of analysis and information.

The recordings were mostly made on wax cylinders and retained for only 48 hours. They were then shaved and re-used. Important broadcasts, however, were recorded on plastic Presto Disks, or on paper disks, and archived. The translators worked in Washington and got their material from disks or directly from audio over telephone lines connected to the receiving stations.

The West Coast stations teletyped their Japanese code transcriptions to Washington for translation. This material included press broadcasts to Japanese stations which were monitored in Portland. These broadcasts first disclosed the resignations of the two Japanese Chiefs of Staff in the middle of the war. The news of the surrender of France was buried in speeches broadcast from France at the time. An F.B.I.S. monitor had to listen to the recordings over and over in order to tease out their meaning. The success of Doolittle's Raid was detected by note of unusual words in Japanese newscasts which provided the needed clues. During the war, one analysis declared:

> "Today almost every political, diplomatic and even military move is presaged by shifts in propaganda treatment. It is often possible for experts to predict such moves. A new course in policy can be reflected in broadcasts long before it is announced officially, or rumored in the press. The altered tone of certain foreign broadcasts, for example, gave the first indication of the German invasion of Russia, and that Japan intended to occupy Indo-China." [77]

All F.B.I.S. posts and stations employed a similar set of sequential procedures:

> First: Scheduling, Interception, Monitoring and Recording;
>
> Secondly: Translating, Editing, Teletyping;
>
> Thirdly: Reports and Analysis;
>
> Lastly, on demand: Special Services.

During the course of the war, Special Services included a live hook-up of Hitler's speech after the Italian surrender which was provided to President Roosevelt, Prime Minister Churchill, General Marshall and others. It also included expert testimony about enemy propaganda at a sedition trial. All speeches by enemy leaders were recorded on permanent disks and furnished to O.W.I. and the British

for use in broadcasting and then they were archived. Much of this detail was laid out by Oliver Read in *Radio News* towards the end of the war. [80, 16]

The Hallicrafters SX-28 was the favorite receiver of the F.C.C. [Fig. 41] It was used almost exclusively in F.C.C. Radio Intelligence Division (R.I.D.) counter-espionage work, as reported by George Sterling. A R.I.D. listening and recording post appears in a nearby illustration from Sterling's article in *Spark Gap Times* (1963). [Fig. 104] Sterling reports that a section of the Radio Intelligence Division known administratively as "NDA" did foreign broadcast interception for the F.B.I.S. [92] (This may refer to Non-Directional Activity). The SX-28 appears to have been the exclusive high frequency receiver of the F.B.I.S. as well. Engineers set them up in banks of as many as 24 with each tuned to a specific station. Rhombic antennas pointed everywhere in the world. From Silver Spring, the audio went through routing consoles and then out over land-lines which were carefully matched for impedance, to the translating and recording center in Washington. End users included the U.S. State, War and Navy Departments, the Foreign Economic Administration, The Department of Justice and the Federal Reserve Board, Allies, and the United Nations Refugee Relief Agency.

Several SX-28s were used as surveillance receivers to search for new frequencies and stations. This was a short wave listener's dream job. Many of the

F.B.I.S. monitors had been amateur radio operators before the war. The manager of the Silver Spring station was Frank X. Green who had been the former engineer of at least five pre-war broadcasting stations. He got to do the tuning around, along with his assistant, James G. Wedewer. A supervisor and assistant appear in the war time Hallicrafters advertisement from *Radio News* reproduced nearby. [Fig. 106] To their left was a full bank of SX-28s tuned to programs destined for recording. Their console is a search and surveillance set up.

The Office of Strategic Services (O.S.S.) briefly operated two listening posts, at Tarzana (Reseda), California and at Bellmore (Long Island), New York. The O.S.S. Bellmore post may well have been the NBC receiving station there at the beginning of the war. The O.S.S. also ran a 'round-the-clock monitoring operation of Japanese Broadcasts in April, 1945 in Kunming, China. [89]

After World War Two, the Cold War quickly came to occupy the attention of intelligence agencies. The F.B.I.S. had enjoyed a $1.5 million budget in the war but it was downsized, lost most of its 350 employees, and had its budget cut by nearly two thirds. The Foreign Broadcast Intelligence Service went over to the Central Intelligence Agency, where presumably its work continues to this day. Perhaps now it receives information ranging from European long wave broadcast-

ing, through medium wave AM, FM, TV such as the new Arab networks, to UHF and SHF satellite links.

WORLD WAR TWO'S HOME FRONT MONITORS:

Thousands of American short wave listeners followed every move in the Second World War. Many were "Armchair Generals" such as Norman Rockwell painted for the Saturday Evening Post, [Fig. 89] reproduced nearby. Others listened more casually. Many American short wave listeners kept a record of prisoner of war names. This monitoring was formalized by at least one nationwide club. This supplemented the F.B.I.S. information conveyed to the Army Provost Marshall who passed it on to families. The bureaucratic process of the F.C.C. and the Army often delayed notification. The cards (and sometimes telephone calls) of concerned short wave listeners [Figs. 111, 112] sometimes contained the first news to reach the families of captured soldiers, sailors and airmen informing them that their loved ones were safe, albeit prisoners of war. [10]

Moreover, as a result of variable high frequency propagation or local conditions, or priorities, it is likely that the F.B.I.S. did not catch all the names broadcast. Thus, some families may have come to know the fate of a son or brother only from the good work of a patient and dedicated short wave listener.

A typical story is told by noted short wave hobby writer Hank Bennett:

> "During World War Two, one of my SWL friends, who (to the best of my knowledge) never held a ham radio license ... did a magnificent job of tuning in the foreign shortwave broadcasts from the capitals and chief cities of the Axis countries; he used several receivers so that he could tune in two or more stations at any one time. He faithfully monitored every possible transmission in an effort to learn the names of Americans who had been taken prisoner of war. Reportedly, he was often able to notify military authorities or family members of the general whereabouts of missing servicemen before the military officials themselves were even able to get the information. I often wonder what happened to this fine gentleman who so ably served his country in a nonmilitary manner. He lived in one of the southern states and certainly should have received some sort of commendation from his appreciative government." [9]

An advertisement from Midwest Radio in the February, 1944 *Radio News* tells a similar story. Mr. Alex Gordon [Fig. 111] used his 16-tube Midwest to monitor the war, and heard prisoners' names broadcast by the NAZIs. He notified the families with post cards, and organized others to do the same. Reportedly,

many such listeners spent a considerable amount on postage and related expenses during the course of the war, which they considered as personal contributions to victory. Both *Popular Communications* and *Monitoring Times* magazines have run stories on this home front effort. [12, 17] According to a later interview with the source for the *Popular Communications* story, Mr. Frank Davis, some 469 short wave listeners are now known, so many years later, to have communicated news to families of prisoners of war. In his own case, his mother heard from 38 listeners writing her to tell her that her son was safe as a prisoner. [29]

LISTENING TO THE ALLIES

As busy as the F.B.I.S. was listening to Axis broadcasts, the Axis powers were listening to American, British and Russian programing as well. Once the BBC implemented its truth-in-propaganda policy, its broadcasts to Germany were well regarded by those brave enough to listen to them. Despite the penalty of death for listening to BBC and other foreign broadcasts, many did. The NAZIs jammed what they could but could not jam all transmissions. The then-new Voice of America was hard to hear in Germany, being quite distant. Its programing was not much favored by Germans, except the programming that featured the noted writer Thomas Mann, "... inspired by a glowing hatred of National Socialism."

[35] Two Allied (British) clandestine stations were popular in Germany, the "Atlantic Sender" and the "German Freedom Station." At least one clandestine station in England, *Gustave Siegfried Eins,* used so many obscenities that it became known as the *Scheissensender.* Germans did not respect it or listen to it much. [35] It was carefully designed to create suspicion among NAZIs about each other, and to offend Germany's ally, Italy. It operated in the 31 meter band on 9482, 9548, 9625, 9635 and 9649 khz. [15] *Deutscher Kurzwellensender Atlantic* operated on 6145, 6212, 7020 and 9760 khz . [15] The British believed that their clandestine broadcasting worked well. It was done by the Political Warfare Executive and ultimately employed an American-made 600 kilowatt transmitter which stayed in service with the BBC after the war. [88]

Short wave broadcasting into Germany (and certainly that done by the Americans) did not have much effect on the outcome of the war. Similarly, NAZI propaganda had little or no effect, and perhaps only served to strengthen Allied resolve. Wilhelm Flicke, in his history of radio interception in the war, concluded:

> "The importance of the English, Russian and other broadcasts seems to me to lie in another quarter [not propaganda]; they helped the German people in its search for truth, in its efforts to learn the real relations of things, in its search for a way out of the labyrinth of

> aberrations. If, after the outward collapse of the National Socialist reign of terror — a collapse which was inevitable — the German people showed that a vast majority had long since broken with that negative system and created conditions favorable to a positive course, then a good part of this cure may be ascribed to the critical searching of the broadcast frequencies. Broadcasting showed that it can only be an effective weapon if it uses the truth."

To extract intelligence from foreign broadcasts, the NAZIs set up a central monitoring bureau. Foreign Secretary Jaochim von Ribbontrop, a polyglot former salesman of champaign, reported directly to Hitler as Chancellor. According to noted historian David Kahn in his definitive book, HITLER'S SPIES, he established a monitoring organization comparable to the F.B.I.S. A series of high NAZI officials ran it.

Inasmuch as it had a lakeside site outside of Berlin, it was known as *"See-haus"* or more formally, *Sonderdeinst Seehaus*, the Special Service Lake Facility. It was much smaller than the F.C.C.'s operation, and not as well organized. Ribbontrop used it primarily as a personal intelligence gathering asset. He had to share the take, however, with NAZI propaganda minister Joseph Goebbels. In 1933, NAZI air minister Herman Goering also set up his "Research Department,"

the *Forschungsamt,* (FA) which was dedicated in part to interception of foreign broadcasts as well as increasing internal security by telephone tapping and domestic radio interception.

The *Seehaus* went into operation in July, 1940. Before that several other organizations monitored short wave broadcasts [Fig. 113] and especially press transmissions. These included the Reich Radio Corporation in Berlin, and the DNB (roughly: German News Bureau), the official wire service. The Foreign Ministry itself monitored international broadcasts, and received the first news of the Japanese attack on Pearl Harbor [49]. By October, 1941, Ribbontrop and Goebbels had agreed to set up the German Foreign Broadcast Company Interradio Inc. It was used mostly for broadcasting abroad, but it also did monitoring, primarily at *Seehaus*. External posts were set up in Denmark, France, Hungary, Italy and Poland. During the war, *Seehaus* grew to the capability of monitoring 37 languages from more than 40 countries with its 700 and more workers. Monitors had to know foreign languages and translate for themselves.

Each monitor listened to the same program on two receivers on different frequencies. This dual diversity technique compensated for adverse propagation and atmospheric conditions. *Seehaus* employed radio frequency amplifiers and signal splitters, all from one omni-directional antenna. In any given year it picked

up thousands of broadcasts and hundreds of speeches by Allied leaders. All British broadcasts and most American broadcasts were heard. *Seehaus* recorded the important ones. The reports from *Seehaus* were generally fastest to reach the NAZI hierarchy (after the press summaries of the DNB) but they were not necessarily regarded as the best. [49]

German military intelligence (part of the General Staff: *OKW*) also manned at least four major listening posts using military receivers. [Figs. 114, 81] A department of its Cypher Branch (*OKW-Chi-Nachrichten* [news]) put out reports on broadcasts heard. Some 3,000 workers monitored and processed radio intelligence for *OKW-Chi*, primarily at sites near Berlin and Nuremberg. There, at Lauf, Herr Flicke, who opposed NAZI policies, supervised a six tower antenna farm and 150 monitors. [35] The two main monitoring stations backed each other up in their target areas, such as British or Russian transmissions. *OKW-Chi* devoted itself primarily to interception of point to point diplomatic and military traffic, and decryption. [49]

The German Navy and Air Force also ran monitoring and intercept posts and stations at all levels. They often served for more than just tactical purposes. The Army intercept service was run by General Erich Fellgiebel until Hitler had him executed after the failed 1944 assassination plot. Short wave broadcasting, it

was thought, could sap the morale of the enemy; hence Hitler forbade listening to any other country's broadcasts. This prohibition was clearly stated, on the label on the German army morale receiver type WR 1.

General Fellgiebel's subordinate, Herr Flicke, noted after the war that the German radio intercept service was entirely too fragmented because it consisted of almost a dozen organizations. He concluded that, except for tactical intercepts by each of the ground, air and sea forces:

> "... all other facilities for monitoring radio traffic of foreign countries should unquestionably be combined in one central organization."

This conclusion is no doubt one of the reasons the U.S. National Security Agency, in 1954, published his work since the N.S.A. is, itself, so centralized. Congress had learned hard lessons from the overall inadequacy of signals intelligence processing up and down the chain of command that resulted in the loss of so many American lives at Pearl Harbor, as well as from the German failures.

RADIO IN SHANGHAI AND CHINA BEFORE AND DURING THE WAR

Shanghai's radio station XMHA, a Blue Network (NBC) overseas affiliate, played an important role in the Asian radio wars. After 1938, its technical side was run by the late Alex Cattell, a Russian refugee and later Chief Engineer at

San Francisco's KRON-TV, according to his family in San Francisco. The *Shanghai Dollar Directory* for January, 1941 lists Alex Catell as the Chief Engineer along with the six other staff members, and notes the XMHA motto: "The Call of the Orient." It operated on 600 khz and it was one of several stations in Shanghai's International Settlement. A reproduction of its QSL card [Fig. 115] is nearby. XMHA operated on short wave at 11.860 mhz and 11.910 mhz. XMHA's programing is remembered as entertaining and dramatic in its work of raking the Axis powers over the coals three times a day. Cattell built XMHA's five kilowatt shortwave transmitter. Upon the Japanese invasion, he escaped first to the Philippines, and then to Australia, according to his family. The Chinese government took the station over in 1946.

Shanghai, China, before, during and after World War Two was the proverbial hotbed of international intrigue. [105] An important aspect of Shanghai's pathology was its radio industry which was full of propagandists for every cause and nation. A good many of them were outright traitors and spies. Before the war, the British owned XMHA and XCDN; the Japanese ran XQHA; the Russian station was XRVN, and the Italians operated XIRS. The French station had French-sounding call letters FFZ . Its engineer was Vladimir N. "Gus" Gercke, later K6BIJ in California. [46]

Inasmuch as the German radio station got the call letters XGRS, one wonders if the call signs were abbreviations, e.g., "Italian Radio Station" and "German Radio Station." At this remove, there is no way to know who assigned call signs or how. Perhaps, station operators simply chose their own. In any event, there were fully 40 Shanghai radio stations broadcasting often at high power and in many languages. [105] After 1941, the British financed in Shanghai a Soviet radio station broadcasting propaganda inimical to the German war effort which continued even after the Japanese occupation. [105].

The German propaganda radio station, XGRS, was the most powerful in the Far East. [105]. Upon the German surrender in 1945, the Japanese took it (and a companion station with call letters XGOO) over for more propaganda broadcasting by turncoats and traitors [105]. The Japanese Navy took over XMHA during the war. [105]

The British, Japanese and Chinese all listened to each other's wireless traffic. [105] The American Navy had operated one of its main listening posts in the Shanghai consulate. [61] During the war, German intercept stations operated from Shanghai copied and decrypted enormous amounts of American military traffic, sometimes as many as 2,000 messages a day. Many of these messages were sent in the clear, posing no challenge at all beyond tuning the dials. [105]

The NAZI *Abwehr* spies were pleased with the take. The NAZIs in the Far East also intercepted the wireless traffic of their ally, Japan. [105]

At least one wireless spy, James H. Smart, worked for the British as the head of their monitoring and intercept operations in Shanghai. After the occupation, but with British connivance, he set up the same system for the conquering Japanese. [105] He then left his 17 year old Russian stepson in charge, as a British agent, and the lad later went to work for the Japanese in the Philippines. [105]

The real hero of the whole war in Shanghai was the British radio operator Petty Officer Jim Cuming, on the captured gunboat *HMS Peterel.* Cuming managed to escape capture and stay at large in occupied Shanghai. He then, on his own initiative, set up a secret communications spy and sabotage network in occupied China for the duration of the war. [105] By 1943 the British had at least one other clandestine radio network of some 20 stations operating in the service of espionage and sabotage. [105]. American Marines manned an intercept station in Outer Mongolia. The Sino-American Cooperative Organization put togther an intercept station near Chunking which controlled the Mongolia operation. It used National Company NC-100s and Hallicrafters SX-28s. [86]

Any self-respecting spy in Shanghai had to be up before dawn to listen to his short wave set for news from Moscow, Honolulu, San Francisco and London,

before heading off for the usual day of conspiracy, betrayal and often murder. [105] The ether rang with the sounds of war in Shanghai from the Japanese invasions of Manchuria in 1931, to the destruction of nearby Nanking in 1937, to the end of the Chinese Revolution in 1949. The communists cleaned out the old Shanghai following the success of the People's Revolution. Oddly enough, Shanghai is once again becoming a cosmopolitan center in China, 50 years later.

THE O.S.S. IN BURMA: JURY-RIGGED SHORT WAVE RADIO AT WAR

General William "Wild Bill" Donovan, a Wall Street lawyer by trade, ran the Office of Strategic Services (predecessor to the Central Intelligence Agency) at President Roosevelt's behest in World War Two. The O.S.S. worked wonders (when other Generals let it) in China and Burma, in North Africa and in Europe. Standard O.S.S. spy radios had nomenclature such as SSTR-1 and contained miniaturized versions of much larger circuits. [21]

The O.S.S. in Burma faced special problems of mountains and moisture. Late thirties radios designed for temperate climates rarely worked well. [63] Detachment 101's commander in Burma, Col. Carl Eiffler, (who died just this year) directed that his radiomen build their own radios. They did. The radios had to be receivers and transmitters powerful enough to do the job but small enough to

be carried, at less than forty pounds including batteries. Lt. Phillip S. "Gob" Huston ran the radio section which was tasked with the creation of these radios. Sgts. Alan Richter, Don Eng and Fima Haimson [Fig. 116] did the actual work.

> "The sets were built from scratch and hunger. The commercial sets they had brought with them didn't work. The monsoons flooded them out. Also, they operated from a.c. current, which was unavailable in the jungle.... The men scrounged around trying to find components. Nothing would work....
>
> "After three or four weeks of improving the design, they came up with a transmitter that had a single tube. It had a 'home brew' receiver that contained three tubes. They couldn't standardize on the transmitter or receiver because when they ran out of one type of tube they would have to use another.... They fabricated their own variable capacitors out of C-ration cans. The resistors proved to be a real problem. Finally, they took some flashlight cells and removed the carbon rods to make their own resistors. When the first set was completed, it was taken one hundred miles away to be tested. It worked fine. The transmitter and receiver weighed ten pounds apiece. ... one final test was made.... to lower India, a distance of

about two thousand miles. From Mysore, a regular schedule was maintained.... Eventually, there were seventy-two of these sets working all over Burma. They were crystal controlled, and the men had to find calibration crystals to get night and day operation out of them. They got them from old Signal Corps equipment. The crystal was on 3,500 kc., and daytime doubled the frequency. The antenna was a piece of insulated wire thrown over the limbs of a tree or bush. the lower the aerial, the better the distance." [63]

It is likely that the receiver had a regenerative detector isolated from the antenna by one or two stages of radio frequency amplification. Otherwise, letting the detector slip into oscillation would broadcast the location of the site to any enemy RDF operator within range.[10] [Fig. 98] So, too, would the transmitter, of course, but its operation would be disciplined with exactly that risk in mind.

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[10]Shipboard equipment including even morale receivers, was also built with low radiation in mind. Designed by Marvin Hobbs, complete copper shielding of the outer cabinet and isolation of a well-shielded local oscillator stage with one or more RF stages did the trick. There is, however, no record of a submarine actually finding a ship from receiver radiation (at least in World War Two, and only an anecdotal instance in World War One involved an oscillating regenerative circuit). "Better safe than sorry" is no doubt what E.H. Scott told the Navy when he asked for the contract for the RBO and the end-of-the-war SLR (Special Low Radiation) series. [84]

Any field transmitter should suppress harmonic and parasitic radiation, for the same reasons. The Burma designers of this equipment likely concerned themselves with these risks, inasmuch as it was they who were *at* risk. It may also be the case that the 1940 or 1941 A.R.R.L. Handbook provided the basic circuits, if only from memory, especially since the design called for operation in the 80 meter and 40 meter amateur radio bands. A photo of that sort of equipment operated in the field by Sgt. Haimson, one of its designers, [Fig. 116] appears nearby.

The O.S.S. also inserted false broadcast feeds into a Japanese puppet broadcasting system in Thailand. This plan JN-27 employed a transmitter in Chittagong, Burma. [89] Although the O.S.S. engaged in radio deceptions, its role in this theater was more combat-oriented, using Burmese troops, than directed to covert action.

RADIO FOR, AND AGAINST, SABOTAGE

Inasmuch as broadcasting covered large areas, a common method of control of spies, saboteurs and partisans was coded messages or sequences in regularly scheduled short wave broadcasts. The high power of the broadcasts, often several hundred thousand watts and as high as one half million watts or more for the

British Broadcasting Corporation, permitted reception by primitive radios with one tube circuits. Saboteurs and partisans on the ground often had little else, but they were only one ionospheric skip away. Churchill set out to use the saboteurs of the Special Operations Executive (S.O.E.) to "set Europe ablaze." These operatives were regarded by the Germans as terrorists and illegal combatants. However they may have been characterized by the genocidal oppressors of Europe, they still needed coordination and orders from England. Coded messages on the BBC and elsewhere provided this direction.

The British broadcasting Corporation (BBC), for example, recited various verses of French poetry to alert and control French resistance elements. Radio Moscow, on the other hand, played different folk tunes to control field agents. Many of the agents sent into France were women who functioned as radio operators as part of their duties. Many died at the hands of their captors, executing them as terrorists and spies. Leo Marks, who died on January 15, 2001, wrote much of the poetry for the agents to use after it was determined that known poems posed a risk. [58] He knew personally many of the women agents to whom he taught his poems before sending them to France and all too often, to their deaths. [88] The technique of the BBC using simple pre-arranged phrases in the clear to instruct agents originated with an agent in France in 1941. It minimized his own need to

transmit to the S.O.E. to be able to hear his instructions. [88] The coded messages, managed by spy-master Vera Atkins, came at the end of the BBC news broadcasts. [4] Coded broadcast messages simply obviated the effectiveness of the German intercept services, at least for one half of the operational circuit.

Very simple receivers like one tube triode circuits sufficed to listen in to these very powerful short wave broadcasting stations. Regeneration, although it increased sensitivity markedly, was, however, to be carefully avoided. The re-radiation of a regenerative circuit could mark a path for the *Gestapo* directly to the radio operator's door. The same was true for any shortwave listener with a regenerative set.[Fig. 102] Many of the clandestine miniature radios have survived. [62] The British designed a particularly elegant little receiver [Fig. 117], the Miniature Communication Receiver MCR-I for its S.O.E. agents. [43] On the receiving end of the circuit, the British wireless station at Sevenoaks handled the incoming traffic from S.O.E. agents, and other receiving sites came into play. [81]

The Special Operations Executive, the O.S.S. European operations, and the like, conflicted with intelligence gathering in the theater. The last thing a spy needs are saboteurs, however well intentioned, blowing up nearby bridges or otherwise antagonizing security forces. Spies like things quiet and unremarkable.

If sabotage is even a possibility, defensive forces are likely to intensify monitoring, and spies prefer to avoid such risks that can lead to mission failure, capture, torture and execution. Sabotage operations can diminish the amount of intelligence transmitted by spies in the field. The weighing of objectives between intelligence and sabotage is, no doubt, a policy matter, but the British MI-6 (Secret Intelligence Service) did not approve of the price paid in lost intelligence for showy sabotage. The balance likely shifted near D-Day, as sabotage created important and direct military advantages. Cutting telephone and telegraph wires forced the Germans to use radio, often interceptable and decipherable. Well over a million pounds of explosives went into France with the S.O.E. [81], along with many thousands of operational messages.

In August, 1944, the S.O.E. traffic into France peaked at 360,000 code groups a week. [57] The sheer volume of pre-D-Day radio traffic in and out of France overwhelmed the German intercept services. The NAZIs had state of the art intercept equipment, including mobile direction finding vans [Fig. 118], and well trained as well as experienced counter-espionage personnel. Despite this edge, intercept activities put only about 10% of the French stations out of business. [57] In the earlier years of the war, S.O.E. did fear the NAZI intercept service for its efficiency, and the especially at-risk radio operators had a field life-

expectancy of three months before capture and worse. [91] According to the German head of the counter-intelligence service for western Europe, Hubertus Freyer, his agents and operatives had to disguise themselves to hone in on the S.O.E. radio operations. [Fig. 119] Their vans, disguised as bakery trucks, could only get so close. Then agents dressed as French civilians did the final direction finding with disguised devices [*cf.* Fig. 103] in their clothes. [91]

HOW THE SECOND WORLD WAR WAS WON; ETHERIC INTELLIGENCE AT WORK

The British interception and cryptanalysis won the war in the European Theater, according to Winston Churchill. RADAR may have saved England in 1940-'41, and the radio proximity fuse made a difference, but radio intelligence provided the edge for a victory as early as 1945. NAZI arrogance believed its codes could not be decrypted, hence they relied on radio rather than silencing their radios. As a result of the work of the intercept operators and with the crypta-nalysis that permitted the reading of much Enigma traffic, the Allies knew many of the Germans' intentions. Technical means were devoted to cryptanalysis, and successfully, but it was German operator error and sloppy operating procedures, all duly copied by intercept operators, that provided the "cribs" that permitted the

British to decrypt even the complex Enigma traffic (with help from spies and a few Enigma machines). The same factor had been true in the First World War; the Admiralty's Room 40 succeeded because of poor radio operating procedures and discipline by the enemy, all duly copied by the intercept operators.

The Japanese believed that their own codes were good enough especially given the difficulty of the Japanese language, and attributed losses to conventional spies. This complacency cost them dearly. In the Pacific, the U.S. Navy had the benefit of many of the Japanese codes from the earliest days of the war. That was a theater of intelligence, especially signals intelligence, at work eliminating so much of the "fog of war." [75]

As historian David Kahn has pointed out, the NAZIs lost their initial military advantage in the Second World War precisely because they were unable to coordinate their military intelligence, especially signals intelligence. Wilhelm Flicke anticipated this conclusion, from a German perspective. Failures in signals intelligence and security played a similar role in the early stalemate of the Germans in the First World War as well.

In the end, the causes of the Allied victory in the Second World War are multiple, including abundant industrial war materials. Taking better advantage of emerging technologies such as radio interception, *especially in their coordina-*

tion, the Allies were able to fight smarter and harder. To be sure, it was Russia committing herself, at the cost of 20 million lives, to defeat the fascist invaders, that turned the tide in the East. The Western Allies did, however, supply the Russians with enormous amounts of war materials including critical intercept receivers, and managed the flexibility to work with Stalin toward bringing an end to the war.

Fighting smarter in the ether was *first and foremost* a matter of intercept operators taking the traffic, then the discovery that enemy operator error could become the key to successful cryptanalysis. Defensively, American and British forces were thus able to make and maintain for themselves largely secure encrypted communications that mostly prevented strategic blunders and tactical surprises, despite constant enemy interception. The Russians on the Eastern Front also maintained very strict operator discipline, frustrating German efforts to read much of their traffic. The Allies took advantage of the arrogance and errors of the Axis powers, by coordinating the intelligence derived from first taking so much of their traffic as intercepts, and then by decrypting it so successfully. The rest, as they say, is History.

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This is necessarily a meta-history, often selecting technical aspects of much more general publications, to bring them together in one place. It has, however, been a pleasure to make some original contributions in telling these stories. With respect to the illustrations, it is hoped that the wide range of sources makes the reproduction of the images an effort of scholarship.

Many people, knowing of my quest, would simply mail me wonderful things, in hope they might be useful. They all have been, and I am grateful for the assistance of so many enthusiasts. We share a deep community of history,

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– – 73 de Bart Lee, KV6LEE, San Francisco.

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