

BLETCHLEY PARK AND THE RAF Y SERVICE

SOME RECOLLECTIONS

Bletchley Park is widely known as the place where the Enigma was broken and became the most important source of intelligence in World War II. It is not always recognised that there were gaps in the wide coverage of this source. For instance, it did not meet the need of the Air Commands for a constant supply of current information about the enemy's operations and tactics. I have two purposes: first to give a broad account of the collaboration between the RAF Y Service and the German Air Section of the Government Code and Cypher School (GC&CS) that served this need in the European theatre; second to show that the Air Ministry's adherence to a particular notion about the division of functions between the producers and recipients of intelligence led it to obstruct the production of some of this intelligence for nearly half the war. My account relies on such memories as I have of working at BP, refreshed by access to some of the GC&CS archives now at Kew.

Both sides in the war equipped their air forces with radio communications enabling real time control of operations. Both were unable to provide more than short-term security for these communications and both suffered from the indiscipline of pilots using radiotelephony (RT). In previous wars interception of enemy RT had been rudimentary, but now a skilled linguist could sit at a desk and write down the words spoken by pilots and their controllers, expletives undeleted. The Air Ministry planned successfully for current exploitation of these communications, but failed to realise that after-the-event exploitation could also produce useful intelligence. GC&CS also failed at first but later engaged in it successfully.

There had been pre-war arguments in Whitehall about the role of GC&CS, but it was eventually agreed that it should be limited to cryptography and translation. The Air Ministry got off to a good start in their war preparations. Their small station at Waddington began to hear bomber aircraft on training exercises before the Germans admitted that they were ignoring their obligation under the Versailles Treaty not to create an air force. These training communications were en clair and were designed to resemble those of civil aircraft. Counting the number of callsigns used in this traffic produced information about the number of aircraft involved in training exercises and was presumably included in the information that was leaked to Churchill before the war. By the time the Germans were using aircraft codes, a major RAF station at Cheadle in Staffordshire was successfully intercepting the wireless telegraphy (WT) communications of German long-range aircraft.

The communications of fighter aircraft were not then within interception range, but the Air Ministry rightly assumed that RT would be used. Small coastal stations, called Home Defence Units (HDUs), were set up jointly with the Admiralty as an anti-invasion measure, control being exercised by the HDU at Kingsdown in Kent. As the RT material was expected to be virtually en clair, the Air Ministry had not planned that the Air Section should have anything to do with it. Recruiting competent linguist operators for the HDUs proved to be difficult. When the supply of suitable linguists of British origin had been exhausted, the Air Ministry had the courage to recruit German speaking foreigners and eventually German refugees. They proved to be very good at the work and loyal, though Kingsdown's access to information with special security classifications had to be limited due to their presence.

German plans for their wartime use of radio were orderly, if insecure in practice. Long-range aircraft and their control stations transmitted their messages on changing high frequencies in a series of changing three-letter codes and with secret changing callsigns. These security systems were quick and easy to use and were expected by the Germans to resist enemy exploitation at least while operations were in progress. But before each operation, tuning signals were sent to ensure that the communications would work properly. Radio beacons were used for navigation, and medium frequencies and callsigns based on the aircrafts' unit markings were used for landing control. Even without any codes being broken these features could reveal the imminence of operations, where the aircraft were operating, and where they were based. The Germans must have realised that these were security weaknesses, but they never found a way of overcoming them.

For the security of their RT the German Air Force (GAF) relied primarily on code words and the radio discipline of their pilots; this was poor in the early stages of the war but improved later. It was always better than the RAF's and much better than the Americans'.

On the outbreak of war, Cheadle with its DF stations was the main component of the RAF Y Service. It reported the activities of bomber, reconnaissance, anti-shiping, mine-laying and transport units to Fighter and Coastal Commands, the Air Ministry and the Admiralty. Its reports and the raw material were also sent to the Air Section at BP, the mixed Service and civilian group under Bletchley control for methodology and local administration, but with AI4 determining its output and external contacts. Its Air Ministry name was AI4f and the primary task of its German section was to support Cheadle by breaking aircraft codes and secret callsign systems. (Such codes were known as "low grade" and when the information derived from them proved to be of value a less disparaging

name was hoped for, but in vain.) There was an underlying assumption that the subject matter of low-grade tactical traffic was only of interest on the day it happened and there was therefore no plan to study it anywhere after the event. Its secondary task was to deal with any other low and medium grade Air Force codes whose contents might be of interest to the Air Ministry or other Intelligence customers, the results to be reported in the form of translated decodes. The first major success of the Air Section was to solve the meteorological codes whose introduction had deprived the Met Office of their access to German weather information. This success continued until the end of the war and applied to all enemy countries.

The Air Section's Head was Josh Cooper, the youngest of the senior members of GC&CS. He was highly qualified in the skills expected of a professional cryptanalyst but nevertheless took a helpful interest in the rather simple problems facing his Section. He ran an informal organisation and he did not mind that the component parts of his Section were also known as sections or even as parties or rooms, but rarely as subsections. They covered German, Italian, Meteorology, Japanese and Russian. Their work benefited from his wide range of knowledge, particularly in linguistics, mathematics and radio. The German section was the largest, consisting in early 1940 of 15 people. It expanded continually, but never fast enough. Its first location at BP was in Hut 4, shared with the German Naval Section because both Sections needed ready access to the nearby teleprinter room in the Main Building. It later moved to Hut 10 and thence to Block F. One advantage of the war being regarded as a temporary situation was that there was no need for staff to be moved from job to job for career planning reasons; if they were doing well at something they could stay on it indefinitely.

Josh himself fulfilled the role of its head, his policy being that we should aim to study all GAF low and medium grade communications so as to discover their part in German operations. He also said that, in order to understand the traffic from the inside, we should work in German, only translating into English anything needed for reporting. He continued in this role until the final stages of the war when he appointed me as Section Head.

I joined it in January 1940 and like others in those early days had been recruited in a rather odd way. It so happened that the landlord of my Cambridge digs acted as a "bulla" for Martin Charlesworth, a University Proctor and a Fellow of St John's College. It was Charlesworth who, before the war, had recruited a number of Cambridge people to work at BP in the event of war. My landlord mentioned to him that "his" student, who had a 1939 degree in French, German and Russian, had recently been rejected on medical grounds for a commission in the Army and was at a bit of a loose end. Along with an

undergraduate, Harry Hinsley, I was invited to Charlesworth's rooms, where we were interviewed by two gentlemen who did not give their names. They asked if we were interested in undertaking confidential war work, describing it only as involving a lot of boredom with occasional excitements. (I found out subsequently that they were Denniston and Tiltman, Head and Chief Cryptographer of GC&CS respectively.) After some weeks delay, I got a letter asking me to catch a certain train on December 31st to Bletchley Junction where I would be met. I should tell nobody where I was going, not even my parents. My starting grade was Junior Assistant in the Air Section.

In those early days the only GAF tactical communications between ground stations that were regularly intercepted were messages reporting the landing conditions at airfields. They used an enciphered version of the German bomber map grid that was easy if laborious to break. It was the first of many so-called "Small Ciphers", a subdivision of low-grade, many of them used by the German air defences. Copying out the messages onto large sheets of paper was my first task.

AI4 was the sole Air Ministry recipient of the information produced by Cheadle, Kingsdown and the Air Section, forwarding to other Air Ministry sections and other Government departments anything of interest to them. With two exceptions AI4 did not at first allow its subordinate units to have direct contacts with other parts of Air Ministry Intelligence. One exception was ADI (Science), which was powerful enough to insist on them. The other exception was the Met Office which handled the weather information direct.

Even during the phoney war Cheadle's lack of competent German linguists limited its effectiveness. With advice from Josh Cooper, the Air Ministry therefore recruited six linguist undergraduates. They were given a short training in the Air Section before going on to Cheadle. Reinforced temporarily by one linguist, they were just in time to play a part in Cheadle's support of Fighter Command during the invasion of the Low Countries, a time when the war's highest levels of aircraft WT traffic occurred. For administrative purposes, civilians at an RAF station had to belong to an unclassified trade group. No existing name being suitable, the name "computer" was chosen. Despite their being at an RAF station, the arrangements for them were very informal and it was over a year before an officer was appointed to lead them. At the time the Navy had no equivalent experts and had to borrow computers from Cheadle, hastily commissioned in the RAF when needed on naval operations in the Mediterranean or elsewhere. The computers worked in the main set room at Cheadle, absorbing an understanding of the problems faced by the radio operators; the operators, in turn, could see use being made of the traffic they had logged.

AI4 must have been in two minds about whether young male civilians in their employ should join the RAF or not. Though they had just recruited civilians for Cheadle, they decided that I should be in uniform. Sent to Cardington, I spent a morning in the airship shed being catalogued and weighed and measured and issued with a knife, fork and spoon. Before I had finished my lunch, I was told there had been a change of policy, so I retraced the route I had followed in the morning, beginning with handing back the knife, fork and spoon, and remained a civilian for the duration.

The computers broke the air-to-ground codes faster than was possible in the Air Section, and they developed new techniques to counter the GAF use of changing codes and callsigns. This German practice was intended to prevent our establishing continuities from one day's communications to the next, necessary if we were to understand them properly. The computers discovered that the radio procedures of the various bomber groups differed very slightly from each other, because their signals officers had individual ways of applying the standard GAF instructions. This new identification process was called "footprinting" and proved to be a valuable tool for the rest of the war. The more skilled radio operators at Cheadle could already recognise some German operators by the way they tapped their morse keys, a process known as "fingerprinting". Use of these techniques, together with evidence from DF bearings, enabled Cheadle to identify bomber and reconnaissance formations and their bases. The callsign and frequency system used for the radio beacons was mastered and RAF 80 Wing was able to apply "meaconing", a radio countermeasure that prevented German aircraft distinguishing 80 Wing's imitation beacons from real German ones.

Throughout the war, regular flights by GAF long-range weather reconnaissance aircraft, called Zenit, helped to break the air-to-ground code of the day. Beginning first thing, up to 6 Zenit aircraft flew out over the Atlantic to the limit of their range, radioing encoded weather reports. Being stereotyped these messages were readily broken. Furthermore, the information in them was needed urgently by many German meteorological authorities and so they were immediately repeated on other networks in other codes, including occasionally Enigma. Zenit flights only ceased when Germany surrendered. Being predictable, they were a tempting target for Coastal Command. The Chiefs of Staff ordered that they should not be singled out for attack.

As current breaking of the three-letter aircraft codes was now done at Cheadle, the Air Section was left with the role of second-instance breaking i.e. completing the code solutions as far as possible, worth doing because the codes were likely to be re-used in the future, but it was a task that involved a lot of

drudgery. The solutions also had to be distributed currently to mobile Y units which began operating in the Mediterranean area. These units did not intercept enough traffic for them to make initial code breaks on their own so they depended on solutions made centrally to give them a way into the traffic in their area.

No one had thought to instruct personnel at the Commands in the use of Y information and some time passed before they could make use of it. Very early in the war, when GAF attacks on Britain were still uncommon, Fighter Command ignored a report by Cheadle that bombers were on a course towards the Forth Bridge and were surprised when the attack took place. Part of the trouble was that, in accordance with the reigning theory about division of functions, Cheadle had been instructed to report their information “raw,” i.e. without any explanations and interpretations which they could have provided but were not allowed to because that meant trespassing into the intelligence sphere. Common sense prevailed, the rules were altered and Cheadle’s early successes included the provision of information about anti-shipping raids and valuable support to Fighter Command and its Groups during the Battle of Britain.

Kingsdown and the other HDUs, working on RT, also came into their own in the Battle of Britain. They were able to report, in almost real time, the take-off and the course and flying height of fighter formations, thus supplementing radar which was in its infancy. Radar was also not good at distinguishing fighters from bombers, a distinction which was obvious from the RT. There was however a weakness in the set-up. Each HDU was responsible for its own solutions of code words and map grids and conflicting and faulty solutions resulted. AI4 therefore changed its policy of not involving the Air Section in the RT problem and ordered that it should become the central authority for the solution of RT security procedures. In July 1940 several sacks of old RT material hand-written on radio log-forms arrived in Hut 4, followed by daily deliveries of current traffic, and a new subsection was formed to deal with it. Some old hands at BP disapproved of working on plain text material, but it proved to have been a correct if belated decision, with unexpected consequences.

In 1941 the RAF began its offensive, and German defensive communications increased. In addition to the fighter RT, there were now three major ground-to-ground WT systems using “small ciphers.” One was a broadcast of German observer corps and radar reports. The second warned their anti-aircraft gunners of the movements of GAF fighters. The third, which became more prominent later in the war, transmitted German radio intelligence service reports about Allied air operations. A Small Cipher subsection was created, with me in

charge. At the height of the war it handled 2000 messages a day. A by-product of work on the observer corps traffic was that it indicated to Bomber Command what had happened to RAF bombers which had strayed off course.

Second-instance study of the RT material in the Air Section, though intended by AI4 only to solve code words and map grids, was found by those doing the research to lead to a better understanding of GAF operations than was achieved by the HDUs in their current reporting. Simple methods of analysis had to be devised. The first problem was the fact that RT intercepts were less reliable than the equivalent WT. To minimise this we put together a fair copy of each day's material, choosing between the several versions of the same traffic received from different stations, correcting the misheard words and including code word and map grid solutions, and we indexed all salient details. This daily product was known as the Diary and it became the raw material for our research. The next natural step was to compare the Diaries with each other, so as to extract further information. This initiative led to our producing detailed interpretations of what the GAF had done, how they had set about it and which units had been involved. We sent them to Kingsdown, along with copies of the Diary, as an aid to current reporting, but AI4 told us to stop sending them to Kingsdown because this amounted to our dealing in Intelligence matters, which was not permitted to us.

However, we continued to do interpretation which was needed for our own research purposes. We extended our analysis by doing a fusion study of the RT and the relevant low-grade code material on WT. Josh agreed that our results would probably be of interest to Fighter Command and others and sought the agreement of DDI4 that they should be circulated. This was refused and AI4 maintained their veto for upwards of a year. Josh also asked for background information that would assist our code breaking, but AI4 refused to send us anything other than captured codes and signals data, on the grounds that it would bias our solutions.

AI4 had some justification for their veto. It had been agreed inter-departmentally before the war that GC&CS should confine itself to code-breaking. It was generally accepted that training and experience were needed for the understanding of military matters. There was no reason to suppose that a few undergraduates, some of them women, nearly all of them civilians, none of them with any operational service experience, would be able to produce useful intelligence from material which was anyway regarded as of ephemeral interest. The last thing they wanted was for a unit under their command to start circulating questionable information. Whereas it was becoming generally accepted that civilians with scientific qualifications could play a useful part in military matters, these people at Bletchley were only linguists, with whom AI4,

as signallers, had little in common. On the other hand I think AI4 should have made an effort to see whether something was developing that should be encouraged rather than vetoed on principle, especially as the principle had been adopted before anything was known about the nature of air intelligence in the first war to involve large scale air operations. Part of the problem was that AI4 had no real understanding of the detailed intelligence requirements of the Commands and Groups, who were the natural users of our kind of information.

In June 1942 they appeared to have yielded to pressure, probably from the USAAF among others. They now agreed that our daily reports containing interpretations could be distributed to the RAF Home Commands and 10,11 and 12 Groups, but they still did not permit us to develop direct customer contacts, presumably because of a desire to stay in close control. As we had no guidance on what the recipients really wanted to know, our reports tended to include pretty well everything to hand, which resulted in unwieldiness of content. The reports were distributed at Secret PEARL level in the BMP series, an acronym that was adopted as the name of the RT subsection. As expected, Fighter Command expressed interest in the reports, but the Intelligence section at Bomber Command was lukewarm at first, leaving it to the Operational Research section to use the statistical element in them.

AI4 eventually agreed that we could develop direct contacts with customers and I remember Josh saying that a new occupant of the DDI4 post was proving much easier to work with. There was still some inertia in AI4 and it sometimes took more than a month for simple improvements to be permitted. On the other hand, the task more appropriate to signals officers of providing the extra communications needed for the new contacts was executed very efficiently.

At last we could design our reports properly. Sketch maps with arrows showing the deployment of GAF fighters were an important means of reporting how they had reacted, and two of our WAAFs became expert at drawing them. The sketch maps could not be transmitted by teleprinter, and despatch riders became an important element in quick reporting. The liaison prospered and we were given advance notice of impending RAF and American raids so that we could make an earlier start on our daily reports. As our knowledge and confidence grew we began to add observations about developments in the tactics employed by the enemy. This made our daily reports too long and customers suggested that we should incorporate these observations in longer-term reports on changes in GAF tactics. It took AI4 three months to agree that we should meet this customer requirement. At my working level I never knew whether these changes, which together amounted to a significant change in the role of GC&CS, were accompanied by high level discussions, nor did I know

what the attitude of the BP Directorate was to Josh in his dealings with the Air Ministry but I doubt that it was very supportive.

Late in 1940, a new sort of German RT had been heard, first of all by the BBC Monitoring Service. It consisted almost entirely of codewords. Coinciding with night raids by Bomber Command it was obviously to do with nightfighters, but it took some time to solve the codewords. The BMP subsection was now divided into two parts known as BMP/D for dayfighters and BMP/N for nightfighters. The first tentative solutions of the codewords were confirmed by an illuminating report by ADI(Science) on the nature and equipment of the new organisation. Its main feature was a north/south line of cells in which individual nightfighters were directed by GCI controls. As the RAF bombers arrived in a loose swarm they could be attacked one by one and grievous losses were suffered. Many people felt that a major change in Bomber Command tactics was required. I can remember discussing this with a member of the Bomber Command intelligence staff and getting the impression that this was sensitive subject in Bomber Command at the time.

Eventually, Bomber Command did change its tactics. Raiding aircraft now flew in concentrated groups that overwhelmed the individually controlled nightfighters. The use of countermeasures, including Windows and the jamming of control frequencies, delivered a huge blow to the German defences. Our reports showed that they were thrown into a state of confusion from which they only slowly recovered. The RT also showed that, in an effort to counter Bomber Command's new tactics, the nightfighters were now controlled at Division level and operated in Squadron formations. The RAF then brought further countermeasure into play, including the transmission of false orders via a high-power transmitter in the UK. The false orders were spoken by RAF and WAAF linguists at Kingsdown and they became known as the "Ghost Voices". To counter their effect the Germans began to use their "Friend or Foe" recognition code. RAF 100 Group asked what the chances were of a "ghost voice" giving the right response to a German challenge. Our estimate was 60% so our solutions of this code were sent to Kingsdown for them to use. I do not remember that this countermeasure had much identifiable effect, so general was the state of confusion among the nightfighters. By this stage Bomber Command had become a keen customer for our reports and arrangements were eventually made for a special early version to be sent by despatch rider in time for the C in C's early morning briefing.

The US VIII AF came to Europe with no Y support of their own and relied on the RAF Y Service and the Air Section for tactical intelligence. They were to become our best customers. Having no experience of the GAF, they assumed that formations of Flying Fortress aircraft flying on daytime raids could protect

themselves. This led to a series of disastrous losses, culminating in those suffered in a raid on Schweinfurt. This raid had been detected by the German Y Service and radar two hours before the US bombers crossed the English Coast. After this experience US operations were limited until the long-range fighter, the Mustang, became available and gave them a real advantage over the Germans for the rest of the war. At the request of the Americans, BMP/D assisted them in their planning of fighter sweeps ahead of their bomber formations. The Mustang was so successful that the Germans often moved their fighters away from the path of expected raids and landed them at away-bases, a manoeuvre to which we gave the name of fugitive sortie.

Right from the start, some Air Intelligence officers feared that we would be taken in by GAF radio deception. The main test of this possibility had come early on when the Germans moved the bulk of their bomber force to the Russian Front, attempting to conceal the move by transmitting fake communications. Some of this camouflage was very crude, such as a ground station pretending to be several aircraft in flight. But even when it was cleverer, "footprinting" identified it as false. Occasionally, when radio propagation conditions were unusually favourable, the traffic of a unit on the Russian Front was intercepted on the same day as its fake version in the West. We were more worried about the thought that the Germans would mount operations in radio silence and were glad that this was not an option normally available to them.

During 1941 a position had been reached in which we could read all regularly occurring low-grade traffic in sufficient detail to derive useful information, though there was a ragbag of systems that never produced enough material to work on. Captured codes and signals data did not reach us in time to help in current work but comparisons between them and our reconstructed versions gave us confidence that our results were reliable.

When told to be ready for the impending raid on Dieppe in 1942, we hoped that a code that only changed at regular intervals of several weeks would yield advance information about the movements of German fighter aircraft in Northern France. But it made an unscheduled change early on the day of the raid, providing some confirmation of subsequent German claims that they had known about the raid in advance. During the raid, Kingsdown provided its usual coverage of fighter activity and BMP/D's report became the basis of Fighter Command's official statement of enemy fighter activity. I was on temporary duty in the control room at 11 Group during the operation, acquiring experience that could have been useful if there had more such raids, but the grievous losses suffered made it the last of its kind.

The Germans derived their changing callsigns from a complicated system used by the whole of the GAF and the German Army. Solving it was undertaken jointly by the Air Section and the callsign research section of Hut 6, the Enigma breakers. Progress was slow but steady. By January 1942 our information enabled Cheadle to identify raiding units on the first appearance of their secret callsigns in traffic. A lucky capture in Libya of the book of 40,000 callsigns led to a complete breakthrough, and from then on it became normal to predict what callsigns would be used by any particular unit. Similar progress was also made with the system of changing frequencies and these too became predictable.

Despite the arrival of new staff, we never had enough for the ever-increasing quantity of traffic sent by the Germans. It all had to be sorted and at least roughly identified on the day we received it. In addition to the need to produce up-to-date results, working currently was vital because occasionally the Germans made major changes in their codes and callsign systems. These were usually accompanied by errors of procedure that we needed to exploit, but we could only do so if we knew early enough that something unusual was afoot. Much of our traffic consisted of short stereotyped messages and was well suited to machine processing, but the BP Hollerith Section could not at first meet all the demands on it, and priority rightly went to Enigma work. It was only late in 1943 that we could normally depend on a regular share of the Hollerith resource.

At this stage the Air Section as a whole still had no access to information from Enigma. An exception had permitted signals data, such as frequency and callsign allocations, to be passed unattributably to senior individuals in the Air Section and the stations. This was done by the SDE, a small Air Section party set up in 1940 in Hut 3, where Enigma was reported. The SDE's RAF signals personnel, some with Y experience, acted as an important link between the various bodies, including ADI(Science), involved in developing radio countermeasures. But what was needed for maximum production of intelligence was a combined and detailed study of Enigma and low-grade material. This could only be done at BP because it was only there that the raw material was available. A small party of Air Section people, called the SALU, worked in Hut 3, where Enigma was reported. They studied Air and Naval Enigma material together with low-grade traffic of the GAF bomber, reconnaissance and anti-shipping units. This work greatly improved the understanding of the operational procedures of these units, thus helping the work at Cheadle, but an arrangement of this kind could not then be made for the rest of our material because of the large numbers of staff who would have had to be "enwised" about the Enigma success. SALU had good contacts with the Naval Section, which had always

worked on Enigma material as well as low grade, thus being out of bounds for most of us.

The wide coverage established by Kingsdown, extending from Southern Norway to Spain, was eventually reduced by the long-planned introduction of VHF for GAF fighter aircraft. Fortunately, the RAF, and above all, the Americans had begun to supplement ground coverage by airborne interception. In 1943 it was noticed that the Germans were practising assembling large numbers of day fighters over specific points. Our chief BMP/D analyst, a young woman, attended a USAAF conference about it, as a result of which we were asked to design schemes for timing American fighter sweeps so as to catch the German fighters as they assembled.

As part of a German drive for improved security, the biggest change in low-grade codes occurred in February 1943. Most aircraft codes were replaced by three-figure code books reciphered by universal daily-changing 3-figure tables. This new system was probably easier for new and less well trained German radio operators and it certainly reduced the amount of code material that had to be circulated throughout the GAF. It took us some days to master it, but we benefited from the fact that the new reciphering tables were now also used on the large number of ground links that had formerly sent messages in separate three-letter codes. This enlarged the body of traffic using the reciphering tables and made them more vulnerable. Josh christened this new system the Orchestra and the fifteen code books were named after musical instruments. A month later the Germans made another change in which callsigns indicating the type of aircraft rather than its unit were used in landing traffic. This made it more difficult to deduce Order of Battle information, but it improved the amount of information on aircraft production, a subject on which we understood there was very little intelligence from any source.

It now made no sense for Cheadle to be a centre for current code breaking, because ground traffic, now the larger element, was not intercepted there. The computers were therefore moved from Cheadle to the Air Section and the opportunity was taken for a wholesale reorganisation of the German Air Section.

The computers formed the core of a new Alpha Watch that was divided into shifts of 10 to 12 people in each. Beginning each day with the Zenit messages, cipher groups were first solved as “probables” and notified as such to the whole shift, and the same procedure was used for “confirmed” solutions. As soon as a message was solved far enough for its intelligence content to be apparent, it was passed to a newly created Air Operational Watch who assessed it along with relevant Air and Naval Enigma. At 9am on the following day a new Beta Watch

took on the responsibility for completing solutions of the Orchestral traffic. Greatly assisted by Hollerith, it decoded as many as 1000 messages a day. All other code work was concentrated in the Gamma Section. This included “book building”, i.e. reconstructing, the Orchestral code books and breaking a miscellaneous range of other low-grade codes. A handful of computers had stayed on at Cheadle to report urgent messages, using Alpha Watch solutions.

The last important new target to be intercepted was the network of the V1 organisation in France. It used very low-power transmitters and could only be heard by the small station at Capel in Kent. Its elementary low-grade code and callsign system showed no sign of expert GAF influence, presumably because, being a hush-hush organisation, it had chosen to design its own. I do not think our decodes were of much value, dealing only with such items as stock levels and weather data for the setting of instruments. More use might have been made of this traffic if we had been able to establish contact with the inaccessible group in Whitehall to whom we sent our results.

With the invasion of Europe in prospect, our main attention was now on maximising efficiency, particularly speed of handling. Forwarding of the current Orchestral solutions to the various mobile Y units was undertaken by a Communications Watch. The high-power radio broadcast set up by the Air Ministry and keyed from Cheadle could be received by ground-based Y units operating in the Middle East, by naval units in the Mediterranean and the Norwegian and Barents Seas and, after Overlord, by Y units supporting Allied Air Forces in Europe. It carried information for RT as well as WT problems and included predicted callsigns and frequencies.

The BMP subsections began to contribute to immediate reporting. This was done by a Fighter Watch that joined a telephone conference circuit, known as the Kingsdown hook-up, on which the RT stations reported their results to the Commands and the Air Section and received immediate feedback from both. AI4 continued to improve the technical side of interception with faster DF arrangements and more accurate frequency measuring. It also increased the number of communications circuits so that everything could move faster.

An important improvement had been made in 1943 when the German Air Section as a whole was given access to the Enigma material. For the first time this permitted detailed work on the whole body of Sigint on the German Air Force. The expected improvements in understanding duly happened in both Hut 3 and the Air Section. The number of BMP reports at Top Secret CX/MSS level in which we combined low grade and Enigma information increased dramatically. Members of Kingsdown’s senior reporting staff paid extended

visits to the Air Section as part of the process of bringing them into the ULTRA picture.

In the weeks leading up to Overlord, top priority was given to intercepting the traffic of any GAF reconnaissance flights that might reveal information about Allied preparations. We understood that as a result all attempts at reconnaissance were detected and subsequently foiled by Fighter and Coastal Commands. Operations by mine-laying aircraft were another high priority.

During the landing and afterwards information was provided which helped the Allies maintain air superiority. A preliminary report on each day's operations was written by 5am on the following day and telephoned to AEAF. There was an increase in the amount of Enigma relevant to current fighter operations and a CX/MSS version of the BMP was produced after each major raid by US bombers. As the Allies advanced, more and more of the enemy's operational communications went beyond range of interception stations in the UK, and correspondingly an ever larger share of the work fell to the mobile Y units on the European mainland. Our knowledge of GAF aircraft movements was maintained by an increase in the amount of low grade traffic on ground networks, many of which remained within range of UK-based interception. The improved communications systems provided by the Air Ministry enabled the RAF Y Service and the Air Section to operate as one.

There are many references in the Public Records at Kew to the value of intelligence from the Y Service. The Allied Air Commands frequently gave figures for the number of enemy aircraft destroyed due to Y information. Commenting at the end of the war, Allied Air Headquarters said "Figures such as (these), whilst impressive, do not represent the full service to Allied Air Forces, the major contribution being the great economy of effort and the saving of Allied pilots' lives which resulted from constant awareness and frequent foreknowledge of the enemy's activities."

In March 1945 GAF units began to destroy their codes and to send their communications en clair. Our subsections were wound up in step with the drying up of their traffic, somebody being picked from each to write a history of its work. The German Air Section was finally disbanded in May. A few of the staff transferred to work on Japanese, but most of them were eager to get on with their ordinary lives and left Bletchley as soon as they could.

Looking back, it is evident that, as planned, Cheadle and Kingsdown, and eventually the mobile Y units, provided valuable support to the Air Commands by reporting on enemy air activities while they were actually happening, sometimes even predicting them. Also as planned, the Air Section assisted the Y

Service units to improve their performance by solving the security systems used by the Germans to protect their tactical communications.

One can also see that there was a delay in creating Sigint arrangements fully suited to the requirements of an air war in the mid-twentieth century. It had been planned that GC&CS should do decoding and translating and that interpretation should be done by recipients in the Intelligence organisations. But it had not been realised that much of the interpretation depended on knowledge of the communications details only available within the Sigint organisation. The Air Ministry also failed to realise for a long time that the Air Section, on its own initiative, had found a way to produce wanted intelligence from after-the-event study and interpretation of low grade codes and radio telephony. When it was allowed to function unhampered, not only did the Air Section's support of the Y units improve but its output became an authoritative source of intelligence about GAF operations and tactics. Its work was one of several BP activities that, together with the production of Enigma, demonstrated that the right form of Sigint organisation in the UK was a centre able to interpret as well as report its results.

It will probably never be known how much the Allied cause could have gained, or not suffered, if there had been no delay in recognising that useful intelligence could be produced from very unpromising material.

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