Signals Intelligence Support to the Cockpit

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Abstract

A continuing challenge for the operational and intelligence communities, is the quest to get relevant cryptological products to warfighters engaged in combat operations. During World War II both 8th and 9th Air Forces used specialized signals intelligence squadrons (low-grade ciphers or open transmissions) to defeat the Luftwaffe in the air and on air fields. After the surprise of the MiG-15 in Korea the USAFSS established intercept sites to monitor controller to pilot radio-links in MiG alley. Data collected was passed to radar sites that helped to place USAF F-86 in optimal intercept position. The Air Force established Teaball at NKP AB, in Thailand which incorporated EC-121 data, highly classified voice intercept data and IFF data to develop a composite air picture. The three case studies examine the balance between operational immediacy and the intelligence communities desire to protect intelligence sources and develop analysis prior to passing intelligence. Linguistic challenges and need to protect operational security are factors in the study.

Text

Intelligence and surveillance of enemy forces is critical to execution of any military operation.[1] Finding the enemy is the first act of combat. Near real-time intelligence, that is

[1] General William W. Momeyer, Airpower in Three Wars (Washington, D.C. US GPO, 1978) 202-203; 231-233. He stresses how important intelligence is in mission planning and targeting.

information delivered almost instantaneously to decision-makers, is important for two reasons, it gives indications and warning of enemy intentions, and it provides up-to-date data on enemy force dispositions. Both are essential to help planners prepare air campaigns and commanders execute air operations. Mapping enemy force dispositions and monitoring operations to draw conclusions on enemy intentions is one of the key roles signals intelligence plays. While other forms of intelligence are vital in military operations only SIGINT data can be delivered in a near real time manner, as other intelligence disciplines require some processing.[2]

Historically national intelligence efforts are directed towards strategic indicators and warning. This means there is little tactical military data gathered in peacetime. The military must rely on its own means or go without. The intelligence community as a whole is typically poorly prepared for combat operations on short notice. It requires a long lead time to acquire data, personnel, and resources to support combat operations. Both intelligence and reconnaissance were criticized by military leaders in the Korean and Vietnam conflicts for lack of support to combat commanders and even during Desert Storm it took months to build an intelligence infrastructure in Saudi Arabia to support the theater.

The significance of near real-time intelligence requires a brief overview of applicable intelligence disciplines. There are many types of intelligence that can provide effective support to air operations. Most intelligence is essential for mission planning purposes, but only certain sources of intelligence give the near real-time data needed by aircrews during a mission. Intelligence support during combat operations is crucial to overall battlefield success. Signals intelligence (SIGINT) is the primary means of collecting immediate threat warning and updates on targets. SIGINT is made up of two components, electronic intelligence (ELINT) and communications intelligence (COMINT). ELINT is information on enemy threats and capabilities of systems such as radars, surface-to-air missile systems, and non-voice data-links. It also provides accurate location information. It is however susceptible to deception and suffers from only being able to intercept signals on a line of sight. COMINT provides information on enemy intentions and assists in determining the enemy command and control structure. SIGINT operations to tactical military commanders includes a dynamic update capability during the execution phase of military operations, especially in direct support to combat aircraft. Some of the shortfalls of COMINT are the requirement for linguists, line of sight of requirement with a transmitter in the UHF/VHF frequency band.[3] The biggest drawback from an operational

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He also mentions (154-155) how intelligence was critical in directly supporting air operations over North Vietnam in 1972. Colonel John A. Warden III, The Air Campaign: Planning for Combat (Washington, D.C.: National Defense University Press, 1988), (35) Two JCS publications also discuss the importance good intelligence, JCS Pub. 3-51 Electronic Warfare in Joint Military Operations, and JCS Pub. 2-0 Doctrine for Intelligence Support to Joint Operations.

[2] The statement while taken from intelligence doctrine publications is not quite current. The U-2 Contingency Airborne Reconnaissance System (CARS) at Beale AFB processes SIGINT and imagery intelligence (IMINT) data (both electro-optical and radar in near-realtime.

[3] The interception of high frequency bands is not a problem since the signal while losing strength still can be picked up hundreds of miles from the transmitting source. The UHF/VHF bands are used primarily for air to air and air to ground transmissions, their signal strength drops with

standpoint however, is that to protect sources intelligence derived from COMINT is highly classified and thus limited in distribution. A collector of signals intelligence does want the enemy to even suspect that his communications, by whatever means he conducts them are being monitored, for fear that other frequencies, new codes or different forms of communications will be used. Thus signals intelligence remains one of the most classified and protected intelligence source. This concern, however, must be counterbalanced by military necessity, winning and achieving one's political and military goals. Dissemination of these products in historical examples shows that during military operation information must flow to decision-makers in a timely manner in order to be useful and relevant. [4]

This intelligence is vital to a number of air force personnel involved in operations and operational support. During air operations, weapons or battle controllers require timely updates from intelligence operations. Today these battle managers[5] are airborne in such platforms as E-3 AWACS, E-8 JSTARS or EC-130 ABCCC, but in pervious conflicts these officers worked in ground control intercept (GCI) sites. Personnel at these radar sites guide aircraft to their targets. While weapons controllers[6] at GCI sites position fighters to optimally engage the enemy. ABCCC controllers support attack missions with updates on mobile targets. SIGINT provides updates on locations of enemy threats, enemy intentions, and enemy movements. This support to air battle managers is critical during air campaigns.

Thus far we have described the ideal, but what does the practice look like? We do have historical examples that give us valuable information on the employment, but especially the problems with near real-time SIGINT support. These case studies hammer home a number of lessons that are relevant. While SIGINT has been used by aircrews since 1940, this study looks at American action in World War II, Korea and Vietnam.

World War II

The decryption of high grade signals intelligence data from Germany was called Ultra (Engima machine) is widely known.[7] In addition, the Allies also analyzed low grade ciphers and

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distance, thus SIGINT collects must be relatively close, no more than 400 miles of site of transmissions in order to intercept these signals.

[4] The description of each type of intelligence comes from JCS Publication 1-02, DOD Dictionary of Military and Associated Terms (Washington, D.C., Joint Chiefs of Staff, 1 August 2000)

[5] Battle managers and weapons controllers are job descriptions of officers who manage the air battle from command and control nodes and authorize weapons release.

[6] Their duty title has been changed to air battle managers.

[7] This data was deciphered at Bletchley Park and an American contingent supplied by Signals Intelligence Service operated here after 1942. This data was limited in distribution and Special Security Officers or SSOs handled the Ultra classified intelligence. Although the terms ULTRA and MAGIC are generically used to refer to allied codebreaking efforts during World War II, they actually refer to different systems. The British effort was primarily against the German coded radio traffic generated by the German Enigma machine. The decoded intelligence data was given the codeword ULTRA to assist in special handling and control of this sensitive information. The primary American effort was against Japanese coded radio traffic generated by the Purple machine. This decoded intelligence was given the codeword MAGIC, also for control

non encrypted voice and morse systems. The RAF Y-service intercepted enciphered Luftwaffe communications[8] and clear voice transmissions since 1940.[9] In 1942 the US Eighth Air Force created a similar service, the 124th Signal Radio Intelligence (SRI) company, part of Military intelligence or G-2.. As the Eighth grew in 1943 the SRI companies expanded. The RAF integrated a large number of Americans at their intercept sites, RAF Cheadle and RAF Kingsdown. Eighth Air Force radio intelligence units were not assigned to RAF Chicksands which intercepted German Engima traffic, these American units were controlled by the Signals Intelligence Service (SIS) a Signal Corps identity.[10]

Eighth Air Force used Y intelligence to plan and execute operations over Europe from 1943 to 1945. Planners of daylight bomber missions learned from Luftwaffe intercepts the location of active fighter bases, how and where fighters assembled, how fighters timed their attacks and defended against American bombers; and the endurance and range of fighters.[11] Planners studied Y intelligence as they developed a system of USAAF fighter escort relay to enable fighters to spend longer periods protecting bombers. Y-intelligence also disclosed changes and improvements in the Luftwaffe fighter command and control system. While not a direct example of near real time intelligence, other uses of Y intelligence were.

The Eighth Air Force also exploited Y intelligence near real time during bombing missions over Western Europe. Activated in 1943 the RAF Kingsdown Hook-up produced and disseminated near-real-time intelligence from voice intercepts to the pilots of Eighth Fighter Command as they flew escort missions and fighter sweeps in Northwest Europe. RAF Kingsdown gathered the data, evaluated it, and passed it directly into the fighter control room at AJAX, headquarters of the VIII Fighter Command. They in turn passed it to the fighter control centers (FCC) of three subordinated wings: the 65th, 66th, and 67th Fighter wings.[12] Specially trained intelligence and operations officers held conference calls and moved aircraft according to intercepted data engaging Luftwaffe fighters and protecting bomber formations.

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of the information. The Americans and British shared ULTRA and MAGIC information extensively and assisted each other efforts to exploit the data to the greatest extent possible.

[8] Engima encrypted communications were broken by Station X or Bletchley Park and send to RAF in manner which disguised their origin.

[9] Aileen Clayton, The Enemy is Listening (New York: Ballantine Books, 1982)

[10] F.H. Hinsley, E.E. Thomas, C.F.G. Ransom, and R.C. Knight, British Intelligence in the Second World War: Its Influence on Strategy and Operations (London: Her Majesty's Stationary Officer, 1979) 5 Volumes. George F. Howe, American Signal Intelligence in Northwest Africa and Western Europe, (Special Research History # 391) Dr Diane T. Putney, "Allied Y Intelligence and the Daylight Air War in Europe" (Washington D.C.: Society of Military Historians, 1996)

[11] Peter Gray Lucas, "Tactical Signals of the German Air Force," in F.H. Hinsley and Alan Stripp eds, Codebreakers: The Inside Story of Bletchley Park, (New York: Oxford University Press, 1993) pp. 246-249.

[12] F.H. Hinsley, British Intelligence in the Second World War , Volume 3 Part 1, pp.308-322, the Kingsdown hookup is also described in Dr Putney's "Allied Y intelligence and the Daylight Air War in Europe".

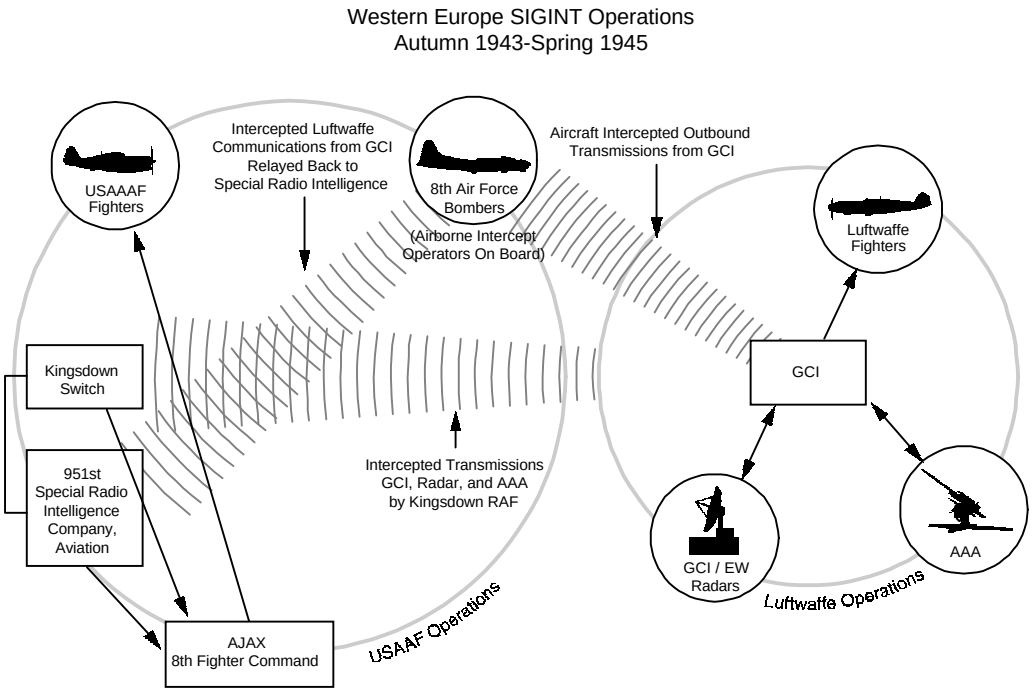

Figure 1 USAAF used a variety of units to collect signals intelligence data to protect bomber formations and to vector fighters towards the Luftwaffe.

Since Eighth Air Force bombers flew outside the range of UK based tracking radars, Y intelligence also informed US fighter controllers where the bombers were located based on intercepted Luftwaffe communications. As longer ranged fighter escorts entered the USAAF inventory, the RAF Kingsdown Hook-up increased in value as wing controllers operating exclusively on Y-intelligence vectored P-51 and P-38 to Luftwaffe fighter assembly areas to engage them far from the bombers and to disrupt the enemy's plan and sequence of attack.

By March 1944 the Luftwaffe withdrew its fighters further east to strengthen the inner defenses of the Reich. The Luftwaffe had withdrawn so far, that UK based Y intelligence collection sites could no longer hear their communications. But the Y-intelligence service did not go completely deaf, it still intercepted data from large command and control bunkers located throughout Germany, which controlled Luftwaffe movements over Germany.

As the planning for OVERLOAD, the invasion of the European continent, got underway, allied tactical air forces (2nd ATAF) wanted to ensure that they too would have the means to collect analyze and use Y intelligence. Ninth Air Force and its primary components, the IX Tactical Air Command (TAC), XIX TAC, and the IX Bomber Command all required Y intelligence. In March 1944 the Army Air Force assigned the 951st SRI Company Aviation, an Eighth Air Force unit collecting Luftwaffe communications for RAF Cheadle to Ninth Air Force and redesignated it 3rd Army Air Forces (AAF) Radio Squadron Mobile (RSM) (German [G]). This unit was self contained and mobile and equipped to "provide radio intelligence to the Air Force Commander and to the Theater Commander by means of radio intercept, radio direction

finding, traffic analysis, and the evaluation of enemy air radio traffic, telegraph and voice."[13] By July 1944 the AAF had nine RSMs to intercept German (G) or Japanese (J) traffic.[14]

Code breaking tools were frequently nothing more than paper and pencils. Intercept operations were conducted like this: six to eight radio in a detachment were used to monitor German radio frequencies, in some cases the operators just kept searching the frequency band until they found something. This work was done in a radio trailer. The intercept message would then be send to a D/F direction finding van were triangulation was used to a get a fix on the target. Then the message would come to the cryptanalysts van, were teams would break the message into plain German and then translate it into English. The message was send to interested parties such as 9th Air Force, SHAEF, the RAF Cheadle, and the Air Ministry in London. The radio, direction finding, and decrypt vans delivered the decrypted and translated Y intelligence data by telephone, motorcycle messengers and direct landlines to users. This procedure protected the source of the intelligence and denied the Germans the means to figure out that the Allies were breaking their message traffic.

The 3rd RSM (G) divided into three detachments to support Ninth Air Force units. Detachment A stayed with Ninth Air Force, Detachment B went to IX TAC and 70th Fighter Wing, and Detachment C supported XIX TAC and the 100th Fighter Wing. Detachment B landed in France on 8 June 1944 with the rest of the unit arriving shortly thereafter. In short order the detachment set up at Cricqueville next to perforated steel plate airfield of the 354th Fighter Group flying P-51s. The unit intercepted its first transmission on 9 June.[15] Detachment A produced order battle reports and situation reports and stayed in close touch with RAF Cheadle to assist in codebreaking. Detachments B and C passed all intelligence they intercepted directly to fighter control centers (FCC) of the tactical air commands that then radioed American fighters and bombers. On 6 October 1944 detachment D was setup to support XXIX TAC with Y intelligence.

Luftwaffe flak messages send by radio were a useful source of Y intelligence. If bombing strikes cut landlines then the Luftwaffe was forced to use radio links to warn flak units of friendly Luftwaffe aircraft in their vicinity. These radio communications were vital in helping Eighth Air Force to steer clear of fighter concentrations, and to intercept Luftwaffe fighters before they could mass against bomber raids. The unit also tracked other Luftwaffe movements such as supply flights to the beleagued garrisons in French ports such as Lorient and Brest, and

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14 In the Pacific the U.S. Navy employed Radio Intelligence Units (RIU) on ships especially aircraft carriers. These collected Japanese tactical aircraft communications and provided valuable information allowing carrier based naval aircraft to intercept and destroy many Japanese aircraft. "The Employment of Mobile Radio Intelligence Units by Commands Afloat During World War II", in Ronald H. Spector, Listening to the Enemy: Key Documents on the Role of Communications Intelligence in the War with Japan, (Wilmington, Delaware: Scholarly Resources, 1988), 76-79.

15 Arnold Franco, Code to Victory, (Manhattan, KS: Sunflower University Press, 1998) p.65 This is the only account written by any member of the 3rd RSM(G) and covers the unit from the UK till Arnold Franco's discharge in 1945 from the Army.

battlefield interdiction bombing sorties early in the Normandy operation. This allowed 3rd RSM(G) personnel to warn U.S. AAA of German aircraft approaching Allied frontlines.

Aircrews had to make compromises in conducting the air war over Europe. Jamming to protect the bomber formations from radar guided flak was conducted by the 36th Bomb Squadron (Heavy) with modified B-17s and then B-24s.This airborne jamming also disrupted Luftwaffe communications links, both radio and Morse operated, which degraded the ability of the Y-service to intercept valuable communications.[16] Therefore careful coordination with jammers was required to ensure that the 3rd RSM (G) could still listen to relevant links to gather Y intelligence. This jamming in 1944/45 over Germany illustrates a point that continues pits operations against intelligence to the present day: When do you jam or destroy a communications node and when is it better to leave a site operational in order to gather signals intelligence data. This issue only is resolved at the highest level of command and frequently will find a theater commander at odds with his intelligence chief.

Korea

At the end of World War II rapid demobilization of radio squadron mobile (RSM) left only minimal expertise in these units. When the Air Force became a separate service in 1947 it received three RSMs one in Europe, one in the U.S. and one in the Far East. These squadrons were formed into the United States Air Force Security Service (USAFSS). The outbreak of the Korean war found intelligence in bad shape. Intelligence information collected in Asia was still processed through agencies located in the U.S. which any precluded any timely distribution. Shortly after the Korean War broke out two highly critical reports decried U.S. intelligence support to Asia theater commanders.[17] The Joint Chiefs of Staff described COMINT in the Far East in 1950 as "far short of requirements for peacetime and incapable of handling a vastly greater load during wartime."[18] Commanders in Punson and Tokyo found themselves without timely intelligence.

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[16] Alfred Price, Instruments of Darkness: The History of Electronic Warfare, (New York: Charles Scribner's Sons, 1978); Martin Streetly, Confound and Destroy. 100 Group and the Bomber Support Campaign, (New York, Jane's Publishing, 1978); Stephen Hutton, Squadron of Deception. The 36th Bomb Squadron in World War II, (Atglen, PA: Schiffer Publishing Ltd, 1999).

[17] Major General Glenn Barcus, An Evaluation of the Effectiveness of the USAF in Korea, (Washington, D.C. Department of the Air Force, 25 June – 31 December 1950) and Robert Steams, Korean Evaluation Project. Report on Air Operations, (Washington, D.C. U.S. Government Printing Office, 16 January 1951). These documents highlight many deficiencies noted on the early conduct of USAF operations in the Korean conflict and focus heavily on lack of intelligence support. See also Complete Air Staff Comments –Stearn's Report Conclusions, (Washington, D.C., Department of the Air Force, 20 March 1951) and Robert Futrell "USAF Intelligence in the Korean War" in The Intelligence Revolution: A Historical Perspective edited by LtCol Walter Hitchcock, (Washington, D.C., Office of Air Force History, 1991) further addressing these shortcomings.

[18] Report to the Secretary of State and the Secretary of Defense, commonly referred to as the "Brownell committee Report", Special Research History 123, National Archives and Records Administration, Record Group 457, pp. 59-60.

The North Korean invasion of the South initially received little COMINT attention as the United States had larger global strategic concerns. Immediately after the first U.S soldiers were send to South Korea most of the COMINT sites in Asia were directed to monitor and ensure that Soviet ground forces were not and would not intervene in Korea. After the Inchon landing on 25 September 1950 and the advance towards the Yalu, Stalin decided to intervene in the war. It was not until late autumn 1950 that COMINT products on Korea air activity were produced. During World War II linguists had been trained on-the-job in both theaters of war. However, since no one had anticipated a conflict in Korea there were no American Korean linguists and the bulk of the work involved direction finding, the pinpointing of emitters and unique cryptological product, traffic analysis. This craft attempts to ascertain valuable intelligence data without decoding or translating a message. Valuable information can be gleaned by watching who is sending messages to whom. It can reveal the enemy's location, strength and purpose, even if the enemy's codes and encryption systems are unbroken. Silence is not an option on a modern battlefield were units move rapidly and must be supplied on the move. Air operations always have some emissions, radio, radar, transponder, or datalink that can be exploited even if encrypted.

Similar to World War II air operations were conducted to obtain greater intercept opportunities. In an attempt to force the North Koreas to stop using land lines following the successful landing at Inchon, the JCS ordered FECOM to destroy all telegraph repeater stations. On 24 September FECOM ordered FEAF to destroy eight telegraph repeater stations especially those at Pyongyang and Wonson.[19] Successful it gave U.S. SIGINT units more radio communications which helped to establish intent of enemy actions.

Following the appearance of Soviet-made MiG-15 jet fighters over the Yalu river, on 13 November 1950 the commander of Fifth Air Force, Major-General Earl Partridge, dispatched his only SIGINT unit, the small USAF OSI-Republic of Korea (ROK) unit to Sinanju airfield in North Korea to intercept the air to ground communications of the MiG-15 fighters. At about the same time in November 1950 the 1st RSM after repeated requests from Fifth Air Force finally moved a detachment in Korea. The 1st RSM part of the USAFSS did not belong to Fifth Air Force and thus had to await approval from Washington D.C. before moving. Saved by sheer luck from being captured during the first Chinese attack the 1st RSM set up operations in Seoul. The Chinese attack prompted FECOM to request Chinese linguists especially those who spoke or understood the Manchurian dialect. Until they arrived, COMINT voice interception efforts could not conducted.[20]

In late autumn 1951, COMINT analysts had noticed a shift in PLAAF radio communications frequencies from HF to VHF. The shorter range VHF radio links required COMINT sites to be located closer to the Yalu to pickup air-to-ground transmissions.[21] An additional RSM the 15th was formed to provide expanded SIGINT coverage to USAF units operating from South Korea. This site was able to provide GCI support to U.S. fighters over

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[19] Matthew Aid, "US HUMINT and COMINT in the Korean War. From Approach of War to the Chinese Intervention", in *Intelligence and National Security* (Winter 1999) 52

[20] History, Far East Air Force, July-December 1950, (Yokota AB, Japan, undated) p. 375

[21] Far East Air Force, FEAF ECM History during the Korean Conflict, K720.04C AFHRA, Maxwell AFB pp. 6-14

most of the Korean peninsula, including the Yalu river was operated by the 608th AC&W.[22] Getting SIGINT support to the GCI site took a while, proposed in August 1952 by Captain Delmar C. Lang of the 1st RSM, it took the personal intervention of Major General Earl Partridge, Commander Fifth Air Force, in December 1952 to bring about a merger of intelligence and GCI capabilities. Concerned about the lack of low altitude radar coverage over the Yalu river, General Partridge requested SIGINT, to enhance the operational air picture for controllers. In response to the request, in December 1952, USAFSS personnel already located on Cho-do island as a detachment of the 15th Radio Squadron Mobile, started to provide intelligence information to the GCI controllers of Detachment 2, 608th Aircraft Control and Warning Squadron on the island real-time allowing USAF F-86s to avoid traps or vector them to intercept targets.[23] Able to listen to Chinese and Russian MiG-15 radio links COMINT helped the GCI controllers with their air picture. The result was a dramatic increase in MiG kills. Between October 1952 and July 1953 American fighters shot down 345 MiG-15 fighters for a loss of only 18 F-86. During the months of May and June 1953 133 MiG-15 were shot down for the loss of only one F-86.[24] Unfortunately there is no statistical data to allow any conclusions to what degree SIGINT contributed to these numbers, but the fact that ratios change can only lead to the conclusion that SIGINT played in role in shooting down MiGs.

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[22] History of the 608th Aircraft Control and Warning Squadron, 1-31 May 1952 through 1-31 August 1953 (Yokota: Japan: 5AF/FEAF, undated)

[23] Delmar C. Lang papers in National Archives

[24] Futrell pp. 60-110 and 652-6 Histories of the 502nd Tactical Control group, 606th Aircraft Control and Warning Squadron, and the 608th Aircraft Control and Warning Squadron from mid 1952 to mid 1953, provided the MiG kill statistics.

Figure 2 Korean peninsula. The map shows the 1954 DMZ line, MiG alley and the location of Cho-Do island that was critical in detecting MiG operations over North Korea.

The spring of 1953 marked the beginning of airborne COMINT collection over Korea. SAC's RB-29 strategic reconnaissance aircraft flew missions around the Soviet Union and China, but due to strategic tasking rarely flew missions over Korea. In December 1952 RB-50G began to accompany SAC bomber aircraft on bombing missions over North Korea. The purpose was to direct ELINT support to the bomber formation. Electronic intelligence in this case meant protecting the bombers from radars and searchlights that tracked the bombers and guided AAA fire at the bombers. Jamming equipment carried by the B-29 could only function if the correct North Korean/Chinese/ Soviet frequencies were detected and USAF jamming equipment programmed. The RB-50s also carried a linguist to monitor radios and record any useful information for analysis on the ground, as well as warn the bomber formation of any immediate

threat such as from night fighters. Specially modified RB-50G also orbited over the Yellow Sea or flew racetrack patterns collecting COMINT on North Korean and Chinese communications.[25]

The Soviet forces in Manchuria tried to make life hard on USAF pilots in the Korea War, Colonel Walker "Bud" Mahurin recalls being scrambled by GCI and not finding any MiGs at the vectored location. Mistrusting the GCI operators he went to a GCI site and discovered that linguists were listening to Russian transmissions and that scrambles were called based on SIGINT data vice actual radar plots. For national security reasons he never revealed this fact to his pilots. A Russian interviewed in 2000 explained why the F-86s frequently did not find any MiGs in spite of the intercepted Russian voice transmissions. The Soviets listen to American radio transmissions in South Korea and if the weather was bad over Manchuria would make fake transmissions to lure aircraft into the air where they found no opponents. This type of deception is a hallmark of Russian electronic reconnaissance operations.[26]

Vietnam

After the Korean War, developing and keeping this SIGINT capability received little official attention. The operations in South Korea became fixed site operations and strategic in focus, the hard won tactical abilities left the Air Force when the focus shifted to other intelligence problems. As with the inter-war period between World War II and the Korean War (1945 to 1950), the focus of the period between the Korean war and start of the Vietnam war (1954 to 1965) was on gathering strategic intelligence about the rapidly growing military and nuclear capabilities of the Soviet Union. Thus the United States entered another war in Asia, unprepared for signals intelligence support to tactical air operations.

When U.S. support of the Vietnam War increased in August 1964, there were no intelligence assets in country. As initial operations escalated into "Rolling Thunder" air strikes over North Vietnam, Seventh Air Force required better intelligence support and tactical air control to counter the North Vietnamese air force. EC-121K with the ability to intercept North Vietnamese IFF signals were the first improvement to the theater.[27] Four years were necessary to build the network In 1966 work on an automated system of intelligence and tactical air control systems named "Combat Lighting" was started on Monkey Mountain near Da Nang, South Vietnam. By 1969 the Southeast Asian tactical systems (Combat Lighting) interface linked

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[25] Historical Report, 91st Strategic Reconnaissance Squadron, Medium, Photo, 1 April –30 April 1953 (Kadena, Japan, undated), Far East Air Force, FEAF ECM History during the Korean Conflict, K720.04C AFHRA, Maxwell AFB p. 20

The U. S. Navy had a Naval Security Group stationed in Japan and send detachments of linguists on board ships operating off the coasts of Korea. In 1951 for example the USS *New Jersey* and USS *Essex* had such detachments embarked, this practice dates back to World War II. Seventh Fleet, *Commander Seventh fleet report of Operations, March 28, 1951 – March 3, 1952*,Enclosure 1 Annex E, p. 5, Operational Archives, Naval Historical center, Washington DC

[26] Ralph Wetterhan, "The Russians of MiG Alley" in ROA Magazine (August 2000), 74

[27] IFF operates in various modes and is a system where the positions of friendly aircraft can be monitored through a transponder. A radar control facility (either airborne or on the ground) sends out an interrogation signal which is received by the IFF transponder on the aircraft. The transponder automatically responds to the query by sending a coded message that identifies the friendly aircraft.

various service (USAF, USN, USMC and USA) tactical data systems together to form a comprehensive air picture.[28] It provided a real-time exchange of tactical air operations information throughout the theater for the first time.

Following a three-year curtailment of air activity over North Vietnam from 1968 to 1971 during peace talks, President Nixon ordered renewed bombing of the north on 9 May 1972 in response to a North Vietnamese invasion of South Vietnam. During the truce the North Vietnamese air force rebuilt its force and greatly expanded the air defense network. It was considered by many air operations planners to be one of the finest air defense systems in the world. With the resumption of full scale bombing on 10 May 1972, the U.S. soon suffered shocking losses to these defenses. From 10 May to 31 July 1972, the U.S. aircraft shot down 31 MiGs while losing 21 aircraft to MiGs and a additional 27 tactical aircraft to SAMs and AAA. During June and July when the North Vietnamese air force was most effective, it shot down 13 U.S. aircraft while losing only 11 MiGs in aerial combat.[29]One factor in this unacceptable kill:loss ratio was North Vietnamese radar control and the lack of American radar warning.

General Vogt sought help from the Air Staff. General Ryan directed AF/IN and the quick reaction group in AF/XOO to take immediate action. He forcefully stated he wanted action, "not another staff study, not a briefing, not a plan."[30] An Air Staff action group was organized and consisted of LtCol William Kirk, Major Ernie Short and Mr Delmar Lang. Lang of the NSA had setup the Cho-Do operation during the Korean War as a USAF captain, and he had repeatedly offered to do the same in Vietnam but had been turned down by commanders in Southeast Asia.. In order to broadcast the intelligence information on UHF radios to pilots over North Vietnam the team developed a KC-135 radio relay aircraft callsign, "Luzon". The weapons control center site at NKP used the call sign "Teaball".[31]

On 26 July 1972 Project Teaball commenced operations.[32] Exploiting data from U-2 orbiting over Laos and the Gulf of Tonkin and RC-135 missions also flying over Laos and the Gulf of Tonkin, Teaball passed the data to U.S. aircrews in the same format used by RED CROWN and COLLEGE EYE.[33] This format made operations easier of the pilots who were used to calls being made from a "bull's eye" point in North Vietnam. Teaball daily operations functioned like this: The RC-135C/M orbited over Laos and the Gulf of Tonkin collecting both COMIN and ELINT. This data was passed via a USAFSS squadron to Teaball's operations

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[28] Southeast Asia Tactical Data Systems Interface, Project CHECO (Hickam AFB, PACAF, 1 January 1975), p. 3 This is an excellent text on how data systems developed and were used through the Vietnam War.

[29] Linebacker: Overview of the First 120 Days, Project CHECO (Hickam AFB, PACAF, 27 September 1973) pp. 44-45 and RED BARON. Vol III, Part 1, p.88

[30] Major General Doyle Larson, "Direct Intelligence Support in Vietnam. Project Teaball," in *American Intelligence Journal*, (Spring/Summer 1994) 56

[31] Major General Jack Bellamy, CORONA HARVEST, End of Tour Report, (Assistant Director Air Operations MACV/J-3 COMUSSAG/7th Air Force Deputy Chief of Staff Operations, 15 August 1974)

[32] History of Linebacker Operations 10 May 1972 – 23 October 1972, (Tan Son Nhut AB, 7th Air Force, undated), pp. 51-53

[33] Red Baron III, Vol III, Part 1, p.88

room. The U-2 flew orbits over Laos and the Gulf at a very high altitude and also passed their collected data to Teaball. In the Teaball operations room the SIGINT data was collated with radar data from the EC-121 orbiting over Laos and the Gulf as well as ground based radar data. Using a data-link the U.S. Navy's radar picket ship send its radar picture and collected U.S. Navy SIGINT data to Teaball. This allowed Teaball to have access to all data being collected real-time over North Vietnam. Once analyzed warnings and the intentions of the North Vietnamese air force were send via a radio relay KC-135 to U.S. fighters flying over North Vietnam. In addition to Teaball, Red Crown in data-link communications with Teaball would also send warning directly to U.S. aircraft. The basis of success of Teaball was the highly classified Iron Horse system a computerized system assimilating and displaying collected SIGINT data to cleared weapons controllers in the Teaball operations room. An NSA system, Iron Horse, was manned by USAFSS personnel. It improved threat advisories issued by Teaball.[34] On 28 August 1972 Teaball helped Captain Steve Richie in an F-4D score a kill on a MiG-21.[35]

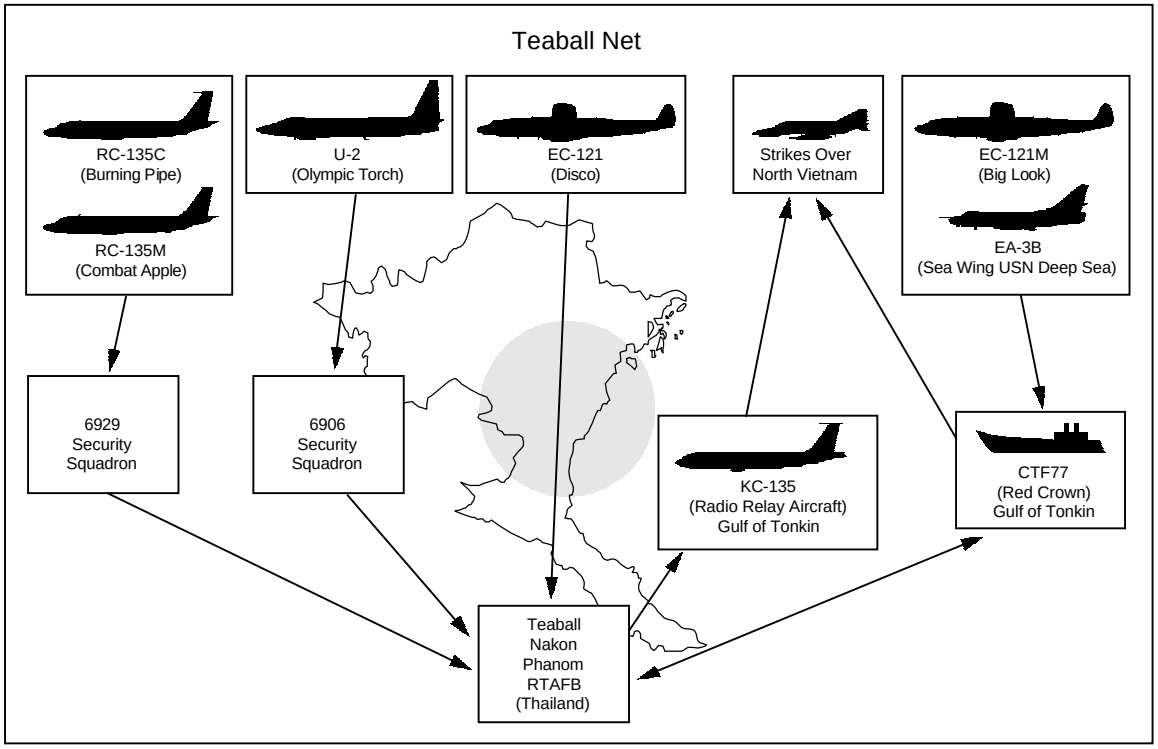

Figure 3 The numerous feeds into Teaball provided the near real time data necessary to defeat the North Vietnamese air force.

Teaball provided critical GCI assistance in 16 of the 59 air-to-air engagements during this period. From 29 July until the end of the war, U.S. aircraft shot down 30 MiGs while losing only 10 aircraft in air-to-air engagements. While other factors also contributed, General Vogt

[34] Southeast Asia Tactical Data Systems Interface, Project CHECO (Hickam AFB, PACAF, 1 January 1975), p. 7
[35] Red Baron III, Vol II, Part 2, pp. 99-102

commented that "all these improvements did not work before Teaball but they all worked after Teaball."[36]

Another feature of Teaball that assisted in planning, was the ability to replay engagements over North Vietnam. Primarily this feature in the case of downed aircrew with any visual sighing reports allowed the search and rescue coordinator to provide data to helicopters searching for downed aircrew. It also allowed commander 7th Air Force to monitor any Chinese border violations if they occurred. But most important for aircrew it allowed for post mission analysis since all radar plots and SIGINT data could be displayed allowing American planners to judge the tactics and engagement criteria of their North Vietnamese counterparts. This technical ability now incorporated in most command and control systems is vital in designing new and better air tactics against foes.

The Future

As the three historical examples show, signals intelligence plays an crucial role in air operations and technology continues to lead to further innovations in this field. Today intelligence data is passed directly to fighters via a secure data link and displayed in the cockpit on a "heads up" display. This allows the pilot to be kept apprised of his target while flying his mission. But task saturation, that is the workload in single seat aircraft and other technical and bureaucratic problems still need be solved. One solution is to let someone else on the datalink cue his weapons to the target. This, however, raises other problems such as bandwidth in current datalink technology.

One problem that continues today is the compartmentalization of much of the intelligence gathered on a daily basis to protect the sources and capabilities of collection systems. Information must be sanitized, that is stripped of information that indicates its source and origin before intelligence community will give it to the operational user. An additional problem that hurt the Air Force hardest in Korea is the fact that linguist require a long time to train and that both the Air Force (and the other armed services) and National Security Agency usually do not have trained personnel in the right language when a crisis erupts. The lead time to train a basic linguist to do basic translation is usually a year to eighteen months. To train someone to do voice intercept with a level of proficiency required for a battlefield takes longer and probably cannot be accomplished while a conflict is on-going. This requires higher headquarters planning and staffing action to determine were contingencies will arise before they occur and to build a robust signals intelligence structure. Since World War II this has been a routine problem, the duration of the Vietnam war allowed linguists to be trained. Finding linguists for modern conflicts which are short in duration is a far greater challenge if not impossible. This short synopsis actually hides a bigger problem because once the communication links are intercepted and translated specialist personnel are required to fuse the data with other intelligence sources and then present it in a format that both commanders (in the command and control loops) and the aircrew planning and flying the mission can use. These personnel also must be trained in peacetime. Some of these shortcomings were eliminated by starting a series of Green Flag exercises at

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[36] General John W. Vogt Jr., Project CHECO Interview, (conducted by Claude Morita, 12 November 1972) also History of Linebacker Operations, 10 May 1972 – 23 October 1972 (Tan Son Nhut AB, Vietnam, Headquarters 7th Air Force, undated), p.68-69.

Nellis AFB akin to Red Flags but they usually demonstrated shortcomings and were rarely used as vehicles to fix identified problems.

Precision strike and SIGINT targeting are some of the new innovations that make SIGINT a dynamic force multiplier on the battlefield. Near real time processing of signals intelligence particularly for use by weapons capable of striking beyond the range of organic sensors is a new but effectiveuse of signals intelligence. While the shooter's organic sensors may be incapable of providing sufficient targeting information the more capable intelligence sensors are often under the control of different national intelligence organizations and are not available for use by theater commanders. Targeting must be a combination of operations and intelligence assets working together. Decision cycles on the battlefield have gotten significantly smaller on the modern battlefield, with increased automation of command and control systems. SIGINT as the ears and to a degree the eyes of the commander must be responsive to these needs. Speed in gathering, decrypting, and displaying data are vital for modern command and control systems.

Signals intelligence data is increasingly vital in modern air operations. Aircrews in the future may fly several missions a day. There thus will be no time to do extensive target and threat study. The aircrew will have to rely on near real time intelligence to update situational awareness enroute to the target area. Information on mobile targets must be passed to aircraft en route to the target is and targeting data via aircraft computer must be passed to stand-off weapons.

It may seem trite but we keep relearning the same lesson. No matter how good our intelligence product is, it is worthless unless we can get it to the commander in a timely manner and in a useable form. Timeliness of near-real time intelligence data plays an even greater role on the 21st century battlefield. As the decision-loops go from being man centric to machine or automation centric, better, faster, quality data is required, to allow aircraft and new weapons to attack and successfully strike enemy targets. Commanders, command and control networks and aircrews themselves require better faster data in order to have situational awareness and to survive on the modern battlefield.