

LAST SUBJECTS

Multi-mission SIGINT aircraft and information superiority

Electromagnetic intelligence is a discipline described by the Anglo-Saxon acronym SIGINT, meaning Signal Intelligence. SIGINT comprises COMINT (Communication Intelligence), meaning radio communication intelligence and ELINT (Electronic Intelligence), which concerns radars. One can see that this scope of activity will enable SIGINT to contribute to intelligence and information superiority.

The importance of aircraft action in crisis management and the stakes involved in electromagnetic spectrum control in all military action makes SIGINT one of the master parts in the credibility of a defense system. From today's operational concepts, it is clear that these aircraft are now integrated in a defense system. Consequently, the Sigint mission is perfectly integrated in a defense system defined according to the architectural concept with force systems like the typology defined by the French Ministry of Defense: C3I (Command, Control, Coordination and Intelligence), control of land, air and sea spaces, and in-depth strikes.

SIGINT aircraft contribution to crisis management

An airborne SIGINT device comprises one or more aircraft with an onboard electronic intelligence payload, an information preparation and processing ground segment and a linking system enabling it to integrate in the overall system.

Their action is part of an operational continuum. In peacetime, such aircraft give early warning on potential crisis, which are materialized by an abrupt increase in radioactivity. Their main missions are as follows: situation and documentation intelligence, protection of forces by providing intelligence to electronic warfare and weapon system libraries, surveillance of a cease fire or even support SAR Combat operations. Their leading characteristic is a short notice projection capacity and offer a wide zone coverage no matter what the relief. Their intervention mode is extremely discreet: they use passive sensors and are inserted in civil air navigation

from the international airspace.

Their use flexibility is a major asset. A SIGINT aircraft participating in an "Observation, Orientation, Decision, Action" cycle, can switch from a strategic mission to a tactical mission. To accomplish this, they need protected communications systems enabling them to enter in contact with other elements of the forces. The technological superiority of a force is therefore measured by the performance level of its SIGINT systems.

A modernized European fleet

The European fleets, comprising practically 20 aircraft are the inheritors of the SIGINT network set up during the cold war. However, different recent crisis, especially in the Balkans have underlined their role. Great Britain and France have made considerable efforts to have at hand the most modern airborne SIGINT facilities. Great Britain has purchased three Nimrod R1. In 1995 they were the subject of a retrofit carried out by Racal (Company attached in July 2000 to Thales, ex-Thomson-CSF). In France, the eighties were dedicated to the development of the C-160 Transall Gabriel, military transport aircraft especially modified for SIGINT missions. During the nineties, the effort in France was dedicated to the Sarigue NG aircraft. This aircraft was developed by Thales based on a DC-8 fuselage and houses onboard an integrated SIGINT system capable of covering the entire spectrum of frequencies. This is the most recent SIGINT aircraft in Europe. Capitalizing on 45 years of know-how in this domain, Thales is the only European corporate able to propose turn-key Sigint aircraft.

The multi-mission SIGINT aircraft

It seems that the approach selected to meet current requirements focuses on a multi-mission SIGINT aircraft: aircraft fitted with several complementary sensors (ELINT, COMINT, optical) and communication facilities to command or operate in centers. During mission, the complementarity of sensors can be considered as follows: electromagnetic sensors intercept and locate useful signals which are then identified and precisely located by means of the onboard optical sensor. Merging of intelligence makes up the next step. During a third step, depending on the target, the aircraft may send an intervention order. Business aircraft constitute platforms

worthwhile considering due to their purchase cost. Integrated self-protection systems can also be added.



The new challenges

The place of SIGINT aircraft in a theatre system and the adaptation of their sensors to new targets are to be defined. The French Minister of Defense announced the use of Transall Gabriel and Sarigue aircraft in the "Allied Force" operation, thus underlining their considerable contribution to the success of military operations. Sigint facilities must now process digital civil telecommunications. With regard to the radar menace, the following upgrades are found: increased transmitter discretion, parameter agility, imaging mode, anti-stealth radars. Consequently, intelligence systems must provide increased sensitivity, greater range of frequencies covered with improved extraction, tracking and analysis capability.

Philippe Wodka-Gallien

Bibliography

Les enseignements du Kosovo. Collection Analyses et Références. Ministère de la Défense/Dicod. Novembre 1999.

French SIGINT revelations. Henri-Pierre Groleau Air forces montly. March 2002.

Eurorenseignement Air.

Jean-Michel Guhl. Air Zone Magazine n°29 . Mars-Avril 2000

French Air force unveils new SIGINT aircraft. Patrick Brunet. Journal of Electronic Defense. June 2001

Annuaire Jane's Aircraft upgrade. 1999-2000. 54^{ème} Escadre de Renseignement Air. Air Actualité. Octobre 2000

Espace, Communication et Renseignement. Bernard Grasset député. Rapport n°3323 Tome III. 11 octobre 2001. Avis sur le projet de loi de finance 2002. Assemblée Nationale.

Combat-Like Training at the Electronic Warfare Training Facility

The contribution of a tri-national US-European EW polygon situated on the French-German borderline to the operational superiority of allied air forces

Every pilot could tell it, the motto of the Electronic Warfare Training Facility "Train as you fight, fight as you train", once again, was verified during the "Allied Force" operation conducted during the spring of 1999. Indeed, it is a clearly recognized fact that only the quality of their training and of their electronic warfare equipment allowed the NATO pilots to escape the hundreds of air defense missiles fired at them during the "Allied Force" operation.

Radar-guided ground-to-air air defense systems have been a major threat to air forces ever since they were extensively deployed during the 1960s.

To counter this threat, air forces had to expand their initial fighting envelope, so as to achieve full control over the immaterial space of the electromagnetic spectrum.

This is the goal which drove the development of combat aircraft self-protection systems; and these systems were later on extended to other platforms: transport aircraft and helicopters. Now, an air force's electronic warfare system features are the prominent factor for the successful performance of any offensive operation.

As evidenced by the conflicts in Vietnam, the Middle East or the Balkans, controlling the radio-electric world on the theater of operations gives a decisive edge over the enemy. Superiority in this area is thus the determining criterion for the credibility of an operational setup.

This challenge was plainly understood by the French Ministry of Defense, when the decision was taken to provide the French Air Force with a Multinational Aircrew Electronic Warfare Training Facility (MAEWTF).

The vocation of the MAEWTF, which was inspired from the American ranges, such as the US Air Force's Nellis AFB or the US Navy's NAS Oceana, which sprouted throughout the United States in the wake of the Vietnam war, is precisely to train the military aircrews in facing hostile air defense systems in a realistic environment. The MAEWTF was founded by an agreement between three countries: the USA, Germany and France, and its running is also tripartite. Starting in 1979, once the decision to have a training facility had been taken, the necessary steps were made rapidly, so that this indispensable tool for the air superiority of the NATO air forces became operational shortly.

Furthermore, even though it was initially designed with a view to preparing for a confrontation with

the Warsaw Pact, the MAEWTF has proven that it could adapt itself quickly to the new threats and the new context of the multiform crises that have emerged in the Persian Gulf or in the Balkans. A three-nation agreement to serve NATO The MAEWTF spreads over 20,000 square kilometers, straddling the borderline between France and Germany, from north to south.

The MAEWTF is limited by two sites in the immediate vicinity of Ramstein AB in the north and by a site near the city of Epinal, France, in the south. In all, the MAEWTF includes seven sites. Contrary to the US training ranges, which could benefit from immense desert stretches of land in Nevada or California, the MAEWTF's sites are included in the urbanized and green landscape of eastern France and south-western Germany.

The operation of the MAEWTF is ruled by the Memorandum of Understanding (MoU) the Defense Ministers of Germany, the USA and France signed in 1979, which founded the range. Managed jointly by the three nations, the MAEWTF is a non-NATO structure which operates for the benefit of the Alliance's air forces.

This tripartite Electronic Warfare unit has a two-tiered command structure. The first level is the Steering Committee, comprised of the representatives of the air force's chief of staff from each of the signatory countries.

This committee meets twice a year, it defines the guidelines regarding the use of the MAEWTF and its technical evolutions. This Steering Committee is chaired alternately by each country for a period of two years. France was in command from 1996 to 1998, then the United States took over and Germany's turn has come in summer 2000.

The second level of command is the MAEWTF Manager. This position is held alternately by each of the three wing commanders each nation has assigned to the MAEWTF. The current Manager is a French former fighter pilot, who took over from a German officer. The role of this senior officer is to implement the directives of the Steering Committee, to handle all the financial issues and to monitor the operation of the MAEWTF.

He is the equivalent of a multinational commanding officer for the operational part.

Each of these commanders retains the prerogatives of a unit commander at the national level for all the administrative matters.

In Germany, the MAEWTF includes the sites of Bann B (Bravo) where the Polygon Coordination Center (PCC) is headquartered, and Bann A (Alpha) nearby. Both sites are located 10 km south of Ramstein AB. Farther south on German land are the sites of Oberauerbach and Pirmasens.

In France, the MAEWTF extends around the sites of Grostenquin (a former NATO Canadian base), Chenevières (a former US Air Force base), and Epinal, from where it is managed by the Electronic Warfare Squadron EGE 48.530.

From an operational standpoint, the French part of the PCC and the EGE are attached to the Combat Air Force headquarters, located in the Lorraine town of Metz. On a daily basis, American, German and French airmen work in a fully integrated way, in an atmosphere of tight friendly cooperation between the three nations.

The PCC has an operations room which allows the management of all the air activities above the MAEWTF. The requests for training slots are centralized there. The same three-nation cooperation spirit is also evident on the German MAEWTF sites where French, German and American military personnel work, as well as civilian operators, Lockheed Martin employees, who provide services to

the US Air Force. The users of the MAEWTF are obviously the air forces of the United States, Germany and France, and also other NATO forces.

For the three nations which signed the MoU, every training slot is free of charge. The same applies to the aircraft of other NATO countries, subject for them to be part of a NATO exercise, such as a Tactical Leadership Program. Also flying in the MAEWTF sky are aircraft from the Istres CEV (Flight test center), the Mont-de-Marsan CEAM (Military air experiment center), and those from industrial companies which use the slots assigned to their own country to test electronic equipment. Apart from these three countries and the above-mentioned cases, the other NATO members are charged a fee for every use of the MAEWTF resources. Electronic Warfare: an intelligence war All the conflicts which have taken place since the Vietnam war have shown that the perfect knowledge of the enemy's air defenses is a must for an air campaign to succeed.

The expansion of Electronic Warfare has come as a response to the development of radar-guided ground-to-air weapon systems. However, reliable and permanently upgraded intelligence has to be collected on the enemy's air defense setups for them to be countered efficiently. Intelligence gathering focuses on several essential aspects: knowledge of the frequencies used by the enemy's radars (both surveillance and tracking radars), knowledge of the missiles' performance data (range, flight envelope), organization of the various components of the system, missiles' operating mode (standalone, guided, semi-guided), and also the working methods of the crews who operate the systems. As a supplement to combat experience, this knowledge relies on electromagnetic intelligence, obtained by specially-designed aircraft, whose function is, while flying within the international airspace, to intercept electromagnetic transmissions (radar and telecommunications) radiating from beyond the borderline. Within the NATO forces, this work is carried out by SIGINT (SIGnal INTelligence) aircraft, such as the US Air Force's RC-135 Rivet Joint, RC-135 Combat Sent and U2, the Royal Air Force's Nimrod MR-2, the German Breguet Atlantic, the French Air Force's DC-8 Sarigue (the latest version of which, the Sarigue NG has just been commissioned), C-160G Transall Gabriel and recce combat aircraft Mirage F1CR fitted with ASTAC pods. These signals are recorded, and after analysis they enrich the threat simulators of the training ranges, including of course those of the MAEWTF, as well as the military aircraft's self-protection system libraries. It is worth noting that the performance level achieved by the military aircraft self-protection systems depends on this intelligence gathering activity. For instance, in France, the CELAR (Centre d'Electronique de l'Armement, electronics test center), a state-of-the-art high-tech laboratory belonging to the Ministry of Defense's DGA (Délégation Générale pour l'Armement, the general procurement directorate of the armed forces) plays a major part in this process, at the crossroad of intelligence and EW equipment development. Furthermore, every opportunity was taken to analyze the Eastern Block's materiel that could be recovered from various enemies during crises.

As regards France, the latest stages of the war fought against Libya in Chad, in 1986 and 1987, were of particular interest, for fully operational advanced air defense systems could be taken over, that were on duty in the Warsaw Pact's forces by that time. For the historical record, let us mention that this equipment, evacuated by a US Air Force's C-5A Galaxy from the Libyan base of Wadi-Doum, in northern Chad was then shared between France and the United States. It was later subjected to experiments both at the Mont-de-Marsan (France) test range, and in the facilities of the industrial companies entrusted with the development of equipment capable of countering them.

Some items of the recovered equipment, of which an SA-6 system, are now on display in the corral of the Nellis AFB (Nevada) Threat Training Facility. But the NATO countries, and particularly the MAEWTF, did hit the jackpot on November 9, 1989, on the day the Berlin wall fell. The National Volksarmee (NVA) was dissolved and part of its resources were integrated in the Bundeswehr as a consequence of the German reunification. Thereby, the MAEWTF's level of competence increased rapidly. In addition to fully operational and well-maintained materiel from Soviet origin, on duty with the NVA, the MAEWTF also incorporated former DRG's personnel into its staff. These crews brought in their experience, their working methods and the "soviet-like" procedures, which significantly increased the quality of the training given by the MAEWTF. Indeed, these crews have allowed (and they still do today) the NATO pilots to familiarize with the working procedures and methods they themselves have taught to the crews manning the air defense systems delivered to the former-USSR customer countries. In the uncertain world born from the ashes of the cold war, many of these countries have become the Earth's "rogue countries" (in the US nomenclature).

Belonging to this category are Libya, North Korea or Iraq, whose air defense is still mostly based on the triad comprised of SA-6, SA-8 and ZSU-23/4. Milosevic's Serbia was also one of them. Training the airmen in countering this type of threats by simulating the hostile electromagnetic conditions remains one of the hinge pins of training at the MAEWTF. Simulated electronic wave warfare between Ramstein and Epinal In creating a realistic combat electronic threat environment, the MAEWTF aims at three complementary goals: developing, testing and verifying tactics in front of actual or simulated ground-to-air weapon systems, assessing and validating airborne countermeasure equipment (on board combat aircraft, and military transport aircraft, special aircraft and helicopters), and increasing the aircrews' skills in a dense electronic warfare environment.

To achieve these goals, the MAEWTF is today equipped with a comprehensive array of simulators which have been reinforced by actual systems. And the presence of these real systems is the outstanding feature of this training range. Threats are produced by fixed T1A, T3, T13 (replica of the SA-6 Straight Flush) simulators or mobile simulators. These systems are capable of generating several dozen different signals. Lockheed Martin has developed the T1A, while the T3 and T13 are designs from Metric Systems. In addition to these systems, a mobile simulation component is provided by semi-mobile TRTGs (Tactical Radar Threat Generators) and Mini MUTES (AN/MST-T1). Mounted on a pickup type vehicle, the TRTG allows the deployment of mobile air defense systems throughout the range, or even outside it. It is capable of simulating the SA-8 threats and the Gun Dish radar of the ZSU-23/4 quadritube guns. Ambushing TRTGs creates for the aircraft an environment with a mobile and evasive threat, as was implemented by the Serbian air defenses during the Kosovo operations. Occasionally, the MAEWTF may dispatch TRTGs to other NATO countries, for reinforcing the realism of maneuvers conducted there. The Mini Mutes on duty at the MAEWTF where developed by the Harris company, from the USA. Two versions are deployed, the "Land Roll" type, which simulates the SA-8, and the Straight Flush type for simulating the SA-6. To further enhance the quality of the service it provides, the MAEWTF has enriched its resources with actual soviet-built fully operational materiel: SA-6 and SA-8 ground-to-air missiles, ZSU-23/4 quadritube guns, and SPN 30 and SPN 40 TERCOR radar jammers. A US Hawk missile battery has

been added and is manned with Luftwaffe staff. Also, to further increase the realism of training, inert soviet-built systems have been scattered on the MAEWTF's sites. For instance, ZSU-23/4 guns recovered from the East aim their four 23 mm barrels at the sky, motionless for ever, in Bann Bravo and Grostenquin. The latter site has also received an SA-13 Gopher. On the Pirmasens site, a TEL SA-6, with its disarmed missile reminds the pilots of the reality of the threat, which is generated by an operational Straight Flush system. This setup is supplemented by Smokey Sam dummy projectiles which release a tail of smoke up to an altitude of 1500 feet to simulate the departure of a missile. The MAEWTF in operation Each pilot determines the list of the threats that will be reconstituted along his flight path in the MAEWTF's airspace. Also, it is fairly frequent that pilots on their way back from a mission want to take advantage of the fuel remaining in their aircraft's tanks. Thus, in flight, they request the authorization to fly over the MAEWTF. They then have to reserve a slot and determine the involved sites, from one up to all of them. More often, training is carefully planned, which includes briefing with operators of the range's simulators and actual systems. Several levels of complexity are possible. The MAEWTF may enable one or more threats, including up to all of them. In this case, the aircraft is confronted with one system at a time (for instance, a ZSU-23/4, then an SA-8, then an SA-6), or to two systems at a time (SA-6 and SA-8), so as to train the crews in specially hard-to-manage situations. Other scenarios consider confronting aircraft with all of the MAEWTF's systems operated simultaneously. Also, the MAEWTF operates its resources for experimentation flights, a service it provides to aircraft from the three MoU signatory countries. Every day, the MAEWTF provides training for about fifty aircraft, combat aircraft of any kind, and also military transport aircraft and even helicopters. In accordance with exercise scenarios, most often inspired from the experience gained in the Balkans, training encompasses every aspect of electronic warfare: self-protection of combat aircraft, offensive missions against hostile air defense installations (SEAD) or training in SIGINT missions.



SA-13



SA-8



ZSU-23/4

The French pilots, who are designated for a Red Flag session must undergo a session at the MAEWTF before departing to Nellis AFB, so that they can become familiar with the stringent training they will be subjected to there. Above all, the MAEWTF is now an inescapable and vital stage before any deployment on a crisis theater. Actually, the French pilots who were to take part in the "Allied Force" operation in the spring of 1999, all made a stop at the MAEWTF with their combat aircraft before joining the base at Istrana, Italy. In-depth briefing sessions with the crews of the former Eastern Germany's systems, whose working methods are very similar to those of their Serbian counterparts, were extremely appreciated at that time. As regards SEAD mission training, the Luftwaffe's Tornado ECR, US Air Force's F-16 C/J fitted with the HTS (HARM Targeting System), in particular those of Spangdahlem AB, US Navy's and US Marine Corps' EA-6B Prowler are all routinely confronted with the MAEWTF's system operators. Also, special aircraft do not hesitate in joining.

US Air Force's RC-135 Rivet Joint, Italian Piaggio 808 and C-160G Gabriel, the French Air Force's SIGINT aircraft, resort to the MAEWTF's resources to refine the training of their crews in SIGINT missions. Finally, US Air Force's B-52 bombers fitted with jammers and Hercules C-130 Compass Call regularly carry out offensive jamming exercises with the MAEWTF.

For the historical record, let us indicate that on three occasions, US Army Aviation's battalions of AH-64 Apache, UH-60A and OH-58 Kiowa Warrior helicopters stationed in Germany were deployed on the Grostenquin base for training at the MAEWTF. Also, the somewhat specific role of the Bann B site should be recalled.

This site was formerly a Strategic Air Command site where B-52 bombers (and also the Mirage IV A of the French Strategic Air Force) used to train every Thursday afternoon, during equivalent missions above the German territory, on their way back from the United States. The analysis of the aircrews' decisions relies on the range's restitution resources, i.e., video and use of the EPICCCS (Enhanced Polygon Integrated Command Control and Communication System), and debriefing sessions with the MAEWTF's staff. This facet of the MAEWTF has been reinforced with the installation of the Perigord 1 and Perigord 2 restitution systems on the Grostenquin and Epinal sites.

These systems, developed by Thomson-CSF Airsys, which have been associated with the threat

simulators, record the parameters of the fictitious combat between the simulated ground-to-air threats and the real attacking aircraft. Based on the data which include the ground-to-air firing simulated by the operators and the actual aircraft countermeasures, the Perigord system software is capable of restituting the firing scores within a very short delay. The Perigord systems are also provided with a feature for visualizing the aircraft flight path and the simulated missile firings, or, in case of ZSU-23/4 training, for visualizing the dummy trajectories of the shells and their impacts, if any. The results are then sent to the pilots on their bases.

The Future of the MAEWTF

More than ever, the MAEWTF is a part in NATO's electronic warfare setup. And as years have gone by, it has reached the top rank in this setup. This very specific training center keeps on reinforcing its resources, so as to be capable of generating the most realistic ground-to-air threats that can be encountered nowadays. The MAEWTF also exemplifies the successful control of a complex electronic architecture in a multinational environment, where each of the three allies has brought in its own competence.

The result can be summarized in a few figures, and the MAEWTF was a significant contributor thereto: during the "Allied Force" operation, even though the Serbian air defense installations fired more than 800 ground-to-air missiles (of which 266 SA-6s, 174 SA-3s, 106 SA-7/14s), only two combat aircraft were lost, including an F-117, for a total of 23 584 offensive missions. This outstanding mark was achieved owing to the systematic and intensive use of the electronic warfare systems. Straddling the French-German border, the MAEWTF thus contributes, in its own way, to the implementation of the "zero casualty" and "zero loss" concept which now rules the military engagement of NATO's air forces.

Philippe Wodka-Gallien

Guerrelec Association La Fayette French Chapter of the AOC

The MAEWTF awarded by the AOC

It is worth noting that after the Gulf War in 1991, the AOC granted an Award to the MAEWTF, in recognition of the help provided to the coalition's aircraft. It happens that, a mere few months after the reunification of Germany, former Eastern Germany's systems and simulators were harnessed for more than 30 days and 30 nights for the live testing of all the electronic warfare systems, from the simplest to the most secret one, in particular, those of the US Air force, before they were deployed for the Desert Shield / Desert Storm operations.

The former soviet-designed air defense systems on duty with the MAEWTF

SA-8 SA-6 ZSU-23/4 SPN 30 and SPN 40

The establishment of the MAEWTF:

the main stages 1976: the idea emerges to create a training range in Europe based on the at Nellis AFB model. **1977:** first study for the purchase of a threat simulator. **1979:** creation of the MAEWTF and signature of the MoU by the Defense Ministers of Germany, the United States and France. **1992:** Perigord 1 is commissioned at Grostenquin (scoring of the ZSU-23/4). **1993:** Perigord 2 is commissioned at Epinal

(scoring of the SA-6).