MOS Organization And Training For Tactical SIGINT Modernization
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EXECUTIVE SUMMARY

Title: MOS Organization and Training for Tactical SIGINT Modernization
Author: Major Joseph A. Bruder, IV, United States Marine Corps
Thesis: The Marine Corps must reorganize and retrain the SIGINT/ Ground Electronic Warfare military occupational specialty or it will effectively lose its tactical SIGINT capability in the coming decade.
Background: The Fleet Marine Force, Radio Battalion plays a vital role in tactical intelligence by collecting, processing, and reporting intellignece information derived from enemy electro-magnetic emissions. Signals Intelligence information (SIGINT) is often the most timely and reliable source of information on enemy capabilites, dispositions, and intentions produced by intelligence units organic to the FMF. SIGINT operations have changed little from the Corps' early involvement with communications intercept in China during the 1920's. Target communication links that a linguist could have prosecuted with headphones and a generic receiver ten years ago are being upgraded with digital technology and may shortly require a highly technical search effort to detect and geolocate, and another highly technical analytic effort to demodulate. All of this must happen before the information can be put into a format that a linguist or analyst can exploit. The key to past Marine success has been the extraordinary efforts of a few well trained Marines who have made the best of marginal equipment. Future success against digital signals will again depend upon well trained Marines.
Recommendation: The Marine Corps must rapidly implement a tactical SIGINT modernization plan that addresses tactical unit organization, SIGINT methodology, equipment procurement, and MOS orgnization and training.

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MOS Organization and Training for Tactical SIGINT Modernization

The Marine Corps has successfully prosecuted tactical Signals Intelligence (SIGINT) targets for the better part of this century while enjoying a comfortable lead in technology. Within the next decade, however, the fielding of tactical digital communication systems wiIl make us ineffective at tactical SIGINT. We must develop a methodology to attack the digital signals environment. The reorganizing and retraining of the enlisted SIGINT/Ground Electronic Warfare Military Occupational Specialty (MOS) is the critical step in implementing a new methodology. If we fail to change, our increasingly obsolete SIGINT efforts will be relegated to targeting the insignificant emissions of a dwindling number of residual analog systems.

The methodology starts with more comprehensive search and development operations. Broadband receivers must map the electro-magnetic spectrum while, detecting, identifying, and geolocating enemy emissions. Non-communications signals must be reported in real time to automated Electronic Counter Measures (ECM) systems while automated files are created and stored for subsequent analysis. Technical signals analysis must then be conducted on communications signals of interest (SOI) to facilitate demodulation. Only then, can linguists work on the demodulated signal, be it voice, fax, or data. SIGINT analysts can correlate the results of the translation effort with their own analysis of enemy emissions to produce SIGINT products and potential ECM targets. This methodology will, however, require a new set of MOS skills.

Here is how we can shape the MOS to support these changes. Start with a new entry- level MOS and a revised occfield basic course. This would produce a 2621, Ground Electronic Warfare Operator. Candidates for the first-term and intermediate level MOS's, 2631, Signals Analyst, 2651, Special Intelligence Communicator, and 2671-75, Crypto-linguist, would be drawn from the 2621s. The 2629, SIGINT Analyst, MOS would be redesignated as an additional MOS for intermediate and career level Marines. MOS 2691 would be retained as SIGINT/EW Operations Chief, while 2692, Special Security Communications and Administration Chief, would be created to recognize the unique skills required of senior cryptologic communicators.

When matched with a comprehensive training program, this MOS structure can give us the force needed to conduct tactical SIGINT in the digital age.

The Fleet Marine Force, Radio Battalion (FMF, Radio Battalion) plays a vital role in tactical intelligence by collecting, processing, and reporting intelligence informa-tion derived from enemy electro-magnetic emissions. Signals Intelligence information, dubbed SIGINT, is often the most timely and reliable organic intelligence source concerning enemy capabilities, dispositions, and intentions. SIGINT operations have changed little from the Corps' earliest

involvement with communications intercept in China during the 1920's. (12:1) Then, a trained linguist needed only a radio receiver and a pair of headphones to produce Communications Intelligence (COMINT). Today, however, the target signals have changed. Gerard Turbe pointed out in 1989 that the days of headset signal monitoring are passed. (13:173) Marine tactical SIGINT/EW operators face a new world of challenges in the wake of the current revolution in communications electronics.

For most of this century, information (usually voice or text) was transformed by electro-mechanical devices (such as microphones and teletypes) into electrical waveforms that were analogous to the input signals. These analog signals were then placed on wire or radio carriers by using techniques such as amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM). More efficient use of individual carriers was made with the introduction of new techniques such as single side band suppressed carrier (SSBSC) AM modulation or time and frequency division multiplexing (TDM/FDM). Special modulation techniques were developed to support machine generated signals.

It was found that machine output signals could be reduced to binary codes (hence the term digital). These coded signals, when transmitted with new modulations such as Pulse Amplitude Modulation (PAM) or Pulse Position Modulation (PPM), yielded significantly reduced error rates and increased data transmission speeds. During the 1980's these relatively simple electromechanical techniques were eclipsed, but not totally replaced, with the introduction of a new generation of electronic terminal devices such as computer modems, digital telephones, and facsimile machines. The output signals of these new devices are digital.

A subsequent generation of techniques has been developed to place these digital signals onto carriers. Management of radio frequencies has also evol ved with the introduction of code-based frequency utilization schemes such as direct sequence spread spectrum, frequency hopping, and code division multiple access (CDMA).

Adaptive frequency management techniques such as free channel search and meteor burst transmission are now being fielded. Radio networks managed by microprocessors can accommodate the agile frequency usage patterns of cellular telephones and packet switching devices. In addition to wire and radio, new carriers such as fiber-optic cable and free space optical have been employed.

For the first time in our history, the commercial communications infrastructure is now both more capable, and more portable than any tactical communications system. As an example, Motorola's "Iridium" satellite-based cellular phone system promises to blanket the globe with hip-pocket telephone coverage by 1995. (4:B1) We should expect that tactical targets will make increasing use of this rapidly expanding commercial infrastructure.

Finally, the distinction between communications and weapons-related emissions is continuing to blur. Greater analytic effort will be required to isolate and identify non-communication signals.

The greatest irony of the digital revolution is that advanced digital equipment is most likely to fielded first by smaller countries, para-military forces, and international criminal organizations. Not surprisingly, these entities are the most likely targets of Marine operations in the coming decade. This paradox is caused by economics. It is cheaper for a small organization to replace its entire communications

system than to maintain old equipment. Large organizations find it cheaper to build their own maintenance capability. Therefore, they use old technology longer. Tactical SIGINT units, however, must identify the most valuable targets and be prepared to exploit as many of these new signals as practicable.

In the analog electro-mechanical world, it was a simple matter to guess what kind of modulation techniques we would encounter in tactical SIGINT collection operations. In the digital electronic world, it is very difficult to identify which modulations schemes we will encounter on a given operation. The depth of this problem is highlighted by the recent FBI request for telephone companies to redesign their digital networks to facilitate wiretapping. (9:A13, 10:C1) If an organization with the technical background of the FBI requires phone company assistance to conduct fixed plant wiretaps, the prospects for continued tactical SIGINT success are not good.

Two key attributes of both the present and future tactical SIGINT environment are the increased volume of communications and the increased diversity of signal and carrier types. Target signals that a linguist could have prosecuted with a generic receiver ten years ago may shortly require a highly technical search effort to detect and geolocate, and another highly technical analytic effort to demodulate, all before the information can be put into a format that a linguist or analyst can exploit.

In gross terms, the value of any one signal as an intelligence target will diminish at the same time that the difficulty of exploiting any particular signal will increase. This leads us to an important conclusion. We must become much more selective about which signals we target for exploitation and we must be more inclined to target signals for Electronic Counter Measures (ECM) such as automated Imitative Communications Deception (ICD) or jamming.

The Radio Battalion, however, is currently not well suited to conduct ECM operations. Not only is considerable effort needed to modernize ground based ECM equipment against new communication techniques and smart weapons such as laser, thermal and IR guided munitions, but there is a more basic need to refocus Ground Electronic Warfare (EW) expertise in the battalion. It is immaterial whether the Radio Battalion is organized with units that perform single functions (Functional T/O), or with units that are task organized to perform all SIGINT/EW functions (Mirror Image T/O). What is relevant, is the need for a ground EW capability be matched by a dedicated structure.

The aviation community has long recognized the importance of a dedicated electronic warfare capability. It is resident in the Marine Air Wing's Marine Tactical Electronic Warfare Squadron (VMAQ). Furthermore, because processing delays could cost lives and equipment, ESM and ECM equipment is organic to most airframes and tactical electronic intelligence (TACELINT) is deliver directly to key nodes in the Marine Air Command and Control System (MACCS). The Wing's EW philosophy could serve well as a model for the reorganization of tactical SIGINT/EW support to the MAGTF.

The current manning problems within the FMF, Radio Battalion are further impetus for changing the organization of the 2600 occfield. The Radio Battalion commander, who in addition to his SIGINT mission has a Ground EW and a Communications Security (COMSEC) monitoring mission, has no personnel trained specifically to accomplish either. (15:7-3) As ECM grows in its relative importance, this shortfall will

become more critical.

Currently 2621s are Manual Morse Intercept Operators. They are the backbone of the Radio Battalion. Their primary MOS skill, manual-Morse intercept, drives the national cryptologic training pipeline, but goes largely unused in the FMF. These Marines, with minimal formal training, accomplish the EW and COMSEC missions. The new Multi-Mode Operator designation for this MOS, while a step in the right direction, does not impart the multitude of skills that these Marines need. Conversely, the proposed elimination of the 2631, Non-Morse Electronic Intelligence (ELINT) Intercept Operator/Analyst in favor of the 2621 Multi-Mode Operator saddles 2612's with more skill requirements than they can reasonably be expected to master.

The 2651 Special Intelligence Communicators man Defense Special Security Communications System (DSSCS) circuits that support FMF and base installations. DSSCS communications involve radically different equipment and procedures than AUTODIN communications. While there has been a suggestion that 2651s can be merged with the 2542, Communications Center Operator field, it is simply too much to ask a DSSCS communications center supervisor to be proficient in the details of both AUTODIN and DSSCS formats. Additionally, cryptologic communicators below the rank of Sergeant have been in critically short supply for the past several years, while 2651 Staff NCO's have extremely limited promotion opportunities.

The 267X occfields are Cryptologic Linguists (crypto-liguists) trained in critical (high-density) foreign languages. Their training is focused on aural recognition and translation. They are not trained to fluency in other (global) language skills. There has been a chronic shortage of skilled cryptolinguists in the Marine Corps. The requirement for formal training to maintain and improve language skills competes with the need to man billets in deploying units. The lack of global language skills among 267Xs is proving to be a false economy. New communications systems allow the user greater flexibility and thus present cryptolinguists with styles and formats that they are poorly trained to handle.

The current intermediate level occfield, 2629, Signals Intelligence Analyst, is basically sound. However, these Marines, and 2691 SIGINT/EW Chiefs need a better foundation in general intelligence matters and Marine Corps doctrine and tactics.

The Marine Corps must meet the challenges of the digital signals environment with an integrated solution that simultaneously addresses occfield structure and training, unit organization, methodology, and equipment. Unit reorganization is relatively easy to accomplish. Methodology is an arbitrary and, therefore, highly flexible variable. Equipment modernization has often been a stumbling block. As our experience with radio reconnaissance has shown, money does not necessarily buy total solutions. If we are willing to work around some shortfalls, many equipment problems can be overcome. However, the most rapid progress can be achieved in occfield structure and training. Furthermore, if the lead is not taken with our Marines, gains facilitated by unit reorganization and equipment modernization cannot be realized. My solution for a restructured MOS follows.

MOS 2621, Ground Electronic Warfare Operator
(GySgt to Pvt)

The Ground Electronic Warfare Operator forms the backbone of the SIGINT/Ground Electronic Warfare MOS. The EW Operator

is trained at the Basic Ground Electronic Warfare Operators Course in EW techniques, basic DSSCS procedures and equipment, Marine Corps common communications equipment and procedure, motor vehicle operation and maintenance, computer operation and programming, communications security monitoring and reporting, and intelligence oversight regulations. This MOS provides the manpower and expertise for tactical ESM, ECM, ECCM, and COMSEC support to the ground elements of the MAGTF. After completion of the EW Operator's initial tour at an FMF, Radio Battalion a lateral move may be requested or directed to MOS 2631, 2651, or 267X. Senior 2621's assist in EW planning at the MAGTF level.

MOS 2631, Signals Analyst (GySgt to LCpl)

The Signals Analyst receives basic training in the analysis and demodulation of communication and non-communication signals and is responsible for the operation of signals search, analysis, and demodulation equipment. At the rank of Sergeant to Staff Sergeant the Signals Analyst receives advanced training in modulation theory and signal analysis techniques. Senior Signals Analysts are responsible for the design and implementation of signals search, development, and exploitation plans.

MOS 2651, Special Intelligence Communicator (GySgt to LCpl)

The Special Intelligence Communicator builds on skills learned in the Basic Ground Electronic Warfare Operator Course or those acquired from practical experience gained as a communications watchstander. The 2651 receives formal training as DSSCS communications watch supervisor and is proficient in DSSCS protocols, cryptographic security procedures, and special security administration.

MOS 2671-5, Cryptologic Linguist (GySgt to LCpl)

The Cryptologic Linguist is trained in one of several designated high-density foreign languages. The 267X is given global language training with an emphasis on passive translation skills. Training in more than one high-density language is discouraged. Training is permitted in one additional low-density language. Cryptolinguists will receive frequent language maintenance training. No formal secondary MOS will be reserved for cryptolinguists in low-density languages. These skills will be referenced by the appropriate DLPT score. Training in one of the low-density languages is open to all 26XX Marines (Staff Sergeant and below). Manual Morse Code proficiency will be treated as a low density language. Language proficiency must be maintained through the rank of Master Sergeant.

MOS 2629, SIGINT Analyst (MSgt to Sgt)

The SIGINT Analyst specialty is a required additional MOS for Marines in the 2621, 2631, and 267X fields above the rank of Sergeant. Marines in the 2651 field may transition to the 2629 MOS. The 2629 will receive formal training in the analysis and fusion reporting of COMINT, ELINT, and FISINT (Foreign Instrumentation Signals) information. SIGINT Analysts are responsible for development and implementation of SIGINT collection management plans in coordination with the general intelligence effort of the MAGTF.

MOS 2691, SIGINT/Ground Electronic Warfare Operations Chief (MGySgt to MSgt)

The MOS 2691 SIGINT/Ground Electronic Warfare Chief is drawn from the 2629 MOS pipeline. MOS 2691 Marines are trained to plan and supervise tactical SIGINT and ground EW operations within the FMF Radio Battalion. The 2629 may also be assigned to a MAGTF or Joint staff to assist in planning SIGINT/EW operations.

MOS 2692, Special Security Communications and Administration Chief (MGySgt to MSgt)

The MOS 2692 Special Security Communications and Administration Chief is drawn from the 2651 pipeline. The 2692 plans and supervises SCI communications. The 2692 is also trained in special security administration and supervises implementation of special security regulations.

The other occfields currently listed in the MOS manual, 2643 Cryptologic Translator, 2649 Cryptanalyst, and 2669 Cryptologic Support Specialist, although still needed skills, have lost their utility as personnel management tools. The automated Manpower Management System (MMS) can accurately Click here to view image
reflect language skill by language, test score, and test date. MMS can also reflect specific schools attended, current security investigation status, and previous assignment to cryptologic billets. This obviates the need for multiple secondary MOS designators. Specialized skills can now be more effectively managed through MMS than through additional MOS designators.

The benefit in forming one entry level MOS is the potential of a common MOS basic course to produce a large group of 2600's with needed skills in a shorter training pipeline. The 2621 occfield provides a dedicated track for EW specialists while providing a relatively large pool of economically trained Marines to man the Radio Battalion. The candidates for the hard skills --language, signals analysis, and communication -- can be recruited from first-term 2621s, or from Marines moving laterally from outside the 2600 field who successfully complete the 2600 Basic course. Hard skill training should be tied to long service obligations as it is today. The proposed hard skill specialties are matched to the proposed reorganization and methodology of the Radio Battalion. These hard skills, especially signals analysis, will require extensive modification of current cryptologic instruction. Marines already in the 2621 and 2631 pipelines will also require retraining. Finally, there is a pressing need for professional training for 2600 Staff NCOs. These Staff NCOs must better understand the role of tactical SIGINT and EW in MAGTF operations.

Any change within a military organization has its costs. The primary expenses for the proposes changes are in training and equipment.

Funding for Marine cryptologic operations and training is dispersed under a number of programs within the Department of Defense budget. The Marine Support Battalion is the national level counterpart of the Radio Battalion. Its billets are paid for by the Consolidated Cryptologic Program (CCP) which is a subset of the National Foreign Intelligence Program (NFIP) which, in turn, fal under Program III (Intelligence and Communications) of the overalI DOD budget. These funds are fenced so that the Marine Corps may neither add nor subtract Marine Support Battalion billets, nor may the Marine Corps divert these funds to other uses. FMF billets, such as Radio Battalion billets and the various MAGTF command element billets are funded by the Tactical Cryptologic Program (TCP) under TIARA (Tactical Intelligence and Related Activities) which in turn is grouped under Program II (General Purpose Forces) of the DOD budget. While TIARA is managed by the Secretary of Defense through OASD (C3I), NSA supervises the expenditure of TCP funds. Cryptologic training is covered by Program VIII (Training, Medical and . . .) of the DOD budget. NSA acts as executive agent for cryptologic training by supervising the programs of instruction and allocating

student and instructor billets. Finally, HQMC billets are funded under Program IX (Administration and Associated Activities). (7)

Equipment modernization is an ongoing process. We must ensure that the equipment procured will support the methodology, and training of the Radio Battalion. We can make the best use of our manpower by focusing our procurement on manual signals analysis and demodulation equipment. This type of equipment is currently available on the commercial market. Eventually, equipment capable of adaptive signals processing will be fielded to automate the analysis and demodulation process. If, however, we wait for this next generation of equipment to be fielded, we will never build the tactical expertise needed to employ it properly.

While the Marine Corps is free to make substantive changes in the organization of its cryptologic occfield, the related changes in cryptologic training must be sponsored by NSA and funded by the Training section of OASD (C3I). Since basic cryptologic training is consolidated at the national level, changes in the program of instruction impact all the services. This makes reform of occfield structure and training a difficult process.

To modernize tactical SIGINT in the Marine Corps we must also balance the competing objectives of Marine Corps manpower management policy and the National Security Agency's charter as executive agent for cryptologic training. Each system seeks to reduce costs, but they often work in opposition.

Marine Corps MOS occfields are structured and managed to provide adequate numbers of trained personnel to the FMF and the supporting establishment while providing promotion and retention opportunities to career Marines. To do this MOS occfields are structured as pyramids. Manpower planners look critically at the ratio of Marines in the top five ranks (MGySgt to Sgt) to the total enlisted population. The Top Five ratio in the Marine Corps is approximately 31.6 %. The 2600 field is surprisingly close to the Corps as a whole with a Top Five ratio of 39.6%. (14)

A series of planning guidelines instituted in 1985, under the title of Career Force Controls, assist in managing the overall enlisted population. The 2600 occfield has historically been faster than the Corps' promotion goals. While promotions in the lower ranks may still be rapid, Staff NCO promotions are slowing drastically.

There is a direct relationship between promotions and retention. As retention increases promotion must slow down. The benefit is a more mature, hence more experienced and more highly skilled, enlisted force. While 2600 retention may exceed manpower goals, the attrition of trained and experienced 2600s still causes critical shortages in key operational billets. One note of caution must be observed With a more stable career force we must become more selective in approving reenlistees. If we do not, some of our best Marines will be forced out for want of reenlistment quotas.

At this point it is necessary to place these different factors in balance. The 2600 field, because of its requirement for extensive formal training, benefits from a more mature enlisted population. At the Radio Battalion there is, however, a requirement for a large population of Marines with only basic training in SIGINT/EW skills. By using EW Operators to perform a multitude of tasks in the Radio Battalion we can reduce our basic training pipeline and reserve our critical school seats in the hard skill areas of Language, Signals Analysis, and DSSCS communications for

Marines who have a better SIGINT/EW foundation and who are willing to commit to a Marine career. I believe that Marines, who are intelIigent and aggressive enough to complete this training, will be willing to live with the reduced promotion opportunities that a more mature force implies. I also submit that, if necessary, we should support training requirements at the expense of FMF and other supporting establishment requirements. Our commonwealth partners have repeatedly shown us, a small, but highly trained effort can be many times more productive than the mass type effort that we attempt to field.

Tactical SIGINT targets have already begun to change as a result of the digital communications-electronics revolution. Without major changes to unit organization, methodology, equipment, and occupational field organization and training Marine Corps tactical SIGINT capability will erode rapidly in the coming decade. Key factors include the greater difficulty of exploiting an increasing number of digital signals and the proliferation of weapons-related emissions. This will result in a greater need for ECM operations based on more systematic signal search and analysis techniques. While adaptive processing techniques may eventually reduce the burden of manual signals analysis, the most expedient solution for the five-year to ten-year time frame will require a more highly trained force.

The Marine 2600 occfield should be restructured with one entry level MOS: 2621 Ground EW Operator; three first term MOS's: 2631 Signals Analyst, 2651 Special Intelligence Communicator, and 267X Cryptolinguist; one career level secondary MOS: 2629 SIGINT Analyst, and two career level primary MOS's 2691 SIGINT/Ground EW Operations Chief and 2692 Special Security Communications and Administration Chief. AlI other current MOS have been made obsolete as manpower management tools by improvements to the on-line Manpower Management System and should be discontinued. Marine Corps manpower policy wiIl accommodate these changes. The cryptologic training process will not. The Marine Corps must convince NSA, OASD (C3I), and the other services that enlisted cryptologic training must be substantially revised to protect our tactical SIGINT capability.

Our enlisted Marines are our best SIGINT resource. We have done a poor job of tapping their potential. If we do not reorganize and retrain them, we will not succeed in the digital SIGINT era.

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