

M. Philippe Gros
Research Fellow
Fondation pour la recherche stratégique
27 rue Damesme, 75013 Paris

July 27th, 2011

NETWORK CENTRIC WARFARE FRENCH CASE STUDY
--

This case study¹ proposes an overview of the conceptual background and the various information and communication programs implementing in France the network-centric or network-enabled operations. It does not develop the basic tenets of the NCW concept, assuming it has been extensively covered by existing literature.

Executive Summary

The French armed forces, as British and other European forces, followed the trend initiated by the US to exploit the new information technologies in order to enhance dramatically the operational effectiveness.

From a conceptual standpoint, the French concepts of “*infovalorisation*” and “*opérations en réseaux*” (OR), are close to UK NEC concept, that is a networking supporting the control of effects. French share the intellectual foundations of Adm Cebrowski’s NCW (shared awareness leading to self-synchronisation leading to a leap in operational effectiveness). Nevertheless, while OR constitute a pillar of the French approach to transformation, their implementation are not seen as a tremendous revolution in warfare.

The OR are enabled at the joint level by several key communication systems, notably the Syracuse satellite communication system and new software radios programs. Regarding information systems, French joint strategic and operational level HQs used the SICA since the last decade. This system is currently transforming

Around 5 years behind the US Army, the French Army launched in 1999 its own program of digitisation, the *numérisation de l’espace de bataille* (NEB). NEB is allowed by the Army signal architecture including RITA 2G communication network and PR4G radio system. It currently consists in a chain of information systems: SICF for brigade and above echelons, which entered into service in 2003, SIR for regiment and battlegroup, and SIT for platforms and section-level unit, as well as several other functional info systems. This incremental and progressive digitisation should be completed in 2020, despite the failure of the first comprehensive operation to ensure full interoperability between these systems, that have been developed separately.

Besides, to better explore the implications of networked operations as a system of systems, Army used a demonstrator, the *bulle opérationnelle aéroterrestre*, whose outputs support the development of SCORPION program. SCORPION is the main program for the future capabilities of the Army. It aims to comprehensively upgrade or renew all the combat means of the *groupement tactique interarmes* (GTIA, combined arms battlegroup) which is the key

¹ This case study has been developed, and published in Italian Language, as a chapter of the Italian Istituto Affari Internazionale study *La trasformazione delle Forze Armate: il programma Forza NEC* under Michele Nones and Alessandro Marrone direction, Quaderni IAI, n°2, November 2011, pp. 103-140, <http://www.iai.it/content.asp?langid=1&contentid=684> (retrieved 05 June 2012)

tactical unit projected onto most theatre of operations. SCORPION features a new information system which is intended to replace incrementally the current set of IS.

Lessons drawn up to date by French officers regarding the digitisation are positive as whole, confirming the conceptual expectations. Many of them are developed in the doctrinal hierarchy developed in parallel of the various systems. The clear added-value is to some extent counterbalanced by many hindering factors, such as the lack of interoperability or the burden of the training. Classical issues of the digitisation such as the risk of micro-management by upper echelons or the way to operate in degraded mode are not dissipated yet.

For the *armée de l'air* (French Air Force), the digitisation is enabled primarily by the SCCOA C² system which manages air operations either over the French territory or on theatres of operations. The SCCOA fourth version, to be implemented in the coming years, will be well integrated with NATO ACCS. At the tactical level, like its allied counterparts, the Air Force:

- introduced widely the Link-16 tactical datalink on most C² and combat platforms,
- developed, with some delay, the procedures and means of the digital close air support, in support of the urgent needs of ISAF commitment. In a first move, French air force developed its own innovative system (SCARABEE) which have been superseded by the most widely disseminated US ROVER system.

The main C² system of the Marine Nationale is the SIC-21 which federates communication networks including RIFAN IP and host planning, operations and intelligence tools to manage naval operations. Navy is committed in the development an equivalent of the US Cooperative Engagement Capability. The first R&D step of this *Capacité d'engagement multi-plate-forme* dealt with situational awareness and could be implemented on its new frigate class.

Finally, since the mid of the last decade, the ministry of defense plan to converge all these IS toward one unique armed forces information system. The approach is to build common communication and basic applicative "socles" (bases), what is under way, then to migrate by 2016 all current joint and service IS onto this socle, at least for high levels of command. It remain to be seen if the so-desired end state of interoperability will be reached, given the daunting challenges of the task.

A French concept close to the British one

In the US, while the digitisation project Force XXI in the Army was launched in 1994, the NCW concept matured among the information technologies community (primarily in the Joint Staff, the NDU and the Navy) during the mid-90s only to emerge in 1998 in the form of NCW, providing afterward, during Donald Rumfeld's tenure, a structuring idea of the transformation. In France too, the concept effort lagged behind the programmatic initiatives by the services to implement these technologies.

The French concept was named for a while "*opérations infovalorisées*" (information-enabled or value increased by information). This term is continued to be used but the concept now shifted to a more classical "*opérations en réseaux*" (networked operations).

The *Centre interarmées de concepts, doctrines et d'expérimentations* (CICDE, joint center for concepts, doctrines and experiments) gave in 2006 the following definition: " '*Opérations en réseaux*' qualify the operations for which the control of the information and the optimal interrelations of all the actors and systems constitutes critical elements of the operational

*efficiency in particular by the control of the effects*². According to the concept, networked operations have four aims:

- To adjust the distance and the tempo of operations to generate the advantage over the adversary;
- To reinforce the ability of joint, multinational and interagency stakeholders to cooperate;
- To enhance the relevancy of operational functions in the reaching of desired effects and controlling their own activities;
- To reduce the frictions and opaqueness of operations.

According to the concept, these aims have notable implications for each of the six fundamental functions:

- For the situational understanding, networked operations ease the information dissemination toward analysis and decision-making centers; allow exploiting expertise via the reachback thus allowing to reduce forward-deployed staffs. They allow the timely understanding and the leverage of each tactical element for the operational-level decision-making. The challenge remains here to de-saturate information;
- In support of the force generation and projection, OR ease the inter- and intra-theater mobility, allow the synchronization of the projection operations, facilitate the build-up of tailored combined and joint packages;
- In support of the command function, OR allow to impose the tempo to the adversary through accelerated decision-making loop, to involve timely various stakeholders through collaborative means, and at all the echelons to develop a shared understanding of the decision;
- In support of the application of the effects, OR optimize the use of weapon systems, enable the synchronization of the operations, the adaptation of modular and flexible force packages to the threat and the evolution of the situation. Finally, they allow to calibrate the sufficient effects according the principle of the economy of force and the need to limit the risk of collateral damages;
- In support of the force protection, OR offer a larger margin of freedom in the organization of operational functions by reducing the need to collocate them, thus reducing their vulnerability. They contribute to a better anticipation of threats, including versatile asymmetrical ones and allow a protection based on mobility rather than on hardening. Combined with the use of unmanned assets, OR allows to reduce the exposure of assets;
- In support of force regeneration, OR allow in-time logistics, and a better knowledge of unit status while reducing the workload to develop it. They finally support the joint and multinational pooling of capabilities.

Among specific concepts related to OR, it is noteworthy to mention the SA2R (*surveillance, acquisition, reconnaissance et renseignement*) the French version of ISTAR. SA2R, as expressed by CICDE³ and used by services, envisions not only the networked multi-sensor intelligence collection but also more broadly the ability to access to non military all source intelligence on the theatre. The author, who participated to the preliminary work on this concept, considers nevertheless that SA2R confirm existing notion among intelligence community (all-source intelligence and collection coordination). The real issue lies rather in the reorganization of the intelligence exploitation function, in order to better organize the

² Centre interarmées de concepts, doctrines et expérimentations, Concept exploratoire des opérations en réseaux, PIA 06-101, n°94/DEF/CICDE/NP du 05 mars 2007, p.4

³ Centre interarmées de concepts, doctrines et expérimentations, PIA-06.102 - Concept exploratoire SA2R, n°153 DEF/CICDE/NP du 5 mai 2008

responsiveness of the expertise of intelligence analysts for users confronted with increasing and divers flow of information.

In substance, while most officers acknowledge the increasing importance of information technologies, many ones, notably in the Army, tend to criticize the US concept for two aspects. The first one is the “centricity” of the network. This critic is related to the wider perception among French of the US military over reliance on technology, an enduring element of US culture, as explained by many scholars including Colin Gray. The second one is about the scope and the ambition of US transformation, maintained by the US so-called notion “revolution in military affairs”, whose the NCW would be the heart. The French developed in 2003 an approach to transformation, encompassing *the opérations en réseaux*, the effects-based approach and the concept development and experiment approach. But, as explained in the *Plan Prospectif à 30 ans* (the main S&T roadmap) of the DGA (*Délégation générale pour l’armement*, the MOD procurement agency), “*The French transformation is neither the translation of a specific strategy based on the power and technological superiority, nor its acceptance as a new dogma, nor the questioning of modes of action that would have lost their relevance: it is essentially a global process of progress, focusing on operational efficiency, able to adapt the military to the variations of environment by making the best use of available resources, and a pragmatic and flexible approach*”⁴.

French claim to be closer of the UK “Network-Enabled” concept, seen as describing more pragmatically that information technologies are a supporting tool not an end in itself. Rapidly, the term of “*infovalorisation*” did emerge in the French HQs as a way to describe the added-value of information without putting in question the enduring key tenets of operations.

As a matter of fact, this difference always seemed to us purely superficial in the case of networked operations: As summarized above, the French concept is totally adhering to the Adm Cebrowski’s NCW basic tenets: information superiority, shared awareness, self-synchronisation of elements, the need for interoperability and so forth. As the author realized it, when the French staff decided to develop, around the mid of the last decade, a Common operating picture at the joint level, it experienced the same difficulties to define discriminating information requirements which would customize the COP. On the other hand, the so-called “control of effects” is shared by all military decision-making including the US one, whatever the way to operate. The question is more about the relevancy of effects, the way to measure them and the difference in the degree of the use of force between US forces and European ones.

Another more important difference, illustrated also in the “pragmatic” approach and the notion of “*juste suffisance*” (just enough means or effects) is related to the constraint of resources which plagues permanently our military far more than US one. This constraint leads to an incremental and limited programmatic implementation of the networked operations.

The programs at the Joint Level

The joint communication systems : Syracuse SATCOM and future software radio

A backbone of the French NCO is the SYRACUSE (*SYstème de RAdioCommunication Utilisant un SatellitE*) satellite communications system⁵. French forces use currently the third

⁴ Délégation générale pour l’armement, *PP30, Chapitre D2 Partenaires, Transformation et opérations en réseaux*, 2007, p.5

⁵ Ministère de la défense, *Dossier d’information, Lancement du satellite Syracuse 3B*, Kourou, août 2006, p.19, <http://www.ixarm.com/IMG/pdf/dossiersyracuse.pdf>

generation of this system. The program started in 1980. This first generation consisted in a payload on three Telecom I satellites, launched between 1984 and 1987 and operated by both Defense Minister and the French civilian telecommunication company, *France Télécom*. These systems were phased out in 1994. The program of the second generation started in 1987. Again, it relied on dedicated payloads, this time embarked on 4 Télécom II launched between 1991 and 1996.

The third generation, started in 1999, is currently composed of two dedicated satellites, SYRACUSE 3A and 3B, launched in 2005 and 2006. While SYRACUSE 2 payloads was exclusively SHF, Syracuse III spacecraft combines SHF and EHF emitters, may precisely calibrate the apportionment of its capabilities to the specific need of each user, and is protected against electromagnetic pulses. The ground segment includes 367 stations. Most of them are to be delivered in 2011⁶:

- 323 ground stations: half of them are man-portable. Other are deployed on armoured vehicles or deployable at the various tactical and operational-level HQs;
- 44 naval stations, equipping the aircraft carrier, the two *Batiment de projection et de commandement*, all surface combatants and submarines.

These stations allow a maximum of 2 Mbits/sec for protected liaisons, 5 Mbits/sec for non-protected ones, and up to 16 liaisons in parallel for ground stations and 6 liaisons for naval ones.

The budget for a third SYRACUSE satellite has been shifted to SICRAL II program in cooperation with Italia. The development started in 2010 with an expected launch in 2013. As Syracuse, SICRAL system is intended to provide forces with satellite protected communications. Finally, under the NATO SATCOM V program, SYRACUSE III, as well as Italian SICRAL I system and UK SKYNET, rent capabilities for NATO operations, notably about 45 % of SYRACUSE III SHF capabilities.

The OR are also enabled by the software radio technology. According to the MOD, "*it can offer, on a single and versatile equipment, a wide range of broadband communications services, replacing equipment specific to each function*"⁷. Key joint and multinational radio-software program under development include:

- The joint program CONTACT (*Communications Numérisées Tactiques et de Théâtre*) which must be interoperable with NATO. It should eventually replace most existing radio and tactical data link systems (PR4G, Link-16 and CARTHAGE, etc.). On December 2010, a study contract has been awarded to Thalès to develop the system ;
- The European secure software defined radio (ESSOR) program launched in 2008 in partnership with Finland, Italy, Poland, Spain and Sweden. According to the EDA, "*The strategic aim of the ESSOR Program is to provide the basis for development and production of Software Defined Radio (SDR) products in Europe in order to have the equipment operational in Europe in the timeframe up to 2015*". The program, managed by the *Organisation Conjointe de Coopération en matière d'Armement* (OCCAR), will study the software architecture, starting from the US Joint Tactical Radio System as a basis, and the development of a high data rate waveform.⁸

The joint information systems for strategic and operational levels

⁶ Xavier Pintat et Daniel Reiner, *Projet de loi de finances pour 2011 : Défense - Equipement des forces*, 22 novembre 2010, <http://www.senat.fr/rap/a10-112-5/a10-112-511.html>

⁷ Bruno Daffix, DGA/COM, « La DGA lance les études du futur poste radio tactique interarmées », 26/01/2011, <http://www.defense.gouv.fr/content/view/full/103015>

⁸ EDA, « ESSOR », <http://www.eda.europa.eu/Otheractivities/SDR/ESSOR>

The current information system for joint C² levels is SICA, *système d'information et de commandement des armées*. The initial SICA G0 program has been launched in 1995, but the system was really mature from the G1 version, fully operational around 2000-2001. It equipped at that time more than 2000 stations on 10 metropolitan and 15 overseas sites, notably at the strategic level, the defense staff and its *centre de planification et de conduite des opérations* (CPCO, planning and operations center), and at the operational level, the *état-major interarmées de force et d'entraînement* (EMIA-FE) at Creil Air Force base, which provides the core element of the deployable joint force headquarters. The applications, whose the number grew up significantly over the decade, include all the tools necessary for strategic and operational-level planning, operations or intelligence staffs including operations plan development, databases, messaging, COP, collection plan, etc. The SICA has been developed and maintained, under the management authority of DGA, by a *Groupement d'Intérêt Economique*, gathering EADS Defense and security, ATOS Origin, and Steria firms⁹.

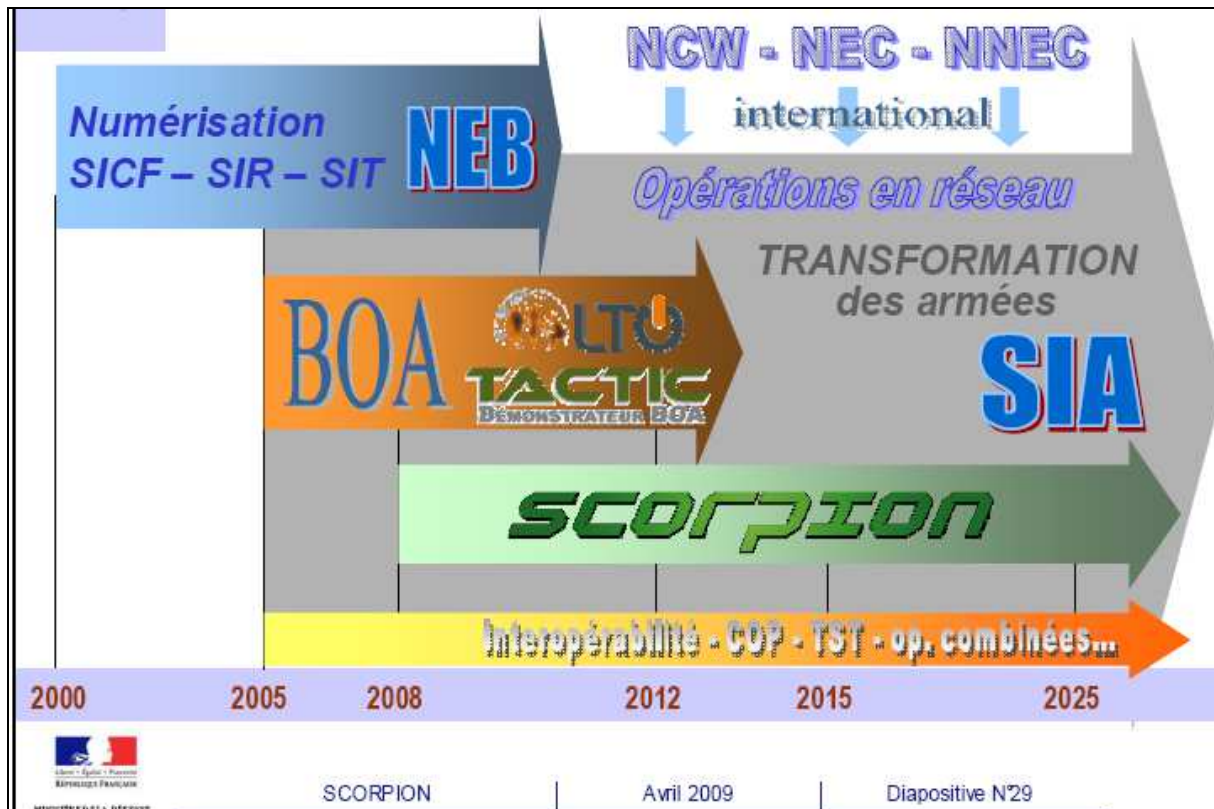
The MOD decided to further upgrade and adapt the CIS to the change of organization at the strategic level, what is named *Pôle Stratégique Paris*. The CIS of the PSP encompasses now the Directorate for Military Intelligence and the Operational Headquarters (OHQ) at Mt Valérien. It is interfaced with NATO and other multinational C² and information exchange networks. A first increment, based on a new SICA version, has been developed in 2007-2009 timeframe. A second increment, started at the end of 2010, fastens the joint IS deployed on theatre of operations, to the interoperable framework provided Army SICF¹⁰. The end state is to create a single armed forces CIS in 2016 (see the final section of this case study).

The digitization of the French Army

The digitization projet in the French army is the *Numérisation de l'espace de bataille* (NEB, digitization of the battlespace), launched in 1999 and incrementally implemented during the last decade and well underway. In 2005, this project has been supported by tools developed with the *Bulle opérationnelle aéroterrestre* (BOA, airland operational bubble) demonstration launched in 2005. The digitization is now part of the joint information system program on one hand, and SCORPION comprehensive program to develop the future capabilities of the battlegroup.

⁹ MOD Factsheet, *Le programme Sica (système d'information et de commandement des armées)*, 2005, available on <http://osdir.com/ml/culture.war.guerrelec/2005-11/msg00028.html>

¹⁰ MM. Xavier Pintat Et Daniel Reiner, Sénateurs, *Avis présenté au nom de la commission des affaires étrangères, de la défense et des forces armées (1) sur le projet de loi de finances pour 2011, adopté par l'assemblée nationale, Tome V Défense - équipement des forces*, 18 novembre 2010



The transformation of the French army at a glance

Source: état-major des armées / état-major de l'armée de Terre, *Scorpion, objectifs opérationnels et capacitaires*, présentation aux industriels, avril 2009

<http://www.ixarm.com/IMG/pdf/Presentation-SCORPION--14-04-2009--Vfinale-c.pdf>

The Digitisation of the battlespace (Numérisation de l'espace de bataille, NEB)

As defined by the Army headquarters in 1999, "The digitization of the battlespace is intended to give any responsible of an action, the informational superiority, that is, the ability to acquire process and use information relevant to its mission. It must have a transparent and all useful information on friends as any opponent in their environment, at the right time, regardless of where it is located, regardless of the source and so securely (integrity and security information) that it can take the first decisions that will give him the advantage."¹¹

Communication systems

The NEB is firstly permitted by the signal capabilities of the Army. The backbone of the communication system of the French ground forces in operations is the *Réseau intégré des transmissions automatiques* (RITA, Integrated network of automatic transmission), providing communication capabilities at the corps level. RITA was conceived in the 1960's and developed in the 1970's by Thomson. When the RITA became operational from 1983 within French and Belgium armies, it was the most advanced ground communication system of the world. The US Army picked up the switching technology of RITA to equip its signal battalions. RITA is a flexible and modular mesh network of nodal centers interlinked with radio relay stations (FHM stations in the first generation) through modular UHF beams, the stations

¹¹ Délégation générale pour l'armement, *Liste des capacités technologiques*, 2008, CT14, p.15, www.ixarm.com/IMG/doc/Capacites_technologiques-_detail.doc

providing radio linkage to subscribers (HQs as well as units). RITA was digitized from the onset, and totally automated¹².

Of course, RITA has been progressively upgraded to take in account the progress in communication technology. The current system is RITA 2G HD (second generation, broadband), experimented in 2005¹³. It incorporated IP technology as well as satellite communication.

Today, a typical RITA 2G area network includes

- The liaison through fiber optic linkages, CHF radio stations (“*Chaîne hertzienne des forces*”) and SATCOM. CHF radio stations allow secured SHF liaisons with a data rate ranging from 2 megabit/sec at the maximum range of 50 km up to 34 megabit/sec at the range of 36 km¹⁴;
- The nodes (either CART, *centre d'accès radio et de transit*, or CTRT, *centre radio de télé-exploitation et de transit*) providing the mesh of the network and the access to the CP and mobile users;
- The stations connecting the command posts: the CMAI (*centre multiservice d'accès et d'interface*) stations for HQ allowing connectivity with other networks and may be more importantly, ASTRIDE (*Accès par Satellite et par Transmission hertzienne au Réseau de zone et de l'Intranet De l'Espace de bataille*) station. With 40 stations delivered in 2006, the ASTRIDE phase 1 allow connectivity between RITA and SYRACUSE. With 129 stations scheduled, the phase 2 will expand this connectivity to the battlegroup level, not only with SATCOM but also with other allied and civilian networks¹⁵.

As a complement to RITA:

- For longer range communication, French Army operational and tactical high level command posts, some intelligence, artillery and engineer units as well as special operations units of the three services use the new HF MELCHIOR (*moyen d'élongation pour les communications en hautes fréquences interarmées et OTAN en réseau*) stations. A total of 1100 stations have been ordered to Thalès Communication SA : 675 ones delivered in 2010, 475 hardened ones by 2012, but delays are expected. The station, either man-portable or embarked on vehicle, allows secured IP, voice, data, messaging communications up to 5000 km, the access to SATCOM and GSM networks.
- For short range ground communications (from 2 km for individual dismounted soldier to 30 km when used by vehicle) at the brigade or battlegroup level, French forces rely mainly on PR4G (*poste radio quatrième génération*) VHF system. From 2005 to 2010, they have been complemented with a new evolution, the PR4G-VS4-IP, highly secured, anti-jam and IP system, allowing voice and data exchange with a quadrupled data rate compared to the previous version. Thalès Communication SA developed the system and delivered more than 7000 IP radios used by the full range of vehicles, aircrafts and dismounted units. PR4G-VS4-IP represents the main

¹² Amicale des anciens du 40^{ème} régiment de transmission, *L'arme des transmissions*, non daté, p.29, <http://le40rt.anciendu40.fr/historique.pdf>

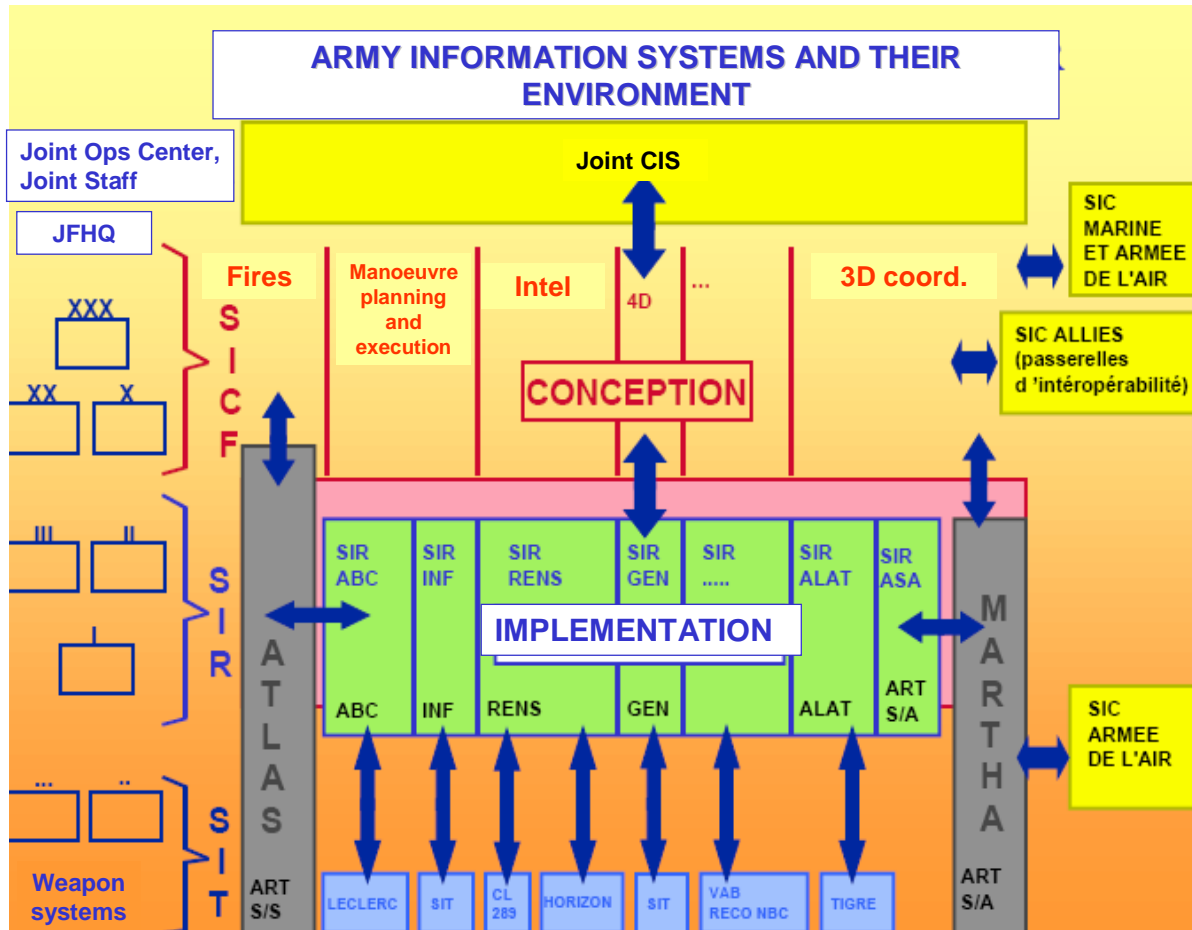
¹³ Centre de la doctrine et de l'emploi des forces, « Retour d'expérience », *Héraclès* n°9, 2005, pp.6-8

¹⁴ Armée de Terre, *Arme des transmissions, dossier matériels*, juillet 2005, p.29

¹⁵ *Les SICs pour tous*, Ecole des transmissions, armée de Terre, non daté http://www.etrns.terre.defense.gouv.fr/sicpourtous/SIC_OPERATION/le_reseau_de_zone_rita.html

communication tool allowing the connection of NEB tactical IS¹⁶. A total of 33 000 PR4G and PR4G-VS4-IP are used by the French forces.

The chain of information systems



Adapted with some translation by the author, of : Armée de Terre, *Manuel d'emploi des systèmes d'information opérationnels, tome 1, Le système d'information opérationnel, SIC 603-1, n°737/CDES/CREDAT/B6, approuvé le 05/09/02, p.13*

French Army current NEB employs a hierarchy of information systems encompassing:

➤ **The *système d'information et de commandement des forces (SICF)*.**

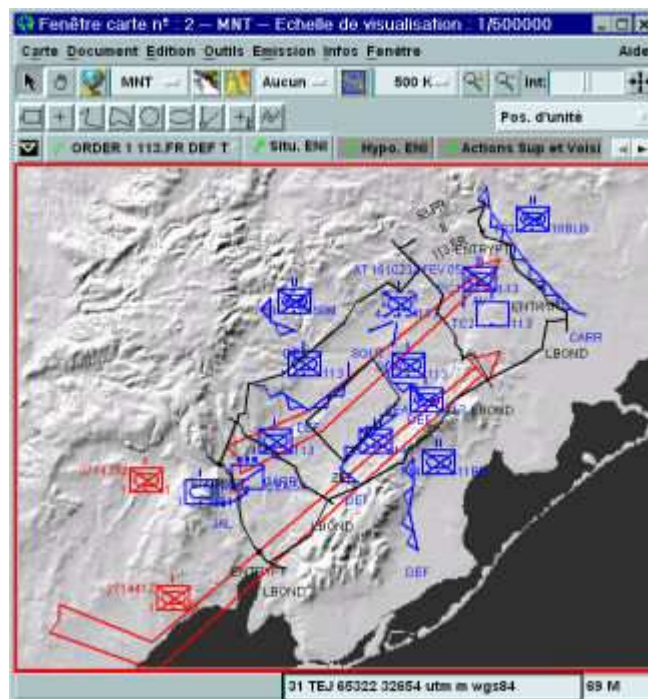
The SICF constitutes the digitized battle management tool of headquarters from brigade up to land component command. The program started in 1995 with an initial capability in 1999. It equips Corps-level Lille-Based *Commandement des forces d'action terrestres (CFAT)* and the Eurocorps, the EMFs (force headquarters), and all the Army combat and functional brigades. It allows the development and the sharing of the tactical situation, supported by graphic tool, the exchange of orders and reports through messaging tool, the collaborative work within the staff. It includes specific functional tools for intelligence, logistics, 3D coordination, fires coordination and so forth. The SICF ensures interface with other service

¹⁶ François Cornut-Gentille, Député, *Avis présenté au nom de la commission de la défense nationale et des forces armées, sur le projet de loi de finances pour 2011 (n° 2824), tome VII, défense, équipement des forces – dissuasion, 14 octobre 2010, pp 243-245*

and allied systems, using for this purpose NATO standards such as AdatP-3 for messaging, APP6-A symbols, and ATCCIS database.

➤ **The système d'information régimentaire (SIR).**

Manufactured by EADS DCS, SIR equips Brigade and below levels, including notably the battlegroup, the basic combined arms reinforced-battalion used for deployment. It allows the exchanges of orders and reports with SICF through messaging and pre-formatted templates, supports the development of the shared tactical situation, through the ground recognize picture, on which the positioning of units is automatically updated and, again, several applications for intel, logistics, etc. First SIRs has been delivered in 2002 and extensively experimented. The system is officially in service since 2007. The regimental command post deploys four VAB forward armored vehicles or shelters, each equipped with two stations and each company commander owns a light SIR kit on its VAB¹⁷. EADS delivered from 2002 to the end of 2010, 721 SIR-equipped new or upgraded vehicles and shelters and 118 dismantled SIRs. The fielding rhythm starts with 2 regiments per year from 2002 to 2006 to 5 regiments per year, 2007 onward. A new version is currently fielded, from 2009, on the new *véhicule blindé de combat d'infanterie* (VBCI, infantry fighting vehicle) which replaces the VAB. Ultimately in 2016, 110 VBCI-SIR and 97 VHM (high mobility vehicles) should have been provided¹⁸.



A view of SIR generated tactical situation

source: Philippe Lépinard, « Le système d'information régimentaire », Géodécisionnel.fr, http://www.sig-gps.net/index.php?option=com_content&view=article&id=81&Itemid=34

First exercise of implementation of a digitized armored GTIA with Leclerc main battle tanks (MBT) took place at Mourmelon in November 2003. The SIR has also been experimented in the *Régiment de marche du Tchad* then fielded in the 2^{ème} *Régiment étranger d'infanterie*,

¹⁷ LtCol Eric de Saint-Salvy,, « Les PC numérisés de l'infanterie », *Fantassins*, n°15, pp.24-25

¹⁸ MM. Xavier Pintat Et Daniel Reiner, Sénateurs, *Avis présenté au nom de la commission des affaires étrangères, de la défense et des forces armées (1) sur le projet de loi de finances pour 2011, adopté par l'assemblée nationale, Tome V Défense - équipement des forces*, 18 novembre 2010, p.62

the first digitized infantry regiment of the Army, which tested the SIR in the second digitized GTIA exercise in November 2004¹⁹.

➤ **The système d'information terminal (SIT).**



the SITEL

Source: Sagem Défense Sécurité

SIT is a family of information systems, extending the NEB down to the squad level (the 10 men-*groupe* in the French unit, headed by a sergeant). The system is deployed since 2008. The DGA ordered first to Nexter 1200 SIT ICONE embarked on the MBT Leclerc and SIT V1, to equip notably 400 infantry fighting vehicles²⁰. Nevertheless, the most numerous systems will SITEL (for ELementary) for other vehicles, and SIT COMDE (*combattant débarqué*, dismounted combatant) for FELIN (see below), each manufactured by Sagem. The contract has been awarded in 2003 with a first prototype in 2005 and a first delivery in 2007. About 4500 SITEL will be delivered by 2012.

➤ **Army aviation digitization**

SIT will be also deployed on army helicopters in the framework of the digitization of the army aviation (NUMALAT, *numérisation de l'aviation légère de l'armée de Terre*). The CP of the *groupement aéromobile* (GAM, airmobile battlegroup, the equivalent of GTIA for Army aviation) is connected to upper echelon (brigade) through SIR, on which missions are planned. SIT have been integrated from the onset on the new Tigre attack and NH-90 utility helicopters (named EUROGRID) and are being retrofitted on older types (SITALAT on Gazelles and Cougar aircrafts). Missions are prepared by the crews on specific station

¹⁹ LtCol Eric de Saint-Salvy, *op cit*.

²⁰ « Commande de 800 Systèmes d'Information Terminaux SIT V1 pour l'Armée française », 19 février 2009, http://www.nexter-group.fr/index.php?option=com_content&view=article&catid=54%3Acommuniqués&id=149%3Acommande-de-800-systemes-dinformation-terminaux-sit-v1-pour-larmee-francaise&Itemid=97&lang=fr

allowing to feed the SIT. Another key component of the NUMALAT is the kit HM PC (utility helicopter command post) allowing to command in flight the GAM. 15 kits have been delivered in 2010. Extensive experiments of NUMALAT are underway since 2009 by the *3ème régiment d'hélicoptères de combat*. SIR and mission preparation module seem to be matured and well employed. It was scheduled to complete the build-up of NUMALAT in 2013 but several problems remain to be fixed with SITALAT²¹.

➤ **Functional information systems.**

Conversely to other units, artillery regiments use vertical functional systems to coordinate fires:

- ATLAS (*Automatisation des Tirs et des Liaisons de l'Artillerie Sol/sol*) is the information system coordinating field artillery fires (MLRS, canons). At the regimental command post level, it allows to plan the fires, to integrate the target information and to direct fire orders to the batteries. The computation of fire solutions is ensured at the battery level (at a speed of 8 rounds in 2,30 min). The regimental network is composed of 92 terminals²² ;
- MARTHA (*Maillage des Radars Tactiques contre les Hélicoptères et les Aéronefs à voilure fixe*) for air defense. This system entered into service in 2005 with 45 stations to coordinate short range air defense (MANPADS and Hawk Surface to air missiles) operations. A second step includes 14 new high level centers and 34 command post vehicles, in order to manage the new mid-range surface-air missile (SAMP/T, sol-air moyenne portée). MARTHA use both PR4G and Link-16 TDL. In 2006, the defense staff decided to fuse MARTHA in the Air Force SCCOA stage 4 (see below)²³.

Regarding intelligence function, the multi-sensors brigade and its reconnaissance regiment CPs used GRANITE NG (*Gestion du Renseignement et Analyse des Informations Transmises par les Equipes*) a dedicated information system allowing the processing and production of intelligence but its functions have been transferred into SICF-SIR system. Each reconnaissance unit, for example the *Escadron d'éclairage et d'investigation* (EEI) continues to feed SIR through the MAESTRO (*Module Adapté aux Échanges Sécurisés, aux Transmissions et au Raccordement des Opérationnels*) system²⁴.

➤ **FELIN (*fantassin à équipements et liaisons intégrées, Infantryman with integrated equipments and liaisons*).**

The FELIN soldier system is the last piece of the digitization. Designed and partially manufactured by Sagem, it is the first "land warrior-like" system to enter into service in wide scale. As explained earlier, the platoon commander and group leaders are connected with the hierarchy through their SITCOMDE, which features many capabilities: The classical exchanges of orders/reports and management of the tactical situation through the mapping tool, but also the digital request for a fire support, etc. All the soldiers of the platoon are connected via the *Réseau d'information FELIN*, a data and voice UHF radio network, which can also be configured to handle sub-networks, for example at the squad level. Each soldier is equipped with a GPS-radio (the voice exchange being made through a very silent osteo-

²¹ Captain Xavier Quintin, « Expérimentation tactique (EXTA) de la numérisation de l'ALAT au 3^e RHC : bilan intermédiaire », *Revue d'information de l'ALAT*, n°21, janvier 2011, pp. XXVI

²² « Le système ATLAS Canon », site du 1^{er} régiment d'artillerie de marine, 2008, http://irama.free.fr/materiel_ATLAS.php

²³ LtCol Loïc Boué, « Mise en application de la coordination 3D », *Doctrine tactique*, n°14, janvier 2008, pp 32-35

²⁴ Armée de Terre, *Arme des transmissions, dossier matériels*, juillet 2005, p.35

microphone) and a small terminal (*interface homme-machine*) used to get maps or, for the half of the combat group, to transmit video taken through the two sights used on their FAMAS assault rifle or Minimi gun²⁵.



During 2007-2008 year, the FELIN have been extensively tested in several environment: the *Régiment de Marche du Tchad*, in Djibouti in desert environment; the *8^{ème} régiment parachutiste d'infanterie de marine* in urban area; the *13^{ème} bataillon de chasseurs alpins* (BCA, mountain troop battalion) in mountain and cold environment as well as in jungle in Guyane. In April 2008, the DGA awarded to Sagem a contract of 143 millions EUR for the delivery of 5045 systems from mid-2009 to the end of 2010, in order to equip 5 infantry regiments. In October 2010, the *1er régiment d'infanterie* (RI) has been the first regiment to obtain its 875 collections of equipment for its 6 companies and supporting units. 3 companies will be projected as the backbone of the first FELIN-equipped GTIA deployed in Afghanistan at the end of 2011²⁶. Are following, in 2011, the *13^{ème} BCA*, the *16^{ème} bataillon*

²⁵ Rupert Pengelley, "Moving towards a digitised future : France steals a march with FELIN", *Jane's International Defense Review*, June 2008, pp 64-70

²⁶ « Le 1er Régiment d'infanterie est la première unité de l'armée française à avoir perçu le système FELIN », <http://www.ri1.terre.defense.gouv.fr/EnjeuxDefense/Specificites/felin.html>

de chasseurs, and 92^{ème} RI and the 35^{ème} RI, both mechanized with VBCI²⁷. The initial objective of the LPM 2009-2014 was the delivery in 2014 of 22 300 systems to equip the 20 infantry regiments of the Army, but the amount has been scaled down in 2010 to 17 884 systems, the remaining being postponed to the 2015-2020 period²⁸.

The BOA demonstration

The BOA (*bulle opérationnelle aéroterrestre*) demonstrator has been launched in 2004. Building on NEB programs, its aim is to experiment all the facets of a digitized force envisioned as a system-of-systems. DGA notified this program to a group composed of Thalès Communications, GIAT industries and Sagem DS in 2005. The contract features an amount of EUR 130 Millions and duration of 7 years. It is focused on

- The development and the maintaining of a common tactical picture;
- The coordination of direct and indirect fires and target designation;
- The reinforcement of force protection;
- The joint and combined interoperability.

The most important component of the BOA (counting for EUR 90 M) is the TACTIC (*Technologies et Architecture du Combat Aéroterrestre aéro-terrestre Info-valorisé au Contact*). TACTIC is a small-size experimental unit (12 armored vehicles, 30 soldiers, 3 UAVs and unattended sensors) to test all these networking-related issues, notably the insertion and management of unmanned assets in the battle network.

Another key product of the BOA is the LTO (*Laboratoire Technico-Opérationnel*) a battlelab provided by the contractors to the DGA to support the experiment of operational concepts, TTPs and technologies of the system-of-systems. Operational since 2006, the LTO is now a key asset of the DGA, oriented by the defence staff and operated by its Centre d'analyse technico-opérationnel de Défense, at Arceuil. It gathers, on specific projects, operational users and industry to simulate and experiment technical solutions, draw up implications in terms of doctrine, organization, material and so forth. LTO worked now on many joint and service-related issues, either off-the-shelf solutions for rapid needs, or supporting multi-years programs submitted by CICDE or defense staff capabilities development division. These projects included the Air force SCCOA, the Navy CEMP (see below), time-sensitive targeting, the effect-based approach to operations, or the SA2R concept, focused on multi-sensors collection²⁹.

BOA program included as well a specific experimentation in collaboration with Germany. Launched in 2009, the Architecture Real-Time Integration System Test bench focused on several aspects of distributed operations :

- Distributed control of ground unmanned vehicles;
- Distributed indirect fire control;
- Combined training based on simulation;

²⁷ Général d'armée Elrick Irastorza, chef d'état-major de l'armée de terre in M. Jean-Louis Bernard, *Avis présenté au nom de la commission de la défense nationale et des forces armées, sur le projet de loi de finances pour 2011 (n° 2824) tome IV défense préparation et emploi des forces terrestres*, 14 octobre 2010, p.43

²⁸ MM. François Trucy, Jean-Pierre Masseret et Charles Guéné, *Projet de loi de finances pour 2011 : Défense*, Rapport général n° 111 (2010-2011), fait au nom de la commission des finances, déposé le 18 novembre 2010, <http://www.senat.fr/rap/110-111-38/110-111-38.html>

²⁹ Délégation générale pour l'armement, Introduction au laboratoire technico-opérationnel, présentation, 22/02/2007, <http://www.see.asso.fr/sds2007/docs/Tutoriel-8-3-Laboratoire-Technico-Operationnel-X-Lecinq.pdf>

- Persistent communication with dismounted platoon.³⁰

The challenge of interoperability and the failure of the *Opération d'ensemble SIC Terre*

The Army deployed or developed during this 2000 decade no less than 14 communication and information systems, developed separately by competing firms. The Army experienced (and continues to experience) therefore a limited interoperability not only with other systems at the joint and multinational level but also between the NEB systems at the combined level, between the branches of the Army. Among many examples of these limitations, SIR and ATLAS are not directly interoperable with negative consequence for the combined arms action. As Major-general (ret.) Klein explained it *“Currently, the gunner cannot obtain the operation order from the GTIA he supports, and conversely, he cannot transmit its “artillery” layer in the GTIA CP. In addition, it is impossible to superimpose a fire plan and a plan of obstacles, which is the basis of combined arms action”*.³¹

Therefore, as soon as 2002, DGA decided of one *Opération d'ensemble (OE) SIC Terre* (Land CIS comprehensive operation) whose the objective was to build-up a single technical architecture, a single technical socle toward which all land CIS has to converge. According to Col Henry, *“Key to technical interoperability of our SIOC, the OE SIC Terre is a precondition for the digitization of the battlespace”*³².

In January 2005, the DGA awarded to a consortium gathering Thalès (70%) and EADS-Défense et sécurité (30%) a contract of 230 Millions Euros for the over 7 years to run this OE SIC Terre. The migration of these systems toward the targeted architecture was intended to be incremental³³. A first milestone was reached in 2007 with an initial operational capability covering 60-70% of the information exchange requirement³⁴. But the operation was a failure and DGA cancelled it in 2009 after increasing delays and technical shortfalls. As the National Assembly reported it, the industrial architecture is designated as the primary cause of this failure: *“The association, without leader, of two competing entities is not sufficient to extinguish the competitive rivalry; the two companies do not share their technological knowledge. The co-contracting has been reduced to a financial sharing and not a sharing of trades”*³⁵. For example, according to a French officer in charge of the NEB in one staff, and discussing about the limited interoperability between SIR and MAESTRO, *“Thales does not issue its DLL in which the mapping is explained and vice versa for EADS”*³⁶

Another area of interoperability issue is with joint and multinational systems. It is notably a concern for army aviation at the crossroad of land and air operations. Helicopters should be

³⁰ Laurent Barraco, « La bulle opérationnelle aéroterrestre », *Technologue et Armements*, n°2, juillet-septembre 2006, pp. 36-41

³¹ GDI (2S) Michel Klein, Philippe Gros, GCA (2S) Michel Asencio, *Comment maintenir la perception de la réalité dans les postes de commandement des opérations infovalorisées ?*, rapport d'étude, Fondation pour la recherche stratégique, 28 janvier 2008, p.18

³² Colonel Heny, « Interopérabilité : de l'OE SIC TERRE à la NEB », *Heraclès* n°32, avril-mai 2009, p.13

³³ Colonel Heny, op cit.

³⁴ Ministère de la défense, *note détaillé sur le programme SIC Terre*, in François Cornut-Gentille, Député, *Avis présenté au nom de la commission de la défense nationale et des forces armées, sur le projet de loi de finances pour 2010 (n° 1946), tome VII, défense, équipement des forces – dissuasion*, 14 octobre 2009, p.90

³⁵ François Cornut-Gentille, Député, *Avis présenté au nom de la commission de la défense nationale et des forces armées, sur le projet de loi de finances pour 2010 (n° 1946), tome VII, défense, équipement des forces – dissuasion*, 14 octobre 2009, p.89

³⁶ « Numérisation de l'Espace de Bataille Des technologies, mais surtout des Hommes ! », *blog Armées.com*, Posté le 10/08/2010 à 11:14 <http://www.armees.com/forums/topic/91351-numerisation-de-lespace-de-bataille/>

able to exchange both air operations control data through the Link-16 tactical data link and command and reporting data with SIR. Currently, SITALAT and EUROGRID can, with unexpected limitation for the former, exchange with SIR through various ground PR4G radio communication modes. Such exchanges are being greatly expanded with HM PC. But as demonstrated by the current engagement of GAM off the Libya coast in Operation Unified Protector, French helicopters (and British Apache as well) do not communicate through Link-16. The requirement is identified for a long time by army aviation, which experimented since 2008 a Link-16-equipped Cougar and expect to field this Link-16 on their command helicopters in the coming years³⁷.

Despite these issues, the MOD keep nevertheless the objective to complete the initial capability of the technical socle in 2012, then to develop in 2013 a “capability level-1” of CIS in the framework of both the SIA program (for Brigade and above level, see the last section of this study) and SCORPION (for battlegroup and below level)³⁸.

The pace of digitization and the dedicated budget at a glance

To date, several brigades have been “NEB-certified” including:

- The 6^{ème} *brigade légère blindé*, in the October 2008 CPX, which trained 1200 men of the brigade, with 600 vehicles (whose 250 ones were digitized)³⁹ ;
- The 3^{ème} *brigade mécanisée* in 2008;
- The 2^{ème} *brigade blindé* in 2009;
- The 1^{ère} *brigade mécanisée* in 2011

These command post exercises aim to certify the procedures and skills of the staff with the chain of command SICF-SIR-SIT. The certification does not mean that the brigade units are fully equipped and trained, especially as the importance of operational deployments in Afghanistan, Lebanon, Ivory Coast and elsewhere hinder significantly the pace and the scope of this training for most brigades and their regiments⁴⁰. The *Loi de programmation militaire 2009-2014* objective is to digitize entirely 5 brigades in 2014 and all Army brigades in 2020⁴¹. From a budget standpoint, the Army dedicated from 2003 to 2008, an average of 190 millions of Euros (2008) to its digitization program encompassing CIS summarized above. Under the current LPM, voted in 2009, this amount is maintained.

SCORPION : A French FCS-equivalent

SCORPION (*Synergie du COntract Renforcé par la Polyvalence et l'InfovalorisatiON*, which could be translated by “synergy of contact operations enhanced by versatility and Information”) is today the main integrating program for the development of the future capabilities of the Army. It may be seen, to some extent, as a French equivalent to the US Army FCS/BCT Modernization program.

³⁷ Captain Benoit Dumail, « État des lieux de la numérisation de l’ALAT (NUMALAT) », *Revue d’information de l’ALAT*, n°20, janvier 2010, pp. 26-30

³⁸ Ministère de la défense, *note détaillée sur le programme SIC Terre*, in François Cornut-Gentille, op cit.

³⁹ « Le 1er REG à la pointe des nouvelles technologies », 22-10-2008, http://1reg.legion-etrangere.com/modules/info_seul.php?id=63&page=1

⁴⁰ Colonel Olivier de Cévin, « L’entraînement du PC numérisé de niveau 3 sur fond d’OPEX régulières », Héraclès, décembre 2009, pp 18-19

⁴¹ Avis n° 548 (2008-2009) de MM. François Trucy, Jean-Pierre Masseret et Charles Guené, fait au nom de la commission des finances, déposé le 8 juillet 2009, *Projet de loi relatif à la programmation militaire pour les années 2009 à 2014 et portant diverses dispositions concernant la défense*, http://www.senat.fr/rap/a08-548/a08-548_mono.html

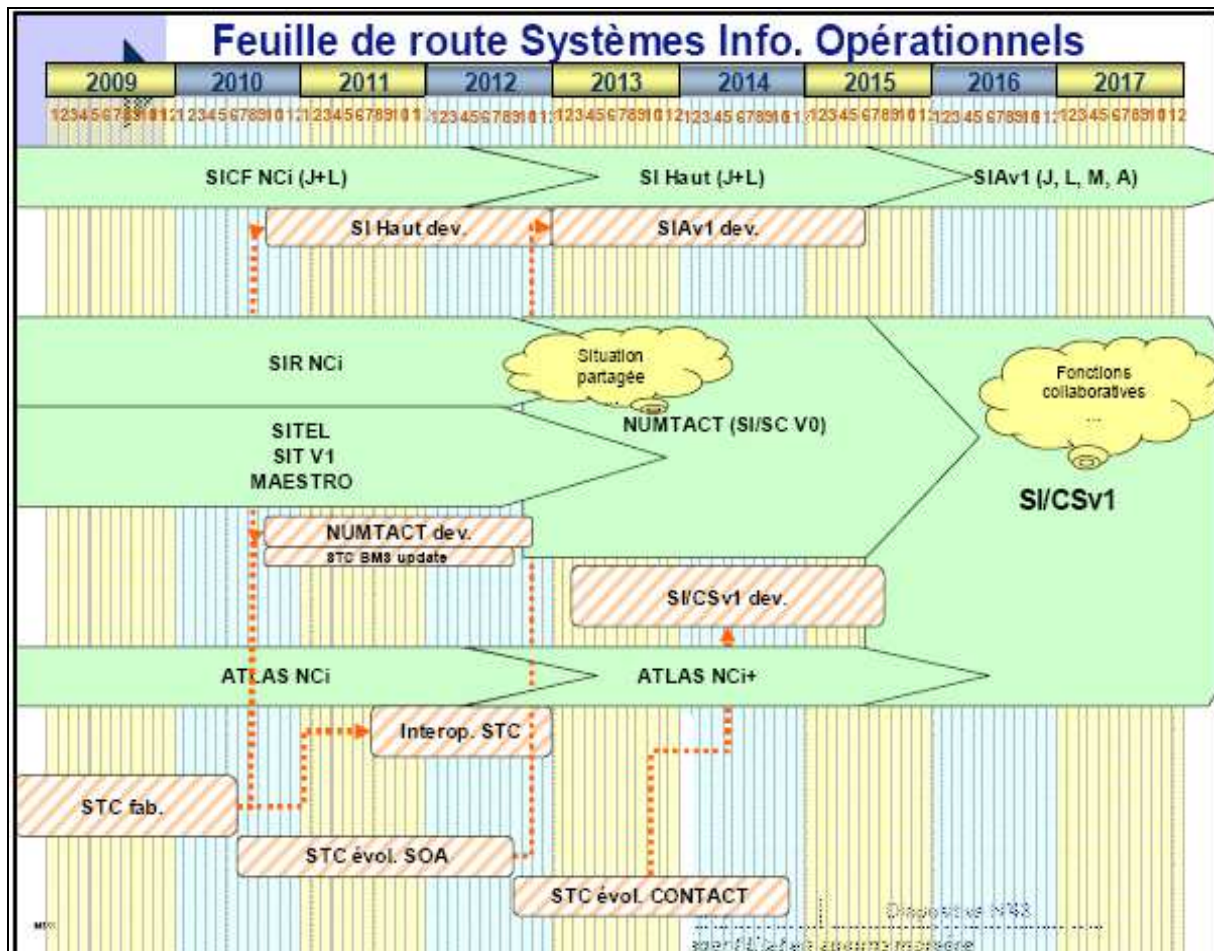
SCORPION is focused at the level of the GTIA. A typical 800-1000 men-strong GTIA includes a command element, the core battalion (either a light or mechanized infantry or armoured cavalry one) or 2-3 of its companies, reinforced by one combined armoured cavalry /mechanized troop (for infantry predominant battlegroup, such as in Afghanistan), one combined artillery battery, one or several engineer platoons, and supported by signal, logistics and medical detachments. It is usually fragmented in company-sized sub-GTIA, organized depending on the mission and commanded by a captain.

SCORPION integrates within one single project management team all previously launched programs related to this GTIA level, and encompasses new ones. It is a very long program, currently articulated in two steps. The first phase extends until 2020. The second one runs in theory over the 2030 decade. In the first phase, regarding vehicles, it includes mainly:

- In the short term, the continuation of the fielding of FELIN soldier systems and the VBCI, already in service in two regiments;
- In the second part of the decade, the upgrade of the 254 Leclerc MBT, the replacement of the current VAB by 977 *véhicules blindés multirôles* (VBMR, multirole armored vehicle) in various versions, and the replacement of AMX-10 RC and Sagaie light wheeled tanks by 72 new *engins blindés de reconnaissance et de combat* (EBRC, armored reconnaissance and combat vehicle). Unmanned tactical air and ground systems are also developed. These new platforms should equip 18 GTIAs in the 2016-2020 timeframe.

A key element of SCORPION is of course the digitization. It leverages directly the lessons gathered through the BOA demonstration. A first intermediate objective in 2014, named NUMTACT, is to enhance the sharing of tactical situation, and all aspect of battle management through the replacement of SIR-SIT-MAESTRO systems by the SI/CS v0 (*système d'information et de combat SCORPION*) (for *numérisation tactique*) based on one single technical socle, as envisioned in the former OE SIC Terre. A second step aims a real step forward in the "*infovalorisation*" by the fielding of SI/CS v1. It will allow collaborative functions such as the management of direct and indirect fires (with the integration of ATLAS functions) and should take benefit of innovations in "*vétronique*" (integration of IS into the new vehicles), GALILEO navigation and positioning. The CONTACT future software radio system will provide the communication linchpin of the system, enhancing dramatically joint and multinational interoperability⁴².

⁴² état-major des armées / état-major de l'armée de Terre, *Scorpion, objectifs opérationnels et capacitaires*, présentation aux industriels, avril 2009, <http://www.ixarm.com/IMG/pdf/Presentation-SCORPION--14-04-2009-Vfinale-c.pdf>



SCORPION information systems roadmap

Source: état-major des armées / état-major de l'armée de Terre, *Scorpion, objectifs opérationnels et capacitaires*, présentation aux industriels, avril 2009
<http://www.ixarm.com/IMG/pdf/Presentation-SCORPION--14-04-2009--Vfinale-c.pdf>

Lessons learned, doctrinal implications and cultural assimilation of the digitization

Concurrently with the development and the fielding of such equipment, Army develops several doctrinal documents. The general principles of the courses of action described in the doctrine of the digitized brigade-level force are the following:

- "Concentration effects and not the forces,
- Increase the tempo of the operation,
- Simultaneous actions rather than successive ones,
- Freedom of action of the combined-arms commander,
- Indirect approach to destroy the coherence of the enemy, not its mass,
- Greater maneuvering capabilities"⁴³.

The doctrine recommends a more distributed and reactive maneuver for offensive as well as for defensive posture. For offensive action for example, "Units equipped with the means to collect tactical intelligence, limit the freedom of action of the opponent and promote, through the airland synergy, the application of effects on contact and in depth. As part of the actions of circumstance, the tactical reserve infiltrates between the various components of the

⁴³ Centre de doctrine d'emploi des forces, *Principes d'emploi de la FOT numérisée de niveau 3*, n°000785/DEF/CDEF/DEO, 8 juillet 2004, p.9

opponent to a designated objective or against which it applies or support the application of effects"⁴⁴.

Beyond tactics, the doctrine deals also with the implementation of digitization. In that regards, two processes gain particular attention.

- The first one, during the planning, is the generation of the digitized force, that means the feeding of the CIS with all required data regarding the force, the enemy, the environment: the establishment of the order of battle, the basic data of each elements of this ORBAT, basic intelligence and terrain products, the technical data for communication systems (i.e. messaging addresses) and so forth.
- The second one, during operations, is the management of the recognized tactical picture, notably the procedures and responsibilities to exchange and validate operational, intelligence and logistics data⁴⁵.

While digitization is not yet completed, years of test and initial implementation allow to draw up already interesting conclusions⁴⁶.

Firstly, most tenets of NCW seem to be confirmed by French officers. A first real test of the SIR has been the exercise executed by the GTIA deployed in the FINUL in Lebanon in July 2009 with obviously good results. A captain testified about the added-value of the system: "*The SIR is interesting because it allows an overview of the deployment of my sections and patrols in progress. In addition, the transmission of orders and reports by the SIR, under the form of an interactive map and pre-formatted messages, can increase their speed and reliability and avoid cluttering the radio network.*"⁴⁷ The digitization reportedly

- Reduces demonstrably the time gap between the evolution of real situation and the perception of this situation by the commander and the risk of obsolescence of orders. It reinforces the responsiveness of the force;
- Reduces the risk of friendly fires;
- According to earlier users, at the end, allow far better collaboration within the staff;
- The 3D tool allow to better characterize the constraints and opportunities of the environment, which were previously apprehended intuitively.

It seems nevertheless that such system are no easy to assimilate. Many problems are hopefully temporary, related to the build-up of the digitization:

- One officer described SIR as a "*tool very long to set up and subjected to numerous malfunctions internally*"⁴⁸;
- The break in the battle management modes between digitized command post and the command of non-digitized dismounted units, what is a very common situation in counterinsurgency and stabilization operations. It should be progressively fixed as the SIT is fielding in unit;
- The time dedicated to find solutions to operate the network which reduces the time available for tactical decision-making;

⁴⁴ ibidem, p.10

⁴⁵ LtCol Pierre Clochard, « L'accompagnement doctrinal de la numérisation de l'espace de bataille », *Doctrine tactique*, n°20, octobre 2010, pp 8-9

⁴⁶ GDI (2S) Michel Klein, Philippe Gros, GCA (2S) Michel Asencio, *op cit*

⁴⁷ Etat-major des armées, « 09/07/09 Sud-liban : exercice de déploiement du déploiement au Sud-Liban », <http://www.defense.gouv.fr/operations/liban/actualites/09-07-09-liban-exercice-de-dploiement-au-sud-liban>

⁴⁸ « Numérisation de l'Espace de Bataille Des technologies, mais surtout des Hommes ! », *blog Armées.com*, Posté le 10/08/2010 à 11:14 <http://www.armees.com/forums/topic/91351-numerisation-de-lespace-de-bataille/>

- It seems that, as the US Army Battle Command System⁴⁹, SICF and SIR software are not well suited to depict and manage knowledge regarding irregular adversary and stabilization operations.

Even if these problems are fixed, some enduring challenges remains.

- These systems require any way a lot of training to gain and maintain skills, regularly hampered by the numerous updates of the systems.
- A typical constraint of such system is the writing of orders and reports through very strictly formatted template, what user tend to bypass by the use of Outlook messaging system.
- The appropriation of SIR by the regiment CP takes one or two years, necessary to manage the risk of information overload and the focalization on the computer. At that time, explained Colonel Dupuy de la Grand Rive, commander of the *1er Régiment de spahis*, “Free from technology, leaders can return to the military decision-making and run the battle. The user is no longer hypnotized by the screen, absorbed in the management of information, it is ready to fight”⁵⁰. Nevertheless, the colonel considers the isolation of the user as a permanent risk to be trained against.
- Other officers consider the gap between the virtual world of the computer-created picture and the real world as an enduring risk.
- Many officers fear also the micro-management, permitted by the digitization, even more coming from strategic level than coming from direct upper echelon, especially as, like their US counterparts again, most of them do not consider that digitization justifies the flattening of the various levels of command, conversely to what envisioned proponent of the NCW. Nevertheless, the digitization allows organizing the operational functions with more flexibility.

As a matter of fact, while SCORPION and FELIN key milestones are well discussed, the digitization per se is no longer a key issue of the debate surrounding the Army. A first cause is the assimilation of systems which are not viewed as revolutionizing the warfare even though their added-value in terms of operational efficiency seems to be widely accepted. The second and more pressing reason is of course the engagement in Afghanistan, which put at the top of the army agenda such concerns as the operational preparation of GTIA to be deployed, urgent material needs to better protect the force against IEDs and other insurgent courses of actions, the counter-rebellion and counterinsurgency doctrine and tactics and so forth.

The French Air Force “network enabled” at the rhythm of allied air forces

The SCCOA

The *système de commandements et de conduite des opérations aériennes* (SCCOA, Air Operations Command and Control system) constitutes the main C² system of the *Armée de l’air*⁵¹.

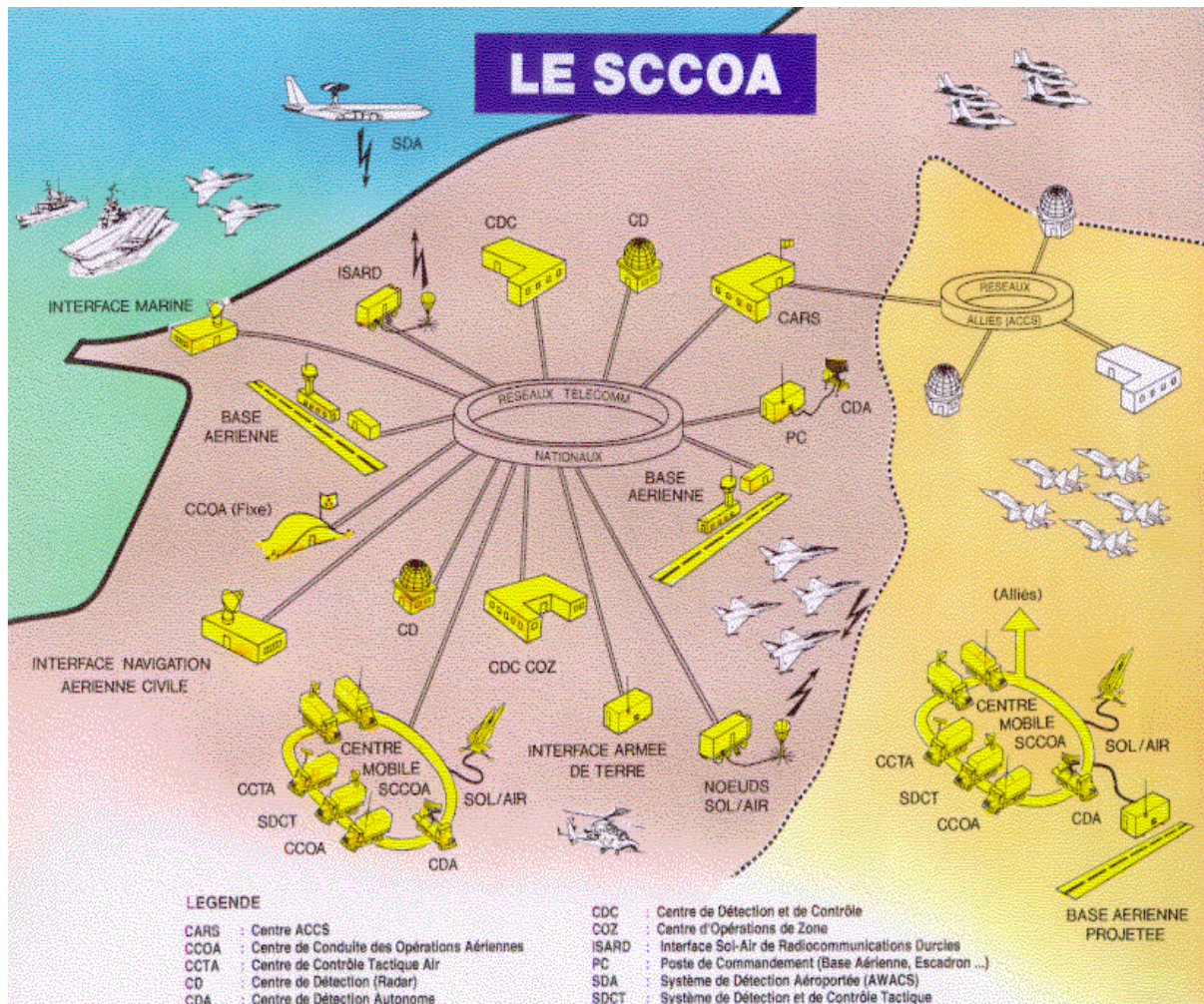
SCCOA integrates several components. It encompasses the fixed elements operating the air defense over France, which were formerly known as STRIDA (*Système de Traitement et de Représentation des Informations de Défense Aérienne*). It includes currently:

⁴⁹ Daniel Gonzales, *Networked Forces in Stability Operations, 101st Airborne Division, 3/2 and 1/25 Stryker Brigades in Northern Iraq*, MG 593, Rand Corporation, 2007, p. xxxi.

⁵⁰ Captain Thomas Dijol, « Liberté d’action », *Terre Information Magazine*, n°215, juin 2010, p.37

⁵¹ for a general overview, DGA, *Le système de commandements et de conduite des opérations aériennes*, mise à jour le 14 juin 2011, <http://www.defense.gouv.fr/dga/equipement/information-communication-espace/le-systeme-de-commandement-et-de-conduite-des-operations-aeriennes-sccoa>

- About one hundred high and medium altitude and approach radars;
- Five Detection and control centers (CDC), which fuse information to detect, classify aircrafts and control the air defense missions. Each CDC is able to handle more than 2000 tracks and 1000 flight plans⁵² ;
- The *Centre national des opérations aériennes* (CNOA, Air operations national center) on Lyon-Mont Verdun 942 Air Base which also hosts the French Joint Force Air Component Command headquarters⁵³;
- The GRAVES system for space surveillance.



Source : adapted from BGen Blandine Vinson-Rouchon, Director Inter-Systems Architecture Service, French MOD, Network Enabled Operations, French Approach, NCOIC AC meeting, 5 juin 2007, slide 20

SCCOA includes also deployable component for theater air operations. This deployable component (C3M, *centre de coordination et de contrôle mobile du SCCOA*), developed during the 2000 decade, has been designed to fulfill the requirements of the NATO air

⁵² SCCOA (Système de Commandement et de Conduite des Opérations Aériennes) (France), Command information systems – Air, Jane's C4I Systems, May 16, 2011, <http://articles.janes.com/articles/Janes-C4I-Systems/SCCOA-Systeme-de-Commandement-et-de-Conduite-des-Operations-Aeriennes-France.html>

⁵³ Ministère de la défense, BA 942, Centre national des opérations aériennes, http://www.ba942.air.defense.gouv.fr/index.php?option=com_content&view=article&id=223&catid=7

component when led by French. It has been therefore certified for NRF 5 in 2005, NRF 12 in 2009 and, recently, for NRF 17 in 2011. It integrates:

- A JFAC HQ and its deployable CAOC allowing to control up to 1000 sorties/day;
- An air coordination center to integrate air support to land and maritime operations;
- An expeditionary air base to control local airfield;
- A deployable CDC ;
- The Joint module of Army MARTHA system allowing to coordinate 3D and notably surface-air systems;
- Other assets such as deployable weather stations or theater surface-air communications center.

The SCCOA is an evolutionary system, launched in 1993. Current modernization activities correspond to the third step of the program started in 2001. These modernizations include upgrades of CDC and radars, the handover of air operations control center from Taverny 921 air base to Lyon-Mont Verdun air base, and more importantly, a limited integration with NATO ACCS and the development of the deployable component. The SCCOA 3rd step has been engineered by MOSS SAS, a dedicated subsidiary company formed by Thalès and EADS, which includes 80 people.

The fourth step, started in 2010, is intended to upgrade the radar coverage of the French territory by the replacement of older radars, to complete the full integration with ACCS to allow a seamless air control of NATO countries airspace and the same integration for air operations. The five CDC will be replaced by three NATO ACCS ARS (Air control center, RAP production center, Sensor fusion post), include the Lyon-Mont Verdun base, which will also host a Combined Air Operations Center with NATO standards. These evolution will allow to fuse one single radar-based air recognize picture. SCCOA step 4 includes also the enhancement to the mobile component and will also fully absorb the management of the once-Army MARTHA 3D coordination system.

The SCCOA program has been funded with

- 171 million Euros in 2009,
- 48 million Euros in 2010 and
- 69 million Euros in 2011 budget.

The tactical level: Link-16 datalink and CAS-related networking

At the tactical level, two important developments allowed recently French Air Force to enter in a more networked environment. The first one is the introduction of the Link-16. The first trial of the Rafale with link-16 took place in 1999. Now the system is fully integrated on Rafale. French Air Force is currently equipping, from 2009 to 2014, its 33 Mirage 2000-5 (dedicated to air defense) and 77 Mirage 2000D (dedicated to interdiction) with MIDS terminal⁵⁴. Link-16 equips as well all French C² platforms : aircrafts such as AWACS, Navy Hawkeye and, from 2015 Maritime Patrol Atlantic-2, ground-based centers such as CDC, ARC and CAOC, and most important naval platforms including the aircraft carrier, the two *Batiments de Projection et de Commandement* (BPC, Command and Projection Ship) Tonnerre-class and Cassard and Horizon-class air defense frigates⁵⁵.

Link-16 constituted “a true revolution”, according to the LtCol Maihol, head of Rafale team in the *Centre des expérimentations aériennes militaires* (CEAM) at Mont-de-Marsan air base in

⁵⁴ Sirpa Air, « Livraison du premier Mirage 2000 doté de la liaison 16 », 12/10/2010, <http://www.defense.gouv.fr/air/breves-migration/livraison-du-premier-mirage-2000-dote-de-la-liaison-16>

⁵⁵ « Liaison 16 », Wikipedia, http://fr.wikipedia.org/wiki/Liaison_16#cite_ref-121

2008. Compared with former operations based on radio exchange, the added-value of Link-16 is reportedly threefold:

- It accelerates considerably the information exchange between AWACS and the combat aircrafts of the patrol;
- The pilot situational awareness is not 'mental' anymore and relies on a comprehensive visualization of all mission-related elements, including targets or tracks beyond the scope of the embarked sensors;
- It allows a dramatic shift in the interoperability with other NATO assets.

Nevertheless, during the implementation of the Link-16, some challenges did emerge. A first one has been the filtering of information. A pilot explained that “ *the more you are remote of combat zone, the more you display Link-16 information. As you are coming closer to the zone, you need to filter the mass of data to keep the most relevant ones*”. This issue has been resolved with new F-3 Rafale standard, in service since 2009⁵⁶.

During current Libya war, French Rafale use the full capabilities of Link-16, including the automated target designation to the *Armement Air Sol Modulaire* (AASM), a new air-surface precision-guided weapon, in the French arsenal since 2008: “ *To illustrate the Rafale’s networking capabilities, one pilot described how the aircraft can receive target coordinates from an AWACS or another aircraft via Link 16. To accept the assignment, the pilot pushes a button, and the coordinates are automatically programmed into the AASM guided bombs, with no further action by the pilot who, once in range (up to 30 nautical miles), again pushes a single button to launch all three – or all six – AASMs to their individual targets. ‘We can fire the AASM against targets abeam or behind us, and can hit up to six in a single pass’ the pilot continues*”⁵⁷.

While the Link-16 is currently widely disseminated, the program remains plagued by an important shortfall. As the LtCol Foussard explained to the 2008 *Livre Blanc* (the French defense review) panel: “ *In Afghanistan, when you are with a Mirage 2000 D, by night, with somebody who roars on the radio that he needs a bomb and that you do not have fuel anymore, you have to refuel and to find with your only night-vision goggles, a tanker which is without any lights and does not speak. [...] This problem is partially bound to the sensors of our planes; these are not equipped with Link 16 yet*”⁵⁸ The French pilot intended to illustrate the slow downgrading of French material, but his example illustrates as well the need to equip all aircrafts involved in the operations, including the tanker, with Link-16. This does not seem to be included in the current program.

Due to current engagement in Afghanistan, the French Air power, like most of its counterparts, made recently tremendous progress in the area of Close Air Support-related networking, the so-called digital CAS. Indeed, in the COIN theatres, more than 85% of the airstrikes are CAS missions coordinated through TACP/JTACs. Nevertheless, it should be reminded that after the initial air strikes in support of Operation Enduring Freedom in the year following the 11/9, the French commitment has been very limited in Afghanistan in terms of air operations. It resumed significantly from 2007. This situation created some discrepancies

⁵⁶ Guillaume Steuer, « Liaison 16 sur Rafale : retours d’expérience », *Air & Cosmos*, n°2114, 29 février 2008, pp. 20-23

⁵⁷ Giovanni de Briganti, “Rafale in Combat: “War for Dummies””, *Defense-aerospace.com*, posted May 31, 2011, <http://www.defense-aerospace.com/articles-view/feature/5/125860/rafale-in-combat%3A-%E2%80%9Cwar-for-dummies%E2%80%9D.html>

⁵⁸ Audition du Lieutenant-Colonel Bruno Foussard, *Livre blanc sur la défense et la sécurité nationale, tome 2, Les débats*, 2008, p.27, http://www.livreblancdefenseetsecurite.gouv.fr/IMG/pdf/livre_blanc_tome2_lesdebats.pdf

with allied air forces since French air force did experience with delay the compelling needs to develop material and procedures adapted to the counterinsurgency context.

To find an immediate solution to this urgent need, the *commandos parachutistes de l'air 10* (CPA 10, special air commandos trained in TACP functions) and the CEAM developed in 2007 on their own experience a COTS solution for digital CAS: the SCARABEE (*Système de Communication Aéroterrestre, de Restitution, d'Acquisition et de Bibliothèque Embarquée Évolutif*). With this system, the pilot and the ground JTAC share the same referenced picture. The latter "dresses" the image with his indications and returns it to the pilot. The referenced image solves the problem of the coordinates, which is useful notably in urban CAS⁵⁹.

But the SCARABEE was plagued with two limitations: it was a unique and "handworked" French system, which competed with the US ROVER (Remotely Operated Video Enhanced Receiver) developed incrementally since 2002 and widely disseminated as the main standard for digital CAS⁶⁰. The SCARABEE was presented as complementary to ROVER, a very sophisticated system allowing to the JTAC to select the best weapon and to perform direct collateral damage estimate but whose video exchange requires more radio discussion and exploit only the airborne pod. The ROVER 5 evolved well to reduce this inconvenient. Nevertheless, from a practical and operational standpoint, the situation was a showstopper for the French system. Indeed, as French Rafale, M 2000D or Super Etendard, as their counterparts of the coalition, support indifferently the ISAF or OEF ground contingents, they have been on several occasion, while engaged on "troop in contact", replaced by other aircrafts which were equipped with ROVER⁶¹. The French Air Force decided therefore to equip its detachment with the latter which is operational on Mirage 2000D since March 2010⁶².

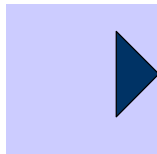
NCO in the French Navy

⁵⁹ Commandant Rémy Martin, « De l'entomologie dans la transmission de données », *Penser les ailes françaises*, Centre des études stratégiques aérospatiales, n°18, pp 140-144

⁶⁰ Olivier Zajec, « Le 'paradigme ROVER' : paradoxes de la standardisation en coalition, *DSI*, n°57, mars 2010, <http://www.dsi-presse.com/?p=1861>

⁶¹ Jean Guisnel, « L'armée de l'air attend avec impatience le système Rover », *Le Point.fr*, 05/08/2009, <http://www.lepoint.fr/archives/article.php/367003>

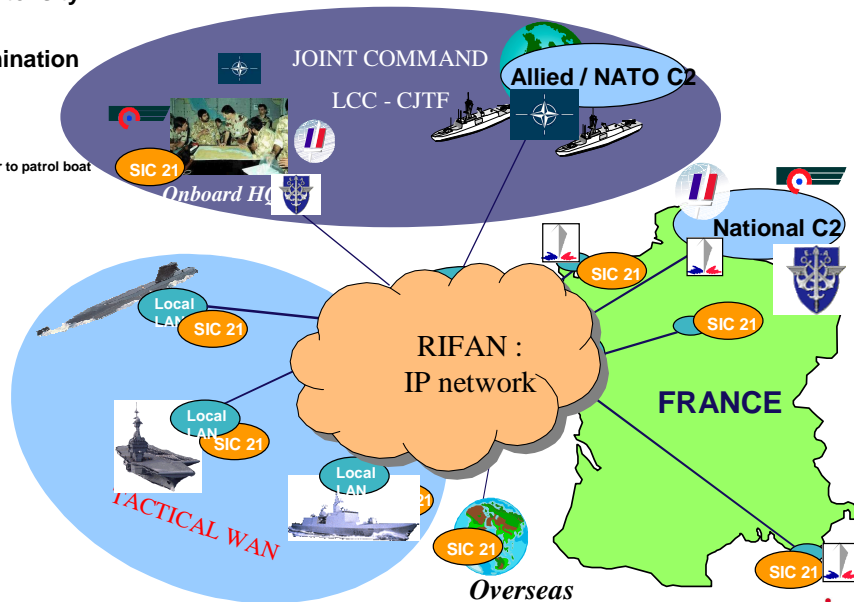
⁶² SIRPA Air, « Le Rover sur les Mirage 2000D en Afghanistan », 12/10/2010, <http://www.defense.gouv.fr/air/breves-migration/le-rover-sur-les-mirage-2000d-en-afghanistan/%28language%29/fre-FR#SearchText=rover#xtcr=1>



SIC21 : the maritime C2 network



- From peacetime to high intensity conflict
- Designed for wide dissemination
- One solution for :
 - All types of platforms
 - ✓ Surface assets : from carrier to patrol boat
 - ✓ Submarines
 - Headquarters
- Main functionalities :
 - E-Mail, workgroup
 - Situation awareness
 - Mission planning
 - Logistics support
 - Intelligence support



NCOIC / AC meeting

Cannes 07/06/2007

Slide n°21



Source : BGen Blandine Vinson-Rouchon, Director Inter-Systems Architecture Service, French MOD, Network Enabled Operations, French Approach, NCOIC AC meeting, 5 juin 2007, slide 21

The main CIS program which allows the digitization of the French Navy is the SIC 21 (*Système d'Information et de Communication du 21e siècle*). After experimentation, SIC 21 entered into initial service in 2007. SIC 21 is funded with 19 millions Euros in the 2011 budget, and is currently equipping 45 land-based and 54 embarked sites. Manufactured by Thalès, SIC 21 uses a service oriented architecture. It hosts the same core of classical applications as Army SICF, ranging from messaging to VTC, chat, and of course applications oriented to plan and conduct naval operations (situational awareness, intelligence, planning tools) and interfaces with other external applications. For example, SIC-21 use LuciadMap geographic information tool suite to generate the shared air and maritime recognized picture, to make terrain analysis supporting mission planning⁶³.

Regarding the communication layer, SIC 21 federate two networks:

- The network ashore linking Navy HQs and other facilities, and
- The RIFAN (*Réseau Intranet des Forces Aéro-Navales*), which provides an IP network for deployed naval forces. RIFAN provides "email, voice over IP, chat, FTP file-exchange, video-conferencing and co-operative mapping to provide ships a common operational picture for shared situational awareness"⁶⁴. A first contract was awarded to Thalès in 2004 for 60 millions Euros to equip the 67 naval platforms of the Navy. EADS Defence & Security, DCNS and Rohde & Schwarz have been awarded

⁶³ SIC 21: The French Navy's new generation C2 system for Network Centric Warfare built by Thales, Luciad, http://www.luciad.com/files/assets/downloads/case_study_dga_sic21.pdf

⁶⁴ Tim Fish, "French Navy to extend intranet system", *Jane's Navy International*, 13 Jan 2009

two contracts in 2008 and 2010 (for a total of 290 millions Euros), for the conception, development, fielding and maintenance of RIFAN 2. RIFAN 2 will equip 116 vessels and 64 aircrafts (Atlantique 2 maritime patrol aircraft, E 2-C Hawkeye et NH90 helicopters)⁶⁵

At the platform level, one key CIS node of the naval networked operations remains the SENIT (*Système d'exploitation navale des informations tactiques*). SENIT integrates and manages all the weapon system of the vessel, links with tactical data network such as Link-16 for air operations and NATO Link-22 for naval operations. Navy have employed nine generations of SENIT, the last one SENIT-9 being used on the BPC.⁶⁶

The 2009 DGA plan for research and technology identified six main stakes for naval warfare, among which “ *The fight over the surface by looking for synergies in the naval force (tenue de situation multi-plate-forme and capacité d’engagement multi-plate-forme)*”⁶⁷.

The *capacité d’engagement multi-plate-forme* (CEMP) represents a very challenging program, at the heart of expected capabilities of NCW. It is the French equivalent for US Navy Cooperative Engagement Capability. The requirement has been expressed in 2001 for a more reactive engagement capability against various kinds of threats including asymmetric ones. But one of the key areas of relevancy for such program is clearly missiles defense.

A first part of this CEMP, the *tenue de situation multi-plate-forme* (TSMP, multi platform situational awareness) has been initiated by the DGA in 2004 and awarded to DCNS. Three architectures have been experimented on 20 scenarios: the development of the tactical situation centralized in one platform, distributed among platforms of the network and hybrid with each platform performing its own situation while one federates and manages the network. The last solution has been selected in 2008, for follow-on development⁶⁸. According to Hervé Fargetton from DGA, who assessed the system, “*The capability offered by DCNS involves, along with conventional Tactical Data Links (TDL), High Data Rate network (HDR) to improve tracks reactivity and continuity. Force units are sharing elementary detections and the DCNS capability is based on distributed multi platform data fusion running on each force unit. Specific technical exchanges on HDR ensure synchronization of the different tactical pictures*”⁶⁹. TSMP are to be completed in 2011. This capability should be implemented in the SETIS combat management system of the new *Frégate Européenne Multi-Missions* (FREMM, multi-missions frigate) class⁷⁰ whose the two first units are to be delivered in 2012 and 2014, on a total of 11 ships.

Finally the DGA included also among priorities “*The fight against submarines and the emergence of the concept of cooperative engagement for the undersea space [...] the*

⁶⁵ « RIFAN 2 - Un nouvel intranet pour les forces aéronavales », *Mer et marines*, 01/09/2009, <http://www.meretmarine.com/article.cfm?id=109195>

⁶⁶ « SENIT : Système d'exploitation navale des informations tactiques », *netmarine.net*, <http://www.netmarine.net/armes/senit/index.htm>

⁶⁷ Délégation générale pour l’armement, *Plan stratégique de recherche & technologie de défense et de sécurité*, 2009, p.57

⁶⁸ Richard Scott, “Sensing in clutter: improving littoral situational awareness”, *Jane’s Navy International*, 23 April 2009.

⁶⁹ Hervé Fargetton, Evaluation of The DCNS Multi Platform Situational Awareness Capability, MAST 2011 Conference Session, Operations & Capabilities (Surface) NNEC, Monday 27th June 2011, <http://www.mastconfex.com/sessions.asp?s=2B>

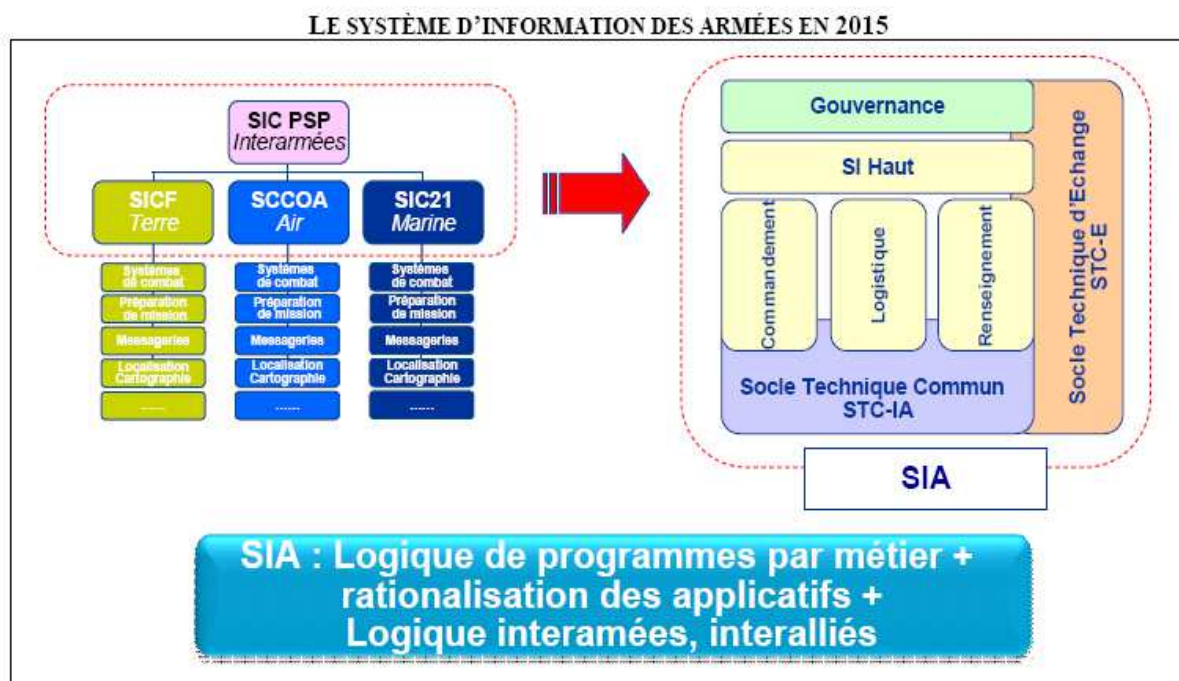
⁷⁰ « FREMM : 11 frégates multi-missions pour la flotte française », 27/10/2008, <http://www.meretmarine.com/article.cfm?id=108646>

cooperation between air (maritime patrol), surface and undersea platforms, by the development of multistatic detection”⁷¹. The upgrade of the acoustic detection system of the maritime patrol aircraft Atlantic 2, which are to begin in 2011 with a first capacity expected in 2014, will include such capability by allowing the delivered sonobuoys to work as a network⁷².

Nevertheless, the full implementation of such cooperative engagement capabilities will probably not be realized until the end of the decade and depends heavily in any way on the shrinking defense budget more than on the technology.

The Joint convergence to SIA: An ambitious target

The defense staff, notably the divisions of joint programs and capabilities coherence developed in the mid of the decade a new approach to reach the end state of the joint interoperability. The whole project is now the *système d’information des armées* (SIA, armed forces information system).



Source : Capgemini.

This approach is the creation of joint *socles techniques communs* (common technical bases, STC) upon which various services corresponding to various functional and operational requirements can develop and exchange data. As stated by the joint objective document : “The referential models, now fragmented, are intended to lead to the formation of a set of common referential called “socle” for orchestrating the convergence of IS (architectural framework, standards and applicable standards, reference models data, ...). This socle

⁷¹ Délégation générale pour l’armement, *Plan stratégique de recherche & technologie de défense et de sécurité*, 2009, p.57

⁷² Vincent Groizeleau, *Patrouille maritime : Le programme de rénovation des Atlantique 2*, 03/02/2010, <http://www.meretmarine.com/article.cfm?id=112321>

*should, at the horizon of this document, be compatible with those defined and implemented by our major allies, to ensure the sustainability of our national investment*⁷³.

The approach is incremental:

- A first step is the convergence toward one common joint set of “socles” with interoperable land, air, sea applications;
- At longer term, the optimization of the socle and the “urbanization”, that is the coherent migration of joint functional applications covering all the need.

There are two “socles”:

- The first one (STC-E) deals with the data exchange (wide area and radio communication networks, hardware, protocols, etc.);
- The second one (STC-IA) create the common set of applications for all users (software architecture, messaging, directorate, etc.).

These STC are deployed since September 2010 on three bases per week and should be therefore completed in the end of 2011. This STC will be upgraded as service oriented architecture (SOA) in the 2011-2013 timeframe. This transformation is implemented by the *Direction Interarmées des Réseaux d'Infrastructure et des Systèmes d'Information*, created in 2003, which operates all defense CIS.

The French minister of defense, Hervé Morin, decided in 2010 the launch of conception studies of this SIA. According to the MOD, “*Operationally, the SIA will allow armed forces to have, by 2016, a unique command and control system, with a global networking, a secure and jointly shared picture of the operational situation and greater interoperability, both internally and with our allies.*” The Mod follow the following approach:

- A first step has been, for operations, to take the SICF as the basic joint and land high levels of command information system from FHQ to brigade level;
- This system is beginning in 2011 to migrate onto the STC-IA (“*SI haut*”) ;
- After the evolution of the “socles” toward a SOA, SCCOA and SIC-21 are intended to migrate onto the STC-IA in around 2016, forming the first step of the SIA.

It remains to be seen if this ambitious project will reach the objective within the scheduled 5 years, what should not be taken for granted. On one hand, the approach is limited at the high level of commands. On the other hand, it is challenging because it encompasses the complexity of joint arena with competing service interoperability needs with other land, air or sea allied partners, and may be hindered by the same problems of information sharing between industries experienced before. Some are also questioning about the interoperability between this high level information system and SC/IS for lower tactical echelons.

* * *

⁷³ état-major des armées, *PIA 06-320, Objectif directeur des systèmes d'information opérationnels et de communication*, N° 429/DEF/EMA/DCE/OCO du 24 juillet 2007