THE FRENCH AOC's NEWSLETTER N° 20

October 2003

THE CHAIRMAN'S WORD

Welcome on our “lettre de Guerrelec” 20th issue. This sounds as a real challenge to keep on improving and interesting people – if possible especially decision makers - in such a moving world. So many important events happened during those few last years – even months… A war against terrorism has been fought very far away – in such a remote and improbable place nobody (but Russians) would have thought of it some years before, and France has taken its part as a true and reliable ally. Then an other war took place in the Gulf area – and it looks very different from the ‘91 one – and we were not part of it.

From a military point of view, one of the major learnt lessons might be the tremendous increase of operations tempo, and above all the one of the information/decision loop. Can we still speed it up – or might there be a barrier somewhere – and what would it be ? coalition operations ? joint operations ? …

But in fact, as important as those conflicts are, we can find some other interesting facts which might appear as very important from a strategic perspective. On one hand, for the first time, NATO keystone – its Treaty article V – was

invoked, and in such different circumstances it could have been during Cold War period. On the other hand, European defense policy has made its first real steps – out of conference rooms or training camps. After a first operation led by the European Union in Macedonia, on a long prepared NATO background, some very few months after, EU has been commissioned by the UN Security Council for an emergency out-of-European continent (in Africa lakes region) operation –and so far has managed it as a success. A really new period might be opened – just at a moment when EU is widening, once more.

During all those last operations, which can be fairly high tech or low tech, high intensity or low intensity, widely international or almost national, the importance of information is always increasing. From conceptual schemes to the brutal warfighter needs, information operations have proved that efficient impact – which can surely be still largely increased. What a field for the AOC – for many years and for international debates! I am sure that this 40th convention will be fruitful –and we will be glad to participate or at least heard of it…

Bruno Berthet
Chairman of Guerrelec

début

CYBER ATTACKS :
A CHALLENGE TO OUR NATIONAL DEFENCE

Information warfare: the new defence challenge

On 5 May this year, Jean-Paul Gillyboeuf gave a lecture on the core theme of information warfare as part of a conference organised by Guerrelec at the École Militaire in Paris. The following text is an extract from his talk.

In a speech in late May 1998, President Clinton stated that a large-scale attack against the United States' information infrastructure was one of the three most serious threats facing the country. Although the terrorist attacks of 11 September 2001 drew attention away from this particular form of threat, it has by no means gone away. A country's information infrastructure includes all the communication networks linked to its economy and key institutions. Greater reliance on information technologies, increasingly interconnected and interdependent, gives attackers more and more loopholes to exploit and makes a country’s information infrastructure ever more vulnerable to attack. In addition, information warfare enables attackers to cause considerable damage at relatively low cost. The US Government estimates that the market for listening and surveillance devices is currently worth around one billion dollars.

Waging this new form of warfare involves setting up a command system armed with the most advanced information and communication systems, using trained personnel to operate them, and protecting them from attack. The aim is to weaken or disable the enemy's command structure using electronic warfare, information warfare, physical destruction and psychological operations.

DGA

Attacks on information systems

These can be grouped under four main categories:

- HERF weapons (High Energy Radio Frequency). These are capable of disrupting the normal operation of electronic equipment by directing high-energy radio frequency emissions at it

- EMP/T bombs (Electro Magnetic Pulse Transformer). These use electromagnetic pulses to permanently destroy the electronic components of the enemy's computers and other electronic systems, storage media, power transmission and telephone lines.
- Actions targeting the area surrounding information systems. These pose a threat to both military and civilian systems. The aim is to disable computer systems and destroy data on hard drives and other storage media.
- Computer-based attacks capable of destroying or disrupting the normal operation of hardware and/or software. A successful attack must remain undetectable, so most of the information we have about these attacks is about failed attempts. Military or civilian installations are under this type of attack every days. Little is known about them and there are few reports, mainly because they exploit loopholes causes primarily by human negligence, and reports tend not to reach the high levels of command.

To counter these attacks, the threat must be assessed, an appropriate policy drawn up and the necessary safeguards and coordinated structures put in place. Measures to protect information systems include: encryption and communications security (COMSEC), information security (INFOSEC) and protection against compromising emanations (CE).

France has begun to take the threat of information warfare more seriously. A policy document was drawn up in September 1999, a trust network was made official on 20 April 2000 and a permanent body tasked with surveillance, early warning and response was set up on 13 July 2001. Information and communication system security has become an integral part of quality of service, since it guarantees information availability, integrity and confidentiality. These are the system performance criteria that will need to be measured in the future, and to measure them reliably we will need to develop new ways of assessing risk costs in an environment where new forms of threat are constantly emerging.

Jean-Paul GILLYBOEUF - General Inspector of the Armed Forces

début

THE RISE OF NETWORK-ENABLED OPERATIONS : NEO, born on the web, grown in the battlelab

Current operations underline the paramount importance of information dominance systems, grouped under the C4ISR acronym (Command, Control, Communications, Computing, Intelligence, Surveillance and Reconnaissance). But in this new form of warfare, today's force mix is showing its limitations : stovepiped chains of command, platforms with crushing firepower seeking in vain among civil environment the massive armored formations of the Cold War, and the ever-needed sensors trying to read an elusive enemy's intentions remain low density/high demand assets, operated by few specialists but requested by all players plugged on the digital battlefield.

Networking sensors with shared information and communication and application allows joint military users to assess the benefits of network-enabled operations.

NEC, NCW, NBD, NEO : same fight

New, market-driven technologies of information and communication and their associated organizational breakthroughs (transverse, project-oriented groupware) can significantly enhance agility, situational awareness and cooperation of digitised military forces. Network-enabled C4ISR thus brings about a revolution in warfighting, still referred to under changing acronyms : NEC (Network-Enabled Capabilities), NCW (Network-Centric Warfare), NBD (Network-Based Defense), and the more recent NEO (Network-Enabled Operations), which ironically recalls the cyber-hero from the Matrix trilogy. But the military, scientific community and industry all share the firm belief that this network-driven information infrastructure, more software-defined than hardware-based, offers operational benefits undreamed of a mere 10 years ago. Effect-based operations, selective and verified in real-time granted by information dominance enable the warfighter to reverse the means / target relationship. A desired level of degradation to be inflicted to an adverse force structure now drives the allocation of available resources, or shooters. The network, integrating shooters with sensors and mission applications (ISR, battlefield management) and offering on-demand services (bandwidth, security, self-configuration), thus frees each asset from its owner, releasing it to authorized users who post their requests for surveillance, fire support, situation reports…online.

A typical battlelab showing a common operational picture

But how to smoothly inoculate these technologic, operational and above all organizational innovations into our force structure, our command and our doctrine ?

The command of civil technologies, but also assimilation of transverse, project-based organizations, place the defense industry at the forefront of this transformation process, with. added value from timely used information resting more on services than hardware. An operational capability can therefore be guaranteed independently from legacy platforms, formations or command chains, since all can be recombined to meet the desired end-state. New concept of operations thus prime over matériel choices, or even software choices. For example, surveillance video broadcast from an Army UAV over a datalink can also be obtained from an aircraft reconnaissance pod equipped with a Link 16, or by vehicle, robot or manportable cameras sending JPEG or MPEG imagery over a tactical internet. Such surveillance could even be enriched by MASINT (processing of acoustic, seismic or magnetic signatures), MTI (Moving Target Indicator), SIGINT (radio and radar interception, location and monitoring). Dated, geolocated, cross-cued from a multi-sensor grid, such fusion brings surveillance close to carefully processed intelligence, but in a much shorter timeframe. The commander is then able to clear any shooter within range to engage the recognized target, with the smartest deception attempts denied by this sensor-to-shooter web.

The stakes borne by this complex systems of systems architecture, and above all its compatibility with legacy systems and concepts of operation, arguably lead MoD contracting agencies to develop new relationship in the definition, procurement and fielding of these future capabilities. A three-fold

buyer/user/integrator partnership is thus replacing the former customer-provider relationship. Studies and experimentation are part of the procurement process, in order to deliver first a demonstrator, which will help validate new capabilities and their impact on the current force structure, and then smoothly field these new capabilities while standing by the customer for training, servicing or devising together new concepts of operation. Such demonstrators, or battlelabs, replicate, simulate or emulate future capabilities resulting from collaborative, synchronized employment of networked systems. In this regard, battlelabs form a critical step in the progressive implementation of NEO.

Today, battle laboratories are necessary to explore intelligence fusion as applied for example to strategic conventional strike mission or combat-SAR

The NECanization of NATO

The United States, incorporating Gulf War and Afghanistan findings in a new threat environment still dealt with by a platform-based, hardware-rich force format, have led the way to this transformation which pools together civil and military alike. Although US industry still cling to their profit-making platform

sales, all move to information-based value added, working to promote the necessary modularity and interoperability for distributed resources to enable collaborative exploitation of fused information. The « NECanization » of C4ISR has come of age, and sensor-rich aircraft, command information systems and future soldiers are now devised with a view to networking all of them. By comparison, Europe appears more modest in terms of deployed numbers of ships, aircraft and tanks, and face shrinking national budgets. But the newest platforms already incorporate collaborative employment (multi-mission frigates, Eurofighter), even if a unified European NEO still lies ahead. On the recently-consolidated industrial landscape, large systems integrators, like Thales or EADS, are ready to take the challenge thanks to their advance in the setting up of transverse battlelabs federating sensors, information systems, and platforms delivered by different sister companies to various national military customers. Therefore, the newly-expressed NATO programs (the top-down Airland cooperative sensor-commander-shooter architectures from theater to tactical levels in France, or the bottom-up, system-based Watchkeeper in the UK and Omnibus in Canada), expect a lot from the « batlabs » and similar battle management centers deployed across Europe by C4ISR architects. There lies the key to a smooth birth of tomorrow's operational capabilities, nurtured by sustained interaction between technology and mission requirements.

C4ISR Center

Valéry ROUSSET with Patrick BRUNET

début

THE ROLE OF OPTRONICS IN THEATRE MISSILE DEFENCE

Theatre ballistic missiles are the ideal vehicle for delivering weapons of mass destruction (nuclear, biological, radiological or chemical) over long distances. This threat, which is now a reality, is much more serious than that posed by missiles carrying conventional warheads used in the past. These missiles constitute a global threat, as they can be used both in classic bilateral warfare, as they were during the Iran-Iraq War in the 1980s, and against allied forces deployed in remote theatres of operations, as witnessed during Operation Desert Storm in early 1991. They can also be used to exert political and diplomatic leverage. In this respect, examples include Iraq's use of Scud missiles against Israel during the 1991 Gulf War, China's firing of ballistic missiles into Taiwan's commercial shipping lanes and the North Korean Nodong missile fired into the Sea of Japan. Such actions can prove highly destabilising in the regions concerned.

ASTER missile intercepting a Scud

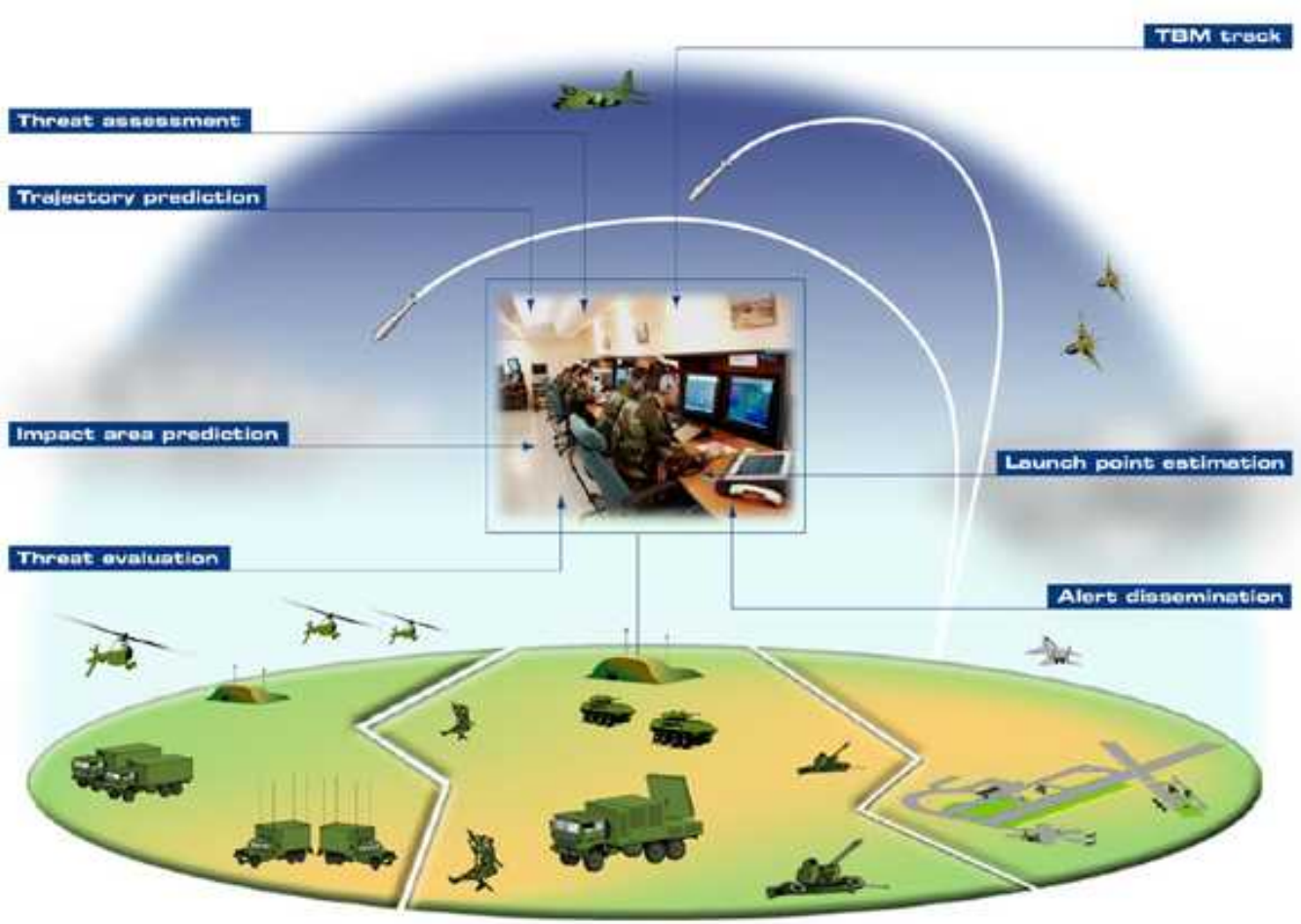
Anti-tactical ballistic missile defence

Theatre ballistic missiles are ballistic missiles with ranges of between 150 and 3,000 kilometres. They use a single re-entry vehicle, usually without terminal guidance, and are not equipped with any sophisticated countermeasures. This puts them

somewhere between artillery projectiles and strategic missiles, which pose different defence problems in terms of detectability, vulnerability, re-entry velocities, stealth, deception and political approach to the threat posed. An effective anti-tactical ballistic missile (ATBM) defence system must fulfil three main functions:

- detect, track and intercept the missile in flight (known as active defence)
- destroy the missile launcher before it can be reloaded and fired again (known as counter-force)
- alert the population centres under threat in time to implement passive defence measures.

To carry out these functions effectively, the missile's launch point, trajectory and impact point must be determined as early as possible. This article investigates the ability of optronic technologies to meet these requirements.



Radar and optronic sensors on aircraft, UAVs or satellites are a decisive element of modern balistic missile defence systems as designated by Thales.

Optronics and launch detection

All ballistic missiles, whether powered by liquid propellant or solid fuel, share one key characteristic: an exhaust plume with an intense infrared signature in bands I (1 to 2 µm) and II (3 to 5 µm), which is visible to optronic sensors from great distances. In addition, the missile type can be identified in certain cases by fine spectral measurements of this infrared signature. Today, optronic sensors of this type are deployed primarily on the American DSP and Russian OKA geostationary satellites. The United States is currently developing a new generation of geostationary satellites under its SBIRS-high programme to provide permanent, global surveillance. These will be complemented by low-earth orbiting satellites, developed under the SBIRS-low programme and capable of more accurate measurements of missile trajectories for the purpose of interception. France has also recognised the need for such a capability, included in its defence spending plan for 2003 to 2006, and has decided to launch a demonstrator programme to assess the performance of a satellite-based system. The demonstrator will be placed in a highly elliptical orbit to test a range of different applications. Launch is scheduled for 2006. It may also be followed by an operational satellite in geostationary orbit.

Airborne optronic detection in the United States

The United States has been heavily involved in developing missile defence systems for several decades. This was illustrated most spectacularly by the Strategic Defense Initiative, better known as the "Star Wars" programme, launched by President Reagan in 1983. President Clinton pursued a more modest missile defence programme in the late 1990s. The Bush administration is currently pursuing plans to implement an ambitious missile defence shield. Alongside these capabilities, designed to detect and locate missiles from space, other solutions involve flying optronic sensors on either crewed aircraft or UAVs.

These solutions are easier to put in place, are less costly than orbiting a constellation of low-earth orbiting satellites, and can work in conjunction with an early warning satellite in geostationary orbit. These aerial platforms would be deployed in the event of a conflict or as a preventive measure during a potential crisis. The United States has been exploring such possibilities for several years. The many successive and overlapping programmes make it difficult to distinguish between research programmes (used to compile signature libraries for example) and operational systems.

The Advanced Hawkeye, set to succeed the Hawkeye 2000, will incorporate a range of new capabilities including a SIRST system (Surveillance InfraRed Search and Track) designed to detect ballistic missile launches at long range. An initial detection test using a ballistic target launched from the White Sands missile range was carried out successfully on 9 July 2001. This new capability, in conjunction with interception technologies currently under development, will enable the US Navy to play a more prominent role in ATBM defence.

The US Air Force's first RC-135 Cobra Ball aircraft—the latest in a long line of strategic intelligence aircraft including the Nancy Rae, Lisa Ann, Rivet Amber, Wanda Bell and Rivet Ball—has long been equipped with optronic detection and tracking sensors and is regularly upgraded. The USAF's other RC-135s are also set to be fitted with such systems, enabling the fleet to play an active role in ATBM defence.

The YAL-1A Airborne Laser is a complete system, in that it combines missile detection and tracking, missile destruction using a high-power chemical laser, and a kill assessment function. The system is capable of destroying missiles shortly after they are launched. This offers clear advantages, including missile debris falling back on the enemy's own territory and low cost of firing. Eight systems, built around Boeing 747-400F freighters, could be operational from 2008. The acquisition function uses six IRST (InfraRed Search and Track) sensors, which offer ranges of several hundred kilometres and are located at various points around the aircraft to ensure 360° coverage. The initial tracking function relies on an ARS (Active Ranging Sensor) located above the cockpit. The ARS incorporates a powerful CO2 laser capable of target telemetry at ranges of several hundred kilometres.

Data fusion

With the advent of network-centric warfare, data from satellites or airborne platforms will be downlinked to central command for subsequent use by all defence systems. The TAWS (Theater Airborne Warning System), for instance, is designed to cross-cue data from the US Air Force's RC-135 Cobra Ball aircraft and DSP satellites. Reports indicate that this system has been operational since December 2002 on two RC-135V/W Rivet Joint aircraft.

Thales and optronic detection

For over ten years, Thales has been developing passive optronic aerial target detection systems for combat aircraft, with the OSF system for the Rafale and the Pirate system for the Eurofighter. The Group has also applied this expertise to the development of specific solutions for detecting and tracking ballistic missiles. A detection system flown on a HALE UAV was showcased at this year's Paris Air Show, with data downlinked to a CAOC (Combined Air Operations Centre) responsible for managing sensors, information systems and allocation of air defence, missile destruction and launcher neutralisation capabilities. Using a HALE (high-altitude, long-endurance) UAV offers a number of clear advantages:

- high-altitude flight, which significantly extends the sensor's visible horizon (500 km at an altitude of 20 km, 350 km at an altitude of 10 km to avoid cloud cover)
- on-station endurance of 24 hours or more (future solar-powered UAVs will be capable of circling the target area almost indefinitely)
- no crew, making it possible to deploy the craft near (or even over) enemy territory without risking human life and/or diplomatic complications (and making it easier to gather signature data during peacetime)
- the ability to locate targets with great accuracy using triangulation measurements from two platforms, thus avoiding the need for heavy, bulky and expensive laser telemetry systems. Other defence contractors have conducted similar studies. Certain sources claim the AIRS sensor (Airborne Infrared Surveillance) flown on the Global Hawk could be a serious rival to the SBIRS-low low-earth orbiting satellites.

Optronic system performance

Latest-generation optronic sensors are capable of detecting a missile during its boost phase at ranges of several hundred kilometres. The high measurement rates offered by CCD sensors operating in band II make it possible to detect with great accuracy the point at which the booster cuts out and (since the duration of the boost phase determines the missile's range) extrapolate its trajectory. If necessary, other sensors operating at longer wavelengths could be used to provide continued tracking of the missile during its post-boost and mid-course (or ballistic) phases. These highly accurate measurements are required by target acquisition and fire control radars, which come into play during the missile's terminal phase, and for counter-force operations. Such accuracies are compatible with current sensor and stabilised surveillance and tracking platform technologies. For a missile tracked at a range of 500 kilometres, for instance, current systems are capable of locating the missile's launch point and impact point to within a few hundred metres.

The Rafale's OSF

The Eurofighter's Pirate IRST

Complementary capabilities

In conclusion, geostationary satellites, airborne platforms, optronic sensors and radar systems are highly complementary and together form an effective defensive network. Although one or more early warning satellites are necessary to provide permanent, global surveillance of potential adversaries, airborne optronic systems are emerging as a vital complement to ensure effective active and passive ATBM defence and counter-force functions. These systems use existing technologies, are available in the short term and offer flexible deployment to counter an evolving and often unpredictable threat. Cooperative development of the airborne component of such a system would provide an opportunity to test European and American resolve to provide an effective response to this threat, which allied nations will almost certainly face in future conflicts.

Jean-Yves Battesti and Patrice Jano, Thales Optronique

Jean-Yves BATTESTI & Patrice JANO, Thales Optronics
début

"General Assemby" of Guerrelec placed under the sign of French EW history

Last June 25th, right after the general assembly of Guerrelec conducted by Bruno Berthet, Lt Col. Pierre-Alain Antoine delivered at the Ecole Militaire a very dense presentation about the history of French EW. An occasion to remind us the role of the listening-in station at the top of the Eiffel Tower during the battle of the Marne in September 1914. Among several achievements (like the SIGINT aircraft SARIGUE NG), Lt Col. Antoine detailed the history of the Huff-Duff radio direction finder which allowed, after industrialization in USA, to detect efficiently German submarines during the Battle of the Atlantic. We encounter again the French EW in the listening-in stations in West German during the Cold War, during the war in Chad in the 80's, and in the self-protection systems to combat aircraft, which had been used in the Gulf and the Balkans. In addition, this very evening, Guerrelec members welcomed very warmly Michael Putté, editor-in-chief of the Journal of Electronic Defense, just coming back from a press trip at the Horizon Squadron of the 1st Combat Helicopter REgiment at Phaslbourg.

Pierre-Alain Antoine, Bruno Berthet (Chairman) and Pierre Roudaut seen congratulating chief-editor Michael Puttré of the JED

in Paris

Philippe Wodka-Gallien
début

French procurement agency (DGA) resumes with advanced prototype planning policy

The last Paris Air Show (June 2003) was another great public opportunity for IGA Yves Gleizes, Chief of the DGA (French procurement agency), to introduce bluntly the new French trends in military research and technology. Part of a global policy of advanced 30 year Defence prospective planning (PP30), this new effort appears in the new French "Loi de Programmation Militaire 2003-2008" which provides extra credits for R&T at the French Minister of Defence, Michèle Alliot-Marie, initiative. Aimed at shaping France's future Defence over the two coming decades, this programme will include EW applications as well as new technology fields open to international co-operations. Among these : space intelligence and electronic gathering (SIGINT) will be DGA's top priorities.

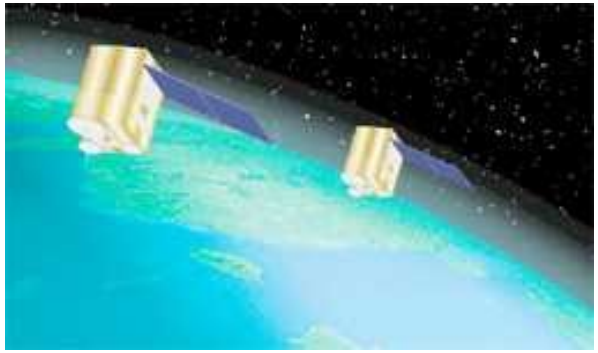
Rafale and UCAVs

Yves Gleizes'hottest announcement was the launch of a French-made UCAV programme supported by a national budget of 300 million euros. Notified to Dassault Aviation and scheduled for 2004, this UCAV prototype is due to perform its maiden flight in 2008. Dassault's Rafale will be as well part of this R&T policy with the development of post 2008 standards for this multirole fifth generation fighterplane earmarked for commissioning (in F3 Standard) this very year. A new Thales RBE2 radar demonstrator (with active array antenna) is also planned. This radar will have enhanced performances, for the same size and energy input, with new functions in air-to-air and air-to-ground modes, including a new SEAD capability, a slavec mode for the new MDBA Meteor BVR missile and all-weather moving ground target high precision acquisition mode.

France in space

Stressing that "France is already a space power who should remain one", Yves Gleizes let François Fayard, Spoti's programme director with DGA, take the floor and introduce to the media the "Essaim" SIGINT mini-satellites demonstrator. Astrium (EADS) will be the industrial prime contractor for this indigenous intelligence gathering project along with Thales for the military payload and CNES and CELAR for the ground segment. This satellite constellation will be placed in orbit by an Ariane launcher at the end of 2004 along with the new Helios II A reconnaissance satellite. "Essaim" is a 4x120 kg-satellite constellation which uses the Myriade platform designed by CNES. It main role will be to elaborate from outerspace a compelte and detailled "electronic order of battle" (EOB) allowing to locate with utmost precision all electromagnetic emissions.

Astrium will be teaming again with Thales and CNES for this endeavour which highly draws from lessons learned with the Cerise (1995) and Clémentine (1999) Sigint space platforms. France will also be very active in the field of early warning satellites as a means to walk along the lines dictated by a fully independent ABM capacity as deemed necessary by Michèle Alliot-Marie and listed as one of the prime topics of the current "Loi de Programmation Militaire". Initial research missions of this satellite will be "to gather pristine and highly-detailled earth ground echoes and balistic missile plume signatures in order to specify the precise performance needs required for this task" as explained by the DGA. The launch of such a warning satellite is hoped for 2010. As an add-on feature to this programme, France also works on the new M3 air defence radar's capacity aimed at dealing with 600 km range balistic missiles.



Last but not least, in order to continue the technological search in reducing transmission rings, the DGA announced that it will launch a new UAV drone programme as well as its very first airborne optical laser link (Liaison Optique Laser Aéroportée). Encompassed in the technological drawn of the Network Centric Warfare, the aim of this endeavour is to achieve, as of 2006, "the validation of a practical optical link between a satellite and an aeroplane, in view of later link applications to a strategic or theatre drone".

Europe is also part of this R&T process (representing for France alone a total of 1,170 billions euros for 2003 - i.e. a thrid of all the European Union's R&T). So far 20% of this R&T sums has been spent with German and UK partners.

Philippe Wodka-Gallien

début

France's "Horizon squadron" : tactical intelligence for theatre operations

The Horizon squadron, part of the French Army's 1st combat helicopter regiment, is unique. Based in Phalsbourg, northeast France, the unit operates four Cougar helicopters equipped with Horizon radars under the operational command of the Army's intelligence brigade. Horizon is a French heliborne surveillance radar system designed to detect moving targets on and close to the ground. The system traces its origins back to 1986, when an SA-330 Puma was fitted with the Orphée radar under the Orchidée programme (Observatoire Radar Cohérent Héliporté d'Investigation des Éléments Ennemis). The Orchidée system was deployed during Operation Desert Storm in 1991, when it demonstrated the clear benefits of a heliborne MTI (Moving Target Indicator) for airland manoeuvres. It was operated by the French Army's Daguet division, attached to the U.S. Army's 18th Airborne Corps and deployed around the Iraqi town of As Salman in January and February 1991, and served as the French counterpart of the American Joint STARS system. During its twenty-four combat sorties, Orchidée provided target data for AH-64 Apache attack helicopters of the US Army and SEAD missions conducted by the US Navy. Based on this experience, the French Ministry of Defence in October 1992 placed an order for the system, now known as Horizon, to equip a Eurocopter AS-532 Mk2 Cougar.

The Fruit RWR systems seen on a Cougar Horizon helicopter

The Horizon system

Designed by Thales Systèmes Aéroportés (formerly Thomson-CSF Detexis) for missions of around three hours, the Horizon system provides real-time data on moving targets at standoff ranges of up to 150 kilometres via a datalink with range capabilities of 100 to 130 kilometres. It can scan an area of 20,000 square kilometres in just 20 seconds and offers high resolution and accurate target positioning by combining inertial navigation technology with GPS. Raw data is downlinked to a ground station for command-and-control, MTI data processing and mission planning (using digital elevation models and propagation models). The processed information is displayed on a map showing the position of the sensor and targets detected (advancing targets in red, retreating targets in blue). The processing system can also discriminate between different target types (light vehicles, helicopters, etc.). The helicopter's self-protection system, installed in early 1999, comprises a Fruit RWR, an MWS-20 Damien from Thales Systèmes Aéroportés and a Saphir chaff/flare dispenser from MBDA.

Horizon-world : the ground station linking the Cougar Horizon helicopter's Target MTI radar antenna (above in Phalsbourg AB) seen during a NATO Strong Resolve exercise in Norway in 2002.

Horizon helicopters had participating at Opera joint exercise in October 2003 in France.

Three-minute OODA loop

Although currently operated by the French Army alone, the Horizon system was designed with joint operations in mind. The system is managed by a Combined Air Operations Centre (CAOC) flexible cell (Flexcell) and controlled from an AWACS aircraft via an encrypted VHF link. This enables Cougar Horizon helicopters to operate in close coordination with UAVs such as the Hunter, as demonstrated during France's ODAX exercises in 2000 and 2001. This is a key capability, as target engagement cannot be authorised on the basis of MTI radar data alone, and a second sensor, typically an imaging sensor, is therefore required. Target tracking in this way makes it possible to implement the short-duration "sensor-to-shooter" loop.

The Horizon system was deployed on 66 missions during Operation Allied Force in Kosovo in 1999, conducted from

Skopje under the command of the CAOC J2 at the Vincenza airbase in Italy. It was also fielded during NATO's Strong Resolve 2002 exercise in Norway. On both occasions it provided extremely reliable data and proved a vital link in the ISTAR intelligence chain. In Norway, the Horizon squadron used two Cougar helicopters and two ground stations to carry out eighteen hours of surveillance in harsh conditions. The Joint STARS aircraft, on the other hand, were unable to fly much of the time due to the bad weather.

The Horizon system, in close coordination with an MLRS artillery battery, shortened the delay between target acquisition and engagement to just three minutes. In addition, Thales Communications' MINDS multi-sensor image interpretation and dissemination system, also fielded during Strong Resolve 2002, demonstrated its full potential in MTI data post-processing. According to operational users, MINDS proved a valuable asset in real-time processing and distribution of surveillance data, both alone and combined with other ISR (Intelligence Surveillance & Reconnaissance) systems. Deployed in conjunction with CAESAR, NATO's SAR/MTI project, the Horizon system enabled allied nations to appreciate the reliability, availability and accuracy of the sensor, judged unanimously to be superior to that of the Joint STARS system. The possible addition of a high-resolution SAR imaging function would further extend the system's capabilities. As the French armed forces operate only a limited number of Horizon systems, it is essential to ensure maximum availability.

Horizon also demonstrated its inherent flexibility, making it possible to deploy the system in more tactical forward operations in support of joint OMG (Operational Manoeuvre Group) formations or onboard amphibious vessels such as the French Navy's landing platform docks or future projection and command vessels. To this end, the Horizon helicopters are being fitted with new laser-gyro inertial navigation systems that can be calibrated with the ships' navigation systems to provide a much more accurate common reference system. Horizon has been deployed during the Opera joint allied exercise, that took place in France in October. Once again, the Horizon squadron demonstrated the advantages of multi-source intelligence, the system's role within integrated intelligence operations, and implementation of short-duration target detection, tracking and acquisition loops. Furthermore, integration of Horizon with the MINDS system, particularly as part of the Joint STARS demonstration, is likely to meet the full expectations of NATO operational staff.

Valéry ROUSSET
début

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Acknowledgements: General François de Goësbriand, commanding officer of ALAT (French Army light aviation), the commanding officer of the first combat helicopter regiment, the commanding officer of the Horizon squadron, its crew, and Pierre Roudaut, secretary-general of Guerrelec.

SELF-PROTECTION OF TIGER HELICOPTER : TWE WORKS !

On July 2nd, the DGA's Direction des Centres d'Essais (Department of Test Centers) gathered the press specializing in defense at its Istres Air Base facilities for a presentation of the main military helicopter programs conducted by Eurocopter. On the agenda : the Tiger, the NH 90 and the EC 725 Cougar for special operations. This occasion enabled the DGA to highlight these machines' innovative features and to report on the testing of the various on-board systems and particularly those involved in electronic warfare.

According to the DGA team working on the Tiger's flight tests, the TWE – Threat Warning Equipment – built-in self-protection system, also intended for the NH 90 TTH (tactical transport version) has successfully completed its third and final test campaign. Conducted on the Tiger for two weeks last April at the Cazaux flight-test center, this campaign was carried out with the help of the EPIGE (Escadron de Programmation et d'Instruction de Guerre Electronique - electronic warfare programming and training squadron) at Mont-de-Marsan AB. Additional testing included launching decoys to ensure they did not hit the rotor. Designed and produced by Thales and EADS, the TWE comprises a radar warning receiver (Thales Airborne Systems France) and a laser detector (EADS), the system being controlled by a CPU (Centralized Processing Unit) produced by TAS. The Tiger's self-protection also includes an EM/IR decoy launcher, MBDA's Saphir M, and in its German version has a passive missile detector, the AN/AAR-60 manufactured by EADS/LFK. The TWE is produced under a €48M contract for 160 systems signed early in 2000 between Eurocopter, and EADS and Thales. Today, 215 Tiger helicopters are to be manufactured for France, 212 for Germany, 22 for Australia following an order received in 2001, and 24 for Spain as announced officially by Madrid, September 5, 2003.

During this meeting, the DGA also shared its vision of the future. By 2020, outwardly helicopters will probably still resemble present ones pretty closely. However, integrated in the French "Bulle Opérationnelle Aéroterrestre" system of systems that will make battlefields go digital and people them with robots, the helicopter will acquire entirely new capabilities in terms of weapons and missions. This will result in a future generation of on-board systems, and explains the DGA's study to demonstrate in-flight

programmability and UAV launching from helicopters.

The PS-1 series Tiger shows its complete TWE self-protection system and twin Mistral missiles.

Philippe WODKA-GALLIEN, Guerrelec

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NEW DEVELOPMENTS IN DECOYS AT LACROIX

In recent months, Lacroix decoy development programs have been especially active resulting in the simultaneous launch of the production of several new products. For airborne applications, following confirmation by NATO specialists of the high effectiveness levels of its spectral flares, Lacroix is investing in production programs at its production facility at Mazères (SW France) for a range of innovative expendables destined for the protection of all types of airborne platform against latest generation IR guided missiles (LIR 111 : 1”x1” for helicopters and transport aircraft ; LIR 121: 1”x2” for F-16 ; LIR 361 : diameter 36mm dedicated to navy aircraft). For naval forces, the latest trials of SEACLAD IR and RF naval countermeasure rounds have confirmed the suitability and credibility of the new decoy concepts employed. The concepts represent a technology step change with respect to current decoy families. Trials were carried out under representative operational conditions in all engagement configurations including the most recent threat generation. For ground forces, following international comparative tests, GALIX multiband obscurant rounds proved to be the best effective system in all operational scenarios.

The GALIX decoys in action on a Leclerc MBT

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UNITED ARAB EMIRATES : the first Mirage 2000-9s have been delivered !

Delivery of the first five Mirage 2000-9 multirole combat two-seaters.
The aircraft were ferried to Al Dhafra AB in the UAE from Istres, France on April 26 by their Emirati crews.

Mirage 2000-9 deliveries to the United Arab Emirates Air Force began some months ago. Mirage 2000-9 is the latest evolution of Mirage 2000 family which includes different aircraft versions operated by eight different countries. Mirage 2000-9 is mainly characterised by highly evoluated avionics, including a new RDY2 radar, a sophisticated EW suit, IMEWS, and a wide range of modern weapons. Major involved companies are Dassault Aviation, MBDA, SNECMA, Thales and Elettronica. This challenging program was developed on request of MG Khaled bin Abulla Mubarak al Buainnain, UAE air force and air defense commander. It was formally launch with global contracts in November 1998, and the first flight of this new version took place in December 2000, at Istres Flight Test Base. Those deliveries concretise a special milestone of this very ambitious program. From now on, the UAE AF has a new outclassing bird in its skies !

Bruno BERTHET, Chairman of Guerrelec
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