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New trends in defence aerospace

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2009 : a great year for aerospace. The Paris Air Show will celebrate its centenary, but we also celebrate the 40th anniversary of *Concorde's* maiden flight, and the first moonwalk. And we should not forget that it was just a century ago that Louis Blériot flew across the Channel for the first time. These anniversaries fall in a difficult context of crisis and a major overhaul of defence in France, set out in the White Paper on defence and national security. Its guidance, stated in the defence spending programme voted this spring, gives the main orientations of defence in the next 15 years, in particular concerning equipment, procurement strategy and industrial policy.

As part of its strategy of geopolitical synergy, *www.diploweb.com* is pleased to present this article, which first appeared in *Défense nationale et sécurité collective*, June 2009, pp. 61-69.

LIKE any other sector, the aircraft industry has been affected by the financial and economic crisis. This crisis has been with us for almost a year. For several months now both passenger and freight traffic have fallen significantly. Reductions in investment seem to be inevitable. And we have to accept that the space industry is also in line for an inexorable and wide-ranging reduction in activity.

In this context the defence share of these activities is also likely to be affected. Even though France itself is making a determined effort to maintain its defence equipment budget, reductions in defence expenditure are becoming increasingly likely in many other countries. This could adversely affect the export of military equipment, so essential for the health of our armaments industry.

The reduction of activity may also adversely affect the civil prospects of certain dual-use military applications ; this is clearly so in the majority of cases in the aerospace industry. Finally, increasing difficulty in finding financing could weaken manufacturers ; this is particularly relevant to all the small and medium-sized firms which play such a vital role in the defence industry, and which represent in certain instances very real sources of technological innovation.

This situation is worrying. There is a real risk that companies which are the repository of key strategic skills may fail. More than ever, as far as the defence industry is concerned, we need to devise (and implement) an investment strategy which is determinist, properly thought through and transparent, which gives visibility in the long term, and which of course takes account of the needs of our armed forces.

The White Paper's guidelines

In the midst of these chaotic times France has the good fortune since last year of possessing a strategic forecast which sets out its orientations over the next 15 years : this is the White Paper on defence and national security. We therefore have a well-defined framework to help us to face up to these difficult times, with a clear course set out for us.

It defines the five strategic functions which defence and security forces must master : these are knowledge and anticipation, prevention, deterrence, protection and intervention.

Among these functions ‘knowledge and anticipation’ is a new strategic function, now defined as a priority. In a world characterised by uncertainty and lack of stability, it is knowledge which is our first line of defence. It will guarantee France’s autonomy of decision-making and allow us to keep the strategic initiative. It must provide our political deciders, our military leaders and those responsible for our internal security with early warning as far ahead of events as possible, in order to clarify the possibilities for future action.

As a logical consequence of this, the importance of aeronautics and space is underlined yet again.

Space

Space, first of all, since it allows us to observe, listen, locate, communicate and transmit information on a global basis, with permanent availability. It allows us to act rapidly and on our own. Space systems have the additional advantage of not being intrusive ; they operate in an open, free environment and liberate us from constraints of sovereignty. Finally, they give us autonomous access worldwide, rapidly and discreetly.

These systems therefore have a major role to play in the knowledge and anticipation business. It is also the case that their advantages, and the way they are used (communications, early warning, surveillance, meteorology, etc.), make them essential components of the other four strategic functions.

The financial effort

It has therefore been decided that a major financial effort should be made by doubling the space budget in the immediate future, compared with the level of funding planned in 2008. This funding will be mainly allocated to the four main military capabilities which are considered to be priorities :

. Until 2016 the effort will be concentrated on observation, whether optical, infrared or radar, and electromagnetic interception.

. The emphasis will then change to communications and early warning.

Observation

The domain of observation plays a key role in our capability of autonomous evaluation and decision-making. Ever since the *Helios* programme was launched in 1995, its optical observation capabilities have been demonstrated as both extremely useful and very effective. This success has led to the procurement of a second generation of satellites : *Helios* IIA has been operational since 2006, and *Helios* IIB is scheduled for launch this year.

Very high resolution instruments working in the visible spectrum are the only means with the precision needed to identify, characterise and evaluate the significance of sensitive

infrastructure and military targets. They are used for reconnaissance missions, which provide some 80 per cent of the intelligence needed for target selection. France is the only European country which has industrial expertise in the domain of very high resolution optics ; this is a considerable advantage.

Nevertheless this technology has its limits, notably when there is cloud cover. It is therefore essential that France has access to radar observation capabilities as well. In the short term, agreements recently signed with Germany and Italy will give us access to their systems (SAR-Lupe and Cosmos-SkyMed).

In the interest of preparing the future and renewing optical and radar capabilities, six European countries joined forces in 2008 (2009 for Italy) in a common European programme called MUSIS, whose first satellite is due for launch in 2015. This programme will have an optical space element developed under French leadership, a space radar component developed by the Germans, an Italian radar module, a wideband optical module developed by Spain and a jointly developed ground segment which controls each of the space components.

This programme is without doubt one of the most symbolic demonstrations of progress in European defence industrial cooperation. For the first time the division of work is not just a production work-sharing agreement but a real sharing of services. This cooperation model is based on the acceptance of a balanced mutual dependence between several countries, itself based on real confidence between each of the partners.

Communications

The communications domain has to meet the challenge of minimising the transitions between the observation, evaluation, decision and action phases. This challenge is rendered more complex by the fact that these phases involve an ever-increasing number of systems, ever-increasing geographical coverage and significant increases in speed and transmission rates.

Bearing in mind the advantages which they offer when faced with these constraints, space systems are naturally being used more and more in operational network architectures, and in particular those which link home-based operational deciders to forces deployed in operational theatres.

These days two different types of communication networks are needed :

. The first are the robust and highly secure networks which underpin the control and use of our nuclear deterrent forces, and guarantee the transmission of the information needed to ensure our autonomy of decision whatever the context of the crisis.

. The second are networks which are less secure but whose needs in terms of speed are continually growing.

As far as secure communications are concerned, France has developed the *Syracuse* system, whose two third-generation satellites (IIIA and IIIB) will meet the military requirement over the next ten years. A further system has been forecast as becoming necessary in the 2012 timeframe, in order to take account of the inevitability that satellite faults will become more frequent over time. France has signed a cooperation agreement with Italy for the joint

development of a satellite called SICRAL 2, which will carry both a French and an Italian payload. Finally, work has started to identify the possibilities of future cooperation for the 'post-*Syracuse* III' period.

By 2012 another Franco-Italian joint programme (ATHENA-FIDUS) will also allow us to field a less secure communications capability. In order to optimise cost of ownership, both countries are studying the possibility of exploiting part of the satellite payload for civil use, for example as a communications means to support rural education projects.

Electromagnetic intelligence

The third domain for which space technology has a strategic use is that of electromagnetic intelligence. This gives us the ability to intercept, locate and exploit both communications intelligence (COMINT) and radar signals (ELINT). Technical feasibility as far as communications are concerned implies the need for significant technological development to take into account the vast number of possible intercept targets, the geographic cover required and the directional properties of the links to be intercepted.

Priority has therefore been given to the interception of electromagnetic signals. This capability allows for the updating of the electromagnetic databases used to programme electronic warfare systems to detect and locate military systems in operational theatres.

To this end France has developed several technology demonstrators, the most recent of which (*Essaim*) was launched in 2004. Its aim is to locate and identify radar transmitters and to create a database for a future operational system. A new demonstrator is due to be operational in 2010, with the aim of exploring higher frequency bands.

All these studies are being carried out so as to have an operational system in 2016 ; France wants this to be a collaborative project. As sensitive national data is involved, the principle will be to share all the basic recorded data, and for each partner country to exploit as it so wishes. Several countries have already indicated their interest in collaborating under such an arrangement.

Early warning

The final domain is that of early warning. It seems likely that by the year 2025 both France and Europe will be within range of ballistic missiles developed by new military powers. The ballistic missile threat also extends to troops deployed on operations overseas.

The White Paper has therefore logically designated anti-missile defence as a priority. Plainly, the budget available makes obvious the impossibility of undertaking all the development which would be necessary. A choice has therefore had to be made. By opting for early warning, France has taken a fundamental step forward : that of being able to understand the reality and the nature of the ballistic threat, and of potential attackers.

In the future a space system and radars will allow us to recognise the threat, to determine the origin of the missile and to broadcast alerts. The DGA [France's armaments agency] and the space industry have anticipated this decision by several years. In February two micro-satellites (SPIRALE) were successfully launched ; they represent the first scientific step towards what

will be the operational space component open to European cooperation in about ten years' time.

Finally, the success of major efforts to be made in these four domains would be in vain, were we not in a position to have autonomous access to space. With *Ariane* V, Europe has a particularly reliable launcher which is well suited to placing satellites into geostationary orbit. Even so, in this domain development cycles are very long. Accordingly the prime minister launched a study at the beginning of 2009 to analyse the changes needed to prepare for the future. This study's conclusions have recently been delivered ; they should allow the Government to make the choices that will (eventually) be shared with our European partners.

Aeronautics

Unmanned aerial vehicles

Let us finish by discussing aviation. The principal (and the most visible) evolution is that of the steadily increasing importance of UAVs. Of course, this does not ignore the significant and continuous technological developments which are such a feature of combat and transport aircraft. Additionally, unmanned combat aircraft are still at the stage of technological development. Nevertheless, operational experience in recent years (in Afghanistan, Lebanon, and Iraq) has demonstrated the importance of surveillance UAVs in the conduct of operations, together with their use by enemy forces.

UAVs fall into three major categories :

. tactical UAVs in direct support of forces in contact ;

. theatre-level UAVs which give continuous intelligence cover to in-theatre commanders ;

. strategic UAVs capable of worldwide operation with an autonomous intelligence-gathering capability, serving strategic commanders.

Tactical UAVs

The main issues with tactical UAVs remain deployment capability, and the availability of suitably adapted sensors. The great opening-out of this market (there are now more than a dozen manufacturers) allows us to think about off-the-shelf acquisitions, with limited further modifications driven by specific requirements.

Direct access to the market has allowed us successively to equip our forces with an initial capability : CL89 (EADS), *Crécerelle* and *Sperwer* (SAGEM), and the small DRAC (EADS). Even so, the capability situation remains fragile.

The White Paper has therefore planned for a reinforcement of tactical UAV capability. Work has started to implement this and to study the solutions available to us : an off-the-shelf buy, the launch of a specific development programme, subscribing to a service, etc. The United Kingdom, for example, has opted to subscribe to a service. Under the terms of the Lydian contract it contracted for the supply of the surveillance services currently being used in Iraq

and Afghanistan.

The acquisition of a national in-house capability is also being looked at. However, the existence of a totally autonomous French capability in the field of tactical aerial vehicles appears to be neither strategically nor financially viable. Furthermore, in order to avoid duplication of skills in the domain of mission systems (in particular), this type of solution cannot be considered in isolation from the existing MALE UAV strategy.

Whatever the final decision, it is important that the security of future supply and operational availability be guaranteed over the long term.

Theatre-level UAVs

The requirements for theatre-level UAVs (MALE-medium altitude, long endurance) reflect those for the commitment of forces ; this means autonomous access to intelligence, either unilateral or shared with European partners, and the guarantee of reliable information.

Satisfying these implies, on the one hand, having access to specifically developed airframes (currently the monopoly of the United States and Israel), and on the other possessing effective sensors and totally reliable communications. The price of entry to this capability (of the order of e1 billion) and the restricted nature of the potential market (10 to 20 machines per country) make international cooperation essential if funding is to be found within national budgets.

The importance of these UAVs, which are tending to become the pivots of theatre-level intelligence, makes it a major industrial challenge to position them in the intelligence market, interfaced with all the other military intelligence systems.

Currently France possesses an initial intermediate capability in the SIDM, produced by EADS and based on an Israeli airframe. The DGA is planning the acquisition of a full operating capability, which will be its successor. At the end of 2007 France, Germany and Italy agreed to cooperate in a risk analysis for the development of a MALE-type (Advanced-UAV) system. Other solutions are also possible. The aim (by the summer of 2009) is to have all the data needed to take a better decision on the way forward for this programme.

Strategic UAVs

Finally, strategic UAVs. These operate at high altitude and have long endurance (HALE), and amplify the capabilities of theatre-level UAVs. The cost of entry to this market, for both the platform and for the sensors, is so large that currently only the United States can afford to develop them. France made the choice in 2004 to abandon an equipment strategy in this domain, as the operational requirement can also be met by the combination of theatre-level UAVs and *Helios* observation satellites.

Conclusion

After more than 50 years of the conquest of space and more than a century of aviation history, aeronautics and space remain passionately interesting. For defence they are strategic domains. The great powers are investing massively, and more and more countries are looking to acquire

space capabilities, and perhaps one day even aerospace industries. All the initiatives we are launching today, as often as we can in cooperation with European partners, demonstrate that France is determined to respond to all the challenges facing it.

The French aviation pioneer Clément Ader said that '. . . military aviation will become all-powerful, and on it will depend the future of nations'. If to this we add the space dimension, this quotation remains more than ever relevant.

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P.-S.

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