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# The Air Force Committed on all Fronts to Protect the French Population

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# The Air Force Committed on all Fronts to Protect the French Population

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# Summary

## *Preparation for the Future—Perspectives*

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# Preface

André LANATA

| General (Air), Chief of the Air Force.

From Operation *Sentinelle* patrols in our streets and our airports to bombing missions against the jihadist sanctuaries in the Levant; from interception of Russian bombers in the approaches to our airspace to tracking terrorist groups in the vast wastes of the Sahel desert; from the measures of reassurance taken when faced with demonstrations of power on the eastern borders of Europe to presence and humanitarian aid overseas; from discreet preparation and maintenance of the airborne element of our nuclear deterrent to support of ground forces in Central Africa—French aviators are today committed on all fronts: they are on the front line of protection of the French population. Aviators are able to seek out the enemy where no others can go, right to his very roots, in depth, everywhere on earth and at less than 24 hours' notice. Right here on our own soil, and over there, far from our borders, the Air Force is essential to the security and sovereignty of France, and to its status as a powerful nation.

In 2015, just 24 hours after the bloody attacks in Paris, its combat aircraft delivered retaliation strikes against Daesh at the heart of its sanctuary in Raqqa. In the Levant, tens of thousands of flying hours, thousands of air strikes and thousands of in-flight refuellings orchestrated around an air campaign have contributed to pushing Daesh back to its rearmost bastions. In pushing back terrorism, the Air Force protects the French population.

In the face of today's considerably deteriorated security situation, aviators are called upon to act simultaneously across the entire range of our operations. For that reason, the Air Force needs to be a model for a fully capable force. The considerable support that the Air Force has given to the export of the Rafale is a further addition to its duties, to which its continuing commitment and support calls constantly upon the full range of our personnel and material resources, degraded by years of reductions and delays in investment. Aviators are most definitely *Unis pour Faire face*, as they need to be under these circumstances. They are committing themselves selflessly to the transformation of their service called for by the *Unis pour Faire face* strategic plan, and are exploring all possible ways of improving efficiency. Yet these unprecedented efforts are no longer enough: our material is

wearing out—our men, too. The Air Force has to acquire again the assets needed to maintain this level of operational commitment in the longer term.

In real terms, that means more people and combat aircraft, which together constitute the spearhead of our internal and external operations. We also need to fill a number of capability gaps—in-flight refuelling, ISR and tactical and strategic mobility. Given that our partners and adversaries are expanding and modernising their air and anti-air arsenals, we have to modernise our aircraft, too, particularly in view of the renewal of the airborne component of the deterrent, and we must develop interoperability with our allies and invest in the future air combat system and its connectivity. This is a far more complex task than simply choosing a new aircraft, since a new architecture has to be adopted, which from the beginning of the design stage must integrate the concepts of networking, collaborative combat and the cloud. The American F-35 clearly already incarnates this change of philosophy.

This is not science fiction, but the reality of the challenges facing the Air Force. One hundred years ago the arrival of wings into military circles came up against the same kind of inescapable reality and, it must be said, a certain degree of incredulity. And yet winning air superiority in the skies over Verdun led to a decisive change in the course of the Great War and an irreversible change in the course of all conflicts that have followed. Today, at a time when some like to think that the air superiority we have acquired will last for ever, airspace is becoming the object of growing competition. In view of that, short and long term investment decisions clearly raise questions regarding our continuing credibility… or the relegation of our status. Our fellow citizens and our allies count on us. Our adversaries will not wait for us.

# Feedback from Current Operations—the Realities

*Les Cahiers de la* Revue Défense Nationale

# Feedback on Current use of C2 and a Look at Tomorrow's Needs

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Lieutenant General, Commander of air defence and air operations.

To defeat an adversary demands more than just troops, weapon platforms and munitions. As in the past, winning a war means deciding upon a strategy that is effective across operations in different environments that are today both material and immaterial, on land, in the air, at sea, in cyberspace, in the infosphere and in space.

The major difference from the past is related to the development of digital capabilities that today allow forces in action to devise, plan and conduct operations through having access to a considerable amount of information and at a tempo never before experienced. The Command and Control system—more commonly, C2—has therefore become central to modern conflicts.

Extensive access to information and to the Combat Cloud, full spectrum targeting (*Ciblage large spectre*, CLS), and acceleration of the decision-making cycle are becoming essential keys to victory. Beyond that, weapon systems need to have sufficient reactivity, information and communications systems (*Systèmes d'information et de communication*, SIC) deployed with our forces need to achieve the performance expected of them and there has to be genuine interoperability between our forces at both joint and combined levels. Such are the demands of an effective C2 in order to be at a level to achieve victory today and even more so tomorrow.

## C2 defined

C2, Command and Control, encompasses a number of theories, assets and means of management of large, complex systems, particularly in the field of military operations. It covers the strategic, the operational and the tactical and, with regard to C2 air, it is constituted of centres of IT material which ensure the collection and treatment of information that is pertinent to decision making and to the application of procedures for the design and conduct of the action that will lead to the desired objective being achieved.(1)

(1) C2 is the tool into which all capabilities are incorporated, which sets them in action and makes them work together intelligently to obtain the best effects. A C2 capability allows successful coordination between the various components in liaison with *knowledge* and *anticipation*.

NATO and the US Department of Defense use the acronym C4ISR (Command, Control, Computers and Communication, Intelligence, Surveillance and Reconnaissance) to refer to the entire collection of assets and military processes that is structured and organised in such a manner as to aid the conduct of operations, and their command and control. Currently, the subject of C2 is encompassed within the even broader concept of C4ISTAR, in which 'TAR' means Target Acquisition and Reconnaissance. Feedback from operations has confirmed that targeting is a critical issue in all operations—the air campaign against Iraq in 1991, the lack of suitable targets during *Allied Force* in 1999 and the French desire to manage targets assigned by a coalition being typical examples of the problems encountered.

Looking at it pragmatically, C2 allows the planning, programming and conduct of friendly action while taking into account possible enemy reaction. It is clear that C2 is more than just the formulation of orders: its capability to devise and evaluate the progress of a campaign and its operations, to communicate using effective SIC assets and to analyse threats and the potential enemy is fundamental.

Developments since the early 2000s have seen the formalisation of an approach by effects, and a dichotomy between what is material (wars of attrition using kinetic systems against the adversary's order of battle) and what is immaterial (in particular, electronic warfare, psychological operations and activities to influence civil and/or military populations, for example). This latter dichotomy relates also to targeting with the advent of full spectrum targeting (French: CLS), which is the direct consequence of other concepts such as the 'global approach'.

#### *Evolution of C2 through crises*

In consideration of the air component in particular, one has to take great care in discussion of the development of C2 in crises, based on feedback from several wars and major operations, for several reasons:

- It is always difficult to draw lessons from recent history, since entire chapters of military activity remain hidden from public view for many years. For example, the *Ultra* file, on decryption of the German *Enigma* devices from 1939, was only declassified in 1974.(2) We will probably have to wait several decades before being in a position to understand the real stakes and hidden agendas behind recent operations such as *Allied Force* in 1999, *Enduring Freedom* in 2001 and *Iraqi Freedom* in 2003.

- Air operations often take place within the framework of coalitions directed by the United States, the dominant hyperpower, which does not always reveal its campaign plans or all of its lines of operation.

(2) See *The Ultra Secret* by Colonel Frederick Wintherbotham (1974). That work, and the declassification of the *Ultra-Enigma* file, should have led to a rewrite of all works on Second World War military strategy.

• In recent operations, we have seen a significant increase in the role played by new equipment, special forces (the French COS[3] was created in 1992), cyber warfare (developed since the end of the 2000s) and other influential actions whose precise activity remains confidential and little known outside their immediate environment, and which does not figure in widely published feedback forums.

Nevertheless, the latest conflicts have highlighted recurrent themes such as the importance of targeting and the acceleration of the OODA[4] loop, and the flattening of the command structure: these need to be analysed critically in order to optimise the functioning of our structures.

***On the importance of targeting and acceleration of the OODA loop***

Since the creation of the first JFAC[5] structure by the United States in the Vietnam War, one adopted by NATO only when the NATO Response Force (NRF) was created, the air component has constantly added dynamism to, and speeded up, the loop between observation and action by focusing on the importance of the chosen targets in order to achieve the desired effects.

The 1991 Gulf War was the first sizeable coalition operation in which structures for planning and conduct—JFAC and CAOC[6]—showed themselves to be of importance. Also apparent was the need for joint-level coordination. US planners of the time applied the targeting principles that had been defined by Colonel John Warden and which served as the reference for air component planners: go for rapid achievement of effects, rather than destroying tactical objectives sequentially. It should nevertheless be noted that the vision then of air operations was limited mainly to kinetic destruction effects and that, as far as France is concerned, it was not until the war in Kosovo that greater consideration of targeting led to finite organisational effects, such as the creation of the national targeting centre (*Centre national de ciblage*, CNC) in 2000 – a full ten years later. Targeting is performed on a traditional three-point plan: obtain the right effect, while avoiding fratricide and collateral damage.

The time factor has always been key for those who take the decisions. The war in Kosovo demonstrated this factor by initially demonstrating the importance of the national control function and the systematic analysis of networks. In a complex political and operational environment, it is essential to have to hand capabilities for identification, time sensitive targeting (TST) and precision weapons in order for collateral damage to be limited. Despite its overwhelming technological

(3) *Commandement des opérations spéciales* (Special operations command).
(4) Observation, orientation, decision, action.
(5) Joint Forces Air Component.
(6) Combined Air Operations Center.

superiority, a permanent cloud of sensors over Federal Republic of Yugoslavia (FRY) and a vast number of SEAD[7] assets (Shrike, ALARM and HARM missiles), the coalition had to accept that it was incapable of destroying all the ground-to-air assets of the FRY, in particular the 20-or-so SAM-6 *Gainful* batteries. It is vital to disseminate intelligence to the effectors (the troops and weapons systems) much more quickly. In other words, to reduce the age of the information. From 1999, NATO began a considerable amount of work on the sensor to effector cycle, also known as the sensor to shooter loop.

Recent conflicts have highlighted the importance of drones on these matters. The long-term presence of sensors and the capability to react in a short space of time, particularly with armed drones (as in Afghanistan), have contributed significantly to speeding up the OODA loop. This development also allows the air commander to play a major role in the operational command, where he can propose new strategies for the decision makers to consider. With the development of satellite capabilities, the collection, exploitation and dissemination of intelligence becomes a major issue in the game and shows US supremacy with its intelligence units working mainly on reach-back in Molesworth (UK), Ramstein (Germany) and in the USA.

#### *A flattening of structures (strategic, operational and tactical)*

Associated with the need to reduce information dissemination time in order to optimise military effects, the political and media tempo has increased. Now, deciders at all levels of command seek to verify achievement of the effects they require, particularly the kinetic effects. The ever more intensive use of devices that allow oversight of a situation in real time, such as the FMV[8] fitted in drones, allows them to do this. In current operations, that is leading to a kind of squashing together, a flattening, of the strategic, operational and tactical levels.

CLS is another factor that explains this new situation. Each field of action, whether cyber, influence or some other, is often dealt with independently, with coordination of action performed at the strategic or operational level. The delegation of decision-making to the tactical level is therefore no longer of importance.

Furthermore, the development of operations with a dominant factor, (say, air, ground, naval or special forces) puts the relevant component on the operational level, no longer delegating it to the tactical level. Such situations can lead to confusion between the different levels of command by dragging the operational level into consideration of tactical issues, thus adversely affecting its role, in turn leading to difficulty in synchronising effects and in defining missions, interference with the coordination cycle or even conduct of matters proper to the tactical domain.

(7) Suppression of Enemy Air Defence.
(8) Full Motion Video.

More generally, it degrades the added value that each component brings in terms of its expertise and appropriate modes of action.

The flattening of levels can be prejudicial to the functioning of C2. Whilst some highly time-dependent operations, such as a first entry raid, may require highest-level centralised control, it is essential that that concept should not be generalised to cover all operations. Retaining information at the strategic or operational level for the purpose of decision making is not always a criterion of speed because of the enormous amount of information to be analysed and merged. The application of tools that permit decision making to be delegated to the tactical level often guarantees effectiveness and speed, but on the condition that precise rules of engagement have been ordered.

The challenge for the Air Force is to be present at all levels of command, notably at the operational level, as represented by the CPOIA(9), in order to assert and recommend its modes of action.

## Short-term challenges

### *Reactivity and permanence*

C2 structures must be adapted to the political tempo. The first mission conducted by the French Air Force in Operation *Harmattan* in Libya, less than 36 hours after the decision was taken by the President of the Republic, is a perfect illustration of this imperative need for reactivity. It is a key factor that relies mainly upon the permanent nature of our structures. In order to respond to demands, the Air Force draws on experience of past missions related to the permanent security posture and to the deterrent role, on the organisation of air bases both in homeland France and prepositioned elsewhere, and on the maintenance of levels of competence of its personnel.

The alert system in France allows for rapid and determined action in low-level crises in order to avoid a situation from degenerating. And yet some conflicts, such as those in Afghanistan and Kosovo, are long lasting. While the high-intensity part may be rapidly resolved, remaining in place afterwards is necessary. With today's increasing number of crises and constraints on human resources, an effective response to this need for a capability to remain in place in the longer term has been established in a centralised command structure, of which the air component is based in Lyon, which in an emergency can call upon existing centres and on the presence of competent and available personnel. This permanent presence also demands quality intelligence on all the areas in which we might intervene. It is costly, and sharing of capabilities and operational commitment is needed, whether on a joint, combined or broader European level.

(9) *Commandement pour les opérations interarmées* (Joint operations command).

***Powerful and redundant SIC networks***

Information and communication systems (French: SIC) are the keystone to how command structures function, and must be carefully monitored. It is crucial to receive information at a rate commensurate with the tempo of operations, one which is ever-increasing. Only by doing that can we be in a position to exploit greater data rates and ensure that we have the ability to pass orders to all the players concerned.

In achieving this, the range of tools essential to command structures is very broad, but two points are worth highlighting:

- Satellite capability is the cornerstone: areas of operation are getting larger and the information that has to be received or transmitted requires ever-broader band channels. The order of magnitude will be even greater with the arrival of 'big data'.

- Redundancy of networks and systems is a priority. The increasing power of cyberspace obliges us to be able to repel possible enemy attacks.

***Essential interoperability***

All operations, whether conducted nationally or with allies, require perfect coordination not only in their conduct, but also in the planning phases.

On a national level, joint integration is essential. The effectiveness of air component action depends on the coherence of its organisation at all levels of command, as well as within other components, such as ASOC[10], CTA and J3ALI. The concept of ALI[11] as the basis for operational coherence of the air component when supporting essentially joint operations is a major challenge: it has to draw on the compatibility of different communication systems and command networks.

When working with allies, the standardisation developed by NATO structures over a number of years forms the first step to this interoperability but does not suit all scenarios. Bilateral and trilateral discussions have been initiated with the United States and the United Kingdom, with whom we have been routinely associated in recent operations. The essential point is the capability to exchange information and to have access to common databases as do the 'five eyes' countries, Australia, Canada, New Zealand, United Kingdom and the United States. Work undertaken in the Trilateral Strategic Initiative is aiming for this goal.

(10) Air Support Operations Centre.
(11) Air Land Integration.

***ACCS: the first step towards integrated systems***

The ACCS, NATO's Air Command and Control System, is intended to provide the facility to command and conduct operations both on national territory and in foreign theatres of operation, and in both national and multinational frameworks, using a single system. The flexibility in use of consoles, the modularity of operations rooms going from delayed time to real time, and the competence acquired by personnel in using a versatile system will improve reactivity and the ability to adapt the command and control structure for future operations.

***The ability to make different systems talk to each other***

Each country and each component, be it land, sea, air or special forces, develops its own systems as a function of its needs. The future of C2 will to an extent depend upon our ability to get all of its sub-systems to communicate with each other. It is an illusion to think that each organisation will one day be able to use a single system which would therefore be by nature interoperable. On the other hand, taking the step to set in place a system of systems which will ensure the capability for each to exchange information with the other will be the key to the future of C2: for example, an F-35 will be able to exchange data with a Rafale.

***A qualified and sturdy human resource***

In an ever more complex environment, which is imposing ever greater demands on knowledge, and on the volume and capacity for handling data, the challenge with regard to human resources is of significant proportion.

The level of expertise and strength in depth of the competences demanded of our personnel are primordial. C2 skills will depend on our ability to maintain a sufficient number of personnel to support the required reactivity, the permanence and the operation of the wide variety of equipment that have been imposed by recent operations, as will be the case in the future, too. In the end, the human will always be key to the effectiveness of C2 structures. Recruitment, training and retention have to be our priorities to maintain our capability to act in the future.

## The Combat Cloud: the response to a need

The capability to connect to the entire range of effectors with existing equipment and structures, particularly those of fifth generation, in the manner of the considerations initiated by the United States and SACT[(12)], is perhaps the key to relevant development of C2 (C4ISTAR).

(12) Supreme Allied Command Transformation.

As we move from the industrial era to the information era, the concept of a Combat Cloud makes the circulation of information and its control an entirely separate goal. It becomes an instrument of power comparable with the traditional tools of the defence trade—tanks, warships and aircraft, for example. The armed forces have not escaped this evolution, for the capability to control and circulate information is already an essential element for success in modern conflicts. The Combat Cloud aims to go further, to use platforms not only as effectors but also as sensors and data relays in a C2 network that relies on automatic interconnection, transmission of vast quantities of data and the use of highly advanced technologies with minimal human intervention, for the purpose of easing the flow and circulation of data.

And yet the Combat Cloud is not merely some evolution of C2 that exploits a profusion of new technologies; it is above all an overall vision based on a new intellectual approach to operations. As things are today, a military effect is obtained by the coordinated intervention of weapon systems, each operating in the manner for which it was designed. Tomorrow, the Combat Cloud's priority will be to use the power of networks to compensate for the weaknesses of platforms when considered in isolation. Its effectiveness will come from the interaction between weapon systems and in the synergy thus created between the land, sea, air, cyber and space environments, all rendered possible by the ease of communications between those systems, whatever their origins. Weapon systems will benefit from the qualities of other systems to which they will be connected, which will avoid our having to develop self-contained systems capable of doing an entire task, and will favour the establishment of systems specialised in a particular field, which is often less difficult than designing a system that has to do everything well.

In this way, the Combat Cloud's priority will be the free circulation of information, data transfer and connectivity within the future operational command and control systems. This is a profound and sensitive change, yet an essential one.

#### *A cultural change*

Converting theory into practice will be a complex task, the more so given that today's forces are organised and trained to fight against physical threats, a fight in which control of information is but one tool among many others. Our procurement procedures, too, are ill-adapted to an approach in which the main objectives would be connectivity and interoperability of weapon systems: new systems are specified on a case by case basis and their interoperability is still all too often considered as an afterthought.

As sensitive as it might be, this development is essential if we are to face up to tomorrow's security challenges in an era of budgetary constraint. First, because technological advances and the wider availability of modern weapon and telecommunications systems mean our enemies are able to challenge our military

power without having to make the same financial commitments. Then, the downward trend in the number of weapon systems in service in Western forces will only increase, when their procurement cost and development time are taken into account. But also because the search for savings has become the norm, one that obliges the military establishment to approach operations differently and innovatively in order to achieve greater synergy between the different environments. Lastly, because the progress made in artificial intelligence and automation of man-machine interaction offers us the possibility to create a new vision. Yet to be credible, this vision has to be shared jointly between all our forces and on an international level, between our allies.

#### *A common vision*

The Combat Cloud is not focused on a particular weapon system or environment any more than it needs identical methods of access to all systems: the military power of a nation comes from the specific contributions of each of its forces, something the future system of systems is not intended to call into question. That said, the Combat Cloud can only exist if each service invests in the need to share information and wishes to turn it into an entirely separate instrument of power. From that point on, there will be a need for some degree of alignment of strategic visions and investments which, in the end, will lead to more effective joint operations and, it is to be hoped, to achieving the final objective though being entirely integrated.

On an international level, it would be folly to think that strategic visions and procurement processes could be strictly identical. In the United States the idea is put forward that modernisations begun by the major American partners will allow contributions to a collaborative network and will facilitate their integration, but only on the understanding that there be a shared vision of the future system of systems. It is nevertheless worthy of note that, with the exception of Eurofighter Typhoon, all the examples quoted concern equipment developed by US industry. The question therefore arises of the practical implementation of the Combat Cloud and its compatibility with non-US systems.

#### *The conditions for success*

Implementation of the Combat Cloud is not simply a question of changing all our current combat systems but a revision of their operating methods by creating the infrastructure and the bridges needed for connecting them to a network. Thereafter, each platform has to become 'Cloud ready' in terms of communications and information management; in other words each system needs to be able to extract information from the Combat Cloud as well as, in the opposite sense, to feed information to the Cloud. Fifth generation systems have been developed with

this precise aim in mind—that is their main added value—but older systems will have to be adapted.

The Combat Cloud aims to have a unique collaborative architecture into which future combat systems will be able to connect. That implies that the latter be developed as plug and play systems which at the moment is an American technology. Other possibilities have been proposed; they consist in particular of constructing bridges to allow different networks to communicate with each other, or of equipping each foreign combat system with its own converter to allow it to connect to the Combat Cloud.

While a number of US players are in agreement in recognising that networking systems together is the key to future military operational success, too many programmes are still being developed independently and without any overall common vision, which multiplies the number of redundancies yet at the same time multiplies the number of capability gaps.

For the major partners of the United States, such as France, the Combat Cloud raises numerous challenges. Above all we need to share our respective visions for the future system of systems. Thereafter, we need to adapt our way of designing, operating, commanding and controlling our future national combat systems that will connect to a single, overall architecture whilst keeping in mind that they must also be compatible with US networks if we wish to work effectively in a coalition.

Beyond the technical aspects, the skills of personnel will remain the key to ensuring successful implementation of equipment which, even if it is increasingly automated, will only be an aid to decision making. Creativity can lead to the surprise that remains a key factor in armed conflicts. It is more than ever necessary to recruit the soldiers and airmen who will up to the mark for the future C2.

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The structure of the future C2 has to allow for continuous operations whose intensity can vary almost instantaneously in time and space as a function of crises or changes in the geopolitical environment. The key is its capability for adaptation both in the quality and competence of its personnel and in the interoperability across the many players concerned.

In order for France to remain a top rank power, the country and the Air Force in particular, must not be left behind in the matters of doctrine, equipment and acquisition of skills by its personnel. It is therefore particularly necessary to take part in studies of the Combat Cloud that have been initiated by the United States and NATO, through the work of SACT.

New opportunities associated with the development of digital capabilities offer a tremendous occasion to keep the upper hand with respect to our adversaries, in particular in the current period of war against radical Islam that we are all experiencing. If we are able to take control of the vulnerabilities associated with these technologies, our armed forces, and more specifically the Air Force, will remain in the front line in ensuring the protection of the French population.

# French and United States Air Forces: Common Challenges and Viewpoints

Arnaud GARY and Matthew SNYDER

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The year 2017 commemorates the hundredth anniversary of the US entering World War I, a commitment reminiscent of the particular relationship between the American and French people. To mark this event, the *Patrouille de France* just completed a remarkable tour of the United States, 31 years after its last trip across the Atlantic. For the French Air Force (FAF), 2017 is also the occasion to remind us of the strong bond between American and French aviators who, for a little more than a century since the creation of the Lafayette escadrille, have operated alongside one another in many theatres, as evidenced by the current engagements in Africa and the Levant.

The relationship of these two air forces, however, is not limited to current operations. Although they operate on different scales, these two air forces are facing similar challenges – both in the near-term and in planning for the future. Two examples fully illustrate these shared concerns: the organic wear due to the intensity and duration of current operations and the challenges associated with the concept of the future global combat system.

## Two air forces under pressure

For over 15 years, the United States Air Force (USAF) has been actively engaged in all American theatres of operation. These operations have been underway in a period marked by a gradual decrease in resources, simultaneous to a reduction in the number of operational USAF aircraft. These dual pressures, which have progressively grown, have increased attrition of the equipment and the airmen who use them.

USAF contingency engagements have been pursued despite the significant budget cuts which began in 2012. Budget issues have been further exacerbated by the cost portion allocated to new weapons system development and acquisition has

increased[1] as the portion allocated for force readiness has shrunk. The resultant decline in aircraft availability and flying hours has led USAF pilots to fly less when not in deployed operations, thus affecting both readiness and morale.

In order to maintain operational readiness, the USAF also chose to cut costs in a number of other areas. They reduced unit-level support functions, which led to an increase in additional tasks for airmen that kept them from fully focusing on their main mission. These changes have challenged the USAF's ability to conduct all the required activities. "Doing more with less" has understandably put a strain on the quality of life of USAF personnel.

Increased attrition, decreased operational readiness, and additional demands have also had an impact on the morale of airmen. The FAF can relate to these challenges given the similar changes undergone over the concurrent period combined with the French current operations level of commitment.

The numerous successes of US operations abroad have also generated increased deployment preparation and training for the USAF as well as a need for greater contractor resources. Furthermore, commercial airlines in the United States have largely resumed hiring since 2014; the latter offers higher salaries than the USAF and a more stable family life; which has precipitated the departure of many pilots. France is in a similar situation. After two exceptional years of Rafale export sales and the announcement that commercial airline companies will resume hiring, military personnel on active duty are leaving the service.

All these factors have presented both the USAF and FAF with manning challenges, and particularly personnel retention. For instance, the USAF is short today 3,500 maintenance personnel and 1,500 pilots, including 800 fighter pilots (or roughly one quarter of the total required). For its part, the FAF estimates it lacks 7,000 personnel to correct for the excessive loses in recent years in order to fulfill their mission.

Both Chiefs of Staff are well aware of these challenges and are conducting large-scale studies to determine both how to retain personnel and sustain operations in the long-term. For the FAF, it is the second phase of the strategic plan "*Unis pour Faire Face*" of General Lanata. For the USAF, it is one of General Goldfein's priorities to "revitalize the squadrons." The measures implemented will obviously be specific to each nation, but the common fundamental problem is leading the two air forces to exchange "best" practices and likely solutions.

(1) The F-35 is a prime example of the cost of a cutting edge weapon system.

## Two air forces facing the future

If the similarities in near-term challenges have led the two air forces to exchange ideas, it will be the same in planning for the future. With the advent of the Information Age and the digital battlefield, combined with potential new technologies such as artificial intelligence and human-machine learning, it will be necessary to encourage the exchange of our respective ideas because the ability to share information will be essential to operate together efficiently.

Indeed, the future global combat system will have to make the dissemination and exploitation of information a goal in its own right. Our ability to surpass the enemy in the future will come, even more so than today, not from individual weapon systems, but from our ability to acquire and exploit information from the battlefield faster than the enemy.

Technological advances and computing power make information a central part of our lives and have revolutionized the functioning of modern societies. The armed forces have not escaped this evolution. The ability to control and disseminate information is already an essential factor in the success of modern conflict, and will be even more so in future. The concept of Combat Cloud,(2) introduced by General (Ret) Deptula in the United States, proposes to go further. Combat Cloud will utilize platforms not only as "effectors", but as sensors and relays of a C2 network based on automatic connectivity, large bandwidth capability, and, thanks to more advanced technologies,(3) minimal human intervention which will allow faster processing and dissemination of information.

But this concept is not simply an evolution of C2 exploiting a new technology. It is above all a vision based on a new approach to operations. At present, military effects are achieved through the coordinated operation of weapon systems operating in their designed environment. Tomorrow, C2 systems will prioritize the power of networks to compensate for the weakness of platforms when operating individually. Its effectiveness will be in the interaction and interoperability between weapon systems and the synergy created between land, sea, air, cyber and space assets.

The implementation of Combat Cloud it is not a matter of changing all current combat systems, but of rethinking how they interoperate by creating the infrastructure and gateways necessary for networking. Then, each platform must become "Cloud ready" in terms of communications and information management. In other words, each system must be able to exploit information coming from Combat Cloud and, inversely, each platform must "power the Cloud." The 5th generation systems have been developed for this specific purpose—this is one

(2) The concepts concerning Combat Cloud introduced in this paper were taken from an article written by General Deptula in September 2016, "Evolving Technologies and Warfare in the 21st Century: Introducing the 'Combat Cloud'", *Mitchell Institute Policy Papers*, Vol. 4, 10 p.

(3) This includes artificial intelligence and autonomous learning systems.

of their defining attributes. The real challenge for 4th generation platforms is that these legacy systems will have to be adapted.

The future global combat system will need to propose a unique collaborative architecture to which combat systems will connect. It will be necessary to rethink the way systems are designed. Instead of first building cars and then designing the road on which they will run, it will be necessary first to build the network and only then think about the systems that will operate therein. Moving from the theoretical to practical will be difficult. The traditional US and French procurement processes are poorly suited to this new global approach whose main objectives is weapon system connectivity and interoperability. New system design will need to incorporate interoperable and networking capabilities from the offset.

As challenging as this evolution may be, it is imperative to face the security concerns of tomorrow in a constrained budgetary environment for a number of reasons. First, technological advances and the spread of modern weapons and telecommunications systems allow our enemies to compete with our military capabilities using far fewer financial resources. Second, the trend in the reduction of the total number of weapon systems in Western militaries will continue, given their cost and lengthy developmental timeframe. Finally, advances in artificial intelligence, automation and man-machine interactions offer the military the opportunity to operate differently and to implement new strategies. To be credible, a strategy rooted in information sharing must be shared by both joint and allied forces.

The future global combat system does not target a particular weapon system or environment, nor does it require an identical acquisition process for all systems. The military strength of a nation is determined by the specific contributions of each of its services—which this future system of systems will only enhance. However, such a concept can only exist if each service fully invests into this information sharing and commits to making it a full-fledged weapon system. Therefore, it will require a certain degree of strategic alignment and investment which, ultimately, will allow us to work together in an open architecture environment where our systems interact.

At the international level, it would be illusory to think that strategic vision and acquisition processes will be identical. However, it is in our interest to share our respective views of the future C2 system so that everyone can contribute effectively to future operations. General Lanata and General Goldfein have made this theme a central part of their bilateral discussions, the Multi Domain Command and Control (MDC2) for the USAF and the Future Air Combat System (SCAF) for the FAF. These topics are also the subject of extensive forum discussions, whether as part of the trilateral strategic initiative between the US, France and the UK, as well as with NATO where the concept of Federated Mission Networking was created by the NATO Allied Command Transformation (ACT).

In order to operate in high-intensity and in contested environments, future command and control structures will be characterized by the speed of information flow, which must be shared among allies. These systems will be based on open architecture and secure networks. This is a challenge our air forces face together. By sharing this strategic vision and pursuing these changes, we will ensure the success of our future operations.

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Despite a clear difference in scale, the French and U.S. air forces are faced with similar challenges in dealing with force reconstitution and in developing the future global combat system. Our air forces continue to exchange ideas and foster understanding thanks to the mutual confidence acquired over nearly a century of flying operations. This trust is also maintained through shared training that enables us to work on hardware interoperability and system connectivity. The trilateral *Atlantic Trident* exercise which took place in Virginia in April 2017, involving F-22 Raptor, F-35 Lightning II, Rafale, and Typhoon, is a recent example of collaborating with high-end systems.

This partnership should enable us to find common solutions because we recognize that in the next major conflict we will need to fight alongside one another, as we have so often done over the last 100 years.

# Air Power in the Sahara-Sahel Band

Stéphane MILLE

Brigadier General (Air), deputy general for *Barkhane* force operations.

Operation *Barkhane*, fighting terrorism in the Sahara-Sahel band, is the major French forces operation in terms of the volume of forces deployed and the particularly national nature of that commitment. It covers a land area the size of Europe, in which slightly over 4,000 French soldiers are operating permanently. Whilst of course the *Barkhane* force acknowledges that it cannot be everywhere all the time, is it demonstrating on a daily basis that it can be where it wants, when it wants. The third dimension affords it its qualities of ubiquity, logistic mobility, speed of intervention, concentration of firepower and control of effects commensurate with the extent of the territory. These qualities are essential when faced with a terrorist enemy that is transient, dispersed and organised.

## Barkhane, an operation for the protection of the French people

### *Far from our borders, strong defence of the homeland*

A terrorist threat to the French homeland is nothing new. The many clones of Al-Qaeda, AQIM being one, have threatened France for years, since well before Daesh was formed. AQIM is itself a successor to the Armed Islamic Group (*Groupe islamique armé*, GIA) and of the Salafist Group for Preaching and Combat (*Groupe salafiste pour la prédication et le combat*, GSPC), which have struck France several times: hijack of flight AF8969 in December 1994 and the campaign of attacks from July to October 1995, not to mention the thwarted plans to attack the World Cup in May 1998 and against Strasbourg cathedral in December 2000.

Al-Qaeda in the Islamic Maghreb (AQIM) has in recent years time and again reiterated its intention to strike at France, in particular in April 2013, when one of its leaders, Abu Obeida Yusuf al-Annabi, called upon the Muslims of the world to attack French interests everywhere, and again when AQIM welcomed the attacks of January 2015.

More recently, the Emir of Ansar Dine created the support group for Islam and Muslims, repeating his allegiance to Ayman al-Zawahiri, the head of Al-Qaeda and to the mullah Haibatullah Akhundzada, leader of the Taliban. That

announcement showed the permeability of the armed terrorist groups seen on the ground in the north of Mali, most of which came out of AQIM (Ansar Dine, Al-Mourabitoun, Al-Furqan and the Macina liberation front). Since then their leader, Iyad Ag Ghaly, has published in the press a list of eleven countries, including France, that are considered as enemies.(1)

Although none of the recent attacks on France originated in the Sahel, it does not mean that AQIM does not threaten our territory: quite the opposite. On the other hand, it is probable that military action in the Sahel—Serval in the past, and *Barkhane* today—is preventing AQIM from developing the capability to attack us.

Similarly, the operational pressure that *Barkhane* continues to apply to terrorist groups in the Sahel is depriving them of the ability to establish sanctuaries there, in contrast to what was seen in Iraq, Syria, Libya and Nigeria. That French commitment means also that the flow of foreign would-be combatants to the Sahel can be limited, as can their subsequent return to their countries of origin. The dismantling of the group in the Paris suburb of l'Haÿ-les-Roses from August 2012 bears witness to the reality of the vocation that terrorist groups in the Sahel have been able to inspire in young French people in the past.

Since 2014, the permanent activity of Operation *Barkhane* has constituted the forward defence of French national territory in the war against terrorism.

#### *Protecting significant French interests in the Sahel*

There are over 15,000 French nationals in the Sahara-Sahel band, and more than 65,000 in West Africa in general. Since the formation of AQIM in January 2007, 23 of them have been kidnapped or assassinated, a rate that has thankfully reduced since the start of Operation Serval—it was an average of one every ten weeks in 2010 and 2011.

The Sahel has particular strategic interest for France for its supply of uranium, which is extracted mainly in AREVA's mines in Niger. These sources of supply were attacked in October 2010 and May 2013.

#### *Contributing to regional stability*

All the Africans who are involved with *Barkhane* tell us that in the absence of French military forces, terrorist groups would recover a freedom of action and control over their sanctuaries that we are denying them today. Not only Mali, of course, but also Burkina Faso and Niger, which have already suffered attacks by these groups, would be back in a situation of crisis with risks of contagion across the whole of West and Central Africa.

(1) USA, Germany, France, Netherlands, Sweden, Chad, Guinea, Côte d'Ivoire, Burkina Faso, Senegal and Niger.

Besides that, the fact is that we could hardly be disinterested in the future of these nations which are so close to us geographically and in human terms: 120,000 people of Mali origin live in France, and 100,000 migrants cross Niger every year on their way to Europe.

#### *A tool for influence*

France went into Mali in January 2013. Since then, the operational commitment of French forces has not diminished. That position initially taken, in both time and volume, means *Barkhane* gives France a considerable lever of influence. At a time when the President of the United States is emphasising sharing of the burden between NATO allies, our presence in the Sahel guarantees us unequalled status in the coalition against terrorism.

The legitimacy of our presence also supports our action in the direction of our European partners so that they, too, commit themselves more to Africa, and the Sahel in particular.

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Essential as it is for logistic manoeuvres, the air component is also vital for the gathering of intelligence and in offensive action against terrorists.

### An integrated operation combining air and ground forces

Almost all of the Air Force's capabilities are deployed in the *Barkhane* theatre. Working together there are aircraft for combat, intelligence gathering, transport and in-flight refuelling, together with the drones and helicopters that combine their modes of action with those of army units. Indeed, one of the principal characteristics of the operation is its joint, or integrated, dimension, which applies from the design of missions, through their planning and on to their conduct. The aim of such a force is clearly the effectiveness of its operations and efficient use of assets in an organisation that favours reduced timescales between observation, decision and action. For that, the air component brings all of its expertise and long experience of the short decisional cycle.

Faced with an enemy that is transient, mobile and well trained, *Barkhane* action depends on multi-source, wide and narrow field intelligence assets that intervene before, during and after an operation. Needs are increasing exponentially—for extended area coverage, capability to focus efforts, capability for identification, ability to maintain assets over a long period… and the list goes on. The long-awaited increased numbers of the Reaper fleet is planned for the second half of 2017: it will lead to vastly better capabilities, particularly in fields related to EW. Equally, the arrival in the Air Force of the first light surveillance and reconnaissance aircraft (*Avion léger de surveillance et de reconnaissance*, ALSR), the Beechcraft King Air 350, will further improve operational capabilities. In this

race against time for usable intelligence, machines and sensors are one thing; centralised asset management and information handling capacity are another, albeit just as essential. There again, the Air Force is making significant effort in support of the operation.

The third dimension also brings its qualities of ubiquity, speed of intervention, concentration of firepower and control of effects commensurate with the extent of the territory that are required against terrorist enemies that are transient, dispersed and organised. Day after day the presence of air power shows its relevance by ensuring that everywhere in the Sahara-Sahel region is under three hours away from an air intervention. This capability is important for the ability to seize every advantage to engage well-organised terrorists. It is vital for ensuring reactive support to the armies of Mali, Burkina Faso and Niger when facing the regular attacks from armed terrorist groups. The reactivity and strike power of the air arm guarantee this support mission for partner forces. For Operation *Barkhane* it relies on eight Mirage 2000 shared between the forward air bases of Niamey and N'Djamena, and on the national in-flight refuelling capability, which is both precious and vulnerable since it consists of a single deployed refuelling aircraft.

*Barkhane* cannot be everywhere all the time but through its air component it can quickly be where it wants to be, when it wants to be and deliver then and there the effects required by Comanfor.

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Its deployment at some 4,000 kilometres from mainland France means *Barkhane* poses a permanent logistic challenge.

### A successful operation is unachievable without reliable air-supported logistics

An expeditionary force like *Barkhane* by definition presumes a capability for projection: it requires 20,000 combat personnel to be moved annually from mainland France to the theatre of operation, and thereafter for them to be moved about within the Sahara-Sahel area. Unsurprisingly, these airlift operations are treated as major operations. They involve all the projection assets of the Air Force—the A340 and A310 (*Estérel* squadron), A400M, C-130 Hercules, C-160 Transall and CASA CN-235. Allied support is also essential, in particular that of the United States, Spain and Germany. Occasional support is outsourced as required for the vital needs of the force throughout the year.(2)

Apart from the numbers of aircraft that are needed, the operation itself is sensitive to excessive delays, which can lead to bunching of connecting flights.

(2) Under these arrangements *Barkhane* charters Beech 1900, Mi-8 and An-32 for logistic needs.

It is conducted from two air platforms, the Air Port of Disembarkation (APOD) of N'Djamena for the eastern part of the country, and Niamey for the western part, which means that everywhere in the Sahel can be reached in a reasonable time. The activity at Niamey represents the equivalent of Brive airport in terms of the number of people passing through, and of Nantes or Bordeaux in terms of freight tonnage—quite surprising facts!

When facing an asymmetrical enemy who operates mainly by ambushes and by planting IEDs and land mines on roads, use of the third dimension for logistic matters affords an ability to keep a distance from those threats and also to reduce the ground footprint. Comanfor's declared preference for reducing the frequency and size of convoys, some of which are more than 10 kilometres long, has led among other things to an increase in air deliveries. In the space of a year, air deliveries have almost doubled, the most regular of these being the several tens of tons of food and water parachuted into Kidal, a vital supply point for the force in northern Mali yet one that has no airfield.

The success of the trials with the A400M on makeshift landing strips at the end of 2016 offers some interesting perspectives for the future. The increasing numbers of A400M mean that direct flights from France to the platforms of Tessalit, Timbuktu and Madama can now be considered for deliveries of men and material.

The medical arrangements put in place by the forces' health service depend to a great extent on air assets—helicopters and medically-fitted transport aircraft—for the evacuation of any soldier, sailor or airman on operation and the ability to reach medical reception facilities, should it be necessary, within a certain timescale.

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The Air Force is committing the vast majority of its components to the joint operation in the Sahel, a first line of defence for France and its interests. As for the whole of operation *Barkhane*, it is protecting the French population here, from over there.

It quite clearly represents a worthwhile investment for our security. Apart from the area that has to be covered in tracking the enemy, the main challenge remains the timescale involved, since bringing our partners' armed forces up to the standard required will not be achieved quickly.

The air assets put into action for *Barkhane* are being thoroughly tried through high temperatures and the abrasiveness of the sand, and are being used at a rate that exceeds human and material limits. The lives of our soldiers, the protection of our fellow citizens and the stability of our friendly and partner countries all deserve our investment in the air component, without which this operation could be neither envisaged nor conducted.

# Operations Against Daesh in the Levant

Michel FRIEDLING

Brigadier General (Air), Commander of the French air component in the Levant, August 2016 to February 2017.

France has been committed since September 2014 to the fight against Daesh in the Levant. In November 2015, after the attacks in Paris, our action was extended to Syria. France is an essential player in this decisive struggle to make safe and to free the Iraqi, Syrian and Kurdish populations from the terrible subjections of that barbaric organisation that disregards human life in the name of a deadly ideology. France is the second greatest contributor of air power to this campaign, on about the same level as the United Kingdom, and for two years its aviators have been fighting every day, showing their skills in a particularly complex theatre in which the air power is playing a vital role against a powerful and resilient enemy who is hard to beat.

## A complicated theatre

The number of players, their diversity and their different agendas, the cross-border aspect of the conflict and the nature of the enemy and of Operation *Inherent Resolve*, together with the complexity of its command structures all contribute to the difficulty of this theatre of operations.

In addition to the fight against Daesh we have to take into account the Syrian civil war, in which the regime is fighting all rebel movements including Daesh, and also some groups supported by the United States; the Kurdish question—the YPG (the 'peoples protection units' of the Syrian Democratic Forces) have used the conflict to establish a territorial base in Syria, whilst in Iraq the regional government of Kurdistan has found the fight against Daesh the ideal opportunity for seizing the territories it has claimed since 2004; and the clashes between Shiites and Sunnis, which are a common denominator in several current confrontations in the theatre.

Additionally, several regional powers are playing on ethnic, nationalist and religious squabbles to serve their strategic interests. Add to that the fact that Russia has used the conflict to re-establish a major role on the international stage and is now considered a credible and battle-proven military power, a player of significance in the region and a loyal ally for its partners. The United States is on the contrary

paying the price for having made the wrong political and military decisions after its intervention in 2003 and, despite the immense effort being made, is the weaker for them.

## A complex operation

The coalition Middle East Stabilization Force (MESF) combines 64 countries and two international organisations that have declared Daesh their common enemy. France is one of the twelve nations to conduct air strikes against Daesh and is a member of a more restricted inner circle of countries (United States, United Kingdom, Australia, Belgium and Denmark) that also strike in Iraq and Syria.

OIR is taking place in two countries that each has different partners and applies different rules to the game. Several US commands are involved in the operation, with shared responsibilities, differing cultures and sometimes diverging agendas. The command structure is a consequence of a rare complexity: the battle space is divided between these different commands that conduct their operations under the direction of the operational-level Combined Joint Task Force (CJTF) based in Kuwait, whose job it is to coordinate as best it can the action of each of the players and to try to impose a tempo across the entire Joint Operations Area (JOA). Air activity conducted by the air component, the Combined Forces Air Component Command (CFACC), is the only activity that covers the whole of the theatre.

On the ground, each of the partners, which include the Iraqi government, the autonomous government of Kurdistan and the Syrian Democratic Forces (SDF), has its own vision of operations and remains sovereign regarding the decisions taken at the operational and tactical levels, which adds to the complexity of the task.

OIR aims at methodical destruction of Daesh by a combination of special and conventional actions associated with our partners' manoeuvres on the ground, all supported by lethal and non-lethal airborne action in order to destroy its military potential and to push it back into an increasingly constrained area and in doing so undermine, then defeat its message—remembering that the legitimacy of the 'Islamic state' (IS) is based on control of the territory of its historical caliphate.

## A powerful and resilient enemy, one that is hard to fight

The vast majority of Daesh fighters and leaders are fanatics and ready to die, which makes the organisation particularly hard to fight and beat. It is simply not enough to alter the will of the leaders, a people or an organisation in order to achieve a negotiated settlement or an agreement. The adversary has to be destroyed: there is no other way out of the fight.

Moreover, Daesh had, and to a lesser extent still has considerable financial income from taxes levied on the populations of occupied territories and from the production of crude oil. This has enabled them to pay large contingents of foreign combatants who initially joined their ranks though conviction, but who are retained by paying them salaries ten times higher than those paid to local recruits. It has also meant they can be sure of their equipment and logistic supply, as well as being able to develop highly effective communication capabilities.

From a military point of view, Daesh originally presented an image of a genuine conventional armed force, equipped with heavy weapons taken from the Iraqis—who can forget the columns of tanks in 2014, over which fluttered the organisation's black flags? Hit by the strikes delivered by coalition aircraft, Daesh has gradually changed into a more asymmetric adversary that combines conventional tactics with guerrilla ones such as the use of booby-traps, underground galleries, bullying of people by its fighters and suicide vehicles. Furthermore, it makes widespread use of vehicle-borne improvised explosive devices (VBIED), particularly in Mosul. They constitute the most murderous mode of action, despite the hundreds of them that have been destroyed by the coalition, and they are responsible for the vast majority of Iraqi losses. Daesh also excels in using easily accessible, though customised, off-the-shelf products and technology, such as the light commercial drones widely used for observing the progression of Iraqi forces, for launching military loads and for jamming GPS, frequency hopping and encrypted communications.

Finally here it must be remembered that Daesh has no regard for human life or for the law of armed conflict. The use of human shields is a standard tactic: it denies the civilian population the opportunity to evacuate combat zones and sets up its positions close to, or within population centres, including residential areas, religious establishments, schools and hospitals. Daesh also uses tactics of disguise, such as dressing in Iraqi army uniforms and using ambulances as combat vehicles.

## The Air Power: a decisive role

Action from the air plays a vital role in the Levant. At first, during the rout of the Iraqi forces and when the United States had withdrawn all its ground combat troops, the air power was the only one capable of stopping the rapid expansion of Daesh at the end of 2014 by strikes delivered by US assets based in the region. Thereafter, it enabled Daesh to be weakened, and its military potential to be seriously degraded by a great number of strikes.

Today, the air power is enabling a recovery of territory by ground forces through permanent surveillance, intelligence and support activity, whilst continuing to weaken Daesh throughout the theatre right back into its most remote

sanctuaries by striking at its command capabilities, sources of finance and logistic and military potential, and by constraining its freedom of movement.

***Understanding and knowing***

Air assets dedicated to surveillance and intelligence gathering are operating permanently across the entire theatre. From the extreme north-west of Syria to Baghdad, to Raqqa, Deir ez-Zor and Palmyra; throughout the Euphrates valley (a grey zone where Daesh is still protected from land-based action), in the desert areas and in the valley of the Tigris, there is nowhere where Daesh territory is not permanently observed from the sky. The knowledge this brings enables an analysis of the movements and intentions of the enemy, hence the targets that need to be hit, either by opportunity or by deliberate targeting. To achieve this the theatre is overflown daily by high-altitude ISR(1) assets, by JSTARS or Sentinel ISR aircraft that are multi-spectrum intelligence capable (which covers IMINT,(2) SIGINT(3) and COMINT(4)), and by several dozen armed drones. Combat aircraft fitted with tactical reconnaissance pods complement this effort every day.

***Weakening and destroying the enemy as a system***

The air power allows Daesh's political, economic and military system to be hit throughout the theatre—its sanctuaries included—in order to reduce its capabilities for command and financing, its military and logistic potential and to limit its freedom of movement. The coalition makes over one hundred strikes per month on the Daesh leadership, command centres, communications networks, centres for manufacture and storage of weapons, oil production sites and logistic chains. Numerous sites had already been hit in Iraq in earlier phases of the campaign and strikes are now being concentrated in Syria.

***Supporting recovery of territory***

No ground manoeuvre takes place in the absence of armed drones, combat aircraft or heavy bombers ready to intervene in just a few minutes in support of Iraqi forces or SDF. Over Mosul, and over Raqqa too, the permanent cover by one to three combat aircraft patrols is the fundamental element of this support, in turn assisted by armed drones and, when needed, by attack helicopters. Air support is an operational necessity and is also a condition for maintaining ground forces' fighting spirit. On 20 October 2016, three days after the start of the offensive, the president of the autonomous region of Kurdistan, Masoud Barzani, expressed

(1) Intelligence Surveillance and Reconnaissance.
(2) Image Intelligence.
(3) Signal Intelligence.
(4) Communications Intelligence.

his discontent about what he considered the weakness of air assets supporting his troops. He said that continued pursuit of the offensive by the Peshmergas would be conditional on improved air cover. His words were more of a political posture and a PR exercise for internal Peshmerga consumption, in response to their severe concerns about the resistance they were facing.

## Mosul

Mosul is the biggest urban battle the world has seen since 1945. It started on 17 October 2016, and was preceded by seizing and holding the air base at Qayyarah, a few kilometres to the south, in July and August of that year. That allowed a vital logistic hub to be set up on the base to serve ground operations, which was supplied by continual rotations of C-130 tactical transport aircraft. In the same timescale, Kurdish Peshmergas approached to establish a front line 25 kilometres from the eastern outskirts that enabled assembly points to be set up for the Iraqi troops that were to conduct the offensive along several lines of attack from the north, east and south. Air strikes from August to October 2016 allowed the battle space to be shaped and Daesh defences to be weakened.

After conquering the approaches that led to the liberation of many villages on the Nineveh plains, the battle took place in this city of a million inhabitants, crossed from north to south by the Tigris, which is twice the width of the Seine: the distances involved were considerable. The battle for Mosul can be compared to an offensive to liberate Paris from the west, north and east, starting from a line 25 kilometres from the *Périphérique* (ring road) and passing through the outer Parisian suburban towns of Les Mureaux, Pontoise, Chantilly and Meaux.

The battle space had long been prepared by the enemy, using artificial obstacles in order to channel the progression of Iraqi forces into confrontation zones favourable to him. Much of the infrastructure had been booby-trapped, which added to heavy Iraqi losses. Iraqi security forces lost some 750 dead in combat and 4,000 wounded during the first 100 days during which eastern Mosul was taken, essentially due to widespread use of VBIEDs, and despite the destruction wreaked by coalition aircraft and the cratering of roads aimed at protecting the progression of those forces.

As for air activity, 70 aircraft take off every day, which includes ten armed drones and as many surveillance and reconnaissance aircraft, 30 combat planes and 20 in-flight refuelling tankers. At any moment a dozen armed aircraft (drones and combat planes) are flying over the city, ready to strike. As soon as an incident arises, or when Iraqi forces come under fire, a call is made for air support. The contacts are often at very close quarters and require highly accurate strikes. French aircraft frequently have to fire on enemy combatants just 200 metres away from friendly forces in the centre of Mosul.

Daesh often conducts sizeable and complex attacks, an example being that of 28 December 2016. In the small hours, they launched an attack in a northern sector of the city against the 16th Iraqi Division's positions. A hundred fighters attacked simultaneously along three axes and four mechanical diggers were used to create gaps in the protection merlons of the Iraqi forces. The attack was backed up by nine VBIED and by mortar fire rom over 20 different positions. It was repelled by a massive intervention of coalition aircraft that led to 47 dead and 4 wounded among the assailants.

In the battle of Mosul, nearly three-quarters of all munitions are fired by combat aircraft, which are the preferred launch platform and the one best adapted to the needs for reactivity, coverage and flexibility. B-52 heavy bombers and drones each represent a little over 10 per cent. Pure GPS guidance is used in 60 per cent of cases, while laser guidance alone (not liked by guidance officers in the JTAC) represents less than 10 per of munitions. France is the second largest 'firing' nation, having launched a little under 10 per cent of all munitions from 17 October 2016 to 31 January 2017, during the liberation of eastern Mosul, far fewer than the United States but more than the United Kingdom.

## Seeing, understanding and acting permanently: the keys to success

The nation that leads and gives the tempo is the one that sees and understands, and the one that also possesses a command structure. The capability to gather and handle intelligence in real or delayed time relies on a combination of complementary ISR assets, and on intelligence structures and organisations tailored to the needs of the components and the operational level. Drones fitted with Full Motion Video (FMV) are essential for target handling for deliberate strikes and for dynamic air support, whilst multi-spectrum ISR heavy aircraft (in particular those handling SIGINT and GMTI[5]) are vital for getting information on the enemy and the battlefield, and preparation of deliberate engagements. The number of MQ-1 and MQ-9 medium altitude long endurance (MALE) drones, whilst considerable, is still not enough to satisfy all needs in the theatre.

Although ISR assets bring knowledge and a view of operations in real time, it is the **command structures** (CAOC[6] and in-theatre TAC C2[7] structures) that constitute the nerve centre of military power, air power in particular. In this regard, the CAOC at Al Udeid (in Qatar) is a remarkable machine that uses sensors, networks, capabilities of reach and notable human competences. A tool of that sort needs the high speed, real-time, secure data links that make possible its fluid and

(5) Ground Moving Target Indication.
(6) Combined Air Operations Centre.
(7) Tactical Command and Control.

reactive action. Connectivity is more than ever the key enabler of operations conducted in and from the third dimension.

In second place, **permanence of air power** is a vital condition for operational success. It allows permanent surveillance of the enemy and anticipation of his movements, the ability to constrain them and to strike at him when the opportunity presents itself, with no possibility of his escaping.

The third lesson is that **weight of force** is essential. It comes from the needs for permanence and to cover all of a theatre in support of multiple ground commitments, and remaining able to shape the battle space, hit the enemy's rear and in his sanctuaries. To achieve this, some 150 aircraft take off every day: 20 to 30 armed drones, 10 to 20 surveillance and reconnaissance aircraft, 60 to 70 combat aircraft and 30 to 40 in-flight refuelling tankers. And even that is not enough to respond to the requests of the commands they support, and those of the operational level.

The fourth point is the lack of **in-flight refuelling capability**. Despite the more than thirty tankers that take off every day, daily support for ground operations continues to be limited by the number of tankers available.

### French wings are greatly appreciated, despite some shortcomings

The French contribution to the air campaign is highly significant. The Air Force operates from air base 104 in the United Arab Emirates with six Rafale, and on occasion a C-135FR tanker, and from a forward base in Jordan with six Rafale and an Atlantique 2 maritime patrol aircraft. An E-3F (AWACS) deployed as required in Al Udeid complements these forces, which together require remarkably little manpower in relation to the effect they have. The air group embarked in the aircraft carrier *Charles-de-Gaulle* has participated in operations three times since 2014, bringing additional striking power to each of them. All French aircraft are put under the OPCON of the commander of the OIR air component, the US General commanding US AFCENT[8] forces, who is based in the CAOC at Al Udeid, within which a French detachment exercises national control over their use.

Among our forces, the unquestionable expertise and knowledge of our crews is widely appreciated. Additionally, the many facets of our contribution, with its kinetic assets, ISR, C2 and in-flight refuelling, are particularly welcomed. Our aircraft are capable of operating in Iraq and Syria, and our arrangements are flexible and can be adapted to suit the needs of the coalition and the tempo of operations. Our rules for use are a good example of balance between operational needs and the necessary national control over use of our assets when made available to

(8) Air Force Central Command.

the coalition. All this gives France a particularly important role in the fight against Daesh in the Levant.

Sad to say, the majority of our weaknesses are already well known.

Our refuelling aircraft are antiquated, which brings with it a lack of reliability and a degree of risk that has to be run by their own crews. It is more than ever necessary to accelerate the replacement of the C-135FR by A330 MRTTs and to consider enlarging the refuelling fleet to reflect the reality of combat aircraft commitments and the needs of all military operations, be they allied or national.

On ISR, despite recent efforts France still lacks the assets needed to bear more weight on the analysis and decision-making process as well as in action. We critically lack permanent platforms that cover broad spectra—radar, SIGINT and FMV—of the Sentinel type used by the United Kingdom.

We also lack the armed MALE drones that play an essential role in target development and acquisition, the maintenance of their recognition and in conducting strikes. That capability offers reactivity and permanence, and also a set of effectors that complements the action of combat aircraft. We have to put an end to the nonsensical debate on the ethics of supposed 'robotisation' of air strikes: armed drones remain piloted aircraft commanded at all times by human operators whose sole oddity is that they are not on board, but in another place. That guarantees exactly the same ethical and legal conditions for opening fire as for a manned aircraft.

The Rafale proves its remarkable performance every day in the Levant. Nevertheless, the absence of SATCOM voice and data links is a real handicap throughout the theatre. Moreover, our range of weaponry is not wide enough: we lack 1,000 kilogramme GPS guided bombs in particular—their absence heavily penalises our aircraft in deliberate strike missions with multiple impact points. We also lack suitable munitions with reduced collateral effects for use in urban combat (of the GBU-39 Small Diameter Bomb type): the SBU-54v4 with a BLU-126 body, as carried by the Rafale is only a palliative solution.

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The strike record of the coalition illustrates the diversity and quantity of Daesh assets, as well as the need for permanent and sustainable long-term action in order to achieve tangible effects when faced with an adversary of that kind. Nearly 20,000 strikes have been conducted since the start of OIR, of which about a quarter have been aimed at weakening Daesh as a system and three-quarters to destroying its military potential on the ground and its combat forces. These strikes have meant the destruction of hundreds of elements of infrastructure used by the enemy, over a thousand arms caches, thousands of vehicles of different types, and

hundreds of tanks, artillery pieces and mortars. It has also led to the elimination of several tens of thousands of enemy combatants—coalition estimates are of more than 50,000 eliminated by air strikes. French aircraft have contributed in large measure to this record by striking at over 1,200 targets in Iraq and Syria with more than 2,500 munitions of all types.

Operation *Chammal* (the French contribution to OIR) is different from operations we have seen up to now, and is particularly difficult and complex for the coalition forces. The enemy is more formidable, more resilient, better organised, more dynamic, more asymmetric and more murderous than those we saw in Kosovo, Libya and Afghanistan. He acts by mixing traditional military methods with those that are totally asymmetrical in very wide-ranging combat. The battle is intense, long, dynamic and complicated: it is a reminder that our military action will have to be to be long lasting, and therefore sustainable, to have any effect, and must be accompanied by political vision if it is to achieve a positive and lasting outcome.

It should not let us forget that future air operations could take place in air environments that are challenged by air defence systems and highly effective aircraft of the latest generation. That is without doubt another story for which we have to prepare ourselves while fighting Daesh day after day.

# French Air Force Homeland Operations

Bruno FOUSSARD

Colonel (Air), reader on the 69th session on defence politics at the Institute for higher national defence studies (*Institut des hautes études de défense nationale*, IHEDN).

The media regularly highlight the overseas military operations to which France has been committed for many years, those in coalitions fighting terrorism in Africa and the Levant in particular. This sometimes excessive exposure risks overshadowing the participation of our armed forces in protection and public service missions in France and its overseas territories.

In parallel with the key missions of maintaining a permanent security posture and deterrence that our air forces have been conducting every day for over 50 years, the Air Force employs its aviators on a large range of activities for our citizens and our nation. They do this in collaboration with regional and local authorities, and the activities concerned go from close protection of installations and the population to sustainable development, via support to domestic and civil security forces and youth contact schemes, to name but a few.

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The idea of the Air Force contribution to protecting the population conjures up an image of a fighter plane on alert taking off to intercept some aircraft that could be threatening the national territory. The Permanent posture of air security (*Posture permanente de sûreté aérienne*, PPSA) has been in effect without a break since 1 October 1964, and is today conducted from the National air operations centre (*Centre national des opérations aériennes*, CNOA) on air base 942 at Lyon-Mont-Verdun. It relies on a network of air bases and a range of assets on permanent alert spread uniformly throughout the country. Armed combat aircraft operate from four fighter concentration points, and constitute the most visible part of this component, the guarantor of sovereignty of our airspace. A permanent complementary arrangement for intercept of slow aircraft has four helicopter concentration points. In addition, an AWACS aircraft and an in-flight refuelling tanker are on six-hour alert in support of these forces. A system of airspace surveillance, with its network of radars (currently under modernisation) linked to

a system for command, control and conduct of operations, ensures the coherence and effectiveness of this permanent air component.

These materiel assets operate 24 hours a day, 365 days a year and are manned by highly trained aviators of all specialisations. They guarantee considerable reactivity in the accomplishment of their missions from their air bases. At the heart of the PPSA lie our motivated, experienced and enthusiastic personnel—the nearly 500 pilots, air defence operators, air traffic controllers and mechanics who contribute daily to these essential missions.

Together with this mission, fundamental to our sovereignty, the PPSA saves lives through its contribution to the national rescue arrangements, whose general coordination is entrusted to the Air Force. The related search and rescue missions bring help to aircraft in flight, assets to search for aircraft involved in accidents and assistance to individuals. These missions require more than 400 personnel round the clock, and represent on average some 120 operations annually, mainly in support of civil aircraft.

The PPSA arrangements are augmented as required to ensure protection of special events—for example the *Salon du Bourget*, COP21 and the 14 July parades—by calling on extra assets such as detection and intervention systems, ground-to-air systems, combat aircraft and helicopters. Such requirements for protection increase year on year, particularly when the cloud of terrorism threatens major national events. The Air Force now has to take into account a new threat to national airspace, that of drones, whose use is growing exponentially.

In the face of the terrorist attacks that have struck France in past months, the Air Force's reactive and permanent PPSA arrangements have been called upon. The same night as the attack of 13 November 2015, Air Force assets were used to transport Operation *Sentinelle* troops to Paris—an example of needs in terms of domestic mobility in the case of a major crisis. Other permanent and reactive Air Force capabilities can usefully be made available for protection of the French population and for crisis management in the homeland, such as the PPSA command chain, communication and C2 (command and control) assets and even, if necessary, our medium altitude, long endurance (MALE) drones that are currently intensively used on overseas operations.

The Air Force also plays a key role in conducting public service missions: using the reactivity of its air bases it regularly opens its capabilities to medical agencies for air transport of organs for transplantation and the associated medical teams. Time is a vital factor in this role since, from the removal of the organ to its transplant, all those acting in this lifeline have only a few hours to effect the grafting operation. To do this, ten military air platforms take over from civil airports essentially out of working hours. In 2016, 127 unprogrammed tasks were performed in this organ-transport role.

Along with these missions, every summer aviators support the *Hephaïstos* campaign for the detection of forest fires around the Mediterranean basin and for guaranteeing the safety of the aircraft employed in fighting those fires. This operation enables detection of nearly 200 outbreaks of fire every year—a salutary contribution to protection of our national natural heritage.

Lastly, the Air Force's expertise in the third dimension, supported by its permanent and proven C2 structure, means it can be of instant help to domestic security forces by providing reactive and effective air coordination in crisis situations.

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Aviators of the Air Force also assist on the ground in protecting vital installations and the French population.

The first of these contributions is Operation Cuirasse: it is an operation aimed at protecting the air bases from which aviators conduct their missions. With an increased threat to the homeland, considerable effort has been made on protection of air bases, and this wide-ranging plan involves 2,400 personnel permanently to ensure the continuity of the bases' missions for permanent postures and for their external missions. This action directly supports the protection of the population by guaranteeing the permanence of the air combat system that enables us to keep watch over national airspace and to intervene all day, every day.

When in support of domestic security forces, aviators are in the front line of *Vigipirate* arrangements. They have doubled their participation in Operation *Sentinelle* that has been in operation since January 2015. A hundred and ten aviators are on daily patrol in the civilian airports of Bordeaux, Orly and Nice, to ward off any terrorist attack. From Nice airport, they were deployed to the Promenade des Anglais on 14 July 2016 after the attack by the lorry that charged into the crowd, and helped to secure the area for the forces of law and order and the mobile emergency services. On 18 March 2017, in the south terminal of Orly airport, aviators on Operation *Sentinelle* coolly neutralised an armed man who attempted to take a weapon from one of the soldiers on patrol.

The Air Force also operates in our overseas territories: for example, the contribution of aviators to the wild vastness of Guiana (administratively a *department* of France) forms an important part of broader governmental action. Military air assets are made available to the Prefect for protection of the space station and to support the gendarmerie in Operation *Harpie*, the fight against illegal gold panning.

To sum up, our aviators' contribution to the peace of their fellow citizens is real, if not always visible. The men and women of the Air Force work permanently

and with professionalism, using the experience as military personnel and specialists that they have acquired in overseas theatres to protect and, if needed, rescue the French population.

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In parallel with its permanent missions that form the core of our citizens' protection, from its air bases the Air Force conducts a wide variety of actions that contribute to the education of our youth, offer assistance to the population, help safeguard our ecology and aid in developing the local economic fabric, within the overall objective of protecting citizens and sensitive sites.

This variety of action is only made possible by the formidable combat system operated by the Air Force, whose very strength depends on a network of units in which dedicated men and women work.

Using their knowledge and soft skills, their enthusiasm and dedication, our aviators put their technical and human competences into action for the well-being of the French citizen.

# The Air Force and Special Operations

Luc DE RANCOURT

Brigadier General (Air), deputy general officer to the Commander of Special Forces.

On 24 June 1992, a fairly brief order formalised the creation of a new command directly responsible to the Chief of the Defence Staff (*Chef d'état-major des armées*, CEMA), the Special Operations Command (*Commandement des opérations spéciales*, COS). It was the result of the principal lessons learned in the Gulf War and the inability of France to conduct special action at the operational level even though the French Armed forces had units capable of doing so. The order opened the door to significant developments.

Since that time, the use of French Special Forces has matured and expanded, through their commitments in Africa, the Balkans, Afghanistan and Libya. Closer to home, since 2013 in the Sahel strip and 2014 in the Levant, the fight against terrorism has made them one of the capabilities best placed to operate in the numerous grey zones of current conflicts. They now conduct structured campaigns at the operational level that go beyond the pattern of occasional, one-off uses that had prevailed at the beginning.

So it is that, in twenty-five years, Special Forces have appeared in the operational landscape. The Air Force has recently made them one of the uniting projects in its strategic plan *Unis pour faire face*. Since its origins, the air element has been intrinsic to special operations and, to varying degrees, units of the Air Force have supported it. Such participation is a true reflection of the fact that air support guarantees the effectiveness of special operations.

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Looking back to 1992 to begin with, from then on the Air Force had three different units: No. 10 Air Parachute Commando (CPA 10—successor to the first French parachute units that the Air Force had created in 1936), 03.061 *Poitou* Transport Squadron and 01/67 *Pyrénées* Helicopter Squadron. Since then, in the words of COS, these units have been 'thinking differently' in order to develop special techniques and create the conditions for maximum interoperability between the Special Forces of the three services. They have also played their part in the

emergence of the rather special culture of the French Special Forces which overlays the culture of the forces in general.

The CPA 10 has become the interface *par excellence* between forces on the ground and air forces, thus facilitating their action in depth: it is the Air Force's shock unit, composed of ten action groups experienced in techniques common to all Special Forces, which include counter terrorism and freeing of hostages.

Its principal field of operation is in air-surface integration (ASI), which, by use of particular standard actions, aims at combining the activities of ground or maritime forces with those of the air forces, both French and allied. More than in any other type of operation, the dynamics of a special operation and the highly interwoven nature of its forces on the ground dictate a need at all levels of command to know how to integrate rapidly the air assets that will enable delivery of the precise effects required. Using innovative technological solutions adapted to suit the conditions of Special Forces' engagements, the commandos of CPA 10 have developed their concept of 'observation and destruction of sites by the air arm', *Odesaa*, which is the response to the need for guidance on to strategic targets.

Far from limiting its skills to air support, the CPA 10 also plays a special role in the field of intelligence, offering the tactical level privileged access to satellite imagery. Equally, and because we have known since the Second World War the strategic importance of an airport infrastructure, its aviator commandos are able to recapture an airfield by force without destroying its installations. Furthermore, it is the sole Special Forces unit able to confirm the feasibility of rough terrain to allow a tactical transport aircraft to land there.

Helicopters and tactical transport aircraft give commandos the mobility and action in depth that they need. The crews of 3.61 *Poitou* transport squadron have developed techniques of air transport and air drop (from 200 m/650 feet to over 8 000 m/26,000 feet altitude with oxygen) which allow rapid and stealthy infiltration or exfiltration of commandos onto or from improvised platforms such as roads or beaches.

The operations in which *Poitou* participated also convinced the crews of the added value that an optronic ball fitted to a transport aircraft could bring to the COS. Today this imagery capability, complemented by an on-board C2 (Command and control) system, offers the COS a C3ISTAR (Command, control, communications, intelligence, surveillance, target acquisition and reconnaissance) capability that is now essential for the conduct of operations against jihadist networks in the Sahel.

These particular operations also showed the urgent need to be able to bring lasting firepower to the Special Forces that is reactive and capable of handling mobile targets. As a result, a programme of arming the C-130 has been started

with the aim of being able to conduct missions that allow for the search for and handling of targets without the presence and guidance of friendly troops.

Regarding the helicopter segment, as well as its participation in the Army's 4th Special Forces helicopter regiment (*Régiment d'hélicoptère des forces spéciales*, 4e RHFS) the Air Force operates its H225M Caracal in support of the Special Forces' need for air mobility and air combat. Using its ability to refuel in flight, the *Pyrénées* enables a capability for action in depth by offering a FARP(1) facility, something not always possible in certain theatres of operation. This counts as real added value for COS, and allows him to consider new modes of action. Several promising scenarios for heliborne raids over 1,100 km have already been tried out with the contribution of US C-130s which have emphasised the need for early arrival in the Air Force of the C-130J Super Hercules tankers so that COS can have available an autonomous unit capable of conducting in-depth heliborne raids.

While these three units form the historical core of the air Special Forces, nowadays the air aspect of special operations is not limited to them alone. Indeed, commitments have demonstrated on a daily basis that to conduct special operations, something more is needed than just Special Forces: COS also needs contributions from the unique skills of conventional units.

The Air Force has therefore developed a pool of additional capabilities (such as SIC, operational infrastructure, air combat engineers and NRBC), called special operations support modules (*Modules d'appui aux opérations spéciales*, MAOS), from which COS can draw as needed for his own requirements. In the same way, to increase synergy with Special Forces, three special units, 02.030 *Normandie-Niemen* fighter regiment, equipped with Rafale, 01.033 *Belfort* drone squadron, and the Centre of drone excellence at Salon de Provence, are in charge of developing innovative modes of action and equipment.

Thus we can see that the whole of the Air Force's coherent combat system is involved. Yet those words barely do justice to that fact that the development of the air power and that of the Special Forces 'system' are intrinsically linked.

Today, the commander of special operations can offer options for commitment of forces whose strategic impact, striking power, surprise effect, small footprint and stealth are measures of their success. Such operations are very often conducted at high speed, exploiting windows of opportunity that close as quickly as they open, and follow three principles of use: discrimination, which is a major challenge in the field of counter-terrorism (the expression often used is Positive Identification—PID); control of risk, which makes the mission acceptable for the decision maker; and strict control of the desired effects on the chosen targets. To achieve this, mastering the characteristics of airspace is paramount. It has to be

(1) Forward Air Refuelling Point: placing of assets on the ground to allow helicopters to land and refuel whilst in action, in order to extend their time on task or to increase their range of action.

controlled in advance of any operation—special operations included—even if control is limited in time and space. This ability to seize the moment relies on the capability to understand the development of a situation, to command and to have in hand the right assets to deal with that situation—three fundamental elements in which the Air Force plays a particular role.

First, to understand the situation, the numerous parameters that need to be considered when taking the go/no-go operational decision have to be patiently assembled. That results from major networking with the various intelligence agencies and our allies. In the field, much relies on traditional and essential intelligence-gathering assets in the third dimension for intelligence, surveillance and reconnaissance (ISR), such as the Reco NG pod, C-160G and satellite imagery. The entry into service of the General Atomics MQ-9 Reaper has changed things by its capacity for long-term surveillance over the area of interest. Such a system contributes to durable observation of the environment of a target, to recording its contours (through reconnaissance and photography for 3-D modelling, for example) and identifying its daily routines – essential steps to be taken before launching an operation. Besides that, the endurance of MALE drones (medium altitude, long endurance), together with control of airspace and the capabilities for surveillance of the electromagnetic spectrum offered by the C-160G and the light surveillance and reconnaissance aircraft (*Avion léger de surveillance et de reconnaissance*, ALSR), will weigh heavily on the adversary's considerations, forcing him to adopt constraining operational security measures by virtue of the constant atmosphere of uncertainty generated by these assets. Then, during the action, it aids tactical manoeuvres and facilitates the work of operators on the ground. It offers the command real-time appreciation of the situation and speeds up the decision-making cycle. The participation of increasingly experienced Reaper crews is therefore a valuable advantage. COS very quickly acquired a taste for this new Air Force capability and now uses some 80 per cent of the annual operational potential of the Reaper drones based in Niamey. In the near future, the procurement of ALSR will add an essential complementary multi-sensor intelligence capability, with far shorter reaction and deployment times.

Second, as in controlling an air campaign, the effectiveness of Special Forces relies on a centralised C2 chain that reacts in real time whilst favouring decentralised action. It is the aviation community that is at the origin of the C2 systems on which liaison cells, deployed operating cells, task force command posts and Paris rely. These systems bring together in real time the tactical, operational and strategic levels, functioning on promising data link devices(2). The C3ISTAR capability, by merging information at the tactical level forms the keystone to all this: the ability to have a short cycle of information coming from the air, space and

(2) Including use of the Adaptive Network Waveband (ANW2).

tactical ground segments provides each level of command with the situational intelligence it needs.

In the same way, the Air Force is dedicating a great deal of energy to the development of Digitally Aided Close Air Support (DACAS), which through the use of digital methods can offer air support without radio communication. Having available tools of this nature plays a considerable role in acceleration of the commitment cycle and, through the accuracy they provide, limits the very high risk of fratricide and collateral damage when the combatants are closely mixed together, as is often the case for those involved in special operations.

Third, and finally, in order to act and for special operations to benefit fully from their striking power and ubiquity, air assets provide the capabilities for power projection, reactivity and extension of range—to enter, hit and return home whenever and however we wish.

In terms of firepower, exploitation of airspace allows it to be focused and its effects to be varied and controlled. In close synergy with action groups and reconnaissance teams on the ground, it enables an unstable balance to be tipped, a balance of forces to be reversed, a situation to be blocked or limited in scope, or a target to be destroyed. Today there is available a wide choice of precision weapons that can be fired from long range and whose lethality is controlled. Given that, it is feasible that special modes of action could preserve the future use of a targeted site.

Regarding manoeuvre, whilst without doubt we lack heavy helicopters, very soon the A400M will play an important role. Using its speed, range and load capabilities we can envisage projection of forces from the homeland with a reactivity that matches the inherent tempo of special operations. Until now, that was unavailable to us. Equally, considering air drops from high altitude, the flight levels of this new aircraft will allow undercover penetration over almost double the distances permitted by current capabilities and with improved stealth. This aircraft should also be thought of as a multi-role weapon system capable during a single mission of committing a significant volume of combat groups while maintaining endurance[2] over an area and exploiting its inbuilt connectivity (L16, UHF, VHF, SATCOM and HF) for the C3ISTAR missions that have become so numerous today.

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In conclusion, while air power in a conventional campaign is the instrument used to achieve strategic paralysis of an adversary, it should be noted that it is also the condition for allowing the commander of a special operation to keep the

(3) Without in-flight refuelling, this weapon system can remain on station for 5 hours at a range of 1,500 miles or 10 hours at 500 miles.

initiative on the ground and to seize opportunities as they arise, thereby reversing the principle of uncertainty that an adversary—in particular an asymmetric one—might wish to impose on our interests. Nevertheless, regarding the particular nature of special operations, we still have to think these things through more thoroughly in order to exploit this potential to better advantage.

Furthermore, as a major catalyst for innovation in the forces, the Special Forces are a test bed of ideas that later turn into developments later taken up by conventional forces. This situation is tied to the need to keep the upper hand and remain a step ahead of the adversary when he often holds the advantage of numbers and ground. In view of this, and in consideration of the issues relating to the fight against terrorism, it is essential to pursue the development of capability of the Air Force in the fields of C2, ISR, intervention and projection, and in those that are today opening up by virtue of the digital revolution. That is one of the unchallengeable conditions for maintaining the capability of our country to conduct special operations in environments that may well become yet more difficult, and therefore for our country to remain a top rank sovereign military power.

As a final word, we must pay tribute to our personnel. From 1992 to today, the considerable progress that has been achieved would not have been possible were it not for their faith, determination and sense of mission (too often at the price of spilled blood), their understanding of the operational challenges that affect each service and the leverage effect that Special Forces bring to bear.

# Intelligence of Air Interest

Étienne CHAMPEAUX

Colonel, commanding the 'knowledge and anticipation' brigade of the Air defence and air operations command (CDAOA).

*Si vis pacem, para bellum.*

The first uses by man of the third dimension were in connection with intelligence gathering, a prime example being the use of the captive balloon *Entreprenant* in June 1794 during the siege of Maubeuge, which gave a decisive advantage to French troops and led to their victory at Fleurus.(1) From the First World War, airborne vehicles allowed partial dispersal of the fog of war by looking over the hill to the benefit of ground forces. In parallel, the first air-to-air combat and bombing missions imposed upon air units the need to have knowledge of the threat and to recognize their targets, thus putting intelligence at the centre of crews' priorities.

Hence the Air Force has a solid culture of intelligence linked both to the capability of aircraft to gather it and also to the need to have good knowledge of threats and to deploy its effectors to good effect across the broad range of its missions.

A description of the general structure and then of the challenges of intelligence of air interest (*Renseignement d'intérêt Air*, RIA) will offer some understanding of the system of personnel organised by the Air Force in order to respond to the numerous challenges of RIA.

## A well-controlled structure

### *Very varied intelligence needs*

Major General (Air) Jean Bézy set out the missions of the air intelligence service in 1940.(2) They were to gather all intelligence on German and Italian aviation, its potential, order of battle, equipment in service, doctrines for use, industry, raw materials (…) and on airfields, radars, anti-air defences, defence

(1) Quoted in *L'art de la guerre aérienne* by Colonel Régis Chamagne (L'Esprit du livre, 2004), p. 18.

(2) Jean Bézy joined EMAA/2 in 1936 and organised resistance networks and the SR Air from 1940 to 1944. He commanded the *École de l'air* after liberation.

works, and in general on all targets open to air bombardment.[3] Today, in particular through IMINT—imagery intelligence, the Air Force is interested in all fixed sites classified by NATO in the 19 categories of STANAG 3596.[4]

In the nineteen thirties, the use of wireless telegraphy in aircraft, and then the deployment of the first radars led to the increased importance of intelligence of SIGINT, Signal Intelligence, which allowed interception of signals emitted by the adversary. With the appearance of the first ground-to-air missiles and the first strategic bombers in the nineteen sixties, SIGINT became an absolute necessity, especially for electronic warfare (EW) and principally in the field of radar signals—ELINT (Electronic Intelligence).[5]

### *Analysis of threats: the battle between the sword and the shield*

Intelligence officers are naturally specialised in the analysis of threats posed by potential adversaries, which can be defined as their 'capabilities and intentions to do harm'. Analyses of these capabilities require knowledge of the technical characteristics of military equipment—the weapons systems that have to be dissected, so to speak, in order to understand the adversary's capabilities, to programme electronic countermeasures for our aircraft and establish tactics for the aircrews.

As with geo-political analysis, analysis of intentions is often addressed at the joint force level and by military and civil intelligence services. During peace time the air component must have available a range of IMINT and SIGINT captors and sensors to be able to observe the activities of the adversary. The triple requirement to know *intention*, *capability* and *activity* guides all analysis of threats.

The intelligence officer sees the enemy as a threatening system containing offensive and defensive assets, and at the same time as a system of targets to be analysed. Therein lies the eternal problem of the struggle of the shield against the sword. When faced with a threat backed by power, the need for technical intelligence is dominant, in particular to support electronic warfare (EW). On the other hand, in asymmetric conflicts the range of Air Force sensors is mainly put to use in targeting and for ground-based units operating in a joint environment.

Acquisition of all the knowledge described above needs to be prepared in peacetime, in anticipation.

(3) *Le S.R. Air* by Jean Bézy (Éditions France-Empire, 1979), page 40.
(4) See: NATO Target Reporting Categories
(http://ncap.org.uk/sites/default/files/NATO_Target_Reporting_Categories_v2.pdf).
(5) See: *La Guerre électronique. Maître des ondes, maître du monde* by General Jean-Paul Siffre (Lavauzelle, 2005).

#### *Intelligence of air interest*

The Air Force has made RIA a defined sub-set of intelligence of military interest, which overall remains the domain of the Directorate of military intelligence (*Direction du renseignement militaire*, DRM). RIA includes the particular intelligence needs of the air arm and also the intelligence gathered by Air Force sensors. This double function of RIA is well established, since intelligence gathered by aircraft has always been put to use at the strategic level, for operational commanders, for the other services and for the air component.

New branches of RIA are being developed today in the fields of cyber, space and ballistic threats. On national territory the RIA organisation is closely interconnected to military and civil intelligence and security services for the protection of air bases and within the framework of the permanent air security posture. One task in particular is to identify among the 11,000 aircraft passing daily through French airspace anything that poses a potential threat.

### The stakes and challenges of RIA

#### *The sensor cloud*

Intelligence is encompassed within the broader field of Intelligence, surveillance and reconnaissance (ISR). Today's surveillance missions, those having a certain duration over the area of interest, are clearly more important than reconnaissance missions. Airborne ISR assets are essential to all operations conducted by France and include combat aircraft fitted with pods, specialised transport aircraft and also drones and light surveillance aircraft. However it should be underlined that the most important sensor remains the pilot's eyes and that modern effectors are therefore also captors.

A cloud of captors today flies over the battlefield, ordered to collect intelligence for the different commands. Controlling the manoeuvres of these captors constitutes a real challenge if that collection is to be optimised to suit all demands placed on it, and there is a requirement to be able to reprogram the aircraft while in flight and to coordinate collection between wide-field captors, such as those with SIGINT sensors, and narrow-field captors. In the air component the new position of Senior Intelligence Duty Officer (SIDO), has been created: SIDO is in charge of regulating the manoeuvres of the captors in real time and generally during the course of an operation.

#### *The digital revolution: the data cloud*

A major issue in operational success is the distribution of intelligence information, for which the RIA has benefited from the digital revolution. Paper documents and photographs long stored in safes were replaced at the beginning

of the current century by digital documents available to all on classified IT stations. Currently, airborne ISR assets are the main consumers of telecommunications satellite bandwidth, and video imagery from drones is available in real time to staffs who are running operations while deployed abroad or from their home base in France.

The age of intelligence is of vital importance: data needs to be available in clouds that are accessible to everyone and allow intelligence to be disseminated as rapidly as possible from the captors to the effectors, in particular to aircrews engaged in action carrying a kinetic weapon—a fighter-bomber launching a bomb, for example. The cloud needs to hold geographical and date/time referenced data from a wide range of sources SIGINT, IMINT and HUMINT (Human Intelligence) from human sources.

#### *The exploitation bottleneck*

The access to an ever-greater amount of information presents a sizeable challenge whatever the source, be it military SIGINT and IMINT sensors or open data from Internet. It is therefore important to look to the use of automatic methods of handling and exploitation of data and also to artificial intelligence in order to get the best from the increasing mass of available information.

Given this high data rate, the main challenge lies in the limited number of personnel dedicated to the tasks of intelligence exploitation, who are also confronted with a vastly increased number of operational commitments and greater diversity of threats that have to be studied. Intelligence personnel therefore bridge the great gap between intelligence support to current operations and broader strategic anticipation performed as part of the overall permanent strategic watch, and can thus identify the threats of both power and weakness.

### A system of professional and experienced manpower

#### *A pool of enthusiastic experts*

Within the Ministry of the Armed Forces there are a little over a thousand officer and NCO intelligence specialists of Air Force origin. The DRM, the Air forces command (*Commandement des forces aériennes*, CFA) and the Air defence and air operations command (*Commandement de la défense aérienne et des opérations aériennes*, CDAOA) each have about a quarter of that number, the last quarter being divided across other Air Force commands and directorates and other organisations attached to the Defence staff (*État-major des Armées*, EMA). The great versatility of these men is worth emphasising: they are able to work in intelligence units and also within organisations that focus on issues such as targeting, geography EW and international relations.

In response to the growing need for intelligence specialists, the Air Force decided two years ago to increase its recruitment rate somewhat. The intelligence specialisation will soon be open to enlisted airmen, now essential to units for data production. This measure also means that officers and NCOs are able to refocus themselves on high-value intelligence analysis tasks.

### *The ORIA course*

Initial training of Air Force officers was fundamentally reformed in 1984 with the creation of the course for intelligence, interpreter and analyst officers (*Officiers renseignement interprètes analystes*, ORIA). Operational commitments at the time had raised consciousness in the Air Staff of the need to improve intelligence officers' training to suit it to the new threats.(6) As the third dimension specialists, ORIA are trained on the analysis of threats, manoeuvre of captors, targeting and EW.

### *The air intelligence centre*

The Air Force decided in 2001 to create a centre for air intelligence (*Centre renseignement Air*, CRA) by grouping together the various intelligence units that had up to then been spread across a number of air commands. The CRA is both the factory for production of RIA and the ISR division of an air component command, able to generate the Deployable Air Intelligence Center (DAIC) during operations abroad. For missions, there is continuity between the CRA and the DAIC for operations Chammal and Barkhane, supported through reach-back by the CRA.

Within the Air Force, the majority of tactical units have an intelligence cell employing some 2 to 20 intelligence specialists. Not a step is taken, and no aircraft takes off without intelligence. Intelligence is an activity absolutely inseparable from operations, and each air detachment on operations has its own intelligence cell.

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From its very origins, the Air Force has had a solid intelligence culture and a wide range of captors and sensors operating for use in operations and political decision-making. For intelligence of air interest, the Air Force has recognised expertise that is essential to its missions in France and on operations abroad and is available to the DRM and the other components in a structure that is always joint, and often inter-ministerial or in conjunction with other national services.

The human structure dedicated to RIA is facing a very rapid development of threats and technologies, and is looking forward to the deployment of future information clouds that, once integrated into the future combat cloud, will make the Air Force even more reactive and effective.

(6) Jaguar by Captain Croci, killed in Chad in 1984, arrival of SA-6 Gainful ground-to-air missiles in Libya.

# Feedback on the Logistic Chain in Air Operations

Pierre-André PARSI

Colonel, Head of the activity support office of the French Air Staff.

As a major player within the forces' commitment across all theatres of operations, the Air Force needs to adapt its organisation and resize its technical and logistic assets in order to ensure a level of activity support that already exceeds the levels expressed in the operational contracts that have been fixed for it.

In facing the challenge of aeronautical support at the heart of military operations, the Air Force is employed to guarantee the capability of forces by bringing them the range extension, flexibility, sturdiness, speed of strike and reactivity that are essential to combat.

In the context of commitment characterised as much by high levels of activity as by high levels of intensity, the Air Force's action must be sustained over long periods. In order that the considerable demands of operational support be not to the detriment of operational preparation of forces, the Air Force needs to have enough qualified personnel within its maintenance units and its deployed air units, able to judge stock levels that are coherent with logistic flows. At the same time it is incumbent upon defence industries to increase their production capacities with regard to current security demands.

## A new basis for operational support

Since 2011, Operations *Harmattan*, *Serval*, *Sangaris*, *Barkhane* and *Chammal* have been active in numerous and highly dispersed theatres, which have combined aggressive environmental conditions with very high-intensity levels of commitment. In achieving this, support has been under particular pressure.

Looking first at usage, is should be noted that on external operations, materiel in general sees an degree of activity which exceeds by far that of units stationed in France. So it is that, even though five-yearly visits of the Mirage 2000D to the *Atelier Industriel de l'Aéronautique* (AIA) in Clermont-Ferrand, where servicing by the *Service Industriel de l'Aéronautique* (SIAé) regenerates some 250 potential technical hours per airframe per year, the average activity of these aircraft in the Levant was some 110 flying hours per month (a ratio of 1:5). In the face of this

increased consumption of the potential of the fleet it is necessary to establish a system of frequent verifications of the aircraft and to increase substantially the frequency of preventive maintenance visits to the aircraft industries in order to augment the available technical potential.

What must be added to this high-level activity is the high level of intensity that results from the severe environmental conditions in operational theatres, which accelerate wear on materiel, increase somewhat the number of breakdowns and unavoidably lead to major repair work. By way of illustration, the abrasive character of the sand in the north of Mali, and the atmosphere across the whole of the Sahara and Sahel regions which is heavily laden with crystalline particles, are particularly detrimental to the engines of the EC-725 Caracal and C-130 Hercules. To limit the cost of maintenance and reduce the down time of the aircraft, palliative solutions have been put into effect such as the structural modification that protects the air intakes of the Caracal, and the periodic washing of C-130s in the desert zone.

Whilst the Air Force is exerting considerable effort in maintenance in order to meet the demands of support of external operations, it has also to look to acquiring infrastructures adapted to the task. In particular, certain complex breakdown recoveries require immediate attention on the spot, which in turn demand operational technical zones with covered maintenance areas and associated environmental control assets. In this regard, the forward air bases in N'Djamena and Niamey need extensive infrastructure work, which includes restoration of the ageing installations used by current fleets in preparation for the arrival of new fleets such as the A400M or the Airbus A330 Multi Role Tanker Transport (MRTT) in 2019, in order to be in a position to maintain the level of support that is essential to the completion of missions.

## Adapted operational support

At a time of increasing operational pressure, the Air Force has shown itself able to adapt its structures and to modify its way of operating. To improve the synergy between the technical and the operational yet further, it is working to bring support back to the centre of units' operational preparation, from the squadron level to that of the activity support groups (*Groupements appui à l'activité*, GAA) on air bases, and on to that of the activity support office (*Bureau appui à l'activité*, BAA) of the Air Staff.

The Air forces command (*Commandement des forces aériennes*, CFA) has been transformed in order to combine under a single command the operations and support aspects of preparation of forces. In particular, the Air Force is distinguished from the other services by its centre dedicated 365 days a year to real-time direction and organisation of the technical-logistic function both on operations

and within national territory (*Centre de permanence et de synthèse organique*, CPSO). Seated at the heart of the CFA, the CPSO collates the needs that come from deployed units, identifies the appropriate solutions and ensures follow-up of the necessary logistic resource throughout until it reaches the aircraft itself. Interface with support structures has also been revised within the air bases themselves. While their efficiency is not in question, they are henceforth organised around squadrons, commanding technical and operational units that ensure the training and intervention activities. They are work alongside the GAAs and integrate in particular the various players in logistic replenishment and ground technical support.

Added to this, the scattered nature of deployment bases together with the scarcity of resources has required considerable logistic effort. By launching a programme of procurement of additional spare parts for the Mirage 2000 and the Rafale, the Air Force has managed to bring back to the front line a number of aircraft which had too long been immobilised for want of parts, whilst at the same time reducing the maintenance load brought about by robbing stored aircraft of missing instruments and accessories. As a result, through a better logistic situation the Air Force has been able to improve the technical availability of deployed fleets while reducing the pressure on personnel, a factor weighing heavily on technical units on external operations as well as at home.

By virtue of recent prerogatives giving it functional authority at the operational support level (*Niveau de soutien opérationnel*, NSO) of the aeronautical element of maintenance of material in operational condition, the defence ministry's integrated 'maintenance in operational condition' structure (*Structure intégrée de Maintien en condition opérationnelle* (MCO) *des matériels aéronautiques du ministère de la Défense*, SIMMAD) plays a major role. It makes every effort to exploit in real time all feedback on technical-logistic experience in order to improve the way support functions, to develop materiel and information systems, to adapt MCO contracts and to optimise logistic cover.

Within this framework, deployment of the Supply Chain project is increasing the performance of support to the benefit of operations. It is characterised by better sizing of stock holdings to ensure continued activity whilst optimising available budgets, by better positioning of stock and deploying only the right amount for local needs, and by accelerating the flows between suppliers, logistic operators, operational units and maintenance sections. It is also optimising reverse logistics.

## Industrial support to the war effort

Feedback from air operations reminds us that any action of the forces' technical-logistic chain is inseparable from the commitment of industrial players. Indeed, as has already been mentioned, operational action is today characterised as much by high levels of activity as by the high levels of intensity associated with the

use of the air arm in severe environments. If an air force is entirely mobilised for long-term action, industrial players need on one hand to regenerate the technical potential of materiel, and on the other to bring technical solutions adapted to the particular conditions of use. This is the price to pay for the Air Force to be in a position to react to the variations in operational and logistic factors in order to ensure the essential support to achieve the expected level of capability.

Furthermore, in the context of war effort, it is essential that industrial support be brought onto a war footing, so it can adapt its production capacity to the needs of the armed forces. Therein lies a considerable challenge when it is considered that the military structure is designed to be reactive, whereas the industrial structure has its own momentum. That said, private industries adapted their 2016-2018 production plans to reduce delivery times, and in the same way, when faced with the increasing need for technical regeneration visits related to the accelerated consumption of Mirage2000 technical potential, the SIAé reviewed its organisation to increase its production capacity significantly.

To give priority to operations, technical units can also call upon industrial players to relieve them of all or part of some of the units' maintenance operations conducted on home territory. There again it is essential that such activity undertaken be effected within timescales compatible with what is required for operations.

Finally, only the full commitment of the industrial concern in a fully operational supply chain will guarantee logistic flows that are optimised and adapted to the intensity of the commitment of the Air Force across all of its theatres of operations.

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In summary, through renewed and adapted support, overall coherence of action between operational support and industrial support, and by effective application of support by type, the Air Force is succeeding in responding to ever-changing operational requirements by guaranteeing the flexibility, robustness and reactivity of the air forces. The short warning times of commitments and their now long-lasting nature also show that the necessary anticipation—fundamental to the exercise of military power—reaches its limits when it becomes necessary to increase rapidly and lastingly a support system that has hitherto been guided by a strict logic of 'just enough'. Following in essence the requirements of the *Livre blanc*, this logic of control of assets must henceforth be allied to one of desired effects in order to take into account more effectively the probable scenarios of rupture and rapid restoration of support.

# Operating Overseas and Assuring Permanent Missions in National Territory

Thierry BÉRON

Lieutenant Colonel (Air), commanding 1/4 *Gascogne* fighter squadron.

Nuclear deterrence is the main professional business of the units of the Strategic air forces (*Forces aériennes stratégiques*, FAS), and yet their combat and in-flight refuelling squadrons have a long history of participation in conventional operations too, in Iraq, Serbia and Kosovo, to name just a few.

The entry into FAS service of Rafale in 2010, and the previously unseen level of commitment of the Air Force that followed, profoundly altered that balance. The combat squadron *Gascogne* operates the intrinsically multi-role Rafale across the whole range of missions that are given to the air arm: nuclear deterrence of course, but also air defence, conventional assault, support to ground troops and air reconnaissance. Its crews therefore work every day on the permanent postures of air security and the airborne element of the deterrent as well as on all overseas operations conducted by the Air Force since 2010—*Harmattan* in Libya, *Serval* then *Barkhane* in the Sahara-Sahel band and *Chammal* in the Levant. The mix of trades in *Gascogne*, the pilots, navigators, intelligence personnel and mechanics, mean the squadron is truly capable of intervening beyond our borders at any moment whilst at the same time giving no concession to its over-riding permanent missions in the homeland.

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When I arrived at the *Gascogne* squadron two years ago, the breadth of knowledge that I had to acquire and put into practice hit me immediately. First was the deterrent mission, with Rafale and its medium-range air-to-ground nuclear missile ASMP-A (*Air-sol moyenne portée*). The demands of that were greater even than the extremely high standards required of its predecessor ASMP, which I had operated with my previous aircraft, the Mirage 2000N. The Rafale also has to protect the nuclear raid, composed of weapon-carrying aircraft and tankers. We have to adapt our tactical level to that of our potential adversaries, which has constantly increased in recent years. That is the reason why aircrews take part

regularly in air manoeuvres unequalled in the world for their realism and intensity. These events occur several times a year over France and involve more than fifty aircraft that face threats of the latest generation from Rafale and Mirage 2000 aircraft, RDY (multi-target radar) and Mamba ground-to-air systems. They are done at night and last more than six hours, during which the aircraft refuel in flight in all weather conditions.

That is not the only mission that FAS crews conduct. They are on alert day and night for the protection of French airspace, ready to take off at a few minutes' notice on the orders of of the National centre for air operations (*Centre national des opérations aériennes*, CNOA), and have to be in a position to go to the aid of any aircraft in difficulty (that has a radio or navigational failure, for example), and to identify, constrain or even neutralise an aircraft that does not conform to the rules of the air.

These periods of alert and permanence for the deterrence and policing of the skies alternate with other taskings. My next overseas operational deployment is programmed for next spring, fewer than eight months after my first flight in a Rafale. Now, whilst I know the rudiments of the ground forces support mission, I have yet to learn fully the techniques of illumination for laser-guided weapons and the specific requirements of air reconnaissance missions. With the help of the squadron's experts, my skills are building up rapidly! In the Sahel, reconnaissance and ground support missions follow one after the other over Mali and the Central African Republic. I had had little more than a hundred flying hours on Rafale when with my navigator I made my first gun firing run using night vision binoculars on an overseas operation. So it was that, in less than a year in the *Gascogne* squadron, I saw before me and felt at my fingertips the true multi-role nature of the Rafale, and above all the commitment of my squadron on all fronts and especially on the front line in both domestic and external operations.

And yet my story could be that of any *Gascogne* combat squadron aviator—pilot, navigator, intelligence expert or mechanic. During the first quarter of this year, aircrews and mechanics were deployed within the coalition in the Levant, taking off from the forward air base in Jordan, hitting Daesh in its sanctuaries with cruise missiles or supporting Iraqi forces during the battle for Mossul. During the same period, other teams that were deployed for the permanent security posture task on an air base in France intercepted long-range Russian air raids that came openly and regularly up to the limits of our airspace to show their capabilities. Other air mechanics were simultaneously employed on domestic missions, such as Operation *Sentinelle* and the protection of their own air bases in the face of the increased threat to our national territory. At the end of the quarter, everyone returned for a major manoeuvre of the airborne element of the nuclear deterrent and thereafter to take part in a first entry exercise alongside a large part of the Air Force before spending a fortnight at Cazaux for aircrew airborne firing training.

What should not be forgotten in all this are the hours of training needed to get to such a level of operational performance. The deterrent mission imposes very strict criteria for the maintenance of hard-acquired qualifications and requires regular exercises involving virtually all of the squadron. Additionally, crews have to be qualified in firing air-to-air and air-to-ground armaments in order to be prepared for external missions in the Sahel and the Levant. Not a week passes without a member of *Gascogne* being deployed out of the squadron for training or to fulfil one of the numerous taskings entrusted to the unit. The high level of commitment to operations has an impact on our training capacity, because permitted flying hours are limited. It requires all the ingenuity of those commanding the wings, the intelligence officers and the heads of the workshops to make the very best of each flight and each maintenance period so that the ambitious objectives set for the unit can be achieved. A combat squadron requires a spirit of service and cohesion from *all* its personnel. And that spirit must endure.

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These few lines go beyond the sharing of my experiences of the Rafale and of external and domestic operations in the conduct of all combat aviation missions: they give homage to the daily routine of the men and women of the *Gascogne* combat squadron, and to the families who suffer their absences. In their operational commitment and their generosity, and more especially in this year that commemorates the Aces of the Great War, they echo the motto of one of the most famous, Captain Guynemer, *Until you have given everything, you have given nothing*.

# Defence Protection in the Air Force: Responding to the New Security Situation

Jean-Christophe ZIMMERMANN and Patrick MENEGHETTI

Major General (Air), Second in command of the Air defence and air operations command (*Commandement de la défense aérienne et des opérations aériennes*, CDAOA).

Lawyer and Colonel (operational reserve) at the CDAOA.

The French Air Force is wholly and permanently committed to the protection of the French population, whether in an external theatre or on home soil. Together, all of its activities contribute directly or indirectly to achieving this objective. Hence, in the current security situation and in order to be constantly in a position to contribute to nuclear deterrence, to conduct air operations in external theatres, to ensure security in national airspace and to employ its particular expertise in supporting domestic security forces in the fight against terrorism, the Air Force needs to protect the capabilities that it puts into action from the combat systems that are its air bases, in particular in the homeland. The protection of air bases, and of the equipment and personnel to be found there, is essential for guaranteeing intervention capability for the safety of the French population. Just as an increase in the threat has been recognised, so has the continuity of that threat between distant theatres of operation and the national territory. Put together, these two aspects have since 2014 led the Air Force Chief of Staff (*Chef d'état-major de l'Armée de l'air*, CEMAA) to take considerable measures in his overall responsibility regarding the protection of defence establishments—defence protection (*Protection défense*, Prodef)—of all elements of the Air Force.

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CEMAA's first step was to adapt governance of Prodef to suit Air Force needs by creating an air committee on security protection (*Comité Air de sécurité protection*, CASP). In presiding the committee personally, he raised the level of governance of the essential Prodef function, and by uniting among its members the higher command, commanders and directors, and also the commanding officers of all air bases and Air Force establishments, he ensures the relevance of the work undertaken, guarantees coherence in the directives given and ensures that decisions taken are put into effect without delay. Prodef issues affecting the Air Force are discussed and debated twice a year in view of approving actions that will advance Prodef in general.

Air Force Prodef stands as the sixth core capability in the second 'act' of the strategic plan entitled *Unis pour faire face*, alongside command and control (C2), projection, intelligence, training and immediate intervention. Its doctrinal corpus has been strengthened significantly, and the 'concept of defence protection' of Air Force installations, activities and personnel identifies the principles, players, organisation and those responsible for the Prodef function. Intelligence has not been forgotten, since it occupies a key position in any operational function, yet it has to be orientated in a manner to serve that function. With this in mind, the concept of intelligence relevant to Prodef air (*Renseignement d'intérêt Prodef Air*, Ripa) has been developed to optimise the business of intelligence gathering and exploitation in coherence with the activities of the various sites though better identification of needs, sources and actors. Prodef activity is organised on a local level according to the pattern now laid out formally in the document Air base XXI (*Base aérienne XXI*), via the coordination office for security protection (*Bureau coordination sécurité protection*, BCSP). The head of the BCSP orchestrates Ripa activity, states needs for Prodef infrastructure and installations, keeps local regulations relevant and up to date and ensures effective use of Prodef specialists.

The new security situation has also modified establishments' Prodef expectations, essentially with regard to capabilities of surveillance, detection of intrusion and intervention. These developments form part of a coherent ministerial plan steered by the forces' central staff (*État-major des armées*, EMA) and have been incorporated into an ambitious overall plan that the Air Force is applying with determination in all of its establishments.

Threats may lead to many types of action that risk prejudicing the capabilities of the Air Force: of these threats, intrusions on the ground by the ill-intentioned attract particular attention. To counter that threat effectively, access to installations has been made progressively more difficult from the outer fence inwards to the most sensitive areas. While remaining places that welcome public attention as long as such attention is benevolent, air bases have adopted means of preventing any entry considered undesirable. To do this, they rely on information about visitors that has been received and analysed before the visit, on particular access control devices which draw on the latest technological developments, and on hardened infrastructure and use of force in accordance with recent legal and regulatory developments. A number of related projects is in hand, though the infrastructure and equipment aspects of Air Force Prodef, which are part of the ministerial plan, will require several years' work to reach full maturity.

In parallel, work has been done on the specialised human resources required for the Prodef function. In the Air Force, this consists mainly of commando troops (*Fusiliers commandos*, Fusco) serving in protection squadrons (*Escadrons de protections*, EP) and of air gendarmes, also stationed on air bases, within brigades of the air gendarmerie (*Brigades de gendarmerie de l'air*, BGA). This specialist manpower has been increased and will continue to be so in order to achieve the aims the Air

Force has set itself in terms of threats considered, sensitivity of the sites in question and the activity that goes on within them. Creating the required posts represents a considerable amount of work but such work is unavoidable, given the context.

Over and above this specialised resource, the Air Force has also involved all of its aviators in the Prodef effort, making them aware of their role in the Prodef process by training them to play it as often as possible. Each aviator is above all a sensor, capable of detecting abnormal situations and reporting them to the command while taking the initial precautionary measures at his own level. Some among them are selected for specific training that will later allow them to take part in certain Fusco missions. Yet others are singled out by the command to carry a 'response' weapon at work, which means immediate defence can be effected against any aggression. Hence aviators have all become individual players in the collective security of the bases to which they are posted, and it is important to continue and amplify this approach. On this subject, exercises are held throughout the year on attempts to penetrate Air Force sites in order both to maintain the level of vigilance and to ensure the quality of reaction to such attempts. Longer and more complex week-long Prodef training exercises—*Basex*—are held twice a year. On these occasions, air bases are thrown into a crisis scenario, and numerous events of an aggressive or otherwise malevolent nature are generated to train and evaluate each person in his or her role and responsibility. The current strengthened security environment makes these exercises more pertinent than ever and allows evaluation of how Prodef is developing, at the same time highlighting work and progress that remains to be explored and achieved.

Collaboration with domestic specialised security forces (such as police and gendarmerie deterrent and intervention groups) is a further line of work to be pursued. These specialised forces have units spread all over national territory, and each air base is in a position to identify its nearest unit, establish relations with it and, if needed, organise joint intervention.

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The Air Force's response to the new security situation is evident in the distinct increase in the priority given to Prodef within the service. It is natural that such high priority be adopted, since the authorities would deem it quite unacceptable that the Air Force's capability for action—needed more than ever for the protection of the population—be affected in the very place from which it is deployed. This policy, together with the will and the need to get visible results rapidly, has led to the establishment of high-level governance, to the exploration and conceptual definition of a Prodef system adapted to the threat and integrated into operational activity. For the latter, decisions taken have been acted upon energetically and the resulting activity involves all aviators to varying degrees. The Prodef spirit is being cultivated in all Air Force units in the search for efficiency and performance in the face of a threat generally acknowledged to be real and lasting.

# Multinational Operation and Preparation

Marc HENRY

Colonel, Head of the bilateral cooperation office of the Air Staff.

Outside our national boundaries, today's Air Force commitments are generally in multinational environments, whether alongside foreign equivalents in a coalition, as in Libya in 2011 or more recently in the Levant, or by operational necessity as in the Sahel where allied strategic transport and in-flight refuelling assets are vital to our operations.

The quality of our aviators and our flying materiel, and their successes in recent operations, have attracted the attention of numerous foreign partners. Our Air Force demonstrates considerable effectiveness despite its medium size and limited resources: it is an example of an achievable model that excites growing interest, and the number of requests for cooperation it receives is expanding, as are export sales of Rafale.

For these two reasons, international cooperation is imperative. The Air Staff (*État-major de l'Armée de l'air*, EMAA) has chosen to benefit from it to the full by leading appropriate international action within the framework of international relations set by the Ministry of the Armed Forces.

For the EMAA, the priority is to develop balanced partnerships that strengthen French air capabilities—with the United Kingdom or Germany, for example. We also need to give our air forces a demanding training structure that bolsters interoperability with close allies, such as that afforded by the Trilateral Exercise Initiative (TEI) with the United States and the United Kingdom. Lastly, we need to make best use of stretched resources as is the aim of the European Air Transport Command (EATC), an example of sensible sharing of air assets between allied, but independent, sovereign nations.

In every case, the object of cooperation must be that it makes our Air Force more effective on operations through development of its own capabilities and its level of interoperability.

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The Air Force maintains close relations with several foreign equivalents and from them gains notable operational benefits: the United States, the United Kingdom and Germany are members if its inner circle of partners. It is also in contact with around a hundred air forces throughout the world, at levels going from simple diplomatic meetings to commonality of activity on operations. Through these relationships, it is creating the conditions for future cooperation.

Bilateral air cooperation is mainly concentrated on European countries because of their proximity and their membership of the European Union or NATO: Spain is a regular partner on operations, Denmark for training, Italy for SAMP/T, Belgium for aircrew training and so on.

The Air Force has always been able to maintain strong interoperability with its NATO allies, among which it counts in the top ranks. It is one of the rare ones to have a Joint Force Air Command (JFAC) capability and its centre for analysis and simulation for preparation for air operations is recognised as a NATO centre of excellence. It participates regularly in the NATO Response Forces (NRF), in NATO air operations and in air defence of the Baltic countries, to name but a few of its activities. This interoperability is set to be strengthened further since France joined the NATO Integrated Air and Missile Defence System (NATINAMDS) in 2015 and with the forthcoming commissioning of the Air Command and Control System (ACCS), which will be common to all European member countries.

We have well developed air cooperation with the United Kingdom and Germany in particular.

- Under the 2010 Lancaster House Treaties and the decision to create a Franco-British Combined Joint Expeditionary Force (CJEF), the Royal Air Force and the French Air Force have established a common capability for first entry and are making efforts to develop a network of exchange officers, including for the new aircraft, the C-130J Super Hercules and the A330 MRTT. Relationships are organised around regular bilateral meetings at air staff level, and annually at board level—that is, between Chiefs of Air Staffs and their major deputies. A number of organisational documents has been signed, which confirm common aims for the future and a common vision for a future air combat system. This arrangement is highly effective and contributes to maintaining a rich and cordial relationship.
- Under the aegis of the Franco-German military cooperation group, the air sub-group brings the Air Force and the Luftwaffe together at least once a year. This forum has existed for some time but remains dynamic and has enables the two air forces to develop pragmatic cooperation with significant benefits for aviators, notably in the use of the C-160 and, from now on, the A400M. Through it, too, the two services have since 2013 set up numerous exchanges

of personnel between the German base at Wunstorf, near Hannover, where mechanics of both nationalities are trained on the A400M (and soon pilots will do their initial training there as well), and our air base at Orléans, which is beginning tactical training. This programme is a leader in Europe and other countries have shown interest in joining it. Among our common projects, that of the European medium altitude long endurance (MALE) drone is showing great promise.

Franco-German cooperation in the air world regularly brings appreciable support to operations, to date with transport, in-flight refuelling and reconnaissance, using the Tornado. The Air Force and the Luftwaffe operate together in the Sahel with Transall, and also in the Levant where German A310 MRTT are refuelling our tactical aviation.

As a final point, the Franco-German coupling is preparing the commissioning in 2021 of a combined unit on the air base at Evreux to operate the C-130J that both countries have just ordered. This future unit has the political support of the inter-governmental agreement that was signed on 10 April 2017 and is symbolic of renewal of European defence, offering interesting possibilities for synergy in the future.

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With the return of the threat of force on NATO's eastern flank, and the delivery of fifth generation aircraft (F-22 and F-35) to our closest partners, the Air Force has had to make a particular effort to adapt. The challenge is to retain a high level of interoperability with allies, to maintain a capability to lead high intensity operations in a non-permissive environment and to be the framework nation for an air operation. The arrival of the F-35 in particular brings with it a doctrinal and technical change as significant as those of the nineteen-nineties. The USAF, and US defence in general, is preparing for this through its Third Offset Strategy.

Together with the USAF and the RAF, the French Air Force launched the Trilateral Strategic Initiative (TSI) in 2011. This initiative strengthens cooperation between these services in three areas: mutual confidence, interoperability and Air Advocacy—the promotion of air power. It involves of a series of seminars that highlight the commonality of interests and encourage proposals for solutions.

The TSI entered a new phase in December 2015 with a first trilateral exercise that involved Typhoon, Rafale and F-22 at Langley Air Force Base in Virginia. The exercise had considerable added value, and was designed with possible near-future, high-intensity engagements in mind. After that very successful event, the exercise was held again from 10 to 28 April 2017 under the name Atlantic Trident, and included F-35 for the first time. This activity is the strategic priority for the Air Force in terms of cooperation and operational preparation.

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Though more complex to set up, successful multilateral cooperation leads to considerable gains. For example, regarding air transport, the Franco-German alliance was the power behind the creation of the EATC: at the Franco-German defence and security council in 1999, President Chirac and Chancellor Schröder decided to set in motion a system for multinational management of military air transportation. In 2001 an initial structure, the European Airlift Coordination Cell, was created at Eindhoven in the Netherlands to coordinate air transport missions for participating nations. In 2004, that cell became the European Airlift Centre, centralising the operational planning of all air transport missions.

The EATC was later established on 1 September 2010, still in Eindhoven, and became the common command for military transportation. It exercises OPCON of aircraft and designs and conducts transport and in-flight refuelling missions. Spain and Italy joined France, Germany, the Netherlands, Belgium and Luxembourg in the EATC, and transferred their transport fleets in March 2015 and January 2016 respectively. At the first quarter of 2017, the EATC had a fleet of 204 aircraft, of which 20 were A400M, and it manages more than 150 aircraft daily.

Pooling these assets enables transport missions to be made more efficient by grouping part loads together. The contiguity of the member countries and the convergence of logistic chains towards the same theatres of operations—Africa and the Levant—help enormously. In 2016, 9,500 transport missions for EATC nations moved a volume of 21,200 tonnes of freight and 333,000 passengers and parachutists.

The EATC also conducts studies: it develops common rules for use and harmonises procedures and training of both air and ground crews. Since 2014 it has organised the annual European Air Refuelling Training (EART). In the future, four Nations of the EATC (Germany, Netherlands, Luxembourg and Belgium) will operate six to eight A330 MRTT in a multinational unit stationed on the air base at Eindhoven, called the Multinational MRTT Fleet.

The forty-eight French military personnel represent a little under a quarter of the total strength of the EATC, and since 2010 France and Germany have each taken command of this multinational structure. In 2016, the French demand for transport was some 43 per cent of the total handled by the EATC, and 24 per cent of the missions were conducted by French crews—all of which conforms that France benefits to the full from this multinational cooperation.

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We see, then, that the Air Force plays a willing part in international cooperation, since the real challenge is for it to operate and prepare in a multinational environment in order to fulfil its missions at a time of stretched resources. The Chief of the Air Staff has made his priorities clear on this issue: ability to operate with our allies, pooling of assets and activities, and development of partnerships that will help us prepare for the future.

The Air Force is committed to close and valuable cooperation in fields such as the development of capability with the United Kingdom, training with Germany, trilateral operational preparation with the RAF and USAF, and multilateral pooling of resources with the EATC.

Whilst concentrating its efforts on a number of high-value cooperative commitments, the Air Force must also be on the lookout for new opportunities. The Salon du Bourget is the major meeting place for the defence aeronautical industry, with which the Air Force is closely linked. It is also the place where, for one week, the focus is on relationships between air forces: the Chief of the Air Staff has invited his equivalents from across the world and will meet a number of them. They will without doubt bring new ideas and the support that are essential for our Air Force.

# Preparation for the Future—Perspectives

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# Intensification of the Conditions of Engagement of Aerospace Forces

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Western aerospace power is completely dominating wherever it is committed on the battlefield. It may currently be seen in the Levant, as it could a short time ago in Libya and in the Afghan-Pakistan region and before that in the Balkans and the Middle East. Over some thirty years it has become a kind of marker for military operations conducted by the West. This situation is the consequence of Western technological and operational supremacy, and has contributed to limiting the political risk of military engagement and to permitting authorities who have had recourse to use it to impose their will militarily, if not politically, in numerous crises in recent years.

Several emerging developments would appear to risk erosion, if not complete elimination in the next twenty years at least, of Western aerospace forces' supremacy. From the military point of view, these developments need to be confronted rapidly by more robust defences based on increasingly capable integrated air defence systems and combat aircraft of fourth or fifth generation. In parallel, less traditional threats to combat aviation are likely to make their appearance in space and in cyberspace.

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The Anglo-American campaign in Iraq at the beginning of 2003 was a historical first, in that there was a complete absence of air activity on the Iraqi side. Never before had domination of the air by one side in a conflict been such that the other was convinced of the futility or excessive risk of the least adventure into the skies. But should that situation be considered as the acme of Western forces' aerospace domination? The question is not out of place when one considers the renewed increase in power of the Russian arms industry together with the constant progress in arms manufacture being made by China. Fourth generation Russian combat aircraft, whose performance is comparable with the best of Western standards, are operational, or soon will be, in Russia, of course, but also in China,

India, Algeria, Venezuela, Uganda, Indonesia and perhaps soon in Iran. At the same time, Moscow is developing the T-50, a fifth generation combat plane, and a cooperative project with India on a similar aircraft has been mooted. The T-50 appears comparable with the American F-22: capable of super-cruise (supersonic flight without the need for reheat), stealthy, hyper-manoeuvrable, fitted with highly advanced avionics and carrying eight very long range air-to-air missiles within its fuselage. China is not being left behind with respect to these advances, and is developing two fifth generation aircraft, the J-20 and J-31, whose overall lines are remarkably like those of the American F-35. Over the next few years, several hundreds of these aircraft will join Russian and Chinese units and, in derivative versions, could be exported to the traditional allies of the two countries. Hence Western air supremacy could well see itself challenged far more strongly than in the past, and in particular by the threat those combat aircraft pose to surveillance, intelligence, in-flight refuelling and command and control aircraft (High Value Airborne Assets, HVAA), which together constitute a large part of Western superiority. In the absence of Taliban Sukhois, or of the MiGs used by ISIS, and considering the extreme weakness of Libyan and Iraqi aviation during past crises, some might think that Western air superiority on operations has been acquired with the minimum of effort. Such an idea is not just wrong, it is dangerous and flies in the face of evident developments. It is indeed a battle for air superiority for which the West has to prepare, and losses have to be expected.

In the short term, the greatest opposition to Western air forces is more likely to come from the ground than from the sky. The threat of ground-to-air systems is not new for Western aviators. In Vietnam, in the Middle East and on a lesser scale in the Balkans, these defensive systems have in the past inflicted sometimes very significant losses. Yet it should be said that since the collapse of the Soviet Union, aviators have held the advantage while Russian industry was unable to maintain a competitive level. Stakes seem to have changed in recent years, with now very capable ground-to-air systems being produced and exported by Moscow and Beijing. The range of interceptor missiles is increasing radically (for the S-400, up to 250 km, even 400 km according to some sources), radars are becoming more resistant to jamming and cover a broader range of frequencies, and anti-aircraft batteries of all types are integrated into multi-layer defence networks that are capable of handling a great number of targets simultaneously. The result is new vulnerability of HVAA and stealth aircraft, and a heightened threat for traditional combat aircraft. Moreover, these ground-to-air systems are widely exported: the Russian S-300 is present in some fifteen countries, and its Chinese derivative, the HQ-9, is said to be operational in North Korea and Pakistan.

If nothing is done to correct it, the combination of intensification of threats mentioned above (which, in the event of a confrontation would mean increased attrition compared to past commitments), and declining defence budgets seen in recent years in many Western countries, could well lead to the end of

Western air supremacy. The consequences of such a development would have an impact on all our military operations, way beyond the purely 'air' ones.

As new fields of confrontation emerge, so do associated non-military threats that put pressure on the future of Western aerospace forces. Elements are appearing in the extra-atmospheric environment and in cyberspace—places wherein a substantial part of the effectiveness of those forces is created—that will contest their domination.

In 2006, a laser based in China blinded a US Keyhole military satellite, and in January 2007, Chinese forces destroyed one of their old satellites, orbiting at 800 km from earth. That firing generated major, lasting pollution in a very busy orbit by spreading thousand of pieces of debris. That alone was a factor of change in the performance of Western aerospace forces highly dependent for their operations on low-orbit space-based assets. Importantly, it offered to all, the United States especially, tangible and highly visible proof of Beijing's military aspirations in space. A few months later, the Chief of Staff of the Chinese air force claimed it was historically inevitable that there would be competition between armed forces in space, and considered it imperative that China develop offensive and defensive space assets. Since then, Beijing has conducted numerous military-related space operations and has been developing equipment programmes capable of operating offensively in space, such as the Shenlong space plane, which is not unlike the US X-37B.(1) For its part, Washington does not exclude the possibility of a military engagement in space, based on the principle of legitimate defence. The generalisation of access to space through the use of the latest advanced technology is an indicator of progress, for sure, but it also appears as a factor of tension and destabilisation by allowing the multiplication of the number of players there and the deployment of new equipment, such as high-performance mini or micro-satellites and low-cost launch vehicles. These developments are contributing to the breakdown of the 1967 Space Treaty, which sets the principles governing state activities in extra-atmospheric space, and are giving shape in an increasingly precise manner to the perspective of military confrontation in space. Satellites are vulnerable, yet essential to modern military operations. They supply highly developed armed forces—their air components in particular—with the bandwidth, for which there is an ever-increasing need. In this respect, it is estimated that the United States has multiplied its bandwidth tenfold every year for the past twenty years, and there is nothing to suggest that this already impressive trend is going to reduce. Without satellites, no long-endurance drones, no cruise missiles, no long-distance communications and no precise weather forecasting. Without them also disappears the widely-used and very precise navigation system, and C4ISR assets would be

(1) The X-37B is a 'space aircraft' put into service by the USAF, which operates in low orbit (less than 1,000 km, and typically 400 km). Fitted with a hold, and manoeuvrable, it is capable of putting a lightweight load into orbit and to inspect and even recover satellites. It flew for the first time in 2010, and an X-37B that had been in orbit since 20 May 2015 for an unknown mission landed in Florida on 7 May 2017 after a flight of over 700 days.

severely degraded, too.[2] Hence without them, that which ensures the superiority of Western aerospace forces would largely vanish. Communications, observation and surveillance satellites are at the very heart of the potential vulnerabilities of high-performance aerospace forces. Given all of that, strengthening the resilience of space systems appears necessary for those would wish to maintain their advantage. To satisfy this need, redundancy of assets, mobility of platforms in orbit, and guaranteed access to space at short notice and moderate cost would seem possible paths to explore. Before making such effort however, means have to be procured for space surveillance not only as an operational necessity but also as a question of sovereignty, if a country is not to lose its strategic position.

On a USAF base in Nevada in September 2011, a computer virus entered the control system for the Predator MALE drones[3] operating in Afghanistan. The operational activity of the fleet infected by this virus was suspended for two weeks. Two months later, a US drone that was operating in the Afghan-Pakistan region on behalf of the CIA, a RQ-170 Sentinel, fell into the hands of the Iranians, who claimed to have taken control of it remotely. These two incidents spectacularly marked the arrival of cybernetics in the range of threats that now have to be taken account of by aerospace forces. Of all military assets, these forces are probably the most vulnerable to cyber attacks because of the omnipresence of information technology (IT) in their weapon, command and support systems. NATO heads of state and government noted at their summit in Warsaw on 8 and 9 July 2016 that cyberspace had become a field of operations in which NATO must defend itself as effectively as it does in the air, on the ground and at sea. Cyber security is now one of the basic missions of aerospace forces. They are already confronted with cyber attacks for espionage purposes, as are the industries that supply them. Attacks aimed at decoying or sabotaging systems should also be anticipated, and some of them could also be conducted with the greatest discretion in periods of low, or no tension, their effects being revealed only once a crisis arises. Given this context, and as a minimum, strict IT hygiene is required in all components of aerospace forces in order to avoid accidental infection of systems and to repel less sophisticated attacks. Beyond that, surveillance of networks and their improved resilience also seem necessary. If these things are not done, the performance of weapon systems, their logistic environment and command and control systems will all be threatened—in other words, the entire air force.

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On 14 March 1933, Winston Churchill declared to the House of Commons that not to have available an air force adapted to the (then) current state of the world would be to compromise the foundations of liberty and national

(2) C4ISR: Computers, Command, Control, Communications, Intelligence, Surveillance, Reconnaissance.
(3) MALE: medium altitude long endurance.

independence. He said that just a few days after Adolf Hitler's success in the elections that plunged Germany into Nazism and at a time when anxiety in the great European democracies was silently increasing. It is quite remarkable that one of the greatest political leaders of the time should have made such explicit reference to air power, and with astounding clairvoyance. Putting aside any excessive sense of optimism or enthusiasm, even if we believe our present times to be more peaceful the relevance of Churchill's opinion lives on.

# The Nuclear Landscape in 2030: The Place of the Air Force

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France has recently begun the renewal of its nuclear deterrent, taking note of the diplomatic uncertainties of its neighbours. This highly significant decision takes account of the probable developments of an international system in which balances are now changing extremely rapidly. The statement credited to Antonio Gramsci that "The old world is dying away, and the new world struggles to come forth. Now is the time of monsters", is just as appropriate to the potential risks attached to the geopolitical landscape in the years from 2017 to 2030. Given the bolt from the blue of Brexit, Donald Trump's accession to the presidency of the United States, German military expansion, the ascension of China, Russian renaissance and the general fragmentation of the Middle East, that we are witnessing the end of an 'old world' is no longer a theory but a fact.

The hierarchy of world power, inherited partly from the settling of scores at the end of the Second World War and partly from the end of the Cold War, has entered a phase of profound redefinition of which the final outline cannot yet be seen. This relative uncertainty is a breeding ground for an increasing number of crises and wars of all types as a result of the predictable friction between a first group of actors wishing to defend the status quo, a second group who will probably want to profit from all the consequences of weakened Western powers and a third group of provisionally neutral spectators simply waiting for the pans of the world political balances to find a new, unstable equilibrium before playing their hand and taking their winnings. Moreover, these three groups are far from being homogeneous within themselves. To take just the example of those defending the status quo, it is not completely sure that in the long term European and American interests will completely converge because of the very different security equations that are being developed on each side of the Atlantic.

In such a state of general uncertainty, prudence requires of an actor such as France to prepare itself militarily—at least, in the medium term—for certain politico-strategic scenarios of violent rupture across the entire peace-competition-crisis-war spectrum whilst at the same time seeking to prevent such occurrences diplomatically. We need, as General Poirier once wrote, to succeed in understanding in a conflict situation how a state passes from one level of tension to another,

the origins, the developments and the decline of these levels: in a word the law, if such exists, according to which they are created. And it is only insofar as we are capable of such analysis that we will be able to identify military war and comprehend its genesis.(1) Facing up to the negative consequences of crises yet to come with proportion and resolution means in particular making the effort to think of the ever-possible creation of high-intensity flare-ups. The period from 1990 to 2000, during which questions were posed on a possible end to major wars, are well and truly over. In the fogginess between a crumbling old world and a new world yet to be defined, all feel that violence between organised political groups (be they state or non-state) could take on surprising and never before seen forms. In this sense, and taking into account the warning signs of the strategic landscape in 2030, the magnitude of French nuclear capability remains more relevant than ever. Moreover, because of its very particular capabilities, the place of the Air Force within this national nuclear posture should be better known, consolidated and preserved.

## The place of the Air Force in French deterrence posture

French nuclear deterrence today is constructed on two pillars, or components. The four *Le Triomphant* class, new generation missile-launching nuclear submarines (*Sous-marins nucléaires lanceurs d'engins nouvelle génération*, SNLE-NG), or SSBNs, fitted with M-51 missiles, represent 'pure' or second strike deterrence, and are maintained and operated by the *Marine Nationale*. Were there to be a direct attack on French vital interests, this nuclear capability, which combines invulnerability, mobility and stealth, is a sign to the aggressor that he always risks losing more than he might gain. It gives France a strategic in-depth sanctuary that its geographical distribution does not offer naturally. It is the response to the core mission of French defence, as stated in the latest *Livre blanc* (Defence white paper), to protect national territory and French citizens, and guarantee the continuity of the essential functions of the nation. From that point of view, the second strike capability is the contemporary technological avatar of strategy as it has always existed. Even in 1787, the author Guibert, in his Eulogy of the Prussian King, wrote that the true perfection of the science of war consists of making the defensive superior to the offensive and of making nations mutually safe from being invaded. Two hundred years later, not a word of that needs to be changed to define the second strike capability that France has built, improved and made credible.

For all that, in an international system where shared multilateral standards are diminishing and in which the alliances that structure it are changing, strategic scenarios are becoming muddled. The hybrid nature of current modes of aggression complicates the defender's analysis of where the threshold lies, above which his vital interests are really at stake. Yet that same nature broadens the operational

(1) Lucien Poirier, Problématique polémologique et volonté de création, *Études polémologiques* N° 12, April 1974, p. 20.

options for the aggressor: he becomes able to take the initiative and alter the tone of events by altering his aims, subtly reinforcing his blackmail and proceeding gently, one foot over the line, the other behind. In doing so he can increase the strategic stakes while betting on the defender's reluctance to launch a punitive response that would be disproportionate to the immediate stakes of the crisis. In this defensive context, the only possibility for pure deterrence, that of a reprisal strike, tends to restrict the options available to political decision makers. The warning that Kissinger gave back in 1974 in *Nuclear Weapons and Foreign Policy*, is just as valid today: he advanced that a strategic doctrine had to allow us to avoid the dilemma between Armageddon or a defeat without war. It is precisely because the air-carried component of French nuclear deterrence allows for a way out of this dilemma that it responds at the right level to the foggy rules of the game that are likely to have a strategic effect on the international system as we approach 2030. Because they control the modularity that comes from the complementarity of the two components in terms of range, accuracy and penetration mode, French political leaders make national nuclear deterrence credible by keeping out of the all-or-nothing trap. If deterrence is the result of an elevated form of discussion of contradictions, the air-carried component of the nuclear deterrent means that, if the moment should come, the adversary can be shown by an absolutely unequivocal final warning that he has reached the nuclear threshold. As tempted as he might be to prolong the indirect blackmail, which might up to then have partially succeeded, he cannot thereafter believe that he could continue beyond a certain threshold without provoking a reaction. It is no longer some modification of the pieces in the game that are now set out before him, but the entire chessboard itself, meaning a brusque passage from the conventional, with its relative gains, to the non-conventional, one of absolute losses.

Announcing this change of chessboard, or level of threat, is a form of pedagogy whose spirit, contribution and logic Lucian Poirier sums up simply in saying that we have always known that to discourage the adversary from taking formidable initiatives, one usually effective means is to prepare oneself to react.(2) This very function of being reactive and proportional is currently provided by the 22 Rafale B and the 31 Mirage 2000NK3 of the Strategic air forces (*Forces aériennes stratégiques*, FAS) of the French Air Force, equipped with 54 ASMP-A missiles with thermonuclear warheads, and supported by the in-flight refuelling tanker aircraft KC-135 FR and C-135 FR, and soon the A330 MRTT Phénix (Multirole tanker/transport). The mission of the pilots of these aircraft is to guarantee in all circumstances the long-distance deployment of ASMP-A, which has a range of 500 km in high altitude cruise mode.(3) The Rafale's operating range is 3,700 km, which increases the direct attack effectiveness to 4,200 km, thus covering the strategic neighbourhood of the European continent. For more distant

(2) Lucien Poirier, *Des stratégies nucléaires*, Paris, Hachette, 1977, p. 86.
(3) *Cf.* Le missile nucléaire ASMP-A entre en service, *Mer et Marine*, 7 October 2009.

requirements, in-flight refuelling means this direct range can be multiplied several times.

Taking into account the possible lines of force of the global strategic landscape in 2030, the capabilities of the FAS (whose training requirements are to the advantage of the entire French Air Force) respond well to the necessary contradictory nature of the final warning. The latter must be conspicuous (visible and able to be seen), effective (capable if necessary to penetrate enemy anti-missile and anti-air defences) and reversible (if the enemy steps back, which it would be in his interests to do, the nuclear countdown stops and the Chief of the armed forces recalls the Air Force delivery vehicles). Looking ahead to 2030, one of the principal challenges of the French Air Force will be to respond to the strategies of denial represented, among others, by the proliferation of ground-to-air defence systems, typified by the S-300, S-400 and the future S-500 series. When appearing recently before the Senate defence, foreign affairs and armed forces committee, General Lanata, Chief of Staff of the Air Force, declared that it must never be forgotten that freedom of action in the third dimension is a prerequisite for all our military operations, and that this major challenge must feed into all consideration of the future of our air combat system. What he said applies particularly to the FAS, and this imperative will continue to grow as we approach the year 2030.

The planned modernisation of the Air Force nuclear squadrons is the right response to this challenge. In 2018, the Mirage 2000NK3 will be withdrawn, leaving a fleet entirely composed of Rafale. Apart from the single type of carrying aircraft, the freedom of action that the air-carried component of the deterrent brings will need to be guaranteed by technological innovations appropriate to the threat and to potential adverse counter strategies. Looking ahead to the Future air combat system (Système de combat aérien future, SCAF) which is currently being defined, this will lead to in-depth studies into modes of detection and counter-detection, which will require a mix of active and passive stealth. Mission preparation systems, too, need to be optimised. The challenge will always be to penetrate non-permissive environments and to guarantee first entry and the ability to reach distant targets. New orientations and lines of rupture of future capabilities will depend on many decisions to be taken in the framework of the preparatory work for the fourth generation air-to-ground nuclear missile ASN-4G (Air-sol nucléaire de 4e génération), successor to the ASMP-A. While waiting for the development of capabilities based on the high velocity (Mach 7 or 8) that will enable future missiles to penetrate adverse defences to overcome their access denial capacity, it is probable that stealth will be a reasonable intermediate solution for the next 25 to 30 years.

The expected technological breakthroughs, combined with the deployment of a new system of air combat systems that mix piloted with remotely-piloted vehicles will also have to take into account current developments in extra-atmospheric space and in cyberspace—the latter notable for the ever-greater

strategic competition seen today. These upheavals will not be without consequences for the future of the FAS. As a player in an overall network, the future versions of the Rafale will have all that is needed to join this development and to become the intelligent central point of a airborne system of piloted and non-piloted aircraft. In this system, which will involve the conventional as much as the nuclear aspects and missions of the Air Force, there will be a need to define the concepts and doctrines for the combined use of combat aircraft and drones, with the latter operating under the control of piloted aircraft. This development will succeed by increasing the power and shape of French combat aviation that is today sub-critical, when seen in relation to the evolution of risks that weigh on the French and European security environment.

# A Strategy to Counter Access Denial?

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Projection of forces and power has been at the heart of Western strategies since the end of the Cold War, and has enabled members of the Atlantic Alliance to defend their interests by imposition of power, wherever they were threatened. Air power has played a decisive role in interventions in the Middle East, former Yugoslavia, Central Asia and Libya. In his book *Airpower for Strategic Effect*, Colin Gray even mocked the enthusiastic use of combat aviation by asserting that air power has sometimes been considered a magic potion that cures all strategic ills. For all that, the improvement in detection and strike systems that has taken place since the nineteen-nineties, the source of much comment when the United States turned its attentions towards the Asia-Pacific region and during the crisis in Ukraine, has augured renewed effectiveness in counter-air strategies. Its very nature calls into question the freedom of action that Western powers currently enjoy. This change in the strategic environment could lead to consequences for balances of power, to follow Hans Morgenthau's line of thought, by making defence against aggression easier in comparison to the ease with which aggression can today be applied through the possession of far superior air power.

Bolstering defensive capability is often described in terms of the concept of Anti-Access/Area Denial (A2/AD). It refers to capabilities, mainly long-range, that are designed to prevent an enemy force from penetrating an operational area, whilst the denial of the area comes down to capabilities that are usually of shorter range intended to restrict the freedom of manoeuvre of an enemy force in the area of operations.(1)

The A2/AD concept was conceived in the nineteen-nineties, but really took off in 2012 with the shift of US interest towards the Asia-Pacific region at the same time as interest in the concept of counter-insurgency war declined. It describes a classic situation in which there is increased strategic interest because of developments in weapon systems, particularly in the fields of sensors, target

(1) Philippe GROS, *La question du déni d'accès et le concept Air-Sea Battle*, Revue Défense Nationale n° 760, May 2013, p. 50-56.

acquisition and the range capability of effectors.(2) The problem is not new, but needs some thought about concepts and the appropriate means to counter A2/AD, in a similar way to Soviet theoreticians such as Tukhachevsky and Svietchine, who considered the operational shock preferable to the concept of a strong, continuous front as a result of lessons learned from the First World War.

## Technical excess and a strategic hole

To understand the responses to the A2/AD problem, we should note that the concept was created in the Office of Net Assessment (ONA), under the direction of Andrew Marshall. In the years following the Gulf War, when studies were initiated on the revolution in military affairs (RMA) and transformation, the ONA director was one of the first in the US administration to identify China as the future strategic challenger of the United States. The first ONA studies, initiated by Andrew Krepinevich in 1993, showed that the A2/AD strategies developed by China risked a considerable increase in the cost of power projection and threatened US forward bases such as those at Dhahran, Luçon and Diego Garcia.(3)

Although Pentagon analysts started thinking about a technical revolution based on the creation of a system of systems and about restructuring forces into complexes combining reconnaissance and strike, the initial response to A2/AD was a call for developing joint-force synergy. In January 2012, the Joint Operational Access Concept (JOAC) proposed cross-domain synergy, in other words an approach that combines material assets operating in different domains with increased integration of space-based and cyber assets into operations.(4) The US Navy and Air Force started to create this synergy around the concept of the Air-Sea Battle, which was defined from 2009 onwards in a series of published documents.(5) The solutions proposed by the US seamen and aviators were still based principally on the use of long-range, powerful systems that call upon highly innovative technical solutions in terms of capability. The USAF, for example, counts on fifth generation aircraft, like the Long Range Strike Bomber (LRS-B) armed with hypersonic and hyper-manoeuvrable cruise missiles, and stealthy unmanned aircraft like the Boeing X-51, in order to penetrate such contested airspace.

This top-of-the-range solution is a typical response from US strategic culture to the challenge of A2/AD and is the subject of the US Third Offset Strategy. However it carries with it a problem of cost, which for European powers is not

(2) See: Corentin Brustlein, Etienne de Durand and Elie Tenenbaum, *La suprématie aérienne en péril. Menaces et contre-stratégies à l'horizon 2030*, La Documentation française, 2014.

(3) Andrew Krepinevitch and Barry Watts, *The Last Warrior. Andrew Marshall and the shaping of Modern Strategy*, Philadelphia, Basic Book, 2015, p. 205-209.

(4) *Joint Operational Access Concept*, version 1.0, 17 January 2012
(www.defense.gov/Portals/1/Documents/pubs/JOAC_Jan%202012_Signed.pdf).

(5) These documents are classified, but an extract can be seen in: *Air-Sea Battle, Service Collaboration to Address Anti-Access & Area Denial Challenges* (http://archive.defense.gov/pubs/ASB-ConceptImplementation-Summary-May-2013.pdf).

insignificant. It also opens up a hole in the strategic logic, since the quantity and power of the means necessary to penetrate an area protected by an A2/AD strategy under the US concept calls into question the end. If Clausewitz's formula is followed, the means need to be proportional to the desired end state, which is the political objective of any war; he said that in order to be certain of the means to be mobilised for war, the political objective has to be considered, both from our own point of view and from that of the enemy.(6) The assets—the means—mobilised to circumvent an A2/AD strategy have to be commensurate with the military action undertaken. If one considers a conflict with unlimited use of force, there is no doubt that air and naval forces will have the capability to break through an anti-access strategy. But if the operation demands limited use of force, which is the case for force and power projection in current conflicts, attention has to be paid to the nature and power of the assets employed.

It is clear that A2/AD increases considerably the level of violence needed for coercive action and also increases its cost, matters that are already evident in current operations. The intercept by Russian ground-to-air defence systems of a third of the 59 Tomahawk missiles fired against the Syrian base at Al-Shayrat during the night of 6 to 7 April 2017 shows that the coercive power of the air arm when applied in isolation is eroding. Whilst that power has been the main coercive instrument of our era, it seems to be losing its competitiveness in current strategic conditions in the face of A2/AD, as Robert Pape has shown in his book *Bombing to Win*.

## The cross-domain approach

To develop a strategic equation that would once more give freedom of action back to Western powers and enable them to defend their interests with strength, the cost of coercion has to be reduced by adopting alternative strategies that employ technical excess to cloud the relationship between the political objective of a war and the means used to achieve it. The first way to do this is probably a combination of assets drawn from various domains, and therefore from different armed forces. Up to now, offensive operations against ground-to-air defence systems have followed the same basic plan since the Vietnam war, using Wild Weasel destruction missions, Wild Weasel being the nickname given to the Suppression of Enemy Air Defence (SEAD) aircraft. This model was perfected using ever more elaborate Integrated Air Defence Systems (IADS) countermeasures to defeat enemy defences, and was used in operations against Iraq in 1991 and 2003, and against Serbia in 1999. This first phase led to action within other components. In these models, the role of the air arm made it the dominant force since, according to Fuller, the key weapon is not necessarily the most powerful, the most accurate,

(6) From Carl von Clausewitz's famous work, *On War*.

the one that deals the greatest number of blows or the easiest to transport. It is the one which, having the longest range, can enter the action first and serve as cover for the others which can then act according to their respective qualities and limitations.(7)

That sequential plan is probably out-dated and we should now consider combinations of assets coming from several domains but acting in parallel in a coordinated manner. This could mean their use by ground-infiltrated special forces to destroy some element of the enemy IADS, which then opens a corridor that enables assets from other components to act. During the 1991 Gulf War, for example, a SA-2 was neutralised by a shot from a MLRS (multi-launch rocket system) guided by a special forces' team.(8) Today however, to borrow Fuller's expression, the weapon with the longest range is the digital weapon. Possibly the most promising way ahead for this was demonstrated by the Israelis in their Operation Orchard in September 2007, in which they broke into the Syrian IADS using Suter software to alter data while F-15 and F-16 aircraft penetrated airspace to destroy their target.(9)

## Wear out, rather than wipe out

This example shows that as far as SEAD is concerned, strategies have to develop a rationale of paralysis, and not simply one of destruction. Disturbing the enemy's OODA loop (observation, orientation, decision, action) in order to penetrate contested airspace consists of creating uncooperative centres of gravity for him that will paralyse the decision-making cycle, as Colonel John Boyd showed on a slide in his *Pattern of Conflict* lecture. We no longer have to destroy the ground-to-air defence sites, but to generate an air situation that makes the adverse defence system ineffective by use of digital weapons and also, for example, by using swarms of drones to saturate its capacity for target acquisition or fire control.

Paralysis of an IADS needs to be achieved by manoeuvre and firepower together, and not just firepower alone. In other words, fighting A2/AD strategies calls for a complete change of strategy. Previously, elimination—or *wipe out*—was preferred, using Wild Weasel type missions but today, achieving that paralysis calls for Hans Delbrück's second strategic system, in order to *wear out* the adversary. In studying Frederick the Great's campaigns, Delbrück contrasted two systems: he considered that a strategy that consisted of cutting down the enemy had only one element, battle, but that a strategy of harassment had two, battle and

(7) Adapted from: Major General J.F.C. Fuller, *Armament and History*.
(8) Major Mike "Pako" Benitez, *Offsetting Air Superiority with Air Force Special Operations*, Warontherocks.com, 3 November 2016.
(9) Erich Follath and Holger Stark, *How Israel Destroyed Syria's Al Kibar Nuclear Reactor*, 2 November 2009, *Spiegel Online* (www.spiegel.de/).

manoeuvre, and that the General formulated his decisions from the latter two.(10) The strategy of wearing down an A2/AD structure depends on manoeuvre—not on manoeuvre organised in a single domain, but on cross-domain manoeuvre that combines the actions of assets operating in different domains.

The development of counter-air strategies using A2/AD had been envisaged by General Ailleret in his 1950 work *L'Art de la guerre et la technique* (The art of war and technique). He reckoned that air warfare would one day reach a stable state when a great number of low-cost ground-to-air missiles would be able to prevent aircraft from crossing a line or reaching an area. Each belligerent could then fly as much as he would wish over his own territory, but could not intervene above enemy-occupied territory. In view of what was available at the time, he rejected this hypothesis, declaring that given the breadth of the fronts we had to defend and the difficulty of manufacturing a vast number of air defence weapons as complex as those that were supposed to exist, it was very unlikely that an air war with a stable front could take place. And yet today's weapon systems enable us to envisage what Ailleret had imagined but rejected. The risk of stabilisation of air warfare that we are witnessing could nevertheless be sidelined by general broadening of strategic space and its extension into the cyber and space domains. The response to A2/AD strategies therefore probably lies less in a sort of technical excess than in the search for highly integrated cross-domain manoeuvre that combines interoperable assets, each working in its own domain.

(10) Hans Delbrück, *La Stratégie oubliée. Périclès, Frédéric le Grand, Thucydide et Cléon* (translation by Joël Mouric), Économica, 2015, p. 38.

# Tomorrow's Air Force: the Future Air Combat System

Thierry ANGEL

Brigadier General (Air), Air Staff deputy head of preparation for the future.

For over 25 years, Western air forces have enjoyed unchallenged operational superiority. Now, however, a new geostrategic wind is blowing which along with major technological developments is upsetting that situation and forcing a rethink of combat aviation in the coming years.

Given the perspective of conflicts that stand to threaten Europe—its periphery in particular— and with the increasing number of asymmetric conflicts, European nations are being invited by their Unites States ally to grasp their growing responsibilities regarding their security. More than ever it is necessary to invest in the air arm, itself weakened by years of budgetary constraint and over-commitment to operations.

The Air Force is joining this highly necessary strategic rethink in order to face the challenges of the coming centuries. Such is the ambition invested in the Future air combat system (*Système de combat aérien future*, SCAF).

## The fundamentals of air operations

Air power has three major advantages, linked intrinsically to the aerospace environment: height, speed and reach. The combination of these three means that action can be undertaken rapidly, flexibly, reactively and deep into the adversary's territory. The air arm is not simply a military tool but one that is eminently political, serving the strategy for defence and national security.

Control of the air is needed for freedom in any military action, be it in the air, on the ground or at sea. It means the adversary can be drastically constrained, even on his own territory. To be effective, air action has to be lasting, and needs perfect coordination between the players so that, when the time comes, assets can be concentrated and action conducted from the air.

The French defence white paper (*Livre blanc sur la Défense et la Sécurité nationale*) states the need for forces that are coherent, independent and reactive, and capable of delivering a decisive impact when national interests are at stake.

Within this framework, the Air Force has to carry out its permanent missions of nuclear deterrence and protection of national airspace. It also has to perform external interventions, in the first place to achieve air superiority and thereafter to act from the air across the entire operational spectrum, including intelligence, ground strike and air transport.

Throughout recent decades air superiority has permitted action with reactivity and effectiveness whilst greatly limiting loss of human life. This superiority is nevertheless contested in the new geostrategic context.

## Evolution of the strategic context

Developments in the geostrategic order are tending to alter the balance of forces from the points of view of threats, strategic repositioning of our major allies and technological breakthroughs.

Recently appearing at the top of the list is the threat from state adversaries, which have greatly increased their investment in defence to acquire military capabilities in terms of numbers and also of an extremely high level of skill. It is not just the major powers, but also regional powers that are benefiting from the proliferation of weapon systems. These countries are developing access denial strategies based on combined use of the latest generation combat aircraft, integrated long-range anti-aircraft defence systems and electronic warfare (EW) assets, which include the ability to jam GPS. The Anti Access Area Denial (A2AD) system changes international balances of forces by challenging control of airspace. Moreover, these adversaries are in a position to attack our space assets that have up to now been considered invulnerable. These assets afford us the capabilities essential for the conduct of modern military operations.

At the other end of the spectrum, non-state groups are operating against our interests while avoiding direct confrontation. They employ asymmetric methods of action, such as hiding in a civilian environment, guerrilla tactics, terrorism, low-cost weapons and freely-available technologies that weaken the Western technological advantage—mini drones, IEDs, smartphones and propaganda on social networks, for example.

In both cases, our adversaries' action depends to a great extent on IT and cyber facilities.

A further point is that, while for many years some countries have considerably increased their investment in the military sector, European countries have continued to disarm and have reduced their air fleets by some 30 to 50 per cent in ten years. In parallel, the United States has been reorienting its geostrategic priorities towards Asia and the Pacific. That highlights the need for the Air Force to have

permanently available a range of military capabilities in order to preserve national sovereignty.

Lastly, major technological breakthroughs have also tended to alter the balance of forces, particularly in the areas of computing, artificial intelligence, robotics and sensors (multi-static, low frequency and passive radars), hyper-velocity and directed energy weapons.

The operational advantage of Western air forces is being eroded and will no longer be able to be guaranteed unless the air combat system is modernised in the next ten years.

## Adaptation of the air combat system

Faced with this changed order, the Air Force has to become part of an overall air combat system. This system has to be based on an interoperable network of weapon systems (manned or otherwise) that cover the widest possible spectrum and are themselves interconnected and also linked into a robust command architecture. It must be capable of rapid adaptation and be resilient—to cyber threats in particular.

Though confronted by access denial and top-level threats, the Air Force must conserve its first entry capability, including deep into the adversary's territory, above all in order to be able to carry out the nuclear deterrent mission. It must control the air to act from the air. To do this, the overall survivability of the air combat system must be strengthened, on one hand through the intrinsic qualities of the platforms such as self-protection, stealth, speed and manoeuvrability and on the other by establishment of networking. Collaborative combat should make coordinated and concentrated use of assets in action possible by winning the information war. The logic of employing the best platforms (sensor and shooter) should be replaced by a network-based logic of effectiveness, in other words, best sensor and best shooter available.

To counter hard-to-pinpoint threats and asymmetric conflicts the Air Force needs to improve its capability for intelligence gathering, reconnaissance and surveillance. There, too, platforms and captors need to be networked in order to speed up the decision-making process to near real time, and to engage the enemy at the right moment by virtue of using weapons adapted to the environment and to the military effects to be achieved.

Whatever the threat, the need for connectivity is the foundation of the entire future air combat system. Networking of weapon systems and the associated real-time exploitation of ever-greater quantities of data whose added value comes from decisional aids, such as big data and artificial intelligence, render possible modes of collaborative combat that will enhance the intrinsic power of the

platforms concerned. Such networking also offers scope for action in the cyber environment. Connectivity is therefore a matter of the highest importance, whose effects go well beyond simple technological improvements. It affects decision-making processes, command decisions and operating modes.

All this technology should not let us forget the essential principles of air power. Faced with the challenges of distant theatres of operation whose dimensions, moreover, are of almost continental size, the Air Force needs also to boost the permanence of its action. That will be sought through a combination of better endurance of the platforms, in-flight refuelling assets and a sufficient number of aircraft.

Major investment is therefore necessary to face the challenges posed by combat aircraft, starting with the very next military programming law. The Air Force is ready to join the strategic revision process by bringing its air combat expertise to the table to aid analysis of future capability requirements.

The challenge is a considerable one: a future air combat system has to be designed that will be able to stand up to changing threats and new forms of strategic competition.

# The CEAM, an Incubator of Innovative Projects

Jean-Pascal BRETON

Brigadier General (Air), Commanding the centre for military air expertise.

In order to keep the initiative on the ground and to be in full command of the threats when engaged on operations, the Air Force takes pains to reduce its own vulnerabilities and seeks to strengthen its modes of action and, with no limits set on imagination, to develop new ones. To this end, the Air Force has developed a capability unique in the field that favours the growth of new tactical thought processes and allows numerous projects of great operational value to be put into effect.

The conversion of the centre for military air expertise (*Centre d'expertise aérienne militaire*, CEAM) into the Air Warfare Center (AWC), and the many related initiatives have led to a profusion of ideas in tactical thought and the identification of operating modes that differentiate them. More than that, the effective management of numerous innovative projects guarantees that, in the end, forces will receive the capabilities that they need. Today the Air Force is benefiting from the highly successful transformation of the CEAM, which has developed from an incubator of ideas to one of innovative projects.

## The CEAM, a modern and singular approach

Conscious of the compartmentalisation of the different systems used by forces, the CEAM decided to bring together in one place and in a short space of time a range of tactical operators, each possessing excellent knowledge of his respective field of expertise. This modern and singular approach, when compared with foreign AWCs, favours the sharing of cultures and encourages the identification of operating modes that are at once cunning and robust.

The CEAM made a positive decision to encourage informal feedback from those on the ground and is achieving great benefit from this environment of inter-specialisation in order to promote lateral thinking—the aim being to draw the best from each specialisation in the Air Force's front line. Since 2015 the CEAM has also been shaping various tactical reference points for the forces in order that internal work can be disseminated via a network that is robust yet unfettered by

compartmentalisation, thus allowing each to contribute to enriching tactical thought and to share any information judged relevant even if unpalatable.

## The CEAM, a real battle laboratory for the Air Force

Ideas, however brilliant they might be, have to be tested, evaluated and experimented in an operational environment in order to verify their relevance. To do this the CEAM has improved its own capabilities for battle lab modelling and can thus efficiently progress consideration of doctrine, modes of action and specification of equipment. Thus equipped, all feedback can be used to determine ways of improvement in the face of problems encountered on the ground: should we, for example, be thinking of modifying our modes of action or our Tactics Technics and Procedures (TTP), or indeed, of some future programming solution?

If changes to modes of action or TTPs are needed, the CEAM is there to analyse the difficulties encountered by aviators in the conduct of their missions, particularly in external operations, in order to identify trends and to lead consideration of current and future operational environments. With its battle lab, the CEAM is giving a boost to aviators' culture and effectiveness, taking into account and evaluating new modes of action within the framework of the exercises in which the AWC participates either in contributing to the definition of training objectives or as organiser and assessor-referee.

To give an example, during the last exercise that put all the conventional air forces into action, and on the request of the Air forces command (*Commandement des forces aériennes*, CFA), the CEAM put the emphasis on training in a hostile electromagnetic environment—that is, one without access to GPS and with radio jamming. The crews confronted with such heavy constraints were forced to rethink their habitual modes of action and from that drew new tactical lessons.

In order to set in place the fundamentals of future modes of action, or those that will be accessible in the near future, and benefiting from the presence of technical experts and personnel in charge of doctrinal issues, the CEAM is piloting work which highlights and explains the potential and optimal use of an item of equipment even before it enters service. Such doctrinal reflection is aimed at guiding the principal operational capabilities of new systems with potential joint force consequences. It will broaden the options of commanders by bringing them new capabilities in the same way that it will inform operators in the battlefield on the way to employ them.

## The CEAM generates ideas and creates projects

Again, however innovative and pertinent ideas might be, they are worth nothing if they cannot be converted into tangible projects. There too the CEAM

is favouring decompartmentalisation and has not shirked from looking to others for guidance on converting operational problems into viable projects. In doing so, the CEAM encourages and practises a permanent dialogue with its state and industrial partners which allows, among other things, early consolidation of identification of a need, feasibility, financial backing and all else that is necessary to see a project through to successful conclusion.

## The CEAM, or how to think differently

During discussions with defence industries, it is unsurprising that their leitmotif of 'innovate to survive economically' often surfaces. Which is, of course, why those industries propose innovations based on sound technological foundations.

Conscious of this situation, the AWC has come up with new challenges with regard to innovation. But we need to be careful here, since innovation in the CEAM does not mean that any and all technology will do.(1) More pertinently, it relates to thinking differently and potentially to combining effects without ever losing sight of the economic aspect.

That is why the CEAM has established its own research section which, in close liaison with the forces, is capable of responding rapidly to a number of needs as they arise. It can design a demonstrator that can be put into a realistic operational environment, after which a formal requirement can be formulated to express the need for a future military capability. Exceptionally, in response to an urgent operational requirement, the CEAM can produce a small number of items in a short space of time.

## The CEAM: new working methods

In its constant search for improved working methods, the AWC has selected some thirty operational problems seen as viable from over fifty that have been directly fed back from the front line and from the CEAM. Each of them has its dedicated head of project! The mission of each of these thirty 'innovators' is not to produce the solution alone, but is to surround himself with the best-informed people in such a manner as to resolve the problem. For example, the centre for expertise on nuclear safety and nuclear, radiological, biological and chemical defence (*Centre d'expertise Sécurité nucléaire et Nucléaire radiologique biologique chimique*, CE SN-NRBC) raised the issue of evacuation of nationals infected with the Ebola virus. The centre of expertise was able to estimate a budget sufficient to allow working with a single outside service provider able to provide the appropriate

(1) Note that the OCDE's Oslo Manual (3rd edition, 2005) defines *innovation* as 'the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations'.

solution. Reflecting the CEAM's working style, the CE SN-NRBC operated in a flexible and economical manner by calling upon those in the know, while managing the project from start to finish.

## The CEAM, precise criteria to follow…

The CEAM does not have the resources to undertake costly technological design projects, which is why it has imposed a number of fundamental evaluation criteria on itself along the lines of the DORESE approach.(2) First of all, a project is judged viable when there is a notion of urgent need from the point of view of the end user. Then, human resources have to be taken into account in order to support the project in the longer term, especially if it concerns an Air Warfare Center that has a small number of staff when compared with its foreign equivalents. In fact, the thirty projects are directly integrated into the CEAM's overall workload. Lastly the budget—the force behind any war—is studied and allocated to be adequate to the needs of each project.

For its part, the Air Staff maintains vigilance that all energies expended are truly warranted, so all problems are passed up to the Staff, who go through them with a fine-toothed comb. Some are known and may already be the subject of needs requirements: in such cases it is the task of the project head to find the best way to resolve the problem. It is for the director of the CEAM to seek financial and legal support and if deemed necessary seek help from industry for research.

Apart from the requirement to apply the DORESE approach, the CEAM innovator is not constrained at all and has full latitude to reconsider his thought processes, his fields of action and to change those who are collaborating with him on the work. The main focus has to be on the problem posed by the forces and not on the search for some technological solution.

To help him achieve all this, a system of markers and checks has been set up. Every six months, up to a maximum of two years, the head of project gives a progress report to the director of the CEAM, a process during which the viability of the project is evaluated. In order to respond as quickly as possible to the needs of the forces the project has to be achievable within a defined time constraint with the best overall approach to the cost of procurement of capabilities.

(2) The French acronym DORESE refers to *Doctrine, Organisation, Ressources humaines, Équipements, Soutien et Entraînement* (doctrine, organisation, human resources, equipment, support and training), which are the constituent bricks of military capability. Applying this method of analysis, some 50 per cent of all projects are still-born.

## The CEAM, a state of mind

The role of the AWC has been considerably enhanced with respect to the missions the CEAM had in its original guise, and its range of interest has been broadened.

The groups composed of the various specialisations are designed to favour careful consideration and the production of new ideas. As the Air Force's battle lab, the CEAM can draw on appropriate tactical think tanks made up of experts from different fields, and can also look to the standard tactical procedures of operational units. In this way, operational problems are approached though innovative methods—in short, thinking out of the box is the standard *modus operandi*.

In conclusion, wherever weak points are discovered, experts seek and find options for adaptation, where possible by better exploitation of materiel already in service in the forces. In order to be more effective together, and with the aim always for operational superiority, the development of methods that cut across the cultures to benefit from the different specialisations of the Air Force is today essential for the CEAM.

# Legal Aspects of Drones Over National Territory

Pascal DUPONT

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Civilian drones are a derivative of military aviation and have the characteristic of being usable across a wide range of aeronautical activities—leisure, with aeromodelling, aerial work for photography and agriculture, industry and soon also for transport. According to the Directorate general of civil aviation (*Direction générale de l'aviation civile*, DGAC), in France the professional use of civilian drones produced a turnover of 160 million euros in 2016 and represented some 9,000 direct jobs in 3,500 operators and 25 constructors. For several months in the department of Var, the French post office has been testing delivery by drones, which is a prelude to the air transport at low altitude and lower cost of low-volume parcels. It seems however that these opportunities cannot be developed unless the public authorities support the developments by ensuring the freedom of users whilst at the same time preserving the integrity of our airspace. France was one of the first countries of the European Union to regulate drone activity with the *arrêtés* (orders) of 11 April 2012 and 17 December 2015, and a law of 24 October 2016 concerning the reinforcement of safety in the use of civilian drones, which will be complemented by a number of decrees regarding their application. Together with international standards drawn up by international organisations, these texts constitute the draft of a law on drones.

## The development of drones with regard to the status of aircraft and the remote pilot

In a 2015 study, the European Parliament proposed to identify drones according to two criteria: first, their uses (protection and surveillance, communications and media, and leisure) and their users (state, commercial sector and private individuals), and second, their weight (from 0 to 20-25 kg, from 20-25 to 150 kg and over 150 kg).(1) The common denominator of all these elements is the application of a single status, which is that of the aircraft.

The International Civil Aviation Organisation (ICAO) defines the aircraft as 'Any machine that can derive support in the atmosphere from the reactions of

(1) See the European parliament's paper on *Privacy and Data Protection implications of the civil use of drones*.

the air other than the reactions of the air against the earth's surface'. Existing drones fit this general description, which also covers aeroplanes, helicopters, seaplanes and free and tethered balloons. The inclusion of drones in the notion of aircraft carries with it the consequential application of the Chicago Convention on international civil aviation, dating from 7 December 1944. Although because of their technical characteristics civil drones are essentially used over short or medium distances, a state could experience overflight by a foreign drone. This case was expressly foreseen by the Chicago Convention, which states in Article 8 that 'No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft'. This clause is a reminder of the fundamental principle of air sovereignty according to which (in Article 1) 'The contracting states recognize that every State has complete and exclusive sovereignty over the airspace above its territory'. This sovereign mission is ensured every day by the Air Force which, with the Air defence and air operations command (*Commandement de la défense aérienne et des opérations aériennes*, CDAOA), has a centralised structure supported by a network of military and civil radars covering the whole of national airspace.

The law of 24 October 2016 results from a proposal from the Senate, itself based on a 2015 report by the General secretariat of defence and national security (*Secrétariat général de la défense et de la sécurité nationale*, SGDSN), and requires drones above a certain mass to be recorded electronically and, for the heaviest among them, to be registered officially. Two thresholds were specified – 800 gm and 25 kg. As for the requirement for registration, it applies to those over 25 kg used by professionals for particular activities in agriculture, industry and services. While these measures, which will apply from 1 July 2018, might appear as constraints for the users, they also constitute valuable help in preventing risks of in-flight collision between drones and aircraft flying at low altitude, as do civil security helicopters, military training aircraft and general and sports aviation.

The essential characteristic of these airborne vehicles is that they are *remotely* piloted. The absence of anyone on board raises the question of the status of the remote pilot. The law of 24 October 2016 defines the remote pilot as the person who manually controls the evolutions of an aircraft flying with nobody on board or in the case of automatic flight is in a position at all times to intervene on its trajectory and in the case of autonomous flight who directly determines the trajectory or the waypoints of the aircraft. The same text introduces a requirement for training, except for the use of leisure drones weighing under 800 gm. A licence is necessary for certain professional operations conducted out of sight of the remote pilot and, additionally since the *arrêtés* of 17 December 2015, for professional flights conducted away from inhabited areas remote pilots must hold an aircraft,

helicopter or glider pilot's licence, and be able to show practical experience of a minimum of 100 flying hours as captain.

It is worth noting from the above that drones are unquestionably aircraft, and that their use cannot be free from civilian aeronautical regulations. Quite apart from drones for leisure purposes, of which there are already 200,000 in France of weights varying from 100 gm to 2 kg, it is hardly possible to envisage the development of transport of goods, or even people, along new motorways in the sky without subjecting the activity to a standardised set of regulations and means of control.

## Special rules on the use of airspace

The drone's status as aircraft is entirely logical when considering navigation in the air and the risks that go with it. As a general rule, drone flight is conducted according to visual flight rules (VFR) when operated in the visual line of sight (VLOS) mode, while for other modes of operation instrument flight rules (IFR) could be envisaged in the short or medium term. These particular constraints explain why drones operate within what is called segregated airspace, which is airspace in which piloted and remotely piloted aircraft cannot exist together. Integration of this new type of aircraft into general air traffic in non-segregated airspace can only be achieved if appropriate safety rules are put into effect. International and European norms on airworthiness and insertion of drones into airspace currently boil down to just a few measures. Within the European Union the regulation of civil drones is currently undertaken by the European Aviation Safety Agency (EASA) for machines of a mass greater than 150 kg, and by national civil aviation safety authorities for those of lesser mass. The result of this is a division of competences that has up to now led to individual member states being able to decide the legal framework applicable to virtually all the drones operating in their airspace.

The rules for use of airspace by aircraft flying without anyone on board appear in the *arrêtés* of 17 December 2015, which identify three aeronautical activities: aeromodelling, special activities and experiments. Leisure drone flights and those performing 'special' activities (which covers professional uses) are height-limited to below 150 metres (about 490 feet) and are subject to restrictions such as bans on night flying, flight over built-up areas or people (unless authorised) and within 5 km around airports. An airworthiness document is required for all machines of over 25 kg.

The press has made much of 'malevolent' drones and illegal overflights since 2014.(2) The measures in the law of 24 October 2016 aim specifically at punishing illicit or malevolent use of drones strongly enough to dissuade users from

(2) By the same author, Les survols illégaux de mini-drones civils en question, *RDN* N° 779, April 2015, p. 59-61.

making banned overflights, which should therefore allow easier identification of events that might constitute a genuine threat. Drones being aircraft, they are subject to the relevant rules in the Transport Code (laws) and the Civil Aviation Code. These specify certain areas that are temporarily or permanently forbidden to overflight for military or public safety reasons. The law of 24 October introduced two new articles, L. 6232-12 and L. 6232-13, into the Transport Code aimed specifically at drones. The first of them imposed a six-month prison sentence and a fine of 15,000 euros on a remote pilot who, though inadvertence or negligence, fails to respect areas of national territory where overflight is forbidden. These penalties are increased to one year and 45,000 euros for anyone who, having introduced, then maintains a drone over these areas or who does not conform to the requirements of the article. The second article specifies that the remote pilot found guilty of these acts or of an offence of putting someone else's life in danger also incurs the additional penalty of confiscation of the drone. Once a drone is fitted with a camera, a mobile cine camera, a sound sensor or a geo-localisation device, it is considered an intrusion on the private life of citizens, something incorporated in the laws providing for protection from attacks on day-to-day security. Some aspects of penal law now apply to drones, such as Article L. 226-1, which provides for one year's imprisonment and a 45,000 euro fine for wilful intrusion into the private life of another person by detecting, recording or transmitting without the consent of the author his words, or the image of a person in a private place. Offenders have already been prosecuted.

Apart from this repressive aspect, it is worth mentioning prevention of terrorist acts committed from a drone, and the strategy adopted by public authorities to counter such threats. In addition to the permanent air security posture maintained by the Air Force under the direct responsibility of the prime Minister, specialised forces of the Gendarmerie protect the nuclear installations of EDF (*Électricité de France*), which are covered by no-fly zones of 5 km radius and 1,000 metres (about 3,300 feet) in altitude. Finally, it should be mentioned that anti-drone protection arrangements were already put into effect for major events in 2016 and that considerable research and development work is in hand to perfect systems for detection, identification and even destruction of mini drones.

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In just a few years France has established a legislative and regulatory framework suited to the challenges of a type of aeronautical activity in full growth and one that can only be harmonised at European Union level. Regulations are expected during 2018 for application from around 2021, which should contribute to the harmonising of existing practices. There is little doubt that the work undertaken by France on these matters will be a useful contribution to the success of such a project.

# Air Force Drones Serving Security Over French National Territory

Cyril CARCY

Colonel (Air), reader on the 69th session on defence politics at the Institute for higher national defence studies (*Institut des hautes études de défense nationale*, IHEDN).

Long endurance drones have a central position in current operations. These discreet machines have the endurance and capability to retransmit in real time, and over long distances, the data that their sensors detect, as well as the capability to direct a laser-guided weapon to a target. They play a key role in battlefield surveillance and in acceleration of the decision-making cycle.

In just ten years, the Air Force has acquired vast experience in the operation of Medium Altitude Long Endurance (MALE) drones. Relying on the strict regulations regarding air traffic movements, and benefiting from the recent delivery of a General Atomics MQ-9 Reaper to the air base at Cognac, drone operators intend to increase their contribution to French citizens in response to a growing demand for surveillance of the French homeland that is resulting from the new security environment.

Such service to domestic operations would not have been possible without the commitment and passion of our aviators, who have been working since 1997 to get the full measure of these modern flying machines, and to put them into service. Full understanding of this new player in the world of aviation goes hand-in-hand with definition of new, innovative regulations, unique in Europe, to facilitate their integration with conventional aircraft in our crowded airspace in peacetime.

## Act I – A contemporary aeronautical epic

The story of drones in the Air Force is not simply the success story of the Harfang MALE system, which has to date completed over 15,000 flying hours on domestic and overseas operations, for that would be to forget the previous episode, which contributed to our considerable knowledge of the Hunter system, a tactical drone of Israeli origin, which saw service with a joint unit from 1997.

This story is to an extent a continuation of that of the pioneers of aviation at the beginning of the twentieth century. A century later, and with immense passion for their work, a team set off into uncharted doctrinal waters. Confronted

by a never before seen technical and operational environment, these military explorers patiently cultivated a knowledge base of varied and complex information that includes network management, data transmission, multi-spectrum sensors and information handling.

With its fertile imagination, this pioneer group of some thirty, highly motivated military personnel was able to bring together the best of joint-service competences and gradually earned its medals, as it were. As a result, the Hunter was deployed twice in Kosovo before contributing to several domestic operations within the framework of the special organisation for air security (*Dispositif particulier de sûreté aérienne*, DPSA). Following six years of valuable and loyal exploratory service, it was retired, and the joint team was disbanded to give way to an experimental squadron of aviators, whose job was to develop the future Harfang, a system derived from the Israeli Heron 1.

In the summer of 2008, operations conducted in Afghanistan confirmed the urgent operational requirement for surveillance missions in support of the coalition and of French forces, which led to accelerated entry into operational service of Harfang, which had just been accepted. Entirely conscious of the stakes involved, the men and women of 01.033 *Adour* squadron (which became the 1/33 *Belfort* drone squadron) succeeded in the task of achieving the first flight over this demanding theatre in under six months from delivery of the system to the Air Force.

The story of the MALE drones is above all a human one—of a handful of enthusiasts who demonstrated unerring faith in the face of the numerous technical pitfalls that punctuate such prototype programmes. Guided by their duty to excellence, and with unfailing goodwill, these pioneers are today writing the first pages of a wonderful story through the conduct of the surveillance missions that contribute regularly to saving lives on external operations, and also to supporting domestic security forces on national territory.

## Act II – Persevering and salutary efforts in the integration of drones into air traffic

While having drones and traditional aircraft share airspace over territory in crisis is perfectly manageable, flying a MALE drone in airspace in peacetime is a far from easy task. International air traffic regulations demand adherence to legal and technical standards in order to have authorisation to fly in the volume principally occupied by commercial aircraft.

The integration of drones into general air traffic flows is the result of considerable dialogue and campaigns of awareness by the national aeronautical agencies since 1997. This investment has led to the appearance of a number of regulatory publications, the most recent of which is the order of 17 December 2015 concerning

the use of airspace by 'aircraft that fly with nobody on board'. Furthermore, this long maturation process has meant drones have acquired a special status as a result of their use on missions of medical aid, rescue, customs, police and civil security, which allows them to develop in accordance with the regulations set out in that order, or by exception to them when the circumstances of the mission and the demands of public order and safety so justify.

By way of comparison, the United States, though pioneers of the application of long-endurance drones, has not achieved the degree of maturity we have in France. Hence in the absence of sufficiently advanced regulatory texts, a MQ-1 Predator (General Atomics) or Reaper drone used for observing forest fires in California has to be accompanied by a manned aircraft in areas of high-density air traffic. Italy limits the use of its drone fleet (a dozen Predator and Reaper) to airspace over water, since overflight of inhabited areas is prohibited. The United Kingdom, which has had Predators since 2007, has no national regulations and limits the use of its drones to overseas operations alone.

The French Air Force has therefore acquired singular experience in the insertion of state-owned drones into national airspace, which allows it to conduct surveillance missions for domestic security forces. The very first operation goes back to 2003, when the tactical Hunter drone took part in the protective bubble surrounding the G8 summit in Evian, taking off from the aerodrome at Annecy. The following year the same platform was positioned at Granville to cover the ceremonies for the 60th anniversary of the Normandy landings.

However, while such previous experience was limited to a local or regional dimension because of the limited range of data transmission, the fitting of a satellite link to the Harfang has markedly increased the geography, type and duration of missions. The first contribution of this MALE drone was in the summer of 2008, when the Air Force planned night and day cover of the three-day visit of the Pope to Lourdes. Since then, Harfang has regularly participated in surveillance operations in connection with national events. For these, the activity involved in having the drone take off from its base in Cognac, overfly Paris at medium altitude for ten hours-or-so, then return to its base in the Charente, remains a performance today unequalled by any other nation. Another point worthy of note is that this mission has also been conducted by the *Belfort* squadron for the 14th July festivities (the national day) every year since 2012.

The Air Force now also has a Reaper drone, which it intends to use for training over national territory. With far superior performance to the Harfang, Reaper will bring a notable operational advantage across a wide range of missions, given the considerably changed national security environment over the past few months.

## Act III - Air Force drones in the service of citizens

As a result of the attacks perpetrated on our soil since 2015, the establishment of the state of emergency carries with it new requirements for the domestic security forces. The customs service is also seeing changes in its tasking following the migrant crisis on one hand, and on the other the threat of a cross-border terrorist act, as was seen on 13 November last. Furthermore, the new phenomenon of the 'zone to defend' (*Zone à défendre*, ZAD) is occupying the forces of law and order by its development and the determination of the 'zadists' in their physical occupation of an area and the consequent hindrance to construction work. In the absence of an adequate network of video-surveillance cameras across the country, this new security environment demands discreet, day and night surveillance assets that can operate for several dozen hours at a time.

The Air Force's MALE drones are capable of satisfying this demand: their support in complementing other assets is essential for the Ministry of the Interior in its creation of an effective multi-sensor facility. Harfang participates on an as-required basis in observation missions for the police and gendarmerie. It was used in December 2016 for the *Fête des Lumières* (festival of lights) in Lyon.

Since the beginning of 2015, 1/33 drone squadron has been operating the Reaper system from the base at Niamey in Niger on Operation *Barkhane*. After more than 15,000 hours dedicated to the search for, and identification and neutralisation of jihadists in Mali, Air Force operators have acquired solid experience than can now be put to use in the service of their fellow citizens at home. Feedback on the use of this MALE drone has highlighted a force multiplier aspect that its predecessor, Harfang, did not offer. It is fitted with high precision multi-spectrum sensors, a powerful engine that allows it to fly at high altitude and high speed, and a capability to integrate with a digital network to disseminate video signals from its cameras. It can thus survey suspect activity for several dozen hours whilst remaining capable of geo-locating certain details at long distance for identification purposes.

Reaper missions in France will most likely be ones principally of discreet permanence, accompanied by continuous real-time video of the scene as observed from the sky, by day and night. This 'God's eye' view could prove crucial to police operations aimed at dismantling criminal or terrorist networks, for the observation and anticipation of 'zadist' action and tracking flows of migrants, as well as surveillance of borders and cross-border traffic.

This list of missions would be incomplete were the contribution to civil safety and security not mentioned. The support to intervention forces in the case of natural disaster, such as flooding or storm damage, the detection of forest fires and fighting a major fire are just a few of the scenarios to which Reaper would bring notable added value.

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In the fashion of the pioneers of the last century, the aviators of the Air Force have since 1997 been writing new pages in the history of aviation. These exploratory narratives, which describe remotely-piloted machines capable of flying for an entire day and carrying all types of sensors, have contributed to cultivating a doctrinal and regulatory pathway which is expanding day by day.

The recent delivery of a Reaper drone to the air base in Cognac should bring notable operational benefit to missions in support of domestic security forces. And yet because France currently has only one of these machines in operation, the operators of the drone squadron must for the moment concentrate on their contribution to high-priority operations, such as the fight against terrorism or support of the DPSA.

# Mini Drones: Risks, Challenges and Opportunities

Daniel-Frédéric GIGAN

Major (Air Force), commanding the drone *Centre d'excellence*.

The remarkable operational potential of drones is already well proven. Their performance and the many missions that they can carry out in dangerous or contaminated environments continue to demonstrate it. The intelligence gathering missions that France has conducted with its Reaper drones in the Sahara-Sahel band, and the daily use of armed drones by the United States and the United Kingdom in Afghanistan and in the Levant attest to the importance of the drone in military operations.

And yet the drone is no longer just a military device: it has also conquered the civilian world with a diversification of uses—surveillance of electricity grid lines, gas pipelines and the railway network, media coverage of events and, for the public at large, leisure uses of mini drones. The civil sector of drone-related business is now highly active and a recent report by the General secretariat of defence and national security (*Secrétariat général de la défense et de la sécurité nationale*, SGDSN) confirmed that the sector represents vast economic potential with a worldwide civilian market estimated to be worth some 1.42 billion euros within ten years.

While the dynamism of the sector is offering technological innovations for the benefit of military and security forces, their proliferation is likely to lead to the emergence of new risks and new threats.

## Risks: from reliability of material to malevolent use

Any new activity will bring with it new human and technical risks. To ensure and maintain safety at the best level, as is done in the conventional aeronautical world, three types of risk that warrant control have been identified:

– risk relating to equipment and to airborne material (the principle of airworthiness),

– risk relating to the operators, in particular the pilots (the principle of training),

– risk relating to use, which covers air operations, malevolent use, adherence to the rules of the air, and also aspects relating to management of airspace, communications, navigation and surveillance (the principle of operation).

All these areas of risk need to be studied from an overall perspective and will require regulatory, judicial and security responses.

Regarding regulatory issues, the reliability of material needs to be guaranteed. This includes some level of assurance against breakdown in order to guarantee permanent control of flight as well as reliability of the data link between the drone and the remote operator, which will include resistance to cyber attacks. Safe incorporation of drones into airspace, as well as the level of competence of controlling organisations will also be imperatives.

Essentially, in the judicial and security fields, protection will be required against malevolent use over home territory and on operations. Increasingly broader access to low-cost mini drones that are both stealthy and capable of carrying loads constitutes a major risk. On operations in Iraq at the beginning of October 2016 and since, French soldiers have unfortunately been victims of them, and Daesh is even now making massive use of civilian mini drones in the urban fighting in Mossul.

In mainland France, different types of malevolent action are conceivable, including use of a civil drone as a weapon in imitation of the military drones designed to detect and kill an enemy, use as a vehicle to launch objects into areas where access is banned, or onto sensitive sites, or for use in smuggling. A further fear is that cyber terrorists might take control of a drone by acting on the radio links used for piloting or positioning it, or even by seizing its ground control station. These threats are not just theories: for example, in September 2013 a drone managed to disrupt one of the German Chancellor's meetings. The overflight in France of a number of sensitive sites by unidentified drones has very clearly highlighted the security risks they pose.

## The challenges: regulation of the drone's operating environment and action to be taken

As a sector experiencing full expansion, the drone industry is a dynamic component of the national and international aeronautical business, but one that is notable for its immaturity and a particular nature: the industry is essentially built upon start-ups of VSE and SME (very small enterprises and small and medium enterprises), and in France currently numbers some forty constructors for the civil and military markets.

### *Strengthening legal and regulatory matters*

The primary challenge for the authorities is to set in place the mechanisms, including regulations, legal framework and support of innovation, which will guide and direct the operating environment of the drone in the long term. The objective is on one hand to build and guarantee a solid and competitive industry for drones, capable as soon as possible to assume the role of a defence drone industrial and technological base (*Base industrielle technologique de Défense Drone*, BIT2D) that will support the operational needs of both military and security services, and on the other hand, to define a controlled 'space for use' for which the associated risks are correctly evaluated.

One of the major challenges in the use of drones and mini drones lies in the production of a framework of standards. The Air Force is of course participating in this, bringing its experience in the third dimension. The work is, however, somewhat sensitive: though the use of drones is not specifically regulated in international conventions, European and national authorities need to find a subtle balance between ensuring safety whilst not limiting development of the sector.

A set of regulations applicable to aerial drones already exists, yet in practice it is not always correctly applied, particularly in the cases of compulsory registration and training, bans on overflight of certain areas of the country, recording of information (notably taking of photographs), and of third party responsibilities and insurance.

Quite clearly there remains much to be done, but the current regulatory system is being developed and should allow better control of the use of drones without putting the brakes on the development of related national industry.

### *Capability for action against drones*

The somewhat piecemeal respect for the existing regulatory corpus quite clearly poses questions of safety and security. The second challenge concerns the ability for control and fighting the drone threat. There is a need to be in a position to limit the use of drones, particularly in the case of mini drones, and if needed to ban their use by constraint or destruction.

Freeing ourselves from the drone or mini drone threat is not easily achievable at present. The best way to fight the anti-drone battle is to acquire assets to detect, pursue, identify and recognise such a threat, then to adapt some solution for its neutralisation.

Innovation is certainly the best protection against the risk. The Air Force and its aviators have a number of projects underway in this vein. Some are high-tech projects, such as *Angelas*, *Boreades* and *Spid*, which have been under test at the air base at Villacoublay, all founded on the principles of detection, identification and

neutralisation. Also within the Air Force's competence is the promising experiment conducted at the Mont-de-Marsan air base, using four eagles trained to intercept. These birds of prey manage to intercept drones with just a couple of flaps of their wings.

The Air Force has developed an initial anti-drone capability. Despite a technology barely out of the cradle, it is capable of establishing three bubbles of anti-drone protection to complement the existing Air safety and protection arrangements (*Dispositifs de protection et de sûreté aérienne*, DPSA). Furthermore, an invitation to tender has been issued for six interim, but more developed anti-drone protection systems.

## Opportunities: a civil-military approach through the Air Force Centre d'excellence drone

Created in 2015 and situated in Salon-de-Provence, the Air Force's Drone centre of excellence (*Centre d'excellence drone*, CED) is participating actively in structuring the drone operating environment. Making full use of the surroundings of the *École de l'air*, the centre is working on the fields of:

- **mini-drone operation**, through training of operators for all the armed forces (Army, Navy and Special Forces) and for ministries (Border police and directorate general of civil aviation, for example);
- **regulation**, in collaboration with the directorate general of civil aviation;
- **innovation**, through its special development capability, its connection with the Air Force research centre (*Centre de recherche de l'Armée de l'air*, CReA) and its industrial and academic partnerships.

The CED gains much from a dual civil-military network called *Provence RPAS Network*, which organises and structures the drone industries of the Provence-Alpes-Côte-d'Azur (PACA) region, and which aims to develop overall solutions for drone systems. Using this connection, the CED analyses and takes into account the evolution, the needs and the technical advances of the various players and users of the regional airspace.

Where development of technological projects is concerned, this dual civil-military aspect puts the CED at the focal point of regional and national players in the field, which gives it sight of where they are competing, thus allowing an active watch over the technology.

For training, and other than for state organisations, current and future protocols and collaborations will allow mini drone operators to be trained for the customs service, civil security (including civilian firemen), the naval fire brigade of Marseille and the army fire brigade in Paris.

Lastly, in the field of innovation, it seems clear that the CED is a highly privileged player, in view of its considerable investment in universities (including Aix-Marseille, Polytechnique, ISAE and Lyon school of management), merging of research expertise (for example, collaboration with the French centre for aerospace research (ONERA) and CReA), its local VSE/SME network associated with Provence RPAS, and its strong links with the major players in technological development, such as the national railway (SNCF), the electricity supplier Engie, and INEO Defense.

Most of CED's partners do not possess any drones when they seek collaboration with the centre, and often have a perception of drone use based on what is available on the market. The CED offers them a broader approach going from acquisition of a drone to training, and which covers development of a concept for use specifically designed for their needs.

These opportunities for cooperation and training mean CED can improve its expertise as well as gain better recognition within the drone community of the Air Force's credentials on the subject. They also mean the CED can now develop specialised drones—for base surveillance or for automatic following of an infantry section, drones for interception using non-predictive targeting algorithms, and specific algorithms for detection, reconnaissance and classification of targets.

## A look ahead

Beyond regulatory, economic and technological developments, it should not be forgotten that use itself, particularly the widespread use of mini drones, can escape all forms of control. As part of its control of the third dimension, the Air Force has acquired the means for anticipation, guidance and contribution to the development of the drone. Within the bounds of its prerogatives, it is also acquiring the assets needed to fight the threat. By virtue of its many experts and units that cover economic, legal, technological and security issues, the Air Force is today in a position to offer standardisation of training, a watch over technology and a capacity for innovation that is available to all the armed forces and ministries.

Future questions will focus on the desired—or acceptable—level of autonomy for this type of machine. Developments in artificial intelligence and robotics will probably lead to greater value being placed on the role of the human in the loop, the one who will probably always be the guarantor of ethical use of force.

# The Smart Base at the Heart of the Digital Transformation of the Air Force

Françoise LATOUR

Commissioner General, advisor to the Major-General of the Air Force.

"If we want things to stay as they are, things will have to change". So said young Tancredi to his uncle, the Prince of Salina, in Tomasi di Lampedusa's novel The Leopard, when explaining his readiness to join those who threatened his own status within the Sicilian aristocracy. His statement is just as relevant in today's world in which the effects of the digital revolution are causing a major shake-up of industry and also of what have up to now been seen as well established positions.

As then, to do nothing now is not an option, unless one is to accept inevitable elimination. The Air Force is operating in an environment dominated by the increasingly rapid transformation of trades, organisations, relationships and balances of power through the effect of new uses rendered possible by information technologies (IT), including massive amounts of data, artificial intelligence, data clouds, social networks, mobility, telecommunications networks, connectivity, virtual or enhanced reality, 3D printing and robotics.

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Not only do adversaries and partners of all kinds rely on technology to improve their own performance, but also the low cost and ease of access to these technologies, which, being the product of the civilian world and not of defence industry, are available to all, leads to the emergence of low-cost threats now within the reach of isolated individuals or small groups. Thus they call into question others' operational superiority acquired at considerable expense.

Just as these things affect everything a company does, so it is for the Air Force. The latter's competitor is not another company, but any potential adversary (whatever its size or nature), partners whose speed of transformation we have to match, or any organisation which is competing for the same resources. The aim is not to alter the general path of a client by offering him new services, but to keep a step ahead of the adversary, be that step strategic or tactical, long or short term,

by transforming the manner of designing, preparing, conducting and supporting air operations. The same applies to methods of working, command, recruiting and training of personnel and management of organisations.

For everything to remain the same, that is to say, to preserve operational superiority, first entry capability, and to avoid being downgraded, the Air Force is undertaking a digital transformation to put it in a position to generate and deploy incremental or disruptive innovations and to create the conditions for its own agility by the use of the new possibilities that digital technology offers.

The aim of digitisation of the Air Force covers the operational, organic and functional areas and is based on three main points—innovation of use, improvement in the value of data and adaptation of human resources.

To put this transformation into effect, the Air Force is drawing on principles already in use by numerous civilian companies, and its objective is to benefit fully from the talents, competences and resources that can be mobilised within or outside the service. In this way it seeks methods of action that favour mobilisation of environments broadened to include start-ups, higher education establishments, research institutes and international players. The meeting of ideas and these environments will aim to create new capabilities from the data collected and new uses for technology, to develop a collaborative way ahead for sharing and collecting ideas and for putting the aviator at the heart of the transformation. This experiment forms part of an agile project which puts greater value on success than industrialisation, and is one that recognises the scope for error, as long as such error is made soon and at low cost. It favours taking incremental steps ahead and takes into account the imperatives of cyber security.

The air base, on which are situated the combat units of the Air Force, its flying, ground and command units, and also a large part of its support sections, is an essential component of the air combat system. As such, it is clearly a place with high priority for application of this transformation and its principles. The Air Force is already well ahead on this, with the Smart Base at Evreux, a project started on Air Base 105 (AB105) as part of the *Unis pour faire face* plan.

The Smart Base concept was from the outset inspired by experience with Smart Cities, intelligent towns that use digital technology to improve the quality of urban services for their inhabitants, and to control costs by better knowledge and management of consumption of resources and services, together with greater citizens' input to that management as to all aspects of life in the town.

With that as background, the Smart base has been designed as a laboratory for innovation—digital, especially—with a view to improving the operational functioning of the base, aviators' conditions of work and living conditions for them and their families. The project was supported during its first year by a number of outside suppliers, principally experts in transformation and intelligent cities,

whose competence and experience gave a boost to early evaluation of a number of concepts and modes of operation. It has three pillars: digital innovation, to modernise base support and its operational capabilities; partnerships, to strengthen the link between the Air Force and the nation and to free up resources for the benefit of the base; and personnel conditions, to improve standards of living and work for personnel and their families.

Research into digital innovation takes place in as wide a variety of fields as there are aspects of running an air base. The first concerns base support and the directorates and services responsible for it (which include SIMMAD, DIRISI, SCA, SSA and SID)(1), which are being encouraged to test their digital projects on the base under real conditions and alongside the future potential users. This is indeed chat has been, and is still happening on AB105 regarding experiments on improving the relationship between supporter and supported for gathering data on consumption of energy or water, on the handling of mission orders or on the use of tools in the workshops. The second relates to the operational running of the base. Several experiments have been conducted on the arrangements for security and protection of the base and the units within it. The analysis of their results is in hand, and further experiments have ben proposed. Feasibility trials have also been conducted on an app for smartphones that would allow aviators to contribute to the smooth running of their air base by sending messages to support services or to the security command post. The value of a single type of device for the exchange of information on life in the air base will soon be examined.

A number of partnership initiatives serve to boost local recognition of air base 105 and its personnel as important and integral players directly or indirectly in local events. One of these partnerships is worthy of particular note: AB105 is a partner of the Chamber of Commerce and Industry (CCI) of the department of Eure and of the greater Evreux area within *Smart'Up Normandy Connection*, a sort of 'seed-bed' dedicated to digital computation which has already produced 11 out of a planned 15 young 'shoots', of which 7 are hosted by the CCI and 4 by AB105. The latter have been integrated with the Projectable command and control squadron so as to permit exchange of information while maintaining the necessary level of security. Cross-fertilisation is thus being developed between those 'shoots' and squadron personnel in areas concerning virtual reality, image recognition using artificial intelligence and connected on-board systems in terms of tactical and operational information handling, command and use. With occasional support from *Polytechnique* students and military infrastructure engineers this grouping of

(1) SIMMAD : *Structure intégrée du maintien en condition opérationnelle des matériels aéronautiques du ministère de la Défense*.
DIRISI : *Direction interarmées des réseaux d'infrastructure et des systèmes d'informations*.
SCA : *Service du commissariat des armées*.
SSA : *Service de santé des armées*.
SID : *Service d'infrastructure de la Défense*.

minds has already led to a number of innovations regarding use and is contributing to familiarising AB105, the Air Force and defence interests at large with codes and practices of digital innovation.

Air Base 105 is now associated with the setting up of a technology bus, an initiative stemming from a number of national and local players (including the CCI), whose aim is to increase awareness of digital issues and trades.

The third pillar, personnel conditions, brings together local initiatives and goodwill to contribute to improving day-to-day life on the base. It is a vital for aviators within the overall Smart Base concept.

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The Smart Base's principal central and local players are the air base itself, its commander, its aviators and the units based there. As the experiment gains maturity, and with the initiatives and exchanges between those players, numerous encouraging signs show the appearance of synergies between the various pillars and gradual construction of an ever-richer environment. There remains nevertheless a number of regulatory issues that hinder the ability to benefit fully from opportunities arising from these initiatives at a rate compatible with that of private sector digitisation. Lessons learned on the ground from the Smart Base project need also to be shared with those concerned at the top levels of the ministry (especially EMA, SGA, DGA and DGSIC)[2], in order to identify where the hold-ups are occurring and to resolve them through better use of, or changes to existing arrangements. The challenge is to ensure the project rapidly becomes part of the daily life of aviators and their families.

The Smart Base at Evreux is the precursor project, which is being conducted in the spirit of an open-minded laboratory, and will continue to evolve through the common effort of current and future players. Its environment will develop in order to highlight to other air bases and organisations of the Air Force and defence in general, the human, legal, administrative and technical conditions pertaining to networking of capabilities and talents. This networking is the power behind the digital transformation of the Air Force working to the advantage of its operational performance.

(2) EMA : *État-major des Armées*.
SGA : *Secrétariat général des Armées*.
DGA : *Direction générale de l'armement*.
DGSIC : *Direction générale des systèmes d'information et de communication*.

# People at the Heart of the Air Force and Air Operations

*Les Cahiers de la* Revue Défense Nationale

# HR 2017: Time to Pull Up

Rony LOBJOIT

Major General (Air), Director of Air Force human resources.

After over eight years of deflation and a loss of 29 per cent of its aviators, the Air Force now needs to stabilise its format in order to fight on all fronts and for long periods while at the same time adapting to modern threats. It is a significant challenge and it is time it were done, for the level of commitment of the men and women of the Air Force has never been so high, be it on air bases, on home territory or on overseas operations. The more so, given that the current security environment is unlikely to lead to any reduction in that commitment in the short and medium term.

This is why the Air Force's human resources (HR) branch is concentrating its attention on ensuring that its 40,000 aviators are up to the mark of the three strategic missions for defending the French people: protect, deter and intervene. Yet for all that, it is not enough simply to pull back sharply on the stick to pull out of the dive. As in aerodynamics, inverting HR trends means overcoming an amount of inertia and the benefits only appear later.

This is also why the challenge to stabilise its format in 2017 presumes that the Air Force puts all its effort in recruiting, training and retention in order to preserve its human capital.

## Full throttle for recruitment

The imperative of youth, the creation of new trades, the arrival of ever more modern weapon systems—the Air Force has a permanent need to generate and regenerate its skills at all levels in order to conduct its missions. Its driving force is, of course, its aviators, be they volunteers, enlisted airmen, NCOs, officers or civilians, whether active or in the reserve. The needs are great in all categories: we have to recruit over 3,000 aviators per annum from 2017 and into the years to come, double the 2014 figure!

To succeed in this jump in both numbers and quality, the Air Force has to emphasise its attractiveness by turning its particular characteristics into trump cards, since it is in direct competition with the civil sector in a number of

professional areas, including aeronautical maintenance, information and communication systems and IT.

It is counting above all on the breadth of its spectrum of recruitment. From the 3rd grade in French schools to Master's degree level,(1) with or without professional experience and at all levels of responsibility, the Air Force offers opportunities in a diversity of fields which allow each person to find his or her right path and to develop expertise through initial professional experience or in a longer career. It also offers a range of some fifty trades, some well established in the Air Force—those that forged its identity such as aeronautical mechanics, flight crews, air traffic controllers, intelligence and air commandos—and others which look into the future to combat modern threats, such as drones, communication systems and cyber defence. It offers many opportunities for internal promotion, too, opening up a wide field of possibilities for the men and women who serve.

Already attractive by the diversity of its trades, the French Air Force offers above all a quite exceptional human adventure in an out-of-the-ordinary environment that mixes a taste for cutting-edge technology, the desire to defend one's country, sharing of values such as team spirit, respect and integrity, early exercise of technical or command responsibilities and determination for the mission to succeed.

The new recruitment campaign, officially launched at the 2017 International Paris Air Show, bears witness to this human wealth through exposing a portrait of several aviators whose experiences are both common and exceptional.

To attract more than 3,000 aviators, the Air Force is committed to weaving and maintaining close links with the nation. It is leading activities aimed at youth and equality of opportunity through an air-youth programme, which interacts with 60,000 young people every year in a number of air and defence sponsored schools,(2) as well as through participation in the teaching of an 'aeronautical initiation' certificate in partnership with the Ministry of Education. It is also opening up thirty posts as volunteer officer cadets for young graduates in their gap year, and is creating local partnerships, notably with the Franco-German campus of the university Sciences Po Paris.

Lastly, and especially, the Air Force is considerably boosting its recruitment system from 2017 and is optimising its processes for enrolling potential candidates as they arrive, and is setting up modern assets for e-sourcing.

(1) This corresponds to an age range of broadly 15 to 24 years.
(2) These include the *École des pupilles de l'air*, *École d'enseignement technique de l'Armée de l'air*, tutorships and classes of *Cadets de la défense*.

## Full beam onto initial training

Absorbing such a recruitment rate means another equation has to be solved, that of initial training, which like the Phoenix has to rise from its ashes and adapt not only its ability to receive recruits but also its processes and methods of instruction in order to improve efficiency. It is a strategic challenge, because the Air Force itself trains virtually all of the trades it requires. Most of the skills employed in the Air Force cannot be acquired off the shelf in the civilian world and are therefore generated internally. Hence aviators benefit from training and guidance from the moment they join and throughout their careers. The Air Force ensures an educational role that benefits society through its contribution to the professional training of different age groups, and to emphasise the status of this progression it has committed to a process of certification which enhances and achieves recognition for the training syllabuses followed by aviators throughout their time in the service.

Now, to absorb 3,000 new recruits this year, the structures for initial training must rapidly improve their efficiency through the use of methods that are more modular, better adapted and diverse. The target is to be able to deliver knowledge, knowhow and inter-personal skills at the right level and at the right moment, through a training plan compatible with the demands of current operations.

Training will therefore be more and more individualised and aimed towards capitalising on, and improving the competences acquired by each aviator, whether within or outside the Air Force.

This is notably the case for aircrew training, which from this year on will see its length optimised, with an approach adjusted to suit to the progression of each pupil and an acknowledgement of skills acquired before entry to the Air Force. This will be even more marked with the arrival of the new Pilatus PC-21 aircraft, which will reduce the technical gap with Rafale-generation combat aircraft in the training of fighter pilots.

Tutoring and sponsoring—something already well anchored in aviators' DNA—will be strengthened. Training by apprenticeship, under the responsibility of a sponsor or a tutor, will be extended to other specialisations than those which have known it traditionally (and genetically!), aircrew and aeronautical mechanics in particular. This system will also be used increasingly to reduce training time in the schools, which will permit the aviator to enter his or her operational environment earlier. Knowledge and skills will be acquired more rapidly when in contact with experienced personnel on the field and will be complemented by shorter courses delivered later in the initial training school.

Additionally, the Air Force is committed to modernising its training structure by digital transformation. The challenge of the *Smart School*, an advanced 2.0

school that the Air Force is firmly pledged to constructing, is to have people learn differently though an optimised and reduced training footprint.

The aim is to be in phase with the expectations of the new generation and to incorporate them into the overall management structure of the Air Force, centred on competences. That goes hand-in-hand with the force's focus on attractiveness and retention.

## Keeping the right flight attitude through retention

Clearly capitalising on, and developing the resources of aviators is logical at a time when competences are becoming ever more specialised and difficult to acquire. Another challenge for the Air Force then, is to retain its personnel and achieve the best convergence of their aspirations with the needs of the service.

Retaining its aviators in particular by offering them conditions for personal and professional development has always guided the Air Force in its decisions, and yet the period of strong deflation it has experienced in recent years has instilled in a number of aviators the idea of leaving early to take up a different career. There is an urgent need to reverse this trend, especially in critical trades. To face this challenge, the Air Force plans to develop its competitive and attractive aspects. Solid professional training, dynamic careers, possibilities for development, visibility and transparency are all elements it is strengthening in order to be in a position to satisfy the expectations of its personnel while guaranteeing in quantity and quality the availability of a pool of resources to match the many missions it has to accomplish.

As an effective social ladder and creator of opportunities, the Air Force stands out in today's uncertain professional world. The notion of individualisation of skills, one of the fundamental pillars of Air Force policy, becomes apparent through motivational and varied career paths that emphasise the value of skills acquired as they move within the forces, support functions and staffs. Furthermore, the qualities and the potential of each person can be enhanced through professional progression within and across categories. Progression within a category is through a policy of advancement and dynamic taking-up of responsibilities; cross-category progression through a policy of internal promotion favoured by the Air Force that allows individuals who are volunteers, and who merit it, to have access to management and senior management posts—airmen becoming NCOs, or NCOs becoming officers. The ambitions and qualities of each are therefore enhanced in value in attractive career management plans by putting people into responsible situations as early as possible. Furthermore, rare skills, or those in shortage categories attract particular attention by dedicated bonuses for technical skill or to encourage retention in order to maintain a satisfactory level of competition with the civilian world.

Lastly, the Air Force is maintaining its connections with the outside world by setting up partnerships aimed at having its aviators' competences recognised by the civil sector. This policy is an assurance for the aviators concerned that at the right moment and in agreement with the service they might comfortably consider a second career outside the Air Force, armed with the competence and skills they have acquired within it. The ability to propose ways of leaving the service that are robust, prepared in advance and which respond to the double interest of aviators and the service also contributes to personnel retention.

## Maintaining the human capital

Whatever assets are brought to bear on recruitment, training and retention, personnel conditions remain an essential element for maintaining the morale of the Air Force's most precious capital, its aviators. The condition of the aviator is the social cement, without which nothing can hold together, and it underpins all major decisions of the Air Force by placing the aviator at the centre of its preoccupations.

Recognition of aviators' commitment is a priority of the first order. The Air Force has established a pay policy that puts greater emphasis on correlating responsibility, acquired competence and remuneration.

It also sets place a policy for personnel and and family support, adapted to the peculiarities of operational demands. This will allow for better action in a number of areas such as housing, accommodation, social action, help with mobility and spouse's employment.

Every man and woman can benefit from the dedicated and personalised services and financial measures that are available to compensate for some of the difficulties of service life, and from events that promote the identity of the Airman. Strict gender equality, account taken of psycho-social risks, responsible, transparent and constructive dialogue with the hierarchy, a fair pay policy and social help are just some of the examples of the will of the higher authorities of the Air Force to take care of its human capital—synonymous with success of its missions in the long term.

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Attracting, training, retaining and taking care of its aviators—men and women are at the very heart of the Air Force's priorities for 2017 and the years to come.

Faced with a level of commitment well above that stated in the *Livre blanc* (the Defence white paper) and which is likely to remain at that level in the long term, pulling up from the dive is absolutely essential.

The Air Force is mobilising all its assets so that this recovery can be made under the best conditions and as rapidly as possible whilst minimising any loss of altitude. Moreover, to guarantee its capacity for action over time, to reduce the angle of incidence and to maintain upward flight after pulling out, the Air Force will have to be able to hold the same targets in 2018 and beyond.

On that, its entire operational capability depends.

# The Third Dimension: Where Myth Meets Reality

Jean-Christophe PITARD-BOUET

Major (Air), head of the outreach department of the Centre for studies, reserves and partnerships of the Air Force.

Was man's ancestor a bird? The idea expressed in this aphorism has driven man to look to the skies since the beginning of time. On 26 September 2008, le Swiss Yves Rossy crossed the English Channel using a rigid wing fitted with jet packs. That extraordinary exploit combines the most recent innovations with man's ancient dream, to fly. Aeronautics continues to symbolise human and technical progress, and yet remains closely linked to the ancient myth, which in setting the divine power in the heavens has led to use of the air such as we see it today.

## Myth and imagination, the principle of the man-bird

Since the beginning, man has looked upwards to communicate with his gods. Priests created a sacred space, the *templum*, and interpreted the passage of birds within it. Various epic tales told of interaction between the world of the gods and that of men, and created the images that form the bases of modern air strategy. The sky is perceived as the high point from which all can be seen and from where everything can be influenced. The continuity of that space affords a freedom of movement and action when traditional land and sea routes are unavailable, even as Ovid recounted in *The Metamorphoses*: when Medea was completely surrounded, she escaped punishment thanks to the winged dragons that carried her away. In the same vein, the connection between man and bird is made even more strongly when Ovid makes the analogies of the eagle (attributed by Zeus, hence by the supreme head), which attacks the snake to take it by surprise and strike it to death, and of Perseus, with agile wings, who kills the Gorgon with his trusty sword. The bird of prey is perceived as the one which sees clearly and far, acts quickly and strikes with precision.

The myth of the man-bird is shared by other cultures. On Easter Island up to the end of the nineteenth century ritual ceremonies were organised around the cult of the man-bird, and in South-East Asia, representations of the bird of Borneo show a warrior ancestor. We clearly see anthropomorphic and ornithomorphic elements combining in this symbolism. Man needed only to conceive of a vehicle that would allow him to turn the symbolism of the man-bird into reality.

Indeed, although Leonardo da Vinci designed his famous flying machines in the sixteenth century, it was not until 1782 with the Montgolfier brothers that the first manned flight took place. That exploit turned an ancient dream into reality. And yet, even before that invention saw day, military aviation had already been conceived by a number of statesmen who followed the progress of inventions, such as René-Louis de Voyer, the Marquis d'Argenson, Louis XV's Minister of foreign affairs, who predicted that there would be air forces (to use the modern expression). 'Our current fortifications would become useless', he said, 'and the guard both of our treasures and of the honour of ladies and young women will be sorely exposed until we have established policing of the air and severed the wings of bandits and the brazen. Meanwhile, artillerymen will have to learn how to fire in flight. The kingdom will need to devise a new role of secretary of state for the air forces'.(1)

The nineteenth century saw the development of literature founded on science. In his work *Five Weeks in a Balloon*, Jules Verne invented an original view of the world seen from above and listened to from a vast distance. From his high vantage point in the air, Doctor Samuel Fergusson, the hero of the novel, occasionally intervened to defend some moral cause or to put an end to a massacre. This original point of view, in a work of an unconventional person, was to become that of those who foresaw the conquest of space. Jules Verne witnessed profound transformations in an already changing society, for which the main driving forces were science and technical development.

## Aeronautics, an innovation that revolutionised modern society

Western society made a major change of direction during the nineteenth and the beginning of the twentieth centuries, indulging in the spirit of progress which nourished a faith in science and matters technical. The nineteenth century was greatly influenced by the theories of the Comte de Saint-Simon and his disciples, who founded Saint-Simonianism, of which two major themes regarding the economy were industrial investment and development of ways of communication. The aim of Saint-Simonianism was to improve the value of creative and scientific genius. The progress in science led to spectacular developments in a world that was taking huge steps in industrialisation. The setting up of numerous specialised companies around Paris bore witness to an infatuation for aeronautics. Profound cultural changes took place before the First World War, and in taking to the heights, men saw the world differently, with a new vision that had never before been possible.

This effervescence for the development of aeronautics was openly demonstrated in the development of the aeroplane, in which the role of the pilot had even

(1) Taken from: J. DUHEM, La guerre aérienne avant 1789, in *Forces aériennes françaises* N° 15, December 1947, p. 413-441.

greater significance. Faced with having to demonstrate control, the pilot was no longer the man who simply observed the surface of the planet, but he who was absorbed by his machine and by the machinery that made it move. The rise of the aeroplane occurred at the same time as the development of the automobile and participated to a major degree in the mechanisation of society. The link between these two fields of development was made stronger, given that some aviators were former cyclists or racing drivers—Henry Farman (1874-1958) being an example. Indeed, sporting competitions were invented to encourage people to emulate these flying men, competitions that were financed by the industrial sector and reported in the printed press. In that way, aeronautics became established at the heart of a cultural transformation of a modern society that foresaw the integration of the aeroplane into daily life.

The press loved all that aeronautics had to offer: the prowess of the aviators, those heroes of modern times, was related and the exploits they performed passed into posterity—those of Clément Ader, the Wright brothers, Santos Dumont, Roland Garros and many others. Their adventures were fodder for the newspapers, which were the best expression of the excitement that carried away the crowds. Aeronautical reporting filled the columns with discussion on modern times, relating to new perspectives on speed, the hero and the machine.(2) The arrival and growth of aeronautics completely upset the relationship between space and time, freedom and mobility.

## The first world war—confirmation of the strategic value of the air arm

Many had great difficulty in understanding the extent of what was happening, rather as General Foch, who in 1910 declared, 'Look at all that—it's just sport. For the Army, aviation means nothing'. Despite which, aeronautics played a full part in the strategic designs of the era and, not much later, of the First World War. With great foresight, in 1908 HG Wells published *The War in the Air*: Louis Blériot had still to cross the Channel, and yet the novelist had already imagined the aeroplane as an offensive weapon that bombarded fleets and ground forces in a décor that was no longer the traditional field of battle. In 1915, Captain Charles de Rose invented a new use for aviation—the acquisition of air supremacy to prevent the enemy from observing and bombing our troops. He became the father of the fighter aircraft. In an August 1917 report, the British Minister of War's office foresaw the pre-eminence of air power and the risk it posed to the security of the British people which until then had largely been founded on the country's geography as an island. The strategic value of the air had been clearly understood by the War Office, which recommended the greatest discretion in the matter. The role of the aviator as a warrior in the third dimension was thus confirmed.

(2) From: Luc Robène and Dominique Bodin, Le feuilleton aéronautique à la Belle époque, in *Le Temps des médias*, N° 9, Winter 2007-2008, p. 47.

Aeronautics also had a part to play in the morale of troops and society in general. There was great admiration for the courage of the man who defied physical laws and became the master of a complex environment, and who incarnated heroism itself when he took to the air to face the enemy, whom he confronted in a modern duel in which his mount was no longer the horse but the aeroplane. This vision clearly echoed Jules Verne's perception of the hero, which incarnated he who had acquired positive knowledge and a virile sense of the moral, to the extent that he was guided by an idea that surpassed his imagination and whose horizon was defined by sacrifice.(3) Air aces were at the heart of this perception of heroism. The military authorities were fully conscious of the role played by the air aces and in particular by Captain Georges Guynemer in the morale of troops. On Guynemer, François Pernot wrote that as a knight of the sky he became an authentic archetype, a figure of reference and a true experimental case of taking up and airing the knightly model as a crucible of identity.(4) The deaths of these young aviators in full flight echoed those of ancient heroes such as Achilles, who sowed terror and profound fear among the enemy. The same mythical sense lasted well after the First World War. The disappearance at sea in 1928 of Nungesser and his aircraft, *L'oiseau blanc*, during his attempt to cross the Atlantic was likened to the death of Icarus, thus sealing the link between modern aeronautics and Greco-Roman mythology.

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By setting the divine power in the sky, the ancients foresaw the use of the third dimension, an exceptional concept at a time when human activity was limited to the surface of the land and the sea. Progress in techniques and better understanding of the laws of physics inspired inventors to translate this mythological concept made up of images and symbols into the real world. It took twenty-three centuries, between Homer and Leonardo da Vinci, before the latter was able to put down on paper his famous images, precursors of what the pioneers of the nineteenth century created in their real world. This conquest of the sky belongs to a time before the birth of the Air Force, one whose tales of fame still inspire every contemporary aviator.

As the successor to ancient times, today's aviator shares with his elders this understanding of the third dimension, an understanding that empowers him to act from and within it and to fight differently.

(3) From: Sylvain Venayre, La belle époque de l'aventure (1890-1920), in *Revue d'histoire du XIX^e siècle*, 2002/1 (N° 24).

(4) François Pernot, *Le destin médiatique des chevaliers du ciel, de Georges Guynemer à Tanguy et Laverdure*, lecture delivered at Lleida, 14, 15 and 16 September 2000.

# Training the Future Decision Maker: How Should Future Commanders be Trained?

Éric AUTELLET

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Training of tomorrow's commanders is already under way: those who will be military chiefs over the next thirty years are already in training. The tools used, the methods, the teaching contexts and the objectives of the training offered by the officers' schools, the *École de l'Air* in particular for aviators, must be sufficient to fit future commanders for taking on their responsibilities in an ever more uncertain and unpredictable world.

Any consideration of how a leader and decision maker should be trained raises questions about the knowledge, aptitudes and competences that will be essential and decisive in tomorrow's world, and therefore about the training needed to acquire them.

Such consideration cannot be take place without analysis of the environment in which these future leaders will operate, their operational field in particular, and even more specifically the demands that the aerospace environment will put upon them.

## Environmental aspects

### *Social development*

It is quite clear that standards, values and social landscapes are changing and that where these things impact military matters they have to be revised regularly since institutions have to adapt constantly. A look ahead to the future shows us, if it were needed, the unpredictable and volatile character of the environment of future decision-makers.

We tend to perceive events and different societal issues today generally in a rather short-term manner, which tends to favour the rather listless situation of our society. This means that our *grandes écoles* and our military schools have to develop in their students an ability to adapt and a capacity for innovation in order to

respond to what are now called the 'hybrid' threats that come from outside the traditional military field.

A further significant development is the increasing role of senior civil servants in public policy making and in directing the administration. That being so, it is of note that the training of senior military officers specifically covers the type of dialogue that their future appointments will require them to entertain with senior civil servants and politicians who, since the end of conscription, have lost a certain amount of expertise in military matters—to the extent for some of having completely lost all understanding of military language and culture. Beyond a knowledge of organisations and how the country's institutions function, the military decision maker needs to have the ability to share his military expertise in understandable language, and to be able to understand and take account in his own analyses of political, economic and diplomatic dimensions.

#### *Development of training methods*

Education, and more generally, training, is evolving today through the use of information and communication technologies. The development of new vehicles for transmission and learning—for example, e-learning, distance learning, on-line courses, *serious games* and simulation—is transforming teaching practices.

The generation gap between pupils and teachers clearly highlights a behavioural difference and risks calling into question the transmission of knowledge. Broadly speaking, pupils have developed more quickly and move with greater ease in the world of information, are more likely to listen without prioritising the information they receive and in general have a great openness of mind.

The *École de l'Air* sees its pupils as hyper-connected and hyper-stimulated. Today, those responsible for training can no longer count on methods known and recognised by the teaching community to stimulate pupils in learning situations. Teaching programmes are being developed around the notion of change and the principle of learning how to learn.

#### *Development of the aerospace environment*

The rapid changes in today's world, so marked by a surfeit of information and by ever-greater interdependency of players, bring with them a need for individuals and organisations to adapt and be flexible.

This is no less true for the world of aerospace. Digital communications, high data-rate links, command networks and the general complexity of systems require real-time collaboration. Distributed and decentralised architecture allows each individual to become a player; the simultaneity, reactivity and mobility of the air arm require capabilities for analysis and synthesis in order to resolve problems

in near-real time. Above and beyond the management of a team, the constraints of the third dimension require *leadership*, which means the capacity to share a goal, to bring together a team, or perhaps several teams, and to rely on delegation supported by complete confidence in the chief: the leader.

## What skills are needed for the twenty-first century?

The accumulation of knowledge, knowhow and soft skills leads to the notion of competence. To determine the knowledge to be acquired and the aptitudes to develop, one needs to understand what competences are required of the twenty-first century leader.

Today's competences are not limited to technical ones: a non-exhaustive list of new competences would include the fields of computers and IT, those related to creativity, critical thought, productivity, management of important projects, communication (public speaking, arguing a case and taking notes, among others). The list would also include areas concerning cooperative organisations and systems, and transverse matters such as management of stress and intercultural issues.

We need in addition to ensure the development of those competences which will allow the new officer to find the right solution when facing a specific problem in an environment which today is anything but precise. For tomorrow's aviator, adaptability and reactivity, a capability for analysis and synthesis and an ability to make decisions are upheld as the principal qualities to possess.

## Training the Air Force officer

### *How de we train for 21st century skills without forgetting the old ones?*

Adding hours to existing learning cycles could be one solution, but needs to be looked at closely to establish the real effectiveness of such an approach. It is clear that, for officers under training to be able to absorb completely all they are taught, common sense must prevail: periods of assimilation are essential.

In addition to these periods for assimilation, it is worth remembering the dictum that one experience is better than a thousand words of advice: indeed, in many cases a experiencing a situation gives better understanding of its benefits and allows its whys and wherefores to be more thoroughly assimilated.

Through the use of a regular and progressive work programme that creates a continuing process of acquisition of competences, rather than just a series of transmissions of fact, the steady development of lasting skills is achieved, each strengthening the others.

The major challenge of the *École de l'Air* is therefore to set the training of future leaders at the centre of a continuing process that draws together three

components: military training, what is called 'academic' training, and aeronautical training. The training plan at the *École de l'Air* consists of guiding each officer under training in the building of professional competences as a leader. For that, the officer has to acquire the skills, and the aptitudes to use them, and to develop them in the precise set of situations relating to each mission that he or she may be given.

#### *Leadership in theory and practice*

Officer training—the goal of the *École de l'Air*—is founded upon solid military training complemented by academic and aeronautical training conducted in parallel. In that way, as well as physical and moral 'hardening' to service conditions, this triple aspect of training develops their leadership, through leading a group in a difficult situation, builds their ability to take decisions and to act independently, and aids their capacity to take into account the peculiarities of the third dimension.

Their leadership ability grows by learning the theories and the various methods that make them aware of good practices, and also of the right questions to ask during the decision-making process. Pupils are taught the importance of ideas related to communication, management under stress, as well as the capacity for reaction in a hostile environment and surpassing one's own abilities—going that bit further.

Being put in the position of leader of a group or the person responsible helps the pupils to identify the importance of different aspects such as the role of the leader, and the rules of the group, the observer and the mediator. The more critical among the pupils are able to categorise different individuals for whom they are responsible and can encourage them to develop through the good practice of command and, more broadly, through leadership. This teaching guides the pupil in developing his or her different skills in the management of a group, conduct of a mission or project and in communication.

#### *Traditions and values*

Building the ethos of the officer, these soft skills built on behaviour and values, allow him or her to face up to future challenges by calling on the transmission of a rich, historic inheritance. Cohesion and solidarity lie at the centre of the system of values, and much effort is afforded to activities aimed at forging them.

The constraints of the third dimension, the pressure of time in particular (and the famous OODA[1] loop!), imply a particular professional culture which distinguishes them from officers under training in the other services. Quite apart

(1) Observation-Orientation-Decision-Action.

from the shared values of the aviator—respect, integrity, sense of service and excellence—the *École de l'air* looks to develop a set of values equally balanced between the ethical and the technological, between tradition et innovation. This is achieved through numerous activities that teach by research and touch on fields from engineering sciences to human and social sciences.

#### *Wargaming: new teaching by project-based learning*

Wargaming is aimed at measuring nine factors that determine the qualities of a leader in the organisation of an air mission or a combined operation. Using a historical operation in which two opposing military camps bring air assets to bear under simulated environmental constraints, and through the use of wargaming, the officers under training have to make considered decisions and execute military manoeuvres, which exercise decision-making at the strategic and tactical levels.

This test, which now takes place during the last year of the syllabus, requires the recall and use of the knowledge acquired throughout training at the *École de l'air*, in fields as varied as history, diplomacy, international relations, management and scientific disciplines pertaining to aeronautics. It also leads to evaluation of particular aptitudes such as negotiation, manipulation, decision-making, command and communication (which includes debriefing).

This training contributes mainly to the development of the future commanders' strategic thinking by putting them into situations that give them an overall view that is not limited to the military aspects. The young officer is then fitted for the consolidation of knowledge and capacity for strategic thought that he or she will have to exercise throughout the career that follows.

#### *Tomorrow's commander after the École de l'Air*

Once trained at the *École de l'air*, the future leader will know how to put into effect his qualities of adaptation, physical and moral resistance, analysis, situational intelligence and independence. He will master the principles of communication that will allow him to balance his judgement, face up to highly delicate situations and, especially, to gain the following of his subordinates in achieving success in the missions he will be given.

Above all, the *École de l'air* is founded on excellence in command and ability to decide when in doubt. Understanding and being sensitive to another point of view and a new perspective on things forms part of a creative mind, one that is not focused on knowledge and knowhow already held. Training at the *École de l'Air* develops a confidence that allows future changes to be tackled with flexibility and openness of mind.

# Reserve and the National Guard: a New Dynamism and a Reservoir of Forces

Angélique RHAMATI

Aspirant, responsible for communication for the Air Force Reserve.

Following its defeat at Sedan, France re-examined ways to defend itself. The ensuing reform affected the active army and also the National Guard of the time, and the law of 27 July 1872, proposed by the minister Adolphe Niel, marked the creation of military reserves in France. Broadly inspired by the Prussian model, this reserve was made up of those exempt from military service, volunteers and the entire collection of citizens who could potentially be mobilised yet who had not done their national service. This reserve could count up to some 600,000 men.(1)

The broad precepts of the current military reserve were established in 2006 by the modification of law number 2006-49: since then the reserve has been divided into two distinct categories. One is the citizens' reserve (*réserve citoyenne*), composed of volunteer civilian from the public service, and the other combines the level 1 operational reserve, which refers to those who have a commitment to serve in the reserve, and the level 2 operational reserve, which is composed of former military personnel who have left active service within the past five years.

The military reserve was thus instilled with a new dynamism. With its increasing numbers, it constitutes a reservoir of different forces, upon which the operational commitment of the Air Force depends today. The operational reserve forms a bridge with the youth of the country and is strengthened through a strategy of communication aimed at making it more dynamic, more visible and more attractive.

## Fresh momentum given to the operational reserve

Between 2006 and 2016, the reserve was limited by the human and financial resources allocated to it. But, following philosopher Emile-Auguste Chartier's

(1) See: Annie CRÉPIN, *Histoire de la conscription*, Gallimard, 2009.

(AKA *Alain*) dictum that *national honour is like a loaded rifle*, the series of attacks that hit France in 2015 and 2016 led to decisions which have given greater assets to the reserve to allow it to develop and modernise. On 20 July 2016, after the terrorist attack in Nice, the President of the Republic decided to call upon all men and women who, in parallel with their studies or their chosen professional path, had chosen to commit themselves to the protection of the French population. So it was that, in October 2016 the new National Guard was created, intended in time to bring together some 84,000 operational reservists of the armed forces, the gendarmerie and the national police force.

## Increased power coordinated with the other armed forces, directorates and services

Initial steps have been undertaken at joint force and inter-ministerial levels. Numerous working groups have been created in order to achieve joint force unity in terms of both training and recruitment policy.

A single recruitment gateway for reserve personnel has been created, and the website *etrereserviste.fr* has been in operation since March 2017. This new gateway will in time allow simplification of all the procedures needed to incorporate a young person into the reserve forces, from the establishment of his file to his signature demonstrating his commitment to serve in the reserve.

The Air Force is therefore intensifying its recruitment and training effort, particularly at the new-entry stage. All the major Air Force commands have committed themselves to this ramp-up of force levels and are contributing to the achievement of the objectives set by the inter-ministerial plans, which are leading to a considerable effort in recruitment, training and maintaining the loyalty of reservists, as well as to modernising the organisation of air bases. The majority of staff handling new recruits are themselves reservists, in charge of the activity of the twenty-four reserve instruction and information centres of the Air Force (*Centres d'instruction et d'information des réserves de l'Armée de l'air*, CIIRAA).

During 2016, some 750 people underwent initial military reservist training, which is 200 more than in 2015. The ease of recruiting bears witness to the willingness of youth to serve and also to the attractiveness of the Air Force within that population. Nearly 1,200 young people were therefore recruited and followed their initial military reservist training in the period 2015-2016.

The effort expended on the recruitment of young reservists coming from the civilian world complements the many aviators who finish their active career and who, whilst pursuing their new civilian career, can continue to put their competences to the service of the Air Force.

## The reservist, an aviator serving the operational commitment of the Air Force

To respond to its commitments, the Air Force has an established policy of employment of its operational reserve, which is above all a human resource of quality—a necessary tool for the accomplishment of the majority of missions. For the Air Force, the reserve plays an essential role in operational reinforcement.

In this way, the operational reserve blends into the overall active resources of the Air Force in a framework that is increasingly joint force and inter-ministerial. The aviators of this reserve complement, and create synergy with, active service personnel in highly visible ways, thanks to a level of commitment never before seen for the reserves.

The reserves constitute a resource which allows the continuance of activity, training and the whole range of missions needed for the operation of the combat platforms that are our air bases. Moreover, nearly one reservist aviator in three is directly involved in the protection of the homeland.

At a time of great operational pressure and of major challenges in recruitment for the active service, the aviators in charge of the reserve are achieving considerable success in training while making best use of this human resource in all the Air Force's missions, of which protection of the home territory is primordial.

## The operational reserve, a bridge between the Air Force and the youth of the country

All that said, the operational reserve is focused principally on the country's youth, from which the number of volunteers is increasing markedly and which constitutes a precious resource that allows the Air Force to become known, to consolidate its link with society and to have available a dynamic, motivated and enthusiastic resource.

Each candidate according to his profile has to undergo *ab initio* training during the first year, which includes a period of adaptation within a unit for a minimum of 30 days before being declared capable of being incorporated into the operational reserve. During these periods he acquires the basic knowledge and competence required of the aviator.

As for active military personnel, the end of this initial training is marked by the ceremony of presentation to the flag, in which the reservist becomes an aviator indistinguishable from his active colleague except by his annual level of activity, which in 2017 reached some 25 days on average.

For some of the young reservists the training continues most often by a Prodef (*Protection défense*) module, followed by a phase of adaptation in a unit—

for example, within a protection squadron or a reserve support section. The determined, professional reaction of the reservist member of the *Sentinelle* patrol that was attacked by a terrorist at Orly in March 2017 bears witness to the relevance and quality of the training given. The Air Force has additionally set in place a system adapted to future senior managers in the civilian world: through this, the Air Force is able to recruit future reserve officers from among students or young graduates for missions which require their high level of expertise or for management appointments.

In the autumn of 2017 the officers' school at Salon de Provence will for the first time receive some fifty young people who have been selected to undergo some complementary training: they will be given a more strategic vision of the challenges facing the air arm whilst at the same time consolidating their leadership in a practical module.

The increasing commitment of young people within the Air Force reserve represents a genuine opportunity for the institution. Reservists are both a precious resource and an indisputable support for active aviators in many areas of their work and from the outset serve to advertise the Air Force to the country, strengthen the link with the country's youth and serve their country dynamically and effectively.

The succession of tragic events on our national territory will in just a few months have led to a complete modernisation of the Air Force operational reserve, given rise to numerous job opportunities and allowed aviators to rise ever more effectively to operational challenges.

## An active communication strategy

Inter-ministerial plans provide for a communication strategy for all the reserve forces. Driven by the general secretariat of the National Guard, the strategy will be seen in the organisation of events identified as *Garde nationale*, to which the Air Force is contributing. As examples, its reserve aviators ran for the Reserve Trophy, organised the National Guard hackathon and passed on their experiences during the European Education Show, held from 18 to 20 November 2016. Major General Gaëtan Poncelin de Raucourt, the Secretary General of the National Guard, has confirmed that such actions well suit the armed forces' will to boost the development of the National Guard, in particular for those young people who have shown real enthusiasm and complete commitment to the project.(2) Several dozen 'air' reservists took part in the Show and passed on their experiences, each one demonstrating his engagement as civilian and citizen to his work as an aviator. When speaking to young people during these different activities these devoted and passionate reservists give true meaning to their commitment.

(2) Message of thanks given by General Gaëtan Poncelin de Raucourt on the occasion of the *hackathon* "*Garde nationale*" which took place at School 42 from 3 to 5 February 2017.

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The increasing size of the military reserve, and in particular the operational reserve, is part of a development that is both inevitable and necessary to maintain the operational commitments of the armed forces, and of the Air Force in particular. This high-quality, trained human resource benefits from a well-considered policy of employment within the Air Force and plays an essential role within the National Guard. It ensures the protection of national territory and of air bases—the essential combat elements of the Air Force—and also promotes the link with the country's youth that is today so essential.

# The Air Force Commitment to Youth: a Chance for the Nation

Hervé DE SAINT EXUPÉRY

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The end of conscription, developments in society and the economic recession have all significantly altered the relationship between citizens and their armed forces. Mirroring these sometimes brutal changes, the armed forces have gradually reorganised themselves to face up to the situation and to ensure continued visibility in society, particularly through working for and with its youth. For some ten years the Air Force has been increasing its activity in this field despite the pressures of a level of operational commitment never before known. The Air Force has freely chosen weave a close liaison with younger generations, and in so doing to participate actively in bolstering national cohesion.

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With the deep changes occurring in our society, the need for social identity and to feel protected are two new aspects that have brought youth closer to the armed forces, a rapprochement that has clearly been of benefit to the Air Force. As a technological force, but one that is also and especially composed of men and women, the Air Force is ever more attractive and innovative in the eyes of young people. For them, the aeroplane synonymous of a dream that inspires them to choose the many military and civilian aeronautical trades that are currently recruiting. The aeronautical world therefore offers them the opportunity to be players, rather than spectators, in a dynamic society, in line with a growing desire to commit themselves to the service of others.

The intensity of the Air Force commitment in theatres of operation should not let us forget that its own aviators also need to have moments of rest and relaxation. Action for youth creates much of the recognition that these aviators need through the sense of excitement that they create among the young.

That very excitement for what aviators do has increased markedly—for example, every day Air Force establishments receive numerous requests for visits, which they try to honour. The number of aviators involved with youth continues

to increase even in these difficult times, so much so that the social role of the Air Force has been considerably strengthened over the past ten years.

## Commitment to youth, a credo for the Air Force

Since 2012, the Air Force has been engaged in a strategic plan called *Unis pour Faire Face*. Its main themes are to modernise combat capabilities, adapt structures, develop partnerships with society and enhance the status of the aviator. The Air Force and society project is one of the principal threads of this plan, and includes sponsorship of youth in a manner that clearly declares the service's commitment to young people. Two significant actions underpin that commitment: dialogue and action on the ground.

The values of the aviator, respect, integrity, sense of service and excellence, amount to a set of rules for soft skills that young people would do well to adopt. That said, such fundamental values only have any meaning if they are put into practice in everyday life.

A major lesson can be learnt from an examination of aviators' activity in support of youth. A profusion of local initiatives demonstrates our aviators' considerable will to act—so much so that it has become necessary to combine these initiatives into a foundation document which specifies what the Ministry of the Armed Forces expects from the Air Force-youth link, organises it and makes it more visible to society.

## The air-youth plan, a vital mission on the ground

Aviators come into contact with nearly 270,000 young people annually through their action in three main areas: the culture of defence and citizenship, the link between the Air Force and the nation, and the equal opportunity programme.

Since 2015, these actions have formed the keystone of the air-youth plan, the three objectives that form the doctrine of the plan being to recruit, train and reach out. The four main themes of its structure are:

- To develop a spirit of defence and citizenship, for example through military air acquaintanceships, leadership courses, employment in units and courses at all levels going from adolescents at school (at about age 16) through to students of justice at the national magistrates' school.
- To be concerned with education in general, for example by participating in teaching of an Introductory aeronautical certificate (*Brevet d'initiation aéronautique*, BIA) in schools.
- To offer advice on the education and career plans of young people by offering tutorials highlighting the equal opportunities programme.

• To interact with civilian society by creating partnerships for youth action with junior and senior schools, universities, foundations and associations. Every year, air shows attract tens of thousands of young people who, as well as being delighted by the show, absorb the messages on citizenship that go with it.

Activity is conducted according to five principles:

– shared interest between the Air Force and society,
– complementarity with that conducted by families, schools, higher education, companies and associations,
– adaptation to the constraints of air bases,
– reversibility, which means it can be suspended should new operational constraints demand,
– development, which means things can be changed, taking feedback into account.

The energy put by aviators into this youth scheme is a great investment, not only for society but also for the Air Force. Young people's enthusiasm to participate in these actions is growing every day.

Quite clearly, the aeronautical flavour of youth action is the Air Force's main asset, and the commitment of aviators to passing on their knowledge of aeronautical issues is its best illustration. Evidence of this can be seen in two particular actions, the air cadets and teaching of the BIA. The first offers reservist posts to young people in aeronautical units; the second offers them the possibility to prepare for the BIA exam. This exam is a diploma of the national education system, which is free of charge and available to all who seek to attract the young into aeronautical careers. Aviators help some 2,000 of the 10,000 candidates who apply annually for the exam, by giving them tailored and personalised courses. Moreover, in 2015 the Air Force signed a partnership with the national education system to enhance and develop this innovative action.

On a broader front, aviators' participation in this tutorial process has led to the establishment of the concept of training by commitment. This concept has improved the efficiency of aviators' training by killing three birds with one stone: it trains them in leadership by allowing them to 'sponsor' young people, teaches them the art and the manner of transmitting messages of citizenship and hope for the future, and allows them to move about in society, thus becoming powerful ambassadors of what might be called the 'spirit of defence'. It therefore means aviators can be exemplary in showing their pride in acting for society with humility. This very human and enriching training brings numerous advantages: greatly increased motivation for the aviator in acting for society, enhancement of his status as a sponsor, creation of links between aviators, and a rapprochement with society in general. By way of example, if they commit to teaching students in

senior schools or the youngest aviators in the Air Force, the officers under training at Salon-de-Provence can gain credits that count towards their engineering degree.

Another strategic factor in the equation is the need to create synergy with the other armed forces. The recent appointment of a Director of national service and youth (*Directeur du Service national-Jeunesse*, DSNJ) and the development of activity by the Armed forces and youth committee (*Commission Armée-Jeunesse*, CAJ) are a good illustration of what is being done. The will of DSNJ to create an annual youth conference will enable the forces to strengthen their collaboration in action for youth. The Air Force is participating actively in this movement—examples being the guidance each year of some 210,000 young people through their defence and citizenship day, and enabling 3,000 of them to take part in the forces-youth sports days. A notable degree of activity in the equality of opportunity programme means aviators help more than 5,000 young people per year. Moreover, to make its commitment to youth more efficient, the Air Force has decided to bring review and management of its activities under one roof, the Centre for studies, reserves and partnerships of the Air Force (*Centre d'études, réserves et partenariats de l'Armée de l'air*, CERPA), which is resident in the *École Militaire*, in the centre of Paris.

Partnerships between the Air Force and diverse players in the civilian world will help to maintain and develop a strong link with youth, particularly in places where the air world no longer has influence. Reconquering these military deserts could be achieved through former combatant associations, those inter-generational pools of experience, as long as such action can be coordinated. Additionally, partners from civilian society could also be more involved with the youth project, in particular those partners in the world of business enterprise. Such partnerships would translate the idea of a strong alliance between key players, whose interest it is to broadcast this youth-positive vision. These future partners would then be capable of instilling in the hearts of young people the level of citizenship and the powerful career ambitions that they so sorely need.

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There are, however, other challenges that face the aviators of the Air Force in 2017, such as setting in place a system of voluntary military service for young people looking for direction in their lives as well as that for civic service adapted to all who wish to commit themselves for a shorter time to serve the nation.

The qualities of its men and women have brought the Air Force closer than ever to the country's youth. But to remain at this high level of commitment, the service will have to favour action with an aeronautical connotation, capitalise on success by developing its communication and demonstrate its agility in staying connected to a youth movement that is evolving at great speed.

It is worth noting that these challenges do not take into account any objectives that the new government might set. Whatever they might be, sponsoring youth will remain timeless and apolitical and, moreover, an opportunity for the Air Force and for society in general.

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