Air and Space Power and Multidimensionality of the Battlespace

Some Elements on the Future of Military Engagements

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In a study published by the RAND Corporation, David Johnson refers to "the future Air Force as an evolving idea," particularly highlighting that

unlike the Army, whose learning has been largely framed by its constancy in adhering to its traditional central doctrinal tenet that wars are won by ground forces closing with and defeating the enemy, the Air Force has shown a greater capacity for adaptation throughout its history. In many cases, it was a service focused on proving an idea: that independent air power can be a decisive, war-winning instrument in and of itself. In the post–Cold War period, the Air Force has employed warfighting strategies whose broad conceptual approaches were quite diverse in the pursuit of this idea. In the 1991 Gulf War, the air campaign was initiated at the start of Desert Storm, and it combined counterair, SEAD [suppression of enemy air defenses], strategic attack, and interdiction. During the ground war, these components of the air campaign continued, but the Air Force also provided CAS [close air support] to ground forces. In Operation Allied Force, Air Force officers believed that the appropriate use of air power was to employ it against strategic targets in Belgrade, rather than against Serb forces in Kosovo. In Afghanistan, air power showed its greatest utility in attacking Taliban and al Qaeda forces in the field, tipping the battlefield balance against these forces and in favor of the Northern Alliance and other Afghan forces. Finally, in OIF [Operation Iraqi Freedom], the Air Force selectively attacked strategic targets but made its most significant contribution during major combat operations by shattering Iraqi forces in the field. During war the basic idea of the decisiveness of air power evolved to meet operational realities.[1]

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Without going back to the origins of military aviation, this general overview shows the adaptive capacity of air and space power, which has really become "diverse and flexible."[2] Moreover, it also underlines changes within the confrontational environment in the two decades following the first Gulf War. Today, Afghanistan and Iraq, together with the Israeli interventions in south Lebanon (2006) and the Palestinian Territories (2009), how a certain number of evolutions in the nature of conflicts, intervention environments, and adversaries, as well as in the use of air and space power. This use is completely different from the strategic, short, and effective air campaigns of the 1990s, which, by establishing the central role of the third dimension and of precision-guided munitions in a war, let us think that airpower would become "the perfect expression of a new warfare model showing that powers are powerless, national interest is relative and, finally, war is disincarnated."[3] Today's operations are in fact very different from the Operation Desert Storm or Allied Force "models," which, after acquiring air superiority (especially through missions like SEAD), destroying troops on the ground, and conducting campaigns of strategic bombing, left quite a small role for ground forces: occupying the field. Things are different today regarding adversaries, intervention environments, and political goals, and this difference determines the use of air and space power to replace traditional air interdiction and deep operations with, among other actions, a show of force or fire support. In this respect, Rebecca Grant points out that "if the Afghan war stretched the concept of strategic airpower, Gulf War II broke it wide open."[4] But should we see those evolutions as having an essential impact on future engagements?

In December 2006, during a workshop organized in Paris by the Centre for Air and Space Strategic Studies (Centre d'études stratégiques aérospatiales) of the French Air Force and dedicated to airpower in the next 20 years, Maj Gen Denis Mercier, then chief of the Plans Office of the French Air Force Staff, explained (paraphrasing Air Marshal Sir John C. Slessor) that if there is a more dangerous attitude than to suppose the next war will be just like the last one, it is imagining that this next war would be so different that we can afford to ignore all the lessons of the previous one.

This idea illustrates the core of the prospective approach and points out its importance, particularly for the preparation of forces. It is in fact one of the main lines of the *French White Paper on Defence and National Security*,

published by the French government in June 2008: "It is the ambition of France to be in a position where it does not have to submit to the effects of uncertainty; its ambition, rather, is to have the capacity to anticipate, respond to and influence international developments." With this aim, the white paper established the "knowledge and anticipation" function as the first of the five main strategic functions forming the architecture of French strategy, together with prevention, deterrence, protection, and intervention.[5] If this strategic function of knowledge and anticipation, presented as "a country's first line of defence," includes intelligence of all types, it also involves the prospective approach.[6] The latter appears all the more important since most armed forces have started to adapt their tools in accordance with the evolution of the international environment. The French Air Force is also subject to such evolution and has therefore initiated a similar process that it should carry on until 2025. Thus, the transformation must be accompanied by more global thinking on the conflictual environment and the battlespace in which air and space power could be engaged by 2025, when it would be "perfectly integrated in a global and interoperable system, controlling all the effects air and space force has at the heart of joint actions."[7]

However, questions about the evolution of the battlespace will not find any obvious answers. Moreover, they lead to analysis of many aspects, such as the evolution of the strategic environment, types of engagements and forms of conflict or technological evolutions, potential breakdowns, threat levels, and so forth. This is quite a complex task, reflected by the many exercises that have grown in number over the past years within the military staffs and bodies in charge of defense and security policies.[8] The works carried out by the US Air Force also show the extent of prospective thinking. We all remember the Air Force 2025 project, conducted by Air University in 1995/1996 and designed to identify the concepts, capabilities, and technologies that would enable the United States to preserve its air superiority over the next 30 years. The study involved almost 300 officers and over 40 studies, producing more than 3,300 pages of text. In 2006 Air University was tasked to conduct similar research with respect to the following 20 years. The work already completed by the Blue Horizon project, which mobilizes students of the Air War College and Air Command and Staff College each year, covers a wide range of fields, such as the use of biofuels as an alternative

solution to oil dependence, cyberspace issues, nanotechnologies, efficiency of directed energy weapons, and battlefield surveillance, among others.

Colin Gray, however, warned of the "perils of prediction," acknowledging that "the more detailed a prediction the more useful it should be" but pointing out that "unfortunately, degree of detail correlates closely with likelihood of error." Consequently, he recommended that we "beware of experts who have grown fond of the comforting, but highly misleading phrase, 'the foreseeable future.' The future is not foreseeable. No one has unique access to a trustworthy crystal ball. That granted, fortunately it so happens that we are in possession of information that should yield guidance for understanding a great deal about the future, including the future of warfare. But, making sense of that information is no simple matter."[9] So we should humbly approach prospective thinking and keep in mind that two strategic surprises—the fall of the Berlin Wall and the terrorist attacks of 11 September 2001—occurred less than 15 years apart. Without even mentioning strategic breakdowns, did we imagine in 1995 that—although four years earlier, Desert Storm had established the triumph of airpower and although North Atlantic Treaty Organization (NATO) forces were about to conduct a series of raids and precision strikes on Bosnia and Herzegovina during Operation Deliberate Force—15 years later the bombing in Central Europe would give way to close fire support or show-of-force missions in Central Asia? Did we imagine four years later, during a 78-day air campaign aimed at forcing Serbian leaders to stop their ethnic-cleansing policy against Albanian-speaking populations in Kosovo, that the threats and adversaries of today would be nonstate and that missions would mainly relate to counterinsurgency (COIN)?

This article does not exhaustively study the evolution of the conflict environment or approach all the challenges that could confront air and space power in the near future. Neither does it draw up a typology of engagements over the next 15 years, not to mention predict the future of warfare. To do so would be ill advised. At most, this article points out certain trends that could prove essential for future conflicts and offers an analysis of how the multidimensional and changing battlespace of the future could affect the employment of air and space power.

Air and Space Power between
Counterinsurgency and Conventional War

In addition to the idea that conflicts are likely to remain lengthy and take place on more distant theaters, one of the main trends that seems to define them in the 10 or 15 years to come is related to the nonstate nature of adversaries that Western armed forces would have to confront. This is almost a truism because it seems obvious that, in the near future, conflicts will be mainly related to COIN. Nevertheless, however commonplace that idea may seem, we mustn't ignore a less obvious fact: that these adversaries can cause real harm. That is, we should not succumb to the sin of pride by thinking that armed forces with great technological potential cannot be defeated by weaker adversaries.

A More Complex Battlespace

From that point of view, we must never underestimate these adversaries' capacity of analysis. Like Western forces, they pay special attention to the feedback of experience and to postengagement analysis in order to take advantage of weaknesses and difficulties observed in the armed forces. That, indeed, is why they favor certain environments such as the urban one, which, due to its human dimension, enables adversaries to exploit the normative and ethical constraints that Western armed forces must observe. But these actors' capability to inflict harm is also related to another aspect: the fact that they deploy, to a greater or lesser extent, advanced technological means, either to use the third dimension themselves or to prevent its use by Western forces. This contributes greatly to diminishing the traditional opposition between conventional and nonconventional warfare. One of the most symptomatic illustrations of this evolution, relating back to the technoguerilla notion, is, without any doubt, Hezbollah, which uses both rudimentary means (particularly related to communication) and more advanced technologies.[10] The events of the summer of 2006 in southern Lebanon demonstrated that the use of rockets, missiles, or drones (capable of carrying a military load and having a low radar signature) was not the exclusive privilege of armed forces having great technological potential but that nonstate actors (supported by certain states, of course) had access to such weapons. The employment of drones, even not very sophisticated ones (e.g., the Mirsad-1), or of antiship missiles (e.g., the C-802 Noor) is particularly significant. As

explained by Joseph Henrotin, one of the main European experts in strategic studies, "Today's guerillas are not a-technological objects."[11] In the future, insurgent or, more generally, irregular forces are likely to continue using the most rudimentary tactics, techniques, and technologies (with no radar signature, a low radar cross section, etc.) and at the same time the most advanced ones (both surface-to-air defense and armed drones). In order to face this wide range of threats, air and space forces will need to be capable of using sophisticated systems, in particular, those related to detection and identification. In the end, we need to keep in mind the adversary's determination and his capacity to adapt, which will without any doubt lead him to use surprising means.[12] That is the very essence of warfare: surprising one's enemy.

In addition to the intrinsic nature of the adversary and his likely means of operating, the nature of the intervention environment is particularly important for the preparation of forces. In this respect, it is interesting to point out that because theaters are extended, air mobility capabilities become even more crucial during deployment, support, or intratheater-maneuver operations. These essential capabilities enable forces to overcome the physical constraints of the field, gain speed in intervention, and avoid the inherent dangers of ground movements (improvised explosive devices, roadside bombs, ambushes, etc.). Today's conflicts demonstrate the importance of this air-ground synergy and the crucial role of maneuver and heavy-lift helicopters, as well as of projection capabilities, both tactical and strategic.

Analysis of the intervention environment also indicates that engagements and conflicts tend to be set in complex, uneven, or populated areas. This trend follows an ancestral principle of warfare: bringing the enemy into a known and controlled field. According to Sun Tzu, "Whoever is first in the field and awaits the coming of the enemy, will be fresh for the fight; whoever is second in the field and has to hasten to battle will arrive exhausted. Therefore the clever combatant imposes his will on the enemy, but does not allow the enemy's will to be imposed on him."[13] This principle is even stronger within a COIN framework. David Galula observes that "the role of geography, a large one in an ordinary war, may be overriding in a revolutionary war." He even believes that "if the insurgent, with his initial weakness, cannot get any help from geography, he may well be condemned to failure before he starts."[14] Thus, leveraging the environment is clearly a

means of leveling the power struggle and a strategy that enables the weaker adversary to bypass the force of the stronger one. Two relevant examples are the wars pitting the Israeli Defense Forces against Hezbollah (2006) and against Hamas (2009). Moreover, the Shiite militia in southern Lebanon has used the environment to take advantage of buried and hardened infrastructures linked by tunnel networks (imperceptible to air forces) and of the presence of civilians within the fighting areas.[15]

From this point of view, several reasons suggest that it is crucial to consider the urban environment when analyzing the evolution of the battlespace. First, cities are likely to remain at stake in conflicts due either to their concentration of political, economical, social, and cultural power or to their symbolic value. Second, urbanization of the world population is an increasing phenomenon: by 2025 almost 60 percent of the world population will live in cities (compared with less than 49 percent today).[16] Furthermore, 15 of the 22 megalopolises of the planet will be located in developing countries.[17] If urbanization rates are higher in developed countries than in emerging ones (53.2 percent compared to 42.7 percent), the latter will face more difficulties, particularly related to sanitary conditions and infrastructure. This situation would increase tension, which could only worsen the sanitary and pandemic crisis, the uneven distribution of resources, and the social, economic, or ethnic imbalance. Third, as previously pointed out, cities allow adversaries to bypass a stronger force's capabilities, especially its airpower. On the one hand, urban infrastructures⊠ ertical and horizontal planes, urban canyons, underground networks, and so forth⊠ place significant constraints on operations. On the other hand, the environment facilitates the deployment and concealment of surface-to-air capabilities (surface-to-air missiles as well as man-portable air defense systems). These aspects are also highlighted in Joint Publication 3-09.3, *Close Air Support*, which lists the main constraints of urban CAS operations, identifying among them difficulties related to urban configurations, communication problems (radio/video connections), disruption of infrared targeting systems, or the exposure of air platforms (particularly the rotary-wing ones) to significant threat. It also addresses all of the human-related constraints of engaging in an urban environment: restrictive rules of engagement, interweaving of armed forces with the adversaries and local civilian populations, and risks of incidental damages.[18]

Indeed, cities are a particularly complex environment where civilians naturally mingle with the fighting parties. This human dimension significantly increases the loose nature of threats and target elusiveness so that in an urban environment, warfare "involves *hitting the bull's-eye*" (emphasis in original).[19] This interweaving of forces with adversaries and civilians, as well as the difficulty of distinguishing between combatants and noncombatants, heightens constraints related to the rules of engagement, no-strike lists, or ethical and legal considerations. This situation generates a form of normative asymmetry in the sense that counterinsurgent forces are subject to a set of legal, operational, and ethical rules, which may just appear as so many constraints that do not weigh on the insurgents, whose "acts are not hindered by any article of the Geneva Convention. Their actions observe no ethical code."[20] The fact that civilian populations are widely exploited by adversaries only makes things more difficult. Once more, examine the wars in the Near East: Hezbollah and Hamas do not hesitate to conceal launchers near (or within) populated areas (schools, mosques, hospitals, etc.) or to "invite" the population to gather on roofs in order to dissuade Israeli Air Force pilots from using their armament. Of course, this is not a recent phenomenon—witness the recourse to human shields in Iraq and the Balkans. But it is likely to increase all the more as the superiority of Western armed forces, particularly their air forces, will continue to lead adversaries to find parries—not necessarily in order to win but at least to prevent such forces from reaching their objectives and political goals.

COIN, Only COIN, Nothing but COIN? Overcoming the Counterinsurgency Tropism

If force identification, precision, and control must be at the core of concerns about air and space power, we should not concentrate only on immediate issues or consider that in the future, cities would be the only environment where rivalries and power struggles could take place. We must not underestimate two other environments—cyberspace and space—that already appear as "future" theaters of operation or new "confrontation fields," as noted by the *Force Deployment Concept* published by the French Air Staff.[21]

It is true that cyberspace is not a particularly recent topic.[22] Still, it has become a crucial issue, in particular due to the dependence of modern armed forces on this environment. And all types of dependence are sources

of weakness. For example, the attacks on Estonia in 2007 and on Georgia in 2008.[23] But this threat is not generated only by state actors, as indicated by the Predator drones pirated by Iraqi insurgents, reported by the *Wall Street Journal* in December 2009. Moreover, such a threat does not require particularly complex means. In this case, a simple movie and MP3 download software proved sufficient to carry out the intrusions. Despite their rudimentary means, it seems that the hacker insurgents managed to obtain the data filmed and transmitted by the drones, partly due to the fact that, in order to accelerate the transmission, the data transferred from the platform to ground stations had not been encrypted. The US Air Force thought that insurgents would not be able to take advantage of this flaw, but they did. Imagine how difficult the situation could become if insurgents finally managed to nullify the tactical-operative advantages of remotely piloted aircraft (RPA) and partly take back the initiative by knowing what those aircraft are watching, and all this for $26.00![24] This is an especially interesting example to analyze because it illustrates so well the fact that cyberthreats are not generated solely by state actors. On the contrary, modern armed forces depend so much on cyberspace that a weaker adversary will strive all the more to damage them in this environment, not only because the technological, financial, and human investment is minimal, but also because it offers a way of harming armed forces without confronting them directly.

What we have here is a modern example of bypass strategy. Air and space power is particularly concerned with cyberspace since it operates and conducts missions by relying to a great extent upon information and communication systems and upon the use of networks such as the Rover system or tactical data link 16. More generally, the importance of drones within the modern battlespace and the increasing data exchanges between ground troops and aircraft (particularly for fire support procedures) are also relevant for this evolution. Whether it is about command and control; piloted aircraft or RPAs; satellite resources used for geolocation, communication, or observation purposes, today's air forces depend entirely on cyberspace. Therefore, in order to prevent any risk, the US Air Force entrusted its Cyber Command with the mission to "provide combat-ready forces equipped to conduct sustained operations in and through the electromagnetic spectrum, fully integrated with global air and space operations."[25] Furthermore, it is symptomatic to point out that, since December 2005, that service's mission

has been to "deliver sovereign options for the defense of the United States of America and its global interests to fly and fight in Air, Space and Cyberspace."[26]

Cyberspace appears as a common environment, and that is why analysis of its vulnerabilities and threats—and more generally its surveillance—must rely upon a shared approach (inter-armed forces, interagencies, interservices, and interdepartments). Nevertheless, for outer space, the Air Force has a special, if not natural, responsibility. Just like cyberspace, extra-atmospheric space has become critical, if not indispensable, to every military operation due to its applications in terms of telecommunications, observation, navigation, advanced warning, and so forth. Because new military actors are emerging in this environment, it needs increased surveillance as threats, passing through or remaining there, tend to grow, whether they are deliberate (antisatellite weapons, jamming capabilities, etc.) or not (space debris).[27] In case of an open conflict, a crisis, or a period of high tensions, the struggle for power might find itself relocated in outer space. Belligerents might try to restrain the employment of command, control, communications, intelligence, surveillance, and reconnaissance systems through jamming maneuvers against telecommunication or control networks, or through direct attacks aimed at space segments. Throughout the 15 years to come, few actors will find themselves in a position to conduct such offensive actions. However, space control will remain critical as the inherent risks of space increase; thus, surveillance of that medium needs to be enhanced. More generally, space, which tends to become an area of contention between states, illustrates what we may call war's absence of irreversibility. That is, total or mass war might not come back in the short term, but interstate confrontations will continue, as will crises—particularly those concerning proliferation. War will not necessarily remain a phenomenon limited to so-called irregular forms, even if this seems the "dominant form of belligerency" throughout the coming years.[28]

Today, we pay great attention, both from an academic or doctrinal perspective, to irregular warfare and COIN. We are rediscovering old books, republishing the proceedings of conferences held almost a half century ago, and writing more COIN and irregular warfare manuals within the armed forces.[29] These include the US Army and Marine Corps common manual (FM 3-24/MCWP 3-33.5), *Counterinsurgency*; COIN doctrine published by the French Army; and US Air Force Doctrine Document 2-3, *Irregular*

Warfare.[30] Such studies are welcome indeed; however, we mustn't think that COIN will inevitably and invariably be the only form of warfare in the next 15 years. This is what Air Chief Marshal Sir Stephen Dalton, the Royal Air Force chief of staff, warned about in his speech at the International Institute for Strategic Studies in London: "Afghanistan must serve as a *prism* to view the future, not a *prison* for our thinking."[31] By limiting the approach, particularly the prospective one, to COIN combat, we might confine ourselves to a model that will not necessarily reflect the possible trends of future conflicts. According to the capability approach, we mustn't limit air and space power's means of action to the "Afghan model."[32] It would be dangerous to think that, in the midterm, air and space power will not be used against adversaries who are similar or at least capable of challenging the full control of the third dimension by Western armed forces. The proliferation of air and space technologies and of surface-to-air systems in particular must be considered a factor of concern. This is all the more important because air and space operations are currently conducted in a permissive or semipermissive environment. To date, however, even though adversaries have not disputed the Western powers' control of the third dimension and if practically no air-to-air or surface-to-air threats exist, nothing guarantees that this situation will last forever⊠ especially regarding the absence of surface-to-air threats. In other words, it would be an illusion to imagine that Western air and space powers will have perfect and systematic control of their environment in the future. The same is true of thinking that adversaries will not have access to capabilities, technologically advanced or not, or to various tactics likely to challenge the air superiority of Western armed forces. Furthermore, we haven't even mentioned the risks and threats related to ballistic missile proliferation⊠ nother air and space issue. Some crises and tensions demonstrate that we need to weigh all these risks carefully and preserve the capabilities and competences we need to face irregular engagements, state threats, and high-intensity conflicts. These capabilities and competences must enable Western armed forces and their air and space powers to engage in high-technology conflicts, however limited they may be, that might turn into hybrid conflicts. Threats tend to increase rather than diminish, as explained by Gen Stéphane Abrial, former chief of the French Air Staff, when he warned about excess confidence generated by Western armed forces' air superiority: "If we rest on our laurels . . . and if we don't take action to

maintain this advantage, we might pay dearly to rediscover an old principle."[33] In other words, we must not let ourselves be captivated by the "all COIN" siren song and risk ignoring the form of war, so well-known in the past, that we call conventional. Above all, we must maintain our capabilities and competences in order to face a wide range of threats and preserve the air superiority that will continue to be crucial, regardless of the type of engagements in which armed forces will be involved.

The War of Times

In addition to complexity, another characteristic of modern conflicts is the importance of tempo⊠more precisely, tempos⊠n the battlespace. The plural form is necessary since both the armed forces, in this case air and space power, and their adversaries, particularly the nonstate ones, tend to act according to various tempos. Time has clearly become one of the main characteristics of today's conflicts and a critical element for future ones.

A Wide Range of Tempos

We know that, like height and reach, the control of short time, long time, and speed is one of the main characteristics of air and space power. In this respect, the *French Air Force Concept* emphasizes that "in theory, an air force in control of these three fields would be capable of making its country fully benefit from the advantages provided by the third dimension."[34] Because it controls the short time, air and space power can reduce the intervention, movement, and deployment times. But in modern conflicts, the use of long time also becomes crucial for operations, particularly for the weakest elements trying to prolong engagements. By attempting to exhaust the armed forces or at least give the impression that they are bogged down, adversaries seek to make local populations perceive counterinsurgent troops as occupation forces and thereby influence opinions of the national and international publics, which tend to withdraw their support for lengthy operations. In order to do that, adversaries of Western armed forces resort more and more to manipulating various media, trying to influence public opinion on the legitimacy of the intervention or take advantage of the public's "low" resilience. In this case, if adversaries make "strategic" use of long time, they act on a

double time level and give priority to the short time, using elusiveness and concealment tactics.

Western armed forces take the opposite approach by trying at a strategic level to reduce as much as possible the duration of their operations, aware that public support decreases as deployment time increases. At the tactical and operational levels, they combine the two paces and try to control the long time in order to act in a short time. Today's operations show us every day that RPAs are crucial. In addition to the fact that they keep people away from the risk area, RPAs have the advantage of long-time control—the ability to persist in the area. This is an undeniable operational gain because having not only control of the air for the long term but also networking sensors and receivers enables armed forces to acquire full situational awareness, a comprehensive vision of the battlefield, and a common picture of the operational situation. At the tactical and operational levels, this advantage allows control of the long time so that armed forces can act in the short time by capturing the elusive moment. In this respect, Col Jean-Christophe Noël of the French Air Force explains that "the systematic control of the short time in a theater like Afghanistan provides new possibilities to review the air maneuver but the 'structural' approach is prevailing and the division of work on the battlefield depends too much and too often on the responsibility areas allocated to each component."[35] Even though the Kosovo War may have demonstrated that intelligence, surveillance, and reconnaissance (ISR) platforms were limited in some respects, their persistence during all types of weather, day and night, appears today as an actual tactical-operative innovation providing area coverage, as well as continuous, instant information to both air and ground forces. From now on, whether in Lebanon or Gaza, Iraq or Afghanistan, no armed force engaged in a conflict can ignore the persistence provided by drones, which "have become a critical component of modern air-ground operations," either during engagements or prior to them, as shown by the four months of intelligence acquisition and geo-referencing before the second offensive in Fallujah (November 2004).[36]

Elusiveness versus Reactivity

It is all the more important for armed forces to operate platforms capable of controlling the long time in order to act in a short time since adversaries' elusiveness is one of the main characteristics of modern conflicts. Within

COIN conflicts, flight persistence has become crucial for capturing these fleeting moments. Among the numerous examples illustrating this idea, retired US Air Force general David Deptula, who served as deputy chief of staff for ISR, reported that even though it took only six minutes for an F-16 patrol to deliver fire on Abu Musab al-Zarqawi, the al-Qaeda leader in Iraq, the Predator had previously performed almost 6,000 hours of target observation, tracking, and localization.[37] Thus, time control is the critical issue here; other than the advantages drones provide in terms of intelligence and information control, they are particularly important because they enhance force reactivity.

This is not a new issue, and it lies at the core of the observe, orient, decide, act (OODA) loop concept and of the find, fix, track, target, engage, and assess (F2T2EA) six-stage target cycle.[38] But today's operations, either the ones carried out by Israel or those conducted in Afghanistan and Iraq, prove the critical nature of this aspect and the importance of performing dynamic targeting and dealing with time-sensitive targets. The necessity of controlling short and, ideally, real time appears to be one of the main evolutions of the battlespace.[39] By trying to blend in with the population or take advantage of the dark areas that cities and their outskirts provide, adversaries attempt to impose their rhythm and control the initiative. In order to stop them, forces need to control the long time (persistence) and diminish the time span between observation and action. In this respect, drones offer a huge advantage; specifically, their persistence, together with the capacity to transmit information on a direct, continuous, and real-time basis, ensures acceleration of pace and time control.

In terms of reducing action time, weapon systems like the Harop Israeli drone or the British Fire Shadow missile seem particularly useful. Both are capable of persistently flying above an area, just like a traditional ISR platform, to provide missile use and enable instant strike of a target.[40] But armed drones are more than "disposable" platforms; they also have the advantage of combining persistence of flight and acceleration of the engagement cycle. This compression of the OODA loop is all the more essential because most of today's offensive missions of air and space power are dynamic, targeting adversaries who avoid direct confrontation and bypass the force. This is one of the reasons that countries other than the United States have become extremely interested in these armed platforms. The United

Kingdom and Italy already operate MQ-9 Reapers, and it seems that Turkey is considering acquisition of them. Since 2001⊠no re particularly, after 2008⊠ he employment of armed drones has increased considerably. For instance, a New American Foundation study points out that drones operated in Pakistan by the United States performed 53 strikes in 2009 and no fewer than 18 during the first two months of 2010, compared to nine between 2004 and 2007 and 34 in 2008.[41] It seems that the Egyptian Mustafa Abu al-Yazid (Sheik Saeed al-Masri), al-Qaeda's "number three," was killed by a drone in May 2010 in North Waziristan.[42] By combining persistence and instantaneity, these platforms have become a "weapon of choice" in modern conflicts.[43] This combination provides yet another advantage. Like a show of presence and show of force, armed drones can have a tactical deterrence (persistent) function, contributing to the controlled use of force. By maintaining a continuous armed presence above an area, suggesting to adversaries that they are under constant control and that armed forces tend to react in a progressively shorter time, drones influence decision making and dissuade adversaries from acting. This dissuasive function of armed RPAs contributes to a controlled use of force, critical in COIN or stabilization operations, especially since forces must avoid causing damage that might turn the population against them.

Due to the central place and increasing role of drones in modern conflicts, but also because of the evolution of threats, we need to protect such platforms. Despite their great importance, drones remain vulnerable to both air-to-air and surface-to-air threats. Two examples are particularly relevant: the Israeli Heron brought down in 2006 by Syrian surface-to-air defenses and the Georgian drone that filmed its own destruction by a Russian MiG-29 in April 2008.[44] This vulnerability underscores the fact that acquisition of air superiority will continue to be a must for future engagements, even in the case of an asymmetric or irregular conflict. This principle is even more crucial because adversaries, whose capacity to adapt shouldn't be underestimated, will inevitably try to diminish the drones' tactical and operative advantages. Network security is also of great importance, as reflected by the Predator piracy cases in Iraq.

Accelerating the Tempo through Decentralization

If current engagements prove the significance of the "observation/strike" tandem, they also show that tempo control implies high decentralization, which does not lack impact in terms of organization. One of the main lessons of these past few years is the apparent rediscovery of CAS missions, suggesting an evolution of the employment of forces towards a real air-ground synergy. This phenomenon contradicts Edward Luttwak's assertion that within COIN, air and space power is "of little use" and that, although it can provide surveillance and transport, "the insurgents are rarely stable and contrasted targets attackable from the air."[45]

Even if CAS missions have not been used in the Iraqi and Afghan conflicts, the latter illustrate the importance of today's combined operations of ground and air forces. Those missions have evolved and are now quite different from the ones conducted, for example, in Bosnia during Operation Deny Flight. The chain of command was so complex then, that "the advantages of air power were finally annulled."[46] By showing the critical nature of air-ground integration and of the transition from airpower to the "interdependence of armed forces," such missions prove the importance, in terms of reactivity, of the distribution of control and execution, as well as of air-ground contacts (particularly for data exchange).[47] It would be profitable to consider intensifying the decentralization of air mobility (not of command but of control and execution), another form of air-ground integration. Doing so could prove particularly useful in commanding and guiding additional units sent to support troops in contact. This alternative form of CAS would enable a forward air controller to direct maneuver helicopters from the ground in order to guide additional ground units intended to support troops in contact. By extending the distribution of control, a different but adapted and reactive one could provide support whenever classical support missions are not an optimal solution due to constraints generated by the environment or the interweaving of forces with civilians or adversaries.[48]

People, Perceptions, and Media:
The Human at the Heart of the Battlespace

This interweaving demonstrates the importance of the human dimension of engagements today. As mentioned above, adversaries of Western

forces try to prolong engagements, hoping that the population would either refuse to support or withdraw its support of those forces.

Nowadays, the battlespace has become globalized and multidimensional. New "confrontation" fields have augmented its classical definition: a physically delimited field where two or several forces confront each other by military means, each trying to impose its will on the other. If space and cyberspace are two examples of the battlespace, then the media and the psychosociological sphere of perceptions appear to be fundamental elements. This leads to a kind of paradox: despite remarks about a "robotization" phenomenon, in reality, war remains a fundamentally "human" activity.

COIN operations have highlighted the key role that populations play whether they are an objective (acquiring their support) or an instrument (human shield). Again, that aspect is not new, as Galula has already pointed out that populations were the ones really at stake in conflicts. More recently, the International Security Assistance Force (ISAF) *Commander's Counterinsurgency Guidance* asserted a similar principle, noting that "protecting the people is the mission. The conflict will be won by persuading the population, not by destroying the enemy. ISAF will succeed when [the government of the Islamic Republic of Afghanistan] earns the support of the people."[49] Numerous authors, both military and academic, have written about this subject, one of them being Gen Rupert Smith, who meditated on the "war amongst people."[50] Another example is a book, recently published by three colonels of the Mountain Infantry of the French Army, entitled *Principes de contre-insurrection* (*Counterinsurgency Principles*), which emphasizes the human dimension. The authors also point out the necessity of pacing, asserting that " '*winning the hearts and minds*' of the local populations, which is crucial in order to defeat insurgency, is a long drawn out work, incompatible with the lightning war pattern deeply fixed in the western people's mentalities. Since they are 'in a perpetual hurry,' western people think a long war necessarily drags on" (emphasis in original).[51] In the end, given the importance of populations and their key role (whether deliberate or not) in modern conflicts, we may wonder if they haven't become actual centers of gravity in the sense used by retired Air Force colonel John Warden. More generally, we may extend the reasoning and consider that a COIN pattern includes several centers of gravity. As Henrotin explains, if Warden's typical adversary "was a State, within a systematic vision we may extend the

reasoning to the insurgent groups: they also operate with a leadership (leaders and ideologists), 'organic essentials' (e.g., media online platforms), 'infrastructures' (financial system or smugglers), a 'population' (supporting the insurgents) and 'fielded forces.'"[52]

This pressing necessity to acquire and preserve popular support demonstrates the importance of perceptions in war. Their role within foreign policy is not really a recent issue, as reflected by several studies, poised between international relations theories and cognitive sciences, referring in particular to the role of perceptions within decision-making processes and more precisely related to nuclear deterrence. These include the works of Robert Jervis and, in particular, his study *Perception and Misperception in International Politics*, published in 1976, which remains topical.[53] Today, perceptions do indeed play a key role in a mainly counterinsurrectionary conflict environment, where the media are of great importance.

In the *Revue française de science politique* (1986), Michael Hearn explains that "it is interesting to study perception in order to analyze the image in foreign policy, which means to identify the representation the decision-maker has on the national, regional or global environment."[54] Even if populations and public opinions might not be decision makers in Hearn's sense, their influence is real. In particular, within COIN operations, where winning hearts and minds has become a key objective. The problem is that both parties share that objective. Thus, by a symmetric effect, armed forces need to dispute this support to the adversary. Therefore, the population's perceptions and empathy become a target. Analyzing the Afghan conflict, Andrew Exum explains his interest in Pakistani press releases because, in this perpetual battle, it is less important how many civilians actually have been killed by the engaged forces than how many the population thinks have been killed.[55] Once again, the insurgents use a roundabout strategy, bypassing the armed forces and trying to shape the public's perceptions in order to make them withdraw their support from the counterinsurgent forces. Their final objective is to make those forces leave the battlefield prematurely.

Air and space power is directly concerned with these issues, especially due to perceptions that the public might have about the means it employs. For example, drones do indeed play a key role for the armed forces but are subject to largely negative popular beliefs associated with no-pilot aircraft, robots, and so forth; additionally, they may seem counterproductive because

the local public considers them a sign of weakness or because of their asso-
ciation with the notion of collateral damage.[56] However, we mustn't ignore
such perceptions just because they are wrong. Moreover, we have a very
techno/industrial-oriented approach to drones instead of a global one. This
is even more important since the media do not do justice to these aircraft,
not necessarily because they intend to tarnish their image but because the
lack of information about these platforms, together with a need to simplify
the information available, makes them spread false impressions. Percep-
tions must be taken into account when using these aircraft in conflicts in
which cultural approach and opinions are important, and when planning
and defining the intended effects. This is an essential approach because the
image of RPAs is likely to cause loss of support from the public. Such an
admission does not equate to questioning the operational importance of
these platforms. That is an undeniable fact. However, this global approach
should help define a specific communication strategy in order to explain
what armed drones are and, of course, what they are not. Otherwise, their
use could prove counterproductive during long-term operations that de-
pend upon the public's support. One must anticipate the commentary re-
lated to armed drones and adopt a proactive approach. Deprived of other
sources of information, populations know little about these platforms, a
situation that makes them vulnerable to the insurgents' propaganda, which
can create a negative opinion about the drones. As Hearn writes, "What
really matters is not the force, but how the force is perceived." He also
points out that "the perception of the reality overtakes reality itself."[57]

   Apart from this aspect specific to drones, armed forces have become
aware to some extent that the battlespace has expanded to the sphere of
perceptions, as reflected in the most recent doctrine. In FM 3-24/MCWP
3-33.5, the term *perception*, for example, appears 59 times, excluding the
tables of contents and indexes. Furthermore, the last editions of France's
Force Deployment Concept stress that "the 'battle of perceptions' becomes
offensive and defensive, strategic and tactical, and it is essential when plan-
ning and conducting an operation." Highlighting the polymorphous nature
of today's conflicts, the *Concept* notes the "critical importance" of that battle
in COIN conflicts, where adversaries favor psychological actions.[58] It is in
fact what Cori Dauber refers to when writing that

waging war against terrorists (or insurgents using a terrorist playbook) is a qualitatively different enterprise from earlier, or different, wars. By definition, terrorists are too weak to fight conventional battles. The question is what kind of battle, then, are they fighting? They fight a battle to shape the perceptions and attitudes of the public⊠   battle over the public's very will to continue fighting, whether that is the indigenous public insurgents seek to intimidate or the domestic American public they seek to influence so as to force counterinsurgents to withdraw from the battlefield prematurely. And in the modern world, this will, of necessity, be a battle to shape media coverage.

Further on, the author explains that today the fight must occur on two fronts:

The *ground war*, meaning the war that has to actually be won on the ground, the state of play on the ground as it exists in reality. But there is also the *air war*, meaning the war as it exists on the nation's front pages and television screens. For a democracy, winning one and not the other will always mean losing, and losing in a very real sense, because the loss of public support means that the war will come to an end, period.

This means that the terrorist attack is a media event in the sense that it is designed to attract the attention of the media, to gain the media's attention, the same way that a political campaign event is a media event, designed to attract the media's attention and thus garner coverage. As in the case of the presidential campaign, when we discuss *media attention* we are really first and foremost talking about television. When we are talking about gaining television's attention, we are really talking about gaining the attention of the cameras⊠   nd the way to do that, of course, is to provide *good visuals*, however those are defined in a particular context (emphasis in original).[59]

The perceptions issue is closely related to the role of media in modern conflicts. It is all the more central as they are not only omnipresent, particularly in cities, but also used⊠   ven exploited⊠   y adversaries. Moreover, today the role of the media⊠   f mass communication⊠   s atomized and thus any individual, even for a short moment, can turn into a receiver or sender of information in real time. This evolution has been made possible by advances in information and communication technologies that have become very accessible (e.g., mobile phones and the Internet). Today, an isolated individual can influence perceptions by broadcasting worldwide a piece of information or a message. Two examples illustrate this phenomenon: the proliferation of blogs and the role played by citizen reporters in media coverage of the suppression of demonstrations following the 2009 presidential election in Iran. We can easily imagine that in a few years, individuals could follow up conflicts live on various platforms, starting with mobile phones. More than simple "wartainment," it would constitute an actual "mobile war"

era.[60] Since people could follow up the conflict in real time, pressure on armed forces will increase greatly, as well as the need to control the effects— particularly through precision. That has to be considered since adversaries use subversion, coercion, and persuasion strategies aimed at influencing populations and public opinion. Thus, propaganda—a key component of this bypass strategy—comes into play at local, national, and international levels to "influence perceptions of potential supporters, opinion leaders, and opponents in the favor of the insurgents; promoting the insurgent cause and diminishing the government's resolve."[61] Making the same observation, James Corum writes that

> we have to be ready to counter a large scale disinformation campaign mounted by insurgent and radical groups against military operations. A senior commander today, operating against irregular enemies, needs a highly trained specialist cadre who can handle media and information operations. The poor Israeli response to the conflict with Hezbollah in southern Lebanon in the summer of 2006 ought to be a warning about the need to anticipate the opponent's media campaign and to proactively develop responses using themes, words and images that will appeal not only to our own public, usually the audience for our own media campaigns, but also to the people of the region. When we catch our opponents using lies and disinformation, or the western media uncritically repeating the disinformation, we need to be able to quickly and effectively counter such propaganda campaigns. Counter-insurgency is still about winning hearts and minds, and effective media operations are one of the main weapons we have.[62]

In other words, a confined environment, deep interweaving with the civilian population, and omnipresent media and real-time broadcasting produce increasingly complex operations tolerating no margin of error; the smallest collateral damage can be instantly broadcasted worldwide. Such things already happen today, and this is only the beginning. Once more, we note a clear evolution during the past 15 years: in 1993 US forces landed on the Somali beaches, followed by cameras of the major Western media. Today, in Gaza, YouTube broadcasts the war of images and communication.

Conclusion

Two decades ago, Martin van Creveld wrote that in the future, war "will not be waged on a battlefield—this kind of space doesn't exist anymore all over the world—but within more complex, natural or artificially created environments. It would be a war of listening, car bombs, hand-to-hand fights. . . . It will be endless, bloody and atrocious."[63] What more can we say

about the conflicts that will involve air and space power during the next 15 years? Van Creveld's remark holds true not only for today but also for tomorrow. Future wars will likely occur in particularly complex environments, whether cities, exoatmospheric space, or various human spheres. Moreover, they will probably cover the entire spectrum of conflict, from stabilization to high-intensity confrontation. Threats could be conventional and symmetrical or completely asymmetrical, mixing rudimentary means and high technology. With regard to the armed forces, this situation will require sophisticated systems, especially those related to detection and identification, maintenance of competences, and development of capabilities in order to carry out all missions, from a show of force to high-intensity engagement.

The capacity to act in the third dimension, a necessity and prerequisite of all forms of engagement, will remain an essential factor for the success of operations. Due to the wide range of means it offers⎯from the extremely rapid projection of forces to the identification and destruction of high-value targets, passing through fire support⎯air and space power is more than a simple tool used to assist actions; rather, it actually gives armed forces a "critical advantage."[64] Control of the third dimension will remain crucial for future operations, regardless of their nature and the environment of engagements, because it enhances force and efficiency as well as contributes to delivering fire and acquiring situational awareness. It will be as essential tomorrow as it is today for freedom of action. If the evolution of engagements and environments demands that we adapt our methods and means in order to control effects, flexibility, and reactivity, it is certain that "the capabilities of the third dimension are not used as an additional contribution to the ground fighting anymore, but as a major component thereof."[65]

Notes

1. See in particular David E. Johnson, *Learning Large Lessons: The Evolving Roles of Ground Power and Air Power in the Post⎯Cold War Era* (Santa Monica, CA: RAND Corporation, 2007), 182.

2. Rebecca Grant, "The Redefinition of Strategic Airpower," *Air Force Magazine* 86, no. 10 (October 2003): 34.

3. Joseph Henrotin, *L'Airpower au XXIᵉ siècle: Enjeux et perspectives de la stratégie aérienne* (Brussels: Bruylant, 2005), 388. (Original version: "L'expression parfaite d'un nouveau modèle de guerre montrant l'impuissance des puissances, la relativité de l'intérêt national et, *in fine* une guerre désincarnée.")

4. Grant, "Redefinition of Strategic Airpower," 35. The author concludes by pointing out that "Gulf War II should put to rest the false debate about what strategic airpower can or cannot do on its own. Operation Iraqi Freedom was a mosaic of action at all points on the compass and at different levels of intensity. Fighters, bombers, and even Predator UAVs [unmanned aerial vehicles] served as 'strategic' weapons by striking high-value targets. Strategic airpower will continue to be a major advantage for U.S. military forces, but it need no longer be tied down to its historical baggage" (38).

5. "The aim of prevention is to avoid the emergence or aggravation of threats to our national security. An effective preventive strategy will rely on a broad range of diplomatic, economic, military, legal and cultural tools, co-ordinated at the

international, European and national levels." *French White Paper on Defence and National Security* (Paris: Odile Jacob/La documentation Française, 2008), 143.

6. Ibid., 125.

7. Col Michel Friedling and Lt Col Philippe Cexus, "Faire Face 2025: Un grand projet pour l'armée de l'air," *Penser les Ailes françaises*, Centre d'études stratégiques aérospatiales, no. 10 (June 2006): 9. (Original version: "Parfaitement intégrée en un système global, interopérable et maître de l'ensemble des effets de la force aérospatiale au cœur de l'action interarmées.")

8. Among the many prospective studies, we recommend those published in France under the aegis of the Defense Staff and/or the Delegation for Strategic Affairs (French Ministry of Defense), the Multiple Futures Project of the North Atlantic Treaty Organization, the Global Strategic Trends Programme initiated by the Development, Concepts and Doctrine Centre of the UK Ministry of Defense, or *Marine Corps Operating Concepts for a Changing Security Environment* (2006). More generally, see Paul Braken, "Net Assessment: A Practical Guide," *Parameters* 36, no. 1 (Spring 2006): 90–100.

9. Colin S. Gray, *Another Bloody Century: Future Warfare* (London: Phoenix, 2006), 37–8.

10. See in particular Joseph Henrotin, "Les ré(é)volutions du caméléon: Combat futur et formation des structures de force entre *Transformation*, guerres hybrides et nouvelles formes d'application des conceptions de techno-guérilla," *Les Cahiers du RMES* 5, no. 2 (2008/2009): 75–127.

11. Ibid., 91. (Original version: "Les guérillas contemporaines ne sont pas des objets a-technologiques.")

12. See, among others, Noam Ophir, "Back to Ground Rules: Some Limitations of Airpower in the Lebanon War," *Strategic Assessment* 9, no. 2 (August 2006).

13. Sun Tzu, *The Art of War*, chap. 6, "Weak and Strong Points."

14. David Galula, *Counterinsurgency Warfare: Theory and Practice* (Westport, CT: Praeger Security International, 2006), 23.

15. See in particular Sarah E. Kreps, "Air Power's Role in Asymmetric Operations: The Case of the Second Lebanon War," in *Air Power, Insurgency and the "War on Terror,"* ed. Joel Hayward (Cranwell, UK: Royal Air Force Centre for Air Power Studies, Royal Air Force College, 2009), 143–5.

16. United Nations, Department of Economics and Social Affairs, Population Division, "World Urbanization Prospects: The 2007 Revision Population Database," http://esa.un.org/unup.

17. Nicole Gnesotto, *Le monde en 2025* (Paris: Robert Laffont, 2007), 26.

18. Joint Publication 3-09.3, *Close Air Support*, 8 July 2009, v, 86–7.

19. Maj Benjamin R. Maitre, "The Paradox of Irregular Airpower," *Air and Space Power Journal* 21, no. 4 (Winter 2007): 36.

20. Sylvain Tesson, Thomas Goisque, and Bertrand de Miollis, *Haute tension: Des chasseurs alpins en Afghanistan* (Paris: Gallimard, 2009), 28–9.

21. French Air Staff, *Concept d'emploi des forces*, no. 004/DEF/CICDE/NP, 11 January 2010, 12.

22. In this respect, review the various works of John Arquilla and David Ronfeldt, including "Cyberwar Is Coming!," *Comparative Strategy* 12, no. 2 (Spring 1993): 141–5; (eds.), *In Athena's Camp: Preparing for Conflict in the Information Age*, MR-880-OSD/RC (Santa Monica, CA: RAND, 1997); and *Networks and Netwars: The Future of Terror, Crime, and Militancy*, MR-1382-OSD (Santa Monica, CA: RAND, 2001). More recently, see Henning Wegener, "Harnessing the Perils in Cyberspace: Who Is in Charge?," *Disarmament Forum*, no. 3 (2007): 45–52; and Lt Col Mel Deaile, "Cyberspace Warfare: The New Frontline," *Journal of the JAPCC* [Joint Air Power Competence Center, NATO], no. 8 (2008): 58–61.

23. See in particular "Cyber Attack on Estonia Stirs Fear on Virtual War," *International Herald Tribune*, 18 May 2007; "The Cyber Raiders Hitting Estonia," BBC News, 17 May 2007; "Estonia Urges Firm EU, NATO Response to New Form of Warfare: Cyber-Attacks," *Sydney Morning Herald*, 16 May 2007; "Russia Accused of Unleashing Cyberwar to Disable Estonia," *Guardian*, 17 May 2007; and Maj Leland Bohannon, *Cyberspace and the New Age of Influence* (Maxwell AFB, AL: School of Advanced Air and Space Studies, June 2008), 43–1.

24. See Siobhan Gorman, Yochi J. Dreazen, and August Cole, "Insurgents Hack U.S. Drones," *Wall Street Journal*, 17 December 2009. As the article points out, according to US authorities, there would be no proof that insurgents could take control of the drones or interfere with their flights.

25. US Air Force, Air Force Cyber Command, *Air Force Cyber Command Strategic Vision*, February 2008, 1. This document also points out that "cyberspace integrates operations across all other domains, facilitating interdependent offensive and defensive operations to achieve dominance at the place and time of our choosing. Controlling cyberspace will allow us to create the full spectrum of desired effects across future integrated battlefields. The Air Force has routinely employed electromagnetic capabilities to engage the enemy, establishing and sustaining the air and space superiority that has proved decisive in winning the nation's battles and wars. We will leverage this expertise and further develop capabilities enhancing our freedom of action while limiting the flexibility of our adversaries" (4). See also Lt Col Shane P. Courville, *Air Force and the Cyberspace Mission: Defending the Air Force's Computer Network in the Future*, Occasional Paper no. 63 (Maxwell AFB, AL: Center for Strategy and Technology, Air War College, December 2007);

and, of course, the *National Space Policy of the United States of America* (Washington, DC: White House, 28 June 2010), http://www.whitehouse.gov/sites/default/files/national _space_policy_6-28-10.pdf.

26. Richard Mesic et al., *Air Force Cyber Command (Provisional) Decision Support* (Santa Monica, CA: RAND, 2010), 2n5.

27. See, among others, Lt Col James Mackey, "Recent US and Chinese Antisatellite Activities," *Air and Space Power Journal* 23, no. 3 (Fall 2009): 82⊠3.

28. Gray, *Another Bloody Century*, 24.

29. Note the symposium held in April 1962 by RAND, in which Galula participated: Stephen T. Hosmer and Sibylle O. Crane, *Counterinsurgency: A Symposium, April 16⊠20, 1962* (Santa Monica, CA: RAND, 2006).

30. Field Manual 3-24 / Marine Corps Warfighting Publication 3-33.5, *Counterinsurgency*, December 2006; French Army, Forces Employment Doctrine Center (Centre de doctrine d'emploi des forces), *Doctrine for Counterinsurgency at the Tactical Level*, January 2009; and Air Force Doctrine Document 2-3, *Irregular Warfare*, 1 August 2007. See also *The 21st Century Air Force: Irregular Warfare*, January 2009; and Richard Mesic et al., *Courses of Actions for Enhancing U.S. Air Force "Irregular Warfare" Capabilities: A Functional Solutions Analysis*, MG-913-AF (Santa Monica, CA: RAND, 2010).

31. Air Chief Marshal Sir Stephen Dalton, Royal Air Force chief of staff, "Dominant Air Power in the Information Age: The Comparative Advantage of Air and Space Power in Future Conflict" (address, International Institute for Strategic Studies, 15 February 2010), 4.

32. See Stephen D. Biddle, "Afghanistan and the Future of Warfare," *Foreign Affairs* 82, no. 2 (March/April 2003): 31⊠46; and Stephen D. Biddle, "Allies, Airpower, and Modern Warfare: The Afghan Model in Afghanistan and Iraq," *International Security* 30, no. 3 (Winter 2005/2006): 161⊠6.

33. Général d'armée aérienne (Gen) Stéphane Abrial (address, 59th session of the Institute for Higher National Defence Studies [Institut des hautes études de Défense nationale], Paris, 7 March 2007). (Original version: "Si nous dormons sur nos lauriers et n'agissons pas pour maintenir cet avantage, le prix à payer pourrait être très élevé pour redécouvrir un vieux principe.")

34. French Air Force, *Concept de l'armée de l'air*, September 2008, 8. (Original version: "Une armée de l'air qui maîtriserait ces trois domaines serait théoriquement capable de faire bénéficier pleinement son pays de l'ensemble des avantages que procure la troisième dimension.")

35. See Col Jean-Christophe Noël, "La manœuvre aérienne en question," in *Guerre et manœuvre*, ed. Christian Malis (Paris: Economica, 2009), 202. (Original version: "Que la maîtrise systématique du temps court sur l'ensemble d'un théâtre comme l'Afghanistan offre de nouvelles possibilités pour repenser la manœuvre aérienne alors que l'approche 'structurelle' domine et que la division du travail sur le champ de bataille reste souvent bien trop dépendante des zones de responsabilité attribuées à chaque composante.") More generally, see Robert R. Leonhard, *Fighting by Minutes: Time and the Art of War* (Westport, CT: Praeger, 1994).

36. Général d'armée aérienne (Gen) Jean-Paul Paloméros (French chief of Air Staff) and Général de corps d'armée (Lt Gen) François-Pierre Joly, "Drones en Afghanistan, la nécessaire complémentarité des vecteurs," *Défense nationale et sécurité collective*, no. 720 (June 2009): 67. (Original version: "[Les drones] sont devenus une composante essentielle des opérations aéroterrestres modernes.")

37. Michael W. Isherwood, "Roadmap for Robotics," *Air Force Magazine* 92, no. 12 (December 2009): 31.

38. On this notion, see in particular Adam J. Hebert, "Compressing the Kill Chain," *Air Force Magazine* 86, no. 3 (March 2003): 50⊠4.

39. See Christophe Pajon and Grégory Boutherin, "Persistance et maîtrise du temps au cœur du champ de bataille contemporain: Les drones comme instrument de contrôle des 'présents,'" *Défense et sécurité internationale⊠ Technologies*, no. 19 (September/October 2009): 8⊠12.

40. See Akram Ghulam and Col Peter Tomlinson, "The Fire Shadow Project: A Big Step towards Rapid Acquisition," *RUSI Defence Systems* 11, no. 2 (October 2008): 77⊠80.

41. Peter Bergen and Katherine Tiedemann, "The Year of the Drone: An Analysis of U.S. Drone Strikes in Pakistan, 2004⊠2010," Counterterrorism Strategy Initiative Policy Paper (Washington, DC: New American Foundation, 24 February 2010).

42. Eric Schmitt, "Strike Said to Kill a Top Al Qaeda Leader," *New York Times*, 31 May 2010; and Greg Miller and Craig Withlock, "Al-Qaeda No. 3 Yazid Reported Killed by U.S. Drone," *Washington Post*, 1 June 2010.

43. Christopher Drew, "Drones Are Weapons of Choice in Fighting Qaeda," *New York Times*, 17 March 2009.

44. Ben Moores, "A Preliminary Military Assessment of the Lebanon Conflict," defense-aerospace.com, 18 August 2006, http://www.defense-aerospace.com/articles-view/feature/72377/a-preliminary-assessment-of-the -lebanon-conflict.html.

45. Edward N. Luttwak, "Les impasses de la contre-insurrection," *Politique étrangère*, no. 4 (2006): 850. (Original version: "Les insurgés constituent rarement des cibles stables et contrastées pouvant être attaquées depuis les airs.")

46. Henrotin, *L'Airpower au XXIᵉ siècle*, 279.

47. Général de corps aérien (Lt Gen, French Air Force, retired) Jean-Patrick Gaviard, "L'héritage d'*Allied Force*," *Défense et sécurité internationale*, no. 51 (September 2009): 40. (Original version: "interdépendance interarmées"). See also Joseph Henrotin,

who refers to an "interdépendance naturelle," soulignant que celle-ci "est déjà établie *de facto* dans un certain nombre de secteurs." Joseph Henrotin, "Les facettes et défis de la puissance aérienne au 21ème siècle: Vers une approche synergistique?," *Les Cahiers du RMES* 6, no. 1 (Summer/Fall 2009): 74⊠75.

48. On the inherent difficulties of air support, see in particular Olivier Zajec, "L'appui aérien dans le cadre de la guerre irrégulière," *Stratégique*, nos. 93/94/95/96 (2009): 477⊠0.   More generally, see Tim Ripley, "The Right Call," *Jane's Defence Weekly* 46, no. 44 (4 November 2009): 38⊠3.

49. International Security Assistance Force Headquarters, *ISAF Commander's Counterinsurgency Guidance*, August 2009, 1.

50. Gen Sir Rupert Smith, *The Utility of Force: The Art of War in the Modern World* (London: Penguin, 2006).

51. Col Hervé de Courrèges, Col Emmanuel Germain, and Col Nicolas Le Nen, *Principes de contre-insurrection* (Paris: Economica, 2010), 28. (Original version: "*La conquête des cœurs et des esprits* des populations locales qui est indispensable pour vaincre l'insurrection, est une œuvre de très longue haleine qui s'accommode mal de la culture de la guerre éclair profondément ancrée dans les mentalités des peuples occidentaux. Pour ces derniers, les 'éternels pressés,' une guerre qui dure est forcément une guerre qui s'enlise.")

52. Joseph Henrotin, "Peut-on penser une campagne COIN en stratégie aérienne? L'apport de Warden," *Défense & sécurité internationale*, no. 54 (December 2009): 29. (Original version: "Une vision systémique permet d'étendre le raisonnement aux groupes insurgés: eux aussi fonctionnent avec un leadership [dirigeants et idéologues], des 'organes essentiels' [plates-formes médiatiques en ligne, par exemple], des 'infrastructures' [système financier ou de passeurs], une 'population' [soutenant les insurgés] et des 'forces déployées.'")

53. Robert Jervis, *Perception and Misperception in International Politics* (Princeton, NJ: Princeton University Press, 1976). See also "Deterrence and Perception," *International Security* 7, no. 3 (Winter 1982/1983); and Michael Brecher, Blema Steinberg, and Janice Stein, "A Framework for Research on Foreign Policy Behaviour," *Journal of Conflict Resolution* 13, no. 1 (May 1969): 75⊠4.   Among the studies related to nuclear deterrence, see R. Harrison Wagner, "Rationality and Misperception in Deterrence Theory," *Journal of Theoretical Politics* 4, no. 2 (1992).

54. Michael Hearn, "La perception," *Revue française de science politique*, no. 3 (1986): 323. (Original version: "L'intérêt de se pencher sur la perception est d'analyser l'image en politique étrangère, c'est-à-dire identifier la représentation que se fait le décideur de l'environnement national, régional ou global.")

55. Andrew Exum, "On Drones," 22 October 2009, http://www.cnas.org/blogs/abumuqawama/2009/10/drones.html. Currently a researcher at the Center for a New American Security, Andrew Exum is a former officer in the US Army Rangers and close adviser of Gen Stanley McChrystal, with whom he has collaborated in order to define the new American strategy in Iraq.

56. See in particular, Marc Mazzetti, "The Downside of Letting Robots Do the Bombing," *New York Times*, 22 March 2009; Doyle McManus, "U.S. Drone Attacks in Pakistan 'Backfiring,' Congress Told," *Los Angeles Times*, 3 May 2009; and David Kilcullen and Andrew McDonald Exum, "Death from Above, Outrage Down Below," *New York Times*, 17 May 2009.

57. Hearn, "La perception," 319, 323. (Original version: "Ce qui compte, ce n'est pas tant la force, mais comment la force est perçue"; "la perception de la réalité prend le pas sur la réalité elle-même.")

58. French Air Staff, *Concept d'emploi des forces*, 23. (Original version: "La 'bataille des perceptions' revêt ainsi un caractère à la fois offensif et défensif, stratégique et tactique, et dans tous les cas essentiel dans la planification et la conduite d'une opération; 'L'importance décisive' de cette bataille dans des engagements contre-insurrectionnels où les adversaires privilégient des actions dans les champs psychologiques.")

59. Cori E. Dauber, *YouTube War: Fighting in a World of Cameras in Every Cell Phone and Photoshop on Every Computer* (Carlisle, PA: US Army War College/Strategic Studies Institute, 2009), 2⊠.

60. By analogy with the notion of "infotainment" ("information" + "entertainment"), referring to the TV shows mixing information and entertainment.

61. US Department of State, Interagency Counterinsurgency Initiative, U.S. *Government Counterinsurgency Guide* (Washington, DC: Department of State, 2009), 9, http://www.state.gov/documents/organization/119629.p df.

62. James S. Corum, "Air Power and Counter-insurgency: Back to the Basics," in Hayward, *Air Power, Insurgency and the "War on Terror,"* 216.

63. Martin van Creveld, *La Transformation de la guerre* (Paris: Editions du Rocher, 1998), 269. (Translation from the French version: "Ne se déroulera pas sur un champ de bataille⊠e   type d'espace n'existe plus de par le monde⊠na   au sein d'environnements plus complexes, naturels ou artificiellement créés. Ce sera une guerre d'écoutes, de voitures piégées, de tueries au corps à corps. . . . Elle sera sans fin, sanglante et atroce.") See also Martin van Creveld, "The Transformation of War Revisited," in *Non-state Threats and Future Wars*, ed. Robert J. Bunker (London: Frank Cass, 2003), 3⊠5.

64. Général de division aérienne (Maj Gen, French Air Force) Denis Mercier, "Une vision renouvelée de la puissance aérospatiale," *Défense nationale et sécurité collective*, June 2007, 52.

65. Général de division (Maj Gen, French Army) Jean-Claude Allard, "L'US Army à la recherche de la rupture tactique: La *Task Force Odin,"* *Défense nationale et sécurité collective*, April 2009, 148.