BUILDING AIR DOMINANCE

T.M. ASTHANA

We have travelled the "full circle". There was a time when the emphasis of all air forces was on gaining 'air superiority' over the adversary, in order to permit friendly air power to operate at will, while ensuring that the adversary's air power does not, or cannot, interfere with the operations of the surface forces. When air superiority was not achievable because the adversary's air power was non-cooperative, air forces sought to achieve a 'favourable air situation' (FAS), and in case FAS was not achievable, air forces sought to achieve an FAS for specific periods. However, this emphasis of the air forces was contested by the surface forces, and, they insisted on support from the air in their operations from Day 1 of the campaign assuming non-interference of enemy air as granted. It has dawned that this non-interference cannot be taken for granted **– it has to be earned.** The transformation of mindset of the surface forces has taken a long time, and, finally, they have accepted that the state of air superiority is a virtue that air power has to earn. We have travelled from air superiority to FAS, to FAS for specific time-frames, and now, air forces consider air dominance as their prime objective. Hence, we have travelled the "full circle". (Air Superiority = Command/Control of the Air = Air Dominance).

Winston Churchill once said, *"There is nothing wrong with change, if it is in the right direction. To improve is to change, so to be perfect is to change often."*

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Transformation is a reality; however, transformation is not just change for change's sake; it is change in the right direction. Reality usually prompts ideas and innovation. Today's reality is that there are unique challenges facing our war-fighters – some obvious, some not so obvious. If we look at where airmen fight, and their contributions, perhaps we can uncover some challenges that need to be addressed. Airmen are providing air dominance over Afghanistan and Iraq, allowing the North Atlantic Treaty Organisation (NATO) forces to operate in any capacity as an effective joint and coalition force with zero risk of enemy aggression from the skies. This air dominance is enabled by network-centric operations. We fly combat air patrols in a different way than we did 20 years ago. Fighters and bombers have become multi-role strike platforms with deadly precision. They carry versatile weapon loads in orbits over critical ground engagements and allow a level of precision never before achieved. Who would have imagined a few years ago that a B-1 crew would be flying a close air support mission? This is a great example of how air power has changed. The soldiers under fire gave their coordinates, bearing and range for the enemy fire. The B-1 crew found the target with synthetic aperture radar (SAR), received clearance to engage, and the crew released two joint direct attack munitions (JDAMs). The first JDAM destroyed the target. You can see how air power has transformed.

Air dominance today is not only about air power but encompasses the entire gambit of aerospace power: a large number of technological assets operating efficiently from the air and space to merge into a composite 'air picture', which provides the much required 'situational awareness'. This statement is only one half of the spectrum. Information seeking technological assets available on the surface also contribute towards 'situational awareness'. All these inputs need to be digested to ensure that 'total

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situational awareness' is achieved. Total situational awareness is a prerequisite for air dominance. While air dominance enables the aerospace forces to operate at will, it also provides freedom and unhindered operations to surface forces, i.e. air dominance possesses the ability to dictate non-usage of enemy air to counter our army and navy.

The objective in this state is the denial of enemy air power *effectiveness* to the extent possible.

AIR DOMINANCE — OFFENSIVE OR DEFENSIVE?

> *In Desert Storm, we had air dominance. That air dominance allowed our strike aircraft to devastate the enemy air forces and, at the same time, allowed our ground forces to operate without any enemy air interdiction. Desert Storm taught us something about air dominance.* ***We had it, we liked it and we're going to keep it.***
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> — Secretary of Defence William Perry

For this paper, it is presumed that every usage of the term air dominance amounts to aerospace dominance. First of all, we must clarify the nature of air dominance. Is air dominance offensive in nature, or is it defensive? In the attempt to answer this question, let us consider all the categories or states of air effectiveness of own vs enemy air.

Air Denial : Friendly air forces may initially operate in a state of air denial at the start of the operations when the enemy has air dominance. Air denial is the lowest air power state where friendly aircraft can conduct air operations sufficient enough to oppose the enemy air dominance while conducting those air power activities necessary to halt an initial enemy advance. The objective in this state is the denial of enemy air power *effectiveness* to the extent possible. The friendly ability, through air defences or airborne threats, to provide protection to friendly ground and air forces, decreases the *effectiveness* of enemy air power. Enemy flak during the Korean War did not prevent air operations but it did make them more expensive. Despite air superiority at medium and high altitudes during the Vietnam War, the United States lost to North Vietnam in part due to the condition of air denial in the low altitude

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environment with its surface-to-air missiles (SAMs) and anti-aircraft artillery. The SA-2 SAM did force the US to devote considerable numbers of aircraft to defeat it. And, in many cases, the SA-2 forced aircraft to jettison ordnance in order to evade it, which in effect negated the aircraft's mission – thus, *effectiveness.* The bottom line consideration is that it does not matter for what reason an aircraft cannot drop its bombs – what matters is that the target is not attacked – or that the mission was *not effective.*

Air Superiority : The next air power state is air superiority. Air superiority "rarely is an end in itself but is a means to the end of attaining military objectives." Air superiority is the degree "in the battle of one force over another which permits the conduct of operations by the former and its related land, sea and air forces at a given time and place without prohibitive interference by the opposing force." This state is not enough to ensure the *effectiveness* of air power.

Air Supremacy : The next state is air supremacy which is "that degree of air superiority wherein the opposing air force is incapable of effective interference." Most theorists add that air supremacy is achieved when superiority is ensured just about everywhere, thus, allowing friendly aircraft the ability to fly anywhere within the theatre of operations. However, this air power state also does not adequately address the issue of air power's *effectiveness* at dropping bombs on enemy targets at will.

Air Dominance : The final air power state is the attainment of *effectiveness* in the conduct of offensive air operations. Air dominance is the highest air power state when the requisite *effectiveness* of air power is achieved, so that 100 per cent of friendly bombs will hit enemy targets while no enemy bombs hit friendly targets, and that wars are won quickly (such as during the Six-Day War of 1967 and Operation Desert Storm of 1991), and fewer friendly casualties are suffered. The lack of air dominance, on the other hand, may give the enemy time to use the "kill as many military personnel as they can" tactic. The low attrition of the friendly military in Desert Storm seems to have established optimistic expectations about war, which may constrain some future

commanders. The lack of air dominance will also make it significantly more costly for the military instrument of power to support "The National Security Strategy." The lack of air dominance will also make it more difficult and costly for the military instrument of power to conduct its growing role in deterrence and military operations other than war (MOOTW). Air intervention plays a key role in the military's expanded role in MOOTW. Air dominance contributes to the safe accomplishment of these missions. The successful application of military power is dependent on uninhibited access to the air and sea. Our forces will seek to gain superiority in, and dominance of, these media to allow our forces freedom to conduct operations and to protect both military and commercial assets. These demands require a capability to rapidly defeat initial enemy advances in order to seize the initiative and minimise the losses of territory and/or life. One is relatively well informed when it comes to defending assets and infrastructure through the use of air power, but protecting and ensuring that space capabilities continue to deliver in all, or, near all, conditions, demands greater planning and money. Air dominance, therefore, delivers the following:

Our forces will seek to gain superiority in, and dominance of, these media to allow our forces freedom to conduct operations and to protect both military and commercial assets.

- Enables fullest range of operations.
- Secures commanders' initiative and fulfills the "what-where—when."
- Provides operational freedom to permit "execute 'as you wish' not 'as you have to' operations."
- Provides opportunities for dominant manoeuvre and shields friendly mobility while denying enemy mobility.
- Simultaneous "Offensive Sword" and "Defensive Shield."

AIR DOMINANCE – PLATFORMS

Air dominance goes beyond air superiority and supremacy, in that, it not only ensures that friendly aircraft can fly anywhere in enemy territory, but they can also be *effective* in performing their mission. Suppression of ground-to-air attacks,

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prevention of attacks on our air bases and forces, and overcoming domestic attacks on military and industrial infrastructure are all important in ensuring the effectiveness, or dominance of air power.

Combat Aircraft—Fighters and Bombers: Nearly four and a half decades ago, each aircraft of this category had a dedicated role allotted like air defence, ground attack, close air support and electronic counter-measures (ECM) (Wild Weasel). In addition, there were aircraft dedicated to the counter-insurgency role known as COIN aircraft. Gradually, but surely, aircraft were produced that were effectively used in more than one role, and the concept as well as the terminology "multi-role aircraft" began to take shape. Today, with the harnessing of a large number of technologies, lighter and more durable materials and miniaturisation, combat aircraft have the capacity to carry a variety of weapons, sophisticated avionics suites, concurrently demonstrating increasing agility and endurance. For the public, the wars and subsequent stabilisation efforts in Iraq and Afghanistan have accentuated the actions of ground forces, but air power has been a key behind-the-scenes factor all along. Air warfare will, if anything, grow even more critical to military operations in the years to come.

Modernisation of the air force is not only a strategic necessity, but is also a fiscally sensible course of action. Significant new capabilities becoming available in the form of upgrades and munitions will help the air force bridge the gap from its existing fleet of ageing fighters and bombers to a force mostly of stealthy aircraft in the coming decade. The aircraft mentioned here are combat ready aircraft and not test or evaluation systems. Basically, the aircraft will be optimised for air superiority missions, but they will also be capable of strike missions with weapons like the JDAMs. These aircraft should have the ability to pick up and go for 90 days to a deployed location and operate a dozen aircraft round the clock. The biggest conditional factor will be having sufficient spare parts for the war readiness kit that must accompany the unit to a deployment.

It is assessed in a US Air Force (USAF) study that the USAF needs 381 F/A-22s to be able to guarantee air dominance in any conflict, from terrorist hunt to all-out war. There is a strong lobby in the US that believes 381 F/A-22s in exchange for 880 fighters of earlier types such as the F-15, F-117 and F-16 "is a good investment trade to make." The F/A-22 fighter, despite just emerging from its development phase, is delivering a 78 per cent mission capable rate and has proved unbeatable even when outnumbered 2-to-1 by today's fighters. With the advanced radar, a new F-15 would have greater detection range but lack the survivability of the stealthy F/A-22 Raptor. Raptors are more cost-effective because more of them will survive combat, and each can destroy more enemies. It takes two to three aircraft to replace the killing capability of the F/A-22. An F/A-22 at $113 million a copy is a better deal than buying at least two $75 million F-15s to accomplish the same effects. The F/A-22 requires fewer personnel, fewer air-to-air refuelling tankers and can operate more frequently than earlier types, and so will save considerable money in the long run. It is claimed that the USAF analysis and maths supporting the 381 figure has been validated over more than a dozen independent reviews. There was a view that "if we can't afford it, we can't afford it, but the threat does not get any smaller just because you can't afford to meet it." It must be noted here that the numbers quoted are of aircraft available for fighting, after deducting a certain number devoted to training, test, maintenance and attrition reserve.

The same study also quotes a similar figure for the F-35. While the F-35 is stealthy, it lacks the speed and altitude capability that allows the F/A-22 to so dominate air combat. It has been indicated that the larger percentage of F-35s acquired should be of the short take-off and landing variety to cater for some objectives. The air force does not have a vertical landing requirement. The main conclusion of the study was that "**air dominance continues to be a key enabler"** for the entire military, regardless of the kind of campaign under way. Another conclusion was that the in-service aircraft such as the F-15, F-16, and F/A-18 are at parity with threat aircraft or at a disadvantage because the overseas designs are increasingly stealthy and fitted with advanced avionics.

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While we accept that the USAF is the leading air force of the world in terms of capability and its overpowering ability to acquire the state-of-air dominance, I personally, cannot reconcile to the logic of reducing the numbers of combat aircraft just because a more capable aircraft has appeared on the horizon. Any air force will always require the numbers of combat aircraft that it has been accustomed to. There should be no compromise on this issue.

The Indian Air Force (IAF) can today boast of a comparable or better fleet of fighters in the neighbourhood. Nearly all the fighters have proven their capabilities in national and international exercises. The IAF can also claim strategic reach now with aerial refuelling becoming a reality. However, we need to remind ourselves that modernisation of the fleet in an ongoing process and one has to continuously plan to remain ahead. Along with the modernisation process, it is mandatory to upgrade and modify the existing platforms and integrate better and more accurate munitions with extended ranges. The absence of a dedicated bomber aircraft has often been adversely commented upon. In all fairness, it must be stated that no serious shortfall in the force's capability has been felt in the recent past, or, indeed, will be felt in the near future. Not for a moment am I suggesting that the IAF need not acquire a fleet of dedicated bomber aircraft, because as we have seen, today's bomber aircraft have also been pressed into service for close air support missions, provided the state of air dominance exists. In other words, the bombers of today and tomorrow will also be multi-role aircraft.

SENSORS

Air dominance allows more deliberate, persistent and penetrating intelligence, surveillance and reconnaissance (ISR). We need to develop the capacity to place ISR assets where and when the joint force needs them.

Airmen provide persistent, dynamic and non-traditional ISR that benefits the entire military. ISR is everyone's job. This means even fighters, strike aircraft and ground units are involved in building the battlespace picture using onboard sensors connected to command and control nodes through networks. Today's ISR is unbelievably effective and timely. Developments in this field are providing and upgrading better data processing and storage technologies by the day. The progress is indeed rapid. The process of miniaturisation is well under way and in the near future, sensors will be available off-the-shelf as COTS. Till now, there was either a space or weight crunch when it came to how many sensors one could put on an aircraft/unmanned aerial vehicle (UAV) or any other aerial platform. With miniaturisation, nearly all the desired technologies would be easily accommodated on the platforms. In respect of ISR, one can be sure to include electro-optical, infrared and SAR imagery on a single platform, all thanks to miniaturisation. This will ensure that the limitations of one sensor will, to a large extent, be adequately covered by the other sensors on board. In all likelihood, the same platform could also collect data for the required signals intelligence (SIGINT) and electronic intelligence (ELINT). However, it must be mentioned here that all these sensors only provide information. This information needs to be collated, analysed, and compared with available intelligence to convert this information to actionable intelligence.

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Combat Support Operations: The mobility and flexibility of air power permit it to ensure that all operations desired to support the combat of the surface forces as well the air force are conducted swiftly and in the desired time-frames. Time is at a premium and when operations are assisted and/or precipitated at unbelievable time-frames, it may even take the enemy totally by surprise. The platforms for this part of operations are the transport and helicopters of air power. Significant and unprecedented movements of the

surface forces to regroup, reinforce or augment the friendly forces at planned and random intervals provide the much-desired fillip to the operations of the surface forces. These operations too can only be executed with impunity when the state of air dominance is achieved.

Unmanned Aerial Vehicles (UAVs): UAVs are here to stay**.** A mere glance at the interest generated by a number of countries to acquire UAVs reflects the international opinion in favour of the UAV. The suitability of the UAVs for the 'dull', 'dirty', and 'dangerous' missions cannot be disputed. However, for a long time from now, the manned aircraft and UAVs will coexist and operate in a complementary manner to each other. We are aware of the tremendous contributions of UAVs in recent wars and names like Global Hawk and Predator are much too familiar to demand a repetition. I intend to cover some of the trends in the platforms of UAVs. These are:

(a) Next Generation Sky Warrior's Maiden Flight a Success. On June 18, 2007, resurrecting a great name from the 1950s, General Atomics completed the maiden flight of their Sky Warrior UAV. The new Sky Warrior will operate as an unmanned long-range surveillance, communications and weapon delivery drone. The Sky Warrior will be able to run on diesel or jet fuel due to its heavy fuel engine and will form part of the US Army's extended range/multi purpose UAV.

(b) On June 28, 2007, Boeing successfully demonstrated the simultaneous command and control of multiple UAVs by a single operator. These UAVs will be able to operate through a central control point while having the ability to self-organise and make independent decisions.

(c) Reaper UAV. On August 31, 2007, the USAF announced the deployment of a new squadron of UAVs into the combat zones of Afghanistan and Iraq. Capable of carrying a payload of 3,759 pounds, the jet fighter sized Reaper can fly at 300 mph, reach 50,000 ft and stay airborne for 14 hours at a time. This 'hunter-killer' UAV also incorporates infrared, laser and radar targeting and is capable of deploying precision-guided weapons.

(d) Fast Jet-Pilots Direct Multiple UAVs. On April 4, 2007, a new system was demonstrated which provides a single pilot with the ability to fly his own

military fast jet while simultaneously directing up to four UAVs. The system gives the UAV an advanced level of autonomously independent decision-making, including self-organisation, communication, sensing the environment, identifying possible enemies, and targeting of weapons with the final decision to shoot retained by the pilot. The project trials initially will take place exploring the use of UAVs for non-military operations. The flight trials were flown using a Tornado as the command and control aircraft and a BAC 1-11 trial aircraft acting as the 'surrogate' UAV. The Tornado pilot also had the responsibility of commanding a further three simulated UAVs. Working in combination, the Tornado and four UAVs carried out a simulated ground attack on a moving target. The sophisticated computer on the UAVs allowed them to target their weapons after an analysis of the environment, including possible enemies. However, the final decision to fire any (simulated) weapons was retained by the Tornado pilot. The system has been designed to provide the UAVs with a significant degree of independent intelligence in order to substantially reduce the workload of the pilot and also ensure that the most important decisions are retained by the human operator, viz, the Tornado pilot (in this case). Consolidation trials and development of expertise will take place in search and rescue, disaster relief and environment monitoring operations before full-fledged induction in military operations.

SPACE

The harnessing of space capabilities for military operations in recent wars has amply demonstrated the advantages that accrue. The benefits of space capabilities are evident in our daily lives also with satellite-based TV and commercial communications. This has led to ensuring that most of the required equipment is of the COTS category. Better data processing and storage techniques, on the one hand, and miniaturisation, on the other, will permit the use of smaller, lighter and more sensitive sensors for the full range of surveillance and reconnaissance needs for electro-optical, infrared, hyperspectral and SAR imagery catering for all weather conditions round

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the clock. With miniaturisation maturing, we will witness a far greater capability on each satellite since weight will no longer be a restriction. Such attractive contributions cannot be ignored, nor can we permit any agency to interfere or deny us these lucrative benefits. Therefore, space control will remain our major objective wherein it will be ensured that our space platforms continue to provide us with the desired inputs. Aerospace domination implies aerospace control and requires build-up of considerable aerospace capability. Miniaturisation will also give us the opportunity to launch smaller satellites, as well as provide the redundancies that are so desperately planned for in every military operation.

NEAR SPACE

The contributions of space are much too expansive indeed. However, there are a few limitations that mainly pertain to persistence of observation and surveillance. It has been realised that launching satellites is an expensive proposition, and that very soon, we will witness saturation of space itself. It is with this background that we are travelling the "full circle" again by thinking of, and trying to launch, lighter than air vehicles, namely balloons, at altitudes from 50 to 70,000 ft. These balloons will have adequate space available and they could be charged with various sensors which will deliver all the information required on a permanent schedule, and that too, continuously. One may argue that with high altitude long range endurance (upto one week) UAVs, we do not need balloons, but the UAVs will not grant persistence of observation of an area as well as a balloon will. Once again, it may be argued that the balloon will be very vulnerable, but that is where the ingenuity of application of air power and ground-based defences would come into play to ensure their safety and survivability. These balloons could also be powered by relatively small motors, which could slowly, but surely, move them to locations as desired. Hence, near space platforms will also be major contributors in future wars.

In addition, they will be inexpensive platforms, and launching alternates may be a suitable plan for redundancies. While accepting the elapsed time gap for the alternate to become operational, one may satisfy oneself by optimum utilisation of the information available through the other platforms as a stop-gap measure.

Offensive and defensive cyber warfare must, hence, also be a major consideration for all military operations.

FORCE MULTIPLIERS

At the very mention of this terminology, terms like airborne warning and control system (AWACs), airborne warning and control (AEW&C) and air-to-air refuelling tankers ring a bell. In my logic, the days have arrived when cyber warfare (both offensive and defensive) should also form a part of this category. The reliance on goods delivered by avionics suites, communications (both line and satellite-based), data transferring capacity and a host of other facilities have made command and control a relatively easy proposition. Any interference with this achieved comfort level would be most disturbing and cause serious discomfort to both plans and execution. Offensive and defensive cyber warfare must, hence, also be a major consideration for all military operations.

NETWORK-CENTRIC WARFARE (NCW)

Converting the host of information collected into actionable intelligence is only half the work done. The other half, and the more important half, is to ensure that the required intelligence data is transmitted to the correct agency/ unit that would put this intelligence to use by converting it into well planned execution with the optimum weapon at the most opportune moment. Time is at stake and real-time intelligence makes it relatively simpler to plan and execute with the perfection and lethality that we desire, with the elements of surprise and shock effects thrown in as confirmed destroyers of the will to fight. The demands on avoiding collateral damage have increasingly become a trend in warfare. This would only be possible when all the participating forces

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and agencies are linked in a network which is capable of transmitting the required data and creating total situational awareness. This is achieved by NCW. We must also not forget that both the task of collecting the information undisturbed, and nil interference during execution by enemy air, can only be achieved when air dominance has been secured.

AIR DOMINANCE INFRASTRUCTURE

Immaculate and intensive planning needs to be undertaken for erecting the air dominance infrastructure, be it in the form of airfields, command and control nodes and installations, NCW infrastructure and all the associated hardware required for building air dominance to optimum levels. The air dominance infrastructure must be robust, survivable and capable of ensuring enough redundancies to cater for a determined enemy.

CONCLUSION

> *If you want to overcome your enemy, you must match your effort against his power of resistance, which can be expressed as the product of two inseparable factors, viz, the total means at his disposal and the strength of his will.*
>
> — Carl von Clausewitz, *On War*

The contest for air dominance is the most important contest of all, for no other operation can be sustained if this battle is lost. To win it, we must have the best equipment, the best tactics, the freedom to use them, and the best pilots. A potential enemy will also observe the history of air dominance and reach similar conclusions, but air dominance/supremacy/superiority (in that order) will be an absolute necessity in future conflicts whether they are big or small. The debate on how, and with what weapons air dominance can be achieved, is never likely to end. As a nation, however, as so aptly

pointed out by Clausewitz, we must never forget that the enemy has a vote. Technological superiority alone does not, and will not, guarantee victory. Stealth has opened a window of opportunity, a window of hope, which offers air superiority with minimal risk to the pilots asked to gain it. It seems likely, therefore, that despite the cost, stealth is here to stay. Stealth, however, has not fundamentally changed how an air campaign is fought. It is unlikely that any stealth platform will fly into a high threat environment without airborne suppression of air defence (SEAD). We must continue to pursue additional technologies to fill the gap between stealth capabilities and limits in current SEAD inventories. One cannot win by fighting head to head.

We are not looking for a fair fight. Each weapon of war must be capable of achieving greater things in war than the weapon it replaces. Options such as the unmanned high altitude Global Hawk with high loiter times and the ability to attack enemy radars and sensors should be explored and fielded. In short, a wide range of technologies must be fielded out of the thinning defence budgets. *"War is, thus, an act of force to compel our enemy to do our will."* The advantage we hold must be so complete and so overwhelming that **air dominance is the only answer.**