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Thinking About Air Power

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> 'The art of war, as it is certainly the noblest of all arts, so in the progress of improvement it necessarily becomes one of the most complicated among them. The state of the mechanical, as well as some other arts, with which it is necessarily connected, determines the degree of perfection to which it is capable of being carried at any particular time'.
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> *Adam Smith, 1723-90*

Introduction

There are some, no doubt, who would take issue with the eminent professor of moral philosophy that the art of war is the noblest of all arts, but few who know anything about it would argue with his precept that it is a complicated business much affected by the sweep of technology and the changing world scene. This article is about the art of using the air for warlike purposes, or air power as it has come to be known.

During the past two years or so Moscow has woken up to the fact that the offensive use of air power can have a dramatic effect on events, not only in the sophisticated environment of Europe but also throughout the rest of the world, where the introduction of even a small force of aircraft (and usually by proxy) can tip dramatically the balance of events. So the Soviet Air Force is now sent on a programme of improving its quality – it always has had quantity – and the types of aircraft, radars, and missiles that are becoming obsolete as improvements are made are proving very useful in ensuring the maximum Soviet influence throughout the world as and when an opportunity presents itself.

This is the situation which now faces the West. It means working to keep ahead of the Soviets in the qualitative sense and at the same time assessing what can be done to counter Russian sorties into the maelstrom of the Third World. Thinkers in the defence world must consider whether one possible aim of Soviet strategy is to lure the bulk of our forces into the heartland of Europe whilst their own naval and air forces reach out further afield, at a time when limitations on natural resources are becoming apparent and of greater strategic significance. Could the conventional political and military lines in Europe be outflanked and what can and should we be doing about it?

The Unanswered Questions

In looking at the way ahead for air power the tendency has been to accept the present Central Europe scenario as a situation which will continue as far as one can see into the future and so plan accordingly; but is this a fair assumption? We need to ask some deeper, more probing questions if we are to explore fully all the capabilities which military power may need. For example, could the West accept a progressive annexation by the Soviet Union of more and more of the world's natural resources? Can we ignore the possibility that the Warsaw Pact could be fragmented by internal pressure, particularly from the Eastern European states, leading to new alignments? Whether or not that happens can we be certain that the Atlantic Alliance will survive in its present form? Can we be sure that none of the nations of Europe

will ever again be obliged by sheer necessity to intervene outside their own continent? What influence might China have on all these uncertainties? Have we thought enough about the consequences of the spread of nuclear technology?

The Extra-European Challenge

There is no end to the questions, and no one is in a position to give definitive answers. But one reasonable major assumption for the future is that a static super power confrontation in Europe will contrast with an increasingly dynamic confrontation elsewhere. Is it the Soviet intention to test the West in a series of small wars or crises in various parts of the world? Or is the major purpose of the Eastern Bloc's enormous military potential in Europe to divert our attention from the rest of the world? If this kind of challenge does materialise, it will be characterised by geographical diversity. The West will need many qualities to counter this probing successfully. Not least will be the acumen to recognise the threat for what it is, and any action resulting will require political will and determination. The more measurable qualities of mobility and ubiquity will also be at a premium; the characteristics of air power in their widest sense fortunately provide just these qualities. In the Middle East, for example, in 1973, considerable tactical air resources were injected into the area of conflict by both super powers. In Angola, proxy military forces were introduced by Soviet long-range strategic air transport.

Oddly enough, there is some parallel with the era of pre-revolutionary wars 200 years ago. It can be argued that the thermo-nuclear element of confrontation has taken the world away from the type of conflict practised in two world wars, and back to the kind of cautious manoeuvring and relatively minor campaigns by small professional armies that were seen in Europe towards the end of the eighteenth century. As Michael Howard recently put it, 'To pile up such minor successes until their aggregated weight and financial exhaustion compelled the adversary to make peace seemed preferable to staking all on a battle in which advantages accumulated over several years might be thrown away in as many hours; especially since the political objectives for which the wars were fought were seldom such as to justify so bloody a solution'. The armies of those times were seeking local decisions, but they were compelled to do so at the lowest possible risk because the stakes were high. The stakes were the armies themselves, extremely expensive and indispensable elements of power. Now the risks must be kept low because the stakes are nothing less than national survival.

Without overstating the case, what all this probably means is that, whereas in the recent past weapons systems have been determined by the requirements of war in the Central Region of Europe and modified by actual wars outside it, we cannot be sure that such a situation will persist. It may be that extra-European conditions could, or even should, have more influence on our systems in the future. I have already suggested that the demarcation in Europe may not be our only concern in the longer-term future. For example, it is not inconceivable that the West could be drawn into some sort of African or Middle East imbroglio during the next

twenty years; perhaps we have already seen such an example in the recent French airlift of Moroccan troops to Zaire.

Concepts and Technology

If our plans are to remain valid through the next quarter of a century or so, we need to do two things. We need to develop robust concepts for future air power, and we need to know what will be the most significant areas of technological progress so that we can understand their military implications. Of course, concepts and technology overlap: each tends to drive the other. But let us accept that concepts give us the directions for air power to look, that technology (and the constraints upon it) will tell us what might be practicable, and that doctrine defines how we apply the result. We can then attempt a useful analysis, although a perfect analysis is precluded by the uncertainty of the evidence. In any case if we really could produce firm answers from such analyses, then we would expect a potential opponent to be able to reach the same conclusions and to rearrange his military affairs accordingly. Even apparent certainties would thus prove fugitive. Perhaps all we can hope to do is to suggest the areas in which we are most likely to need flexibility, and those in which we are most likely to find it.

Concepts

If we look first at concepts, we see that they must depend in the first place on what capabilities are going to be needed and where. Clearly in this kind of thinking the European confrontation is of considerable importance. There is a kind of balance in Europe which, if disturbed, might be tipped very quickly and perhaps irreversibly against the West because of the massive Warsaw Pact air forces and mechanised ground forces held at very high states of readiness. Even if the Alliance had the necessary reserves of ground forces to match a surprise offensive, it is difficult to see how enough of those reserves could arrive in time to help conduct the forward defence to which the Alliance is committed. It would be the vital function of air power to intervene to restore the balance in these circumstances. Alliance air power must then be capable of a highly effective reaction in war, not only without the benefit of a lengthy period of preparation, but perhaps with little or no opportunity even for innovation or adaptation. When Napoleon said, 'Go, Sir, gallop, and don't forget that the world was made in six days. You can ask me for anything you like except time', he was thinking in terms of days or even weeks: we must think in terms of hours. Yet because we are members of an alliance that is explicitly structured for defence, surprise will be one of the most lethal weapons in the armoury of the opposition.

The Advance of Technology

Some months ago Dr Malcolm Currie, the former US Director of Defence Research and Engineering, said, 'We should compete in areas which can neutralise the massive Soviet investments and render them impotent. We must compete in an arena in which technological content over a range of the most challenging and difficult technologies will be dominant, and then make up our minds nationally to win the competition'. He went on to identify tactical missiles and precision munitions as one such arena.

As air strategists we need to think about what this implies. Because modern technology has led to large increases in costs as well as in performance, front lines now comprise smaller numbers of fewer types of aircraft. The fact that an aircraft like Jaguar can carry up to ten times the bombload of a Second World War fighter-bomber has to be considered in the context of this great numerical reduction in resources: the loss of one Jaguar would have a greater material effect than the loss of ten aircraft in World War II. This is a theme I shall return to later when I discuss attrition.

Complexity and cost have made it much more difficult frequently to re-equip air forces. Before World War II, design teams would visit annual air shows to weigh up one another's products and then go off to design something new for the following year. Now the gestation period is more like ten years, and once in service aircraft tend to stay there a long time. Some of our present aircraft, the Vulcan for example, took ten years to plan and develop and have now been in the front line for over twenty years; we can expect at least that length of service from the new generation of aircraft, the Tornado among others. This means that we are designing weapons systems for crews who have not yet been born, with squadron commanders who are now celebrating their sixth or seventh birthday.

So far I have been arguing for open-mindedness when discussing the future of air power and pleading that we get away from what has become known as replacement thinking. I would now like to look at the tools which are likely to be available as a result of new technology.

Electronics

In the whole field of technological development, electronics seems likely to have the most profound influence on the future development of air power. Micro-electronics and micro-processing are already producing miniaturised systems with an extraordinarily high density.

Only twenty-five or so years ago, 'computer' meant at least a small room full of cabinets, and as recently as ten years ago a computer had to be at least the size of a large typewriter. Now many are literally pocket-size, and the central element – the chip on which are printed the integrated circuits – can be examined only under a lens. Just as remarkable has been the rapidly falling cost of computer capacity, which had been reducing at something like 20 per cent a year. The scale of this 'computational plenty', the low cost and the savings in weight are already profoundly affecting the air environment and the possibilities for the future are enormous.

The result of all this is that complex but expendable equipment will be feasible. By combining miniaturised electronics with the extreme precision with which it will be possible to measure differences of time, very accurate and reliable guidance and navigation systems can be built. These small, relatively inexpensive systems will have particular uses in weapons and weapon

delivery, and their development is likely to have three important consequences. First, their reliability will increase their lethality. Second, the computer element of the system will be tiny, and although the sensors may not be miniaturised to the same extent, the whole system will be much smaller. The opportunity to choose between more fuel, more explosive and more weapons will be extended. Third, accuracy will be even less a function of range than it is today, and the lethality of longer-range weapons will be greatly increased.

These three advantages of weight, reliability and accuracy represent three variables for future designers to employ in producing weapons for particular needs, and some targets that have so far been thought unsuitable for conventional weapons may be more vulnerable as a result. A fundamental review of targeting policy will be necessary as the full range of highly accurate weapons becomes available.

Radar

It also seems certain that the full potential of radar has not yet been exploited. One can foresee the further development of very long-range radar, and also accuracy and discrimination over shorter distances. With its ability to locate and identify point targets, it may complement or even surpass optical systems, particularly in operational conditions and in low visibility.

The disadvantages inherent in other fields of beam energy may well be overcome, such as the attenuating effect of atmospheric particles on laser and infra-red beams and the enormous power needed for high energy beam effects, although there is no real sign of it so far. Lasers may have particular application at altitudes where atmospheric attenuation is not significant. The massive power sources for destructive beams may be available where they are most needed – in the defence of large, fixed targets exposed to attack by, say, ballistic missiles. Some interesting conclusions may be drawn from the current controversy about Soviet capabilities in this field, and, whatever those conclusions are, their application to future strategic weapons systems may well also have an effect on theatre weapons and, of course, the strategic balance.

Electronic Countermeasures

Developments in ECM will also influence almost all aspects of future warfare and they will be particularly relevant in the air. Efforts to counter enemy electronic systems, on the other hand, hold less prospect of success because they cannot be fully applied until the enemy electronic capabilities are identified. Because of the closed nature of Soviet society, and the open nature of our own, this may not be until after the start of hostilities by which time the Soviet Union may hold the advantage. The critical factor will be the flexibility that can be built into our ECM and ECCM equipment so as to cover a wide band of possibilities, and the speed of analysis of new threats necessary to exploit this flexibility. But nothing can really change the 'leapfrog' nature of electronic warfare, so we must put ourselves in the best possible posture to fight the electronic war.

Aircraft and Engines

In aerodynamics, we can expect the refinement of airframes capable of high speed and very high altitude performance. More emphasis seems likely to be given to a search for very high general aerodynamic efficiency, from which both manoeuvrability and low-speed flight would benefit. A primary goal must be to change the fundamental performance characteristics of aircraft to eradicate their dependence on lengthy operating surfaces and to improve their combat agility.

There are many signs that more efficient aero-engines are feasible and it is possible that the energy of fuels may be improved by using additives. Payload and range would then increase the general efficiency of aircraft, bringing valuable improvements in military capabilities and providing much higher specific excess power for critical phases of flight such as combat manoeuvre, and for take-off at full war load. Another attractive development would be the use of supplementary thrust sources such as small rockets to avoid incurring the usual weight penalties over the whole flight and such devices may come to play a part in a general trend towards shorter airfield operating requirements. Finally, a combination of engine and airframe developments leading to new possibilities in the control of air flow over aerodynamic surfaces must be thoroughly researched.

Wither Air Power?

It is against the background of an uncertain strategic situation and these probable technological developments, that we must try to draw certain conclusions about the air environments of the future and the application of air power.

The first conclusion is that, as the enemy is likely to have the initiative, and be moving to the offensive, we must beware the pre-emptive strike and work to retain our full capability while our forces are on the ground or being deployed ready for use. This must tell us something about the future characteristics of airfields and aircraft. There are three areas in which progress must be made. First, we need to reduce our dependence on extensive operating surfaces and this is an urgent requirement. Second, because that will not be done overnight, and because it may be difficult for some types of aircraft such as strategic transport, we need to improve our resilience by presenting a more dispersed target to the enemy by means of new airfield layouts or the use of a greater number of airfields. Third, we need to present a harder target to the enemy, partly by improving our ability to recover from attack but most important of all by building up both our active and passive defences.

The next conclusion is that we must make the most of our small but effective force. This requires a largely new approach to force planning and systems serviceability which will act as a force multiplier. This will be greatly helped by the major developments taking place in command and control. Dramatic advances in signal processing methods (in particular the very rapid, secure and ECM-resistant transmission of information), coupled with new sensors and the improvements in data processing, could offer to future commanders a wealth of information to

aid decision-making and a means to dispose their forces that would have been inconceivable thirty years ago.

Complementary to these conclusions we must ask ourselves whether the term air superiority has any real meaning in the sophisticated air environment of Central Europe, particularly if the battle were to remain conventional. It may be that we will have to be content with causing the maximum disruption to the Warsaw Pact Air Forces. Outside the European scenario it still seems perfectly feasible for a well organised air force to gain air superiority over the adversary. In 1967, for instance, the Israelis achieved air superiority against the Arabs with a pre-emptive strike. By 1973, the Arab air bases had been hardened and this included a dense, ground-based air defence system, and the Israeli Air Force, after a decisive defensive operation against Syrian armoured forces on the Golan Heights, turned to defence suppression and to attacks on more diffuse targets in an attempt to disperse and thus dilute the defences. A ceasefire was agreed before a real state of air superiority was achieved, though the Israelis must have been close to it.

But in Central Europe the particular complications of the scenario, including the strategy of both sides, make it unlikely that a battle of attrition would take place giving air superiority to one side or the other before nuclear weapons began to figure in the equation.

Attrition

There are some who would argue that defences are now so powerful as to make the attrition rate insupportable for manned aircraft attacks. Certainly the Warsaw Pact has deployed a massive air defence screen to protect airfields and other vital points. The experience of the Israeli Air Force in the Yom Kippur war is usually quoted to support this thesis, but how do the facts stand up under examination? The attrition rate for Fighter Command during the Battle of Britain was about 5 per cent, and that of the German bombers 8.6 per cent. The rate for the daylight USA B17 raids over Germany later in the war was 9.1 per cent – high by any standards – and during the last few weeks of World War II in Europe the attrition of the German fighter force had risen to a staggering 30 per cent. The 1967 war, acknowledged to have been an outstanding success for Israeli air power, cost the Israelis an overall rate of 1.4 per cent, with 4 per cent on the first day when they launched their pre-emptive attack. So what of the Yom Kippur war? Attrition during the critical first forty-eight hours was 4 per cent – the same as for the Six-Day war; but the overall figure was only 1.1 per cent – 0.3 per cent *less* than June 1967! Defence suppression played a vital part.

Another point is that a dense air defence system absorbs men, material and financial resources that would otherwise be deployed elsewhere. According to Albert Speer, in 1944 several hundred thousand men, over 10,000 guns, one-third of the output of the optical industry and half that of the electronic industry were employed in the air defence of Germany.

The argument on the balance between offence and defence has raged for as long as air power has been in business. Accepting the fact that we are faced by a formidable defensive system, we must identify the weak points and attack them to break down the system. Radars are clearly a vital part of any system and these are vulnerable to ECM and to direct weapon attack. One distinguished US airman has already suggested that the 'Aces' of the next war will be those who knock out the greatest numbers of radars! Command and control centres will also be vulnerable, and modern sensors and intelligence-gathering methods must quickly establish their location, and much can be done in peacetime.

In the present air defence scenario of Central Europe, it will be necessary to clear a path through the Warsaw Pact defences so that our air forces can get in amongst the airfield complexes and other vital installations further to the rear. Even their airfields will continue to be vital but difficult targets, and, to ensure they can be effectively attacked without prohibitive losses, offensive air forces must use every possible innovation. Clearly, with the sort of terminal accuracies predicted, the stand-off munition is going to be the weapon of the future, and a great deal more emphasis must be placed on its development.

The Cruise Missile

That particular line of thought deserves further expansion because it leads to discussion of a weapon system of the future – the cruise missile. The concept of a relatively small, highly accurate and inconspicuous vehicle, evading enemy defences, particularly dense terminal defences, has very clear attractions. However, in two phases of the cruise missile's operating profile there are vulnerabilities. The first will be during the prolonged flight of the missile across hostile territory to the target area. The missile will no doubt be a difficult target for the defence to acquire, but once acquired, the automatic progress of the missile and the total absence of any capability to respond to specific threats seem to make it vulnerable to interception.

The second weakness of the cruise missile may lie in its vulnerability before launch. Submarine deployment is one possibility, but this is likely to be an expensive concept and one with little or no reload capability. This may not be important for nuclear-armed missiles, but it almost certainly rules out conventional warheads. If on the other hand the missile were to be ground-launched, there is the decision of whether to make it a static or mobile system. If the missile launch platform was static it would soon be registered, and be vulnerable to several forms of attack including sabotage. If it was ground mobile there would be three problems. First, although a pattern of constant peacetime mobility might seem attractive at first sight, the need to guard against sabotage would tend to make it more conspicuous, increasing its vulnerability from the air and attracting protest from the local inhabitants. Second, there is the danger that last-minute dispersal designed to overcome these objections could be mistaken for deliberate provocation. Third, the avoidance of such provocation by delaying dispersal until actual warning of attack was received would leave the missiles unlikely to get away from the depot fast enough to avoid a pre-emptive strike.

If the cruise missiles were based on an air launched system, dispersal during peacetime exercises of aircraft armed with these weapons would soon become a familiar pattern and arouse no comment; yet it would give a very high level of survivability and in a crisis it might well offer a useful balance between protection of the force and a signal of warning to a potential aggressor. In addition, aircraft can disperse very rapidly and in an extra dimension when attack is imminent. Having thus survived the enemy's initial strike, they retain a wide range of options; at one extreme they could make use of bases and support facilities which have survived attack and at the other extreme they could launch an immediate counter-strike. Lastly, aircraft can choose from a variety of directions of attack giving the cruise missile the best chance of penetrating enemy defences.

However, by whichever means it may be launched, the cruise missile lacks the vital element of human judgement by which the manned aircraft is able to adapt to changing circumstances as the mission develops. It is likely that the cruise missile and the manned aircraft will complement each other admirably by allocating the cruise missile to the bombardment of difficult fixed targets such as airfields, thus releasing manned aircraft for the more transitory objectives.

ENVOI

Air forces have a vital part to play in any future war. This is true equally in the Central Region of Europe and the Third World. Flexibility has been and still is the first and most important principle of air power but it is also one which practitioners have consistently failed to exploit. Even more disappointingly, there has been an absence of flexibility in air power thinking throughout the whole history of air power. In this article I have tried to highlight the dangers of basing future planning irrevocably on present scenarios, particularly that of the confrontation in Central Europe, and the danger perhaps because of economic pressures of taking the Royal Air Force out of one of our traditional roles. This has to be avoided but we must examine the air environment of the future with an open mind, taking full account of international developments and technical possibilities.

We must now take great care to work out a balance between the value of the manned aircraft and that of the missile. I am in no doubt that each must complement the other. The most likely direction of change is towards the missile doing more and more of the terminal work whether in air defence or attack. This in turn may lead to changes in the structure of aircraft as progressively they adopt the missile carrying role.

I have tried to show that one feature common to most of the foreseeable developments in air power is a new approach to the disposition of air forces. If this teaches us that we must rearrange our airfields to reduce the vulnerability of their installations and to become more independent of long stretches of concrete, then I want us to do this effectively and in good time.

In this article I have set out not only to draw attention to the conceptual and technological challenges which confront us but also to show how the great reserves of brain power in this country, and particularly in the Royal Air Force, can be applied to them. Adam Smith was right to point to the complicated aspect of the state of war, but he could never have imagined the degree of perfection, to use his own words, to which air power is capable of being carried at the present time.