Air Power into the 21st Century

By Air Chief Marshal Sir Peter Squire, Chief of the Air Staff

I regard it as a huge privilege to be invited to address you this evening under the banner of the Andrew Humphrey Memorial Lecture. Sadly, I cannot claim to have known Sir Andrew for, as a junior officer, I was never under his direct command. He was AMP when I was out in the Far East cutting my teeth under the watchful eye of your President. When I returned to do my stint as a QFI at Valley, the great man had moved on to be CinC Strike Command before becoming the sixteenth CAS. That said, we might have met 20 years previously when in 1954 my father completed the Flying Course at Manby. The then Wing Commander Humphrey was the Senior Instructor for that course and, you will recall, it was at this stage of his career that Sir Andrew made his mark in pioneering a series of long range flights of navigational acclaim. As a student on the Course in 1951, he flew as a co-pilot over the North Pole in the Lincoln ARIES III. Two years later, and now as a member of the Staff, he piloted ARIES IV, a Canberra B2, on its record breaking flight from Cape Town to London and in 1954, relying almost exclusively on astro navigation, he flew the same aircraft on the first jet flight to the North Pole.

But if our paths did not cross, then there was no doubting the enormous reputation he brought to the post of CAS and subsequently CDS. It is entirely appropriate to link his name with the theme of my presentation this evening, as his career spanned the crucial years of air power development – from the outset of World War 2 to the height of the Cold War, when the pace of modernisation was starting to accelerate – specifically for air forces – such that in relative terms, the Western Alliance could begin to outmatch the Soviet Union.

When one recalls all that has been achieved by airmen, together with the scientists and engineers behind them, it is sometimes difficult to believe that we have yet to be in business for 100 years. Indeed, the first century of manned powered flight will be celebrated in just over 12 months.

This evening, I want to take a look at air power as we move into the 21st Century. I will start by considering the developments of the last 90 years and see how it has measured up to the various prophesies made on its behalf. I will then offer a commentary on how air power has changed since the end of the Cold War and look at strands of further development for the first half of this century.

Many commentators, in recent times, have made the link between air power and technology. It is normally the case that developments in technology give rise to new capabilities and thence changes in doctrine. On the other hand, visionaries with ideas and radical concepts can be the catalysts for new technology. The role, therefore, of the individual cannot be excluded in this relationship, the dynamics of which I would wish to consider as they are fundamental to the story of air power.

Only 8 years after the first flight at Kitty Hawk, the Italians deployed a mixed force of 2 airships, 2 Drachen balloons and 9 fixed wing aircraft to Libya. Within days they were conducting both reconnaissance and bombing operations. So we can already see, in the classification of roles of air power, the developments of a rudimentary doctrine. By the time of the Somme offensive in July 1916, the Royal Flying Corps had a full expeditionary air force in place in France, with fighter, Army co-operation, reconnaissance and strategic bomber aircraft. But the pace of technological change, given such an impetus by war, can clearly be seen by starting with the Bleriots that the Italians used in 1911 and then considering the slow, almost defenceless, BE2Cs which were flying reconnaissance missions in the winter of 1915/16. These suffered under the 'Fokker' scourge - the effect of the German Fokker Eindeckers which were the first fighters to be fitted with a machine gun synchronisation gear, which enabled the pilot to aim the whole aeroplane at his opponent. They in turn were repulsed by the DH2 pusher fighters which were then outclassed by the German Albatross and Halberstadt single-seat fighters. The balance shifted once more in the favour of the RFC in 1917, when the Sopwith Camels and SE5s came into Service. Finally, by the end of the First World War, the DH4 was in service with a ceiling of 23,000 feet, an oxygen system and electrically heated clothing for the crew which, although it was a bomber and reconnaissance aircraft, was also used for air defence against the Zeppelins.

In parallel, there were continual developments in doctrine. Larger and larger formations were being flown, without the benefit of R/T, while Army co-operation – in particular artillery spotting – was developing well. There was also recognition, particularly from the RNAS, that long-range bombing could take the war to the enemy's heartland, though Haig and Trenchard both insisted that only when air superiority had been established over the Western Front should other uses of air power be considered. Long-range bombing raids against Germany, in retaliation for the Gotha raids on England, and a raid by carrier-borne aircraft on the Zeppelin sheds at Tondern – examples of power projection and offensive counter-air – were tasked only fifteen years after the first heavier than air flight. In May 1918 the decision was taken to create the Independent Force tasked with conducting a strategic bombing campaign into Germany and marked the true beginning of the RAF as a separate service. The force only operated for some 5 months until the Armistice, but it highlighted the ability of air power to be operated in an independent offensive role.

Now, even before the Italian foray in 1912, people had started to predict how air power would transform warfare. H G Wells' book, *War in the Air*, contained visions of aerial leviathans and was the first published use of the term 'air power'. But it was Douhet's book *Command of the Air*, published in 1921, which was the first systematic treatise on air power and in particular the transformational effect of air power on warfare in general. Douhet took a very purist view, insisting that the bomber was invincible and would terrorise populations such that governments would be powerless to oppose it. But even before Douhet's writing, the Smuts memorandum of 1917, which led directly to the creation of the Royal Air Force, stated: "as far as can at present be foreseen, there is absolutely no limit to its future independent war use. And the day may not be far off when aerial operations with their devastation of enemy lands and destruction of industrial and population centres on a vast scale may become the

principal operations of war, to which the older forms of military and naval operations may become secondary and 'subordinate'.

But the RAF's main role in the inter-war years, apart from fighting for its own survival, was empire policing. The defeat in Somaliland of the Mad Mullah by a squadron of 12 DH9s, in collaboration with a small force of the Camel Corps, in just 3 weeks marked the start of the use of the technique of 'air control'. The expeditionary use of air power, developed in the 20s in Iraq, achieved something that neither land nor maritime power could do at an acceptable cost.

Now, in addition to air control, Sir Hugh Trenchard also emphasised the primacy of independent – ie strategic – bomber operations against an enemy's material and moral resources. This I would suggest was not only because he was fighting for the continued existence of the RAF but also because of a genuine desire to avoid the slaughter of trench warfare in a future war – incidentally in his view, against the French. 'Billy' Mitchell was also stressing the 'bomber doctrine', but as part of a mixed force which would also need to achieve control of the air and support the land battle. On the other hand both Fuller and Liddell Hart discussed the synergy of air and land power in armoured warfare. And the then Wing Commander John Slessor, in his book *Air Power and Armies,* emphasised the need for air superiority and air intelligence, and argued that in addition to the direct support of land forces, enemy armaments and supplies should be targeted – in other words, interdiction. But the most influential military 'think tank' of the time was the US Army Air Corps Tactical School, the ACTS, which by the 30s was teaching that the independent strategic bombardment role was dominant. Now whilst Douhet and Trenchard in particular were emphasising the 'morale' effect of air power, without any evidence to support that thesis, the ACTS was starting to explore the concept of the 'bottleneck' target – in other words effects-based targeting. Thus, we were already seeing a dichotomy between at one level the exponents of the strategic bomber and the air-land battle doctrines and, at a higher level, between the strategists and the pragmatists.

For the RAF the expansion schemes of 1934–39 came only just in time. At the start of World War II the total regular and reserve strength of the RAF was less than half the strength it had been in November 1918. Again, technological developments under the impetus of a forthcoming war ensured that the RAF had sufficient Hurricanes, Spitfires, Blenheims and Wellingtons as the basis for a modern and balanced force, although there were still plenty of Gladiators and Fairey Battles on the front line. Perhaps more important even than the development of the Hurricane and the Spitfire was the development of radar and the institution of the Chain Home system, the first modern Integrated Air Defence System, without which the RAF would have been unable to win the Battle of Britain. Again in World War II, we see the steady progression of technological improvement, countered by doctrinal change and overcome by further technological improvements on the other side. During the bomber offensive, navigation and bombing accuracies were slowly improved and doctrinal changes, such as the creation of the Pathfinder Force, were implemented to give the less well equipped Main Force the best possible chance of finding and bombing its target. The first doctrinal response to German air defences was to bomb at night. This was met by the German IADs, the Kammhuber Line, and the increased night fighter threat was then countered by improved tactics and innovations such as the use of Window.

By early 1944, the Allies had achieved air supremacy over western Europe, and I want to touch on two aspects of the use of air power at that time, both of which have resonances today. First is the 'transportation' plan, which was the use of all available bombers, principally those from Bomber Command and the Eighth Air Force, to interdict communications nodes, in particular, the rail network, throughout the whole of France. This was initially fiercely resisted by both Harris and Spatz, who believed the war could have been won within a matter of weeks by an all out strategic bombing effort. They were overridden in the end by General Eisenhower, whose decision was subsequently endorsed by President Roosevelt, who believed that ensuring the success of Operation OVERLORD was paramount.

Over some 40 years, people exemplified perhaps by Harris and Spatz and their advocacy of the strategic bombing of Germany, had sought to use air power to achieve strategic effect. With the possible exception of the use of atomic weapons against Japan, strategic bombing did not live up to the 'war winning' claims made for it. At the same time, the bombing campaign against Germany was not given the resources its proponents demanded. Air support for the battle of the Atlantic and the preparation for OVERLORD, for example, were competing priorities. However, at both the political and strategic levels the contribution of the bombing campaign was such it could be argued that, without it, the war in Europe would have been lost. And at the operational level, the bomber campaign caused the diversion of significant amounts of manpower and 88mm guns for the anti-aircraft role thus providing direct support to the war on the Eastern Front.

Technologically the Korean air war was one of contrasts, with the USAF Shooting Star jets, deployed from Japan and America to South Korea, being swiftly replaced by ageing F-51 Mustang ground attack aircraft because of their greater robustness and their ability to operate off semi-prepared strips. The most well known technical and tactical battle was that between the Mig-15 and the F-86 Sabre. Here we saw the key differences; higher speed, rate of climb and ceiling favouring the Mig-15, while for the F-86 – greater manoeuvrability, better tactics and increasing numbers.

The major technical advance in the Vietnam War was, of course, the introduction of laser guided bombs when, during Operation LINEBACKER 1, between 10 –13 May 1972, the Tanh Hoa and Paul Doumer bridges were attacked by F-4s of the Eighth Tactical Fighter Wing. Enormous efforts had previously been made to close both these two crossings; over the 2 year period 1967/68, some 380 tons of unguided bombs were dropped on the Paul Doumer bridge alone. Both bridges were damaged but not beyond relatively swift repair. On switching to precision guidance, it is interesting to note both the number and weight of the weapons dropped. Nine 3,000 lb and fifteen 2,000 lb LGBs were used on the mission against the Tanh Hoa bridge, with the result that one span was knocked completely off its abutment and the superstructure damaged such that it was unusable for several months. Similar results were obtained in the raid on the Paul Doumer bridge, where two 3,000 lb LGBs dropped 3 spans into the river and damaged 3 more. Furthermore, whilst the term 'tank plinking' would not be invented until the Gulf War, during the summer of 1972 individual North Vietnamese tanks were destroyed by aircraft using LGBs; a sign of what was to come.

The Falklands War in 1982 saw the first operational use of laser guided weapons by Royal Air Force aircraft and although by 13 June – when the second of 2 weapons destroyed a command centre on the outskirts of Stanley – the writing was already on the wall, I have always contended that the knowledge that we now had a weapon of such accuracy may have been instrumental in forcing the decision to surrender. But Operation CORPORATE will be remembered most for the demonstration of what can be achieved through reach. At the outset of the campaign it was difficult to see how air power could make a full contribution because of the distances involved and a lack of forward mounting bases. But within a remarkably short time we fitted AAR capabilities to Nimrod and C-130, and restored the system in the Vulcan which had not been used for many years. The importance of strategic reach was demonstrated in spades. Whilst considered an aberration at the time, the Falklands War can now be seen as the exemplar of modern joint, expeditionary operations, albeit there were many lessons to be learned in terms of command and control. The starkest lesson of all, however, was again the vital requirement for control of the air without which land and maritime forces are exposed and vulnerable.

Now perhaps we should not overlook, from a historical perspective, the war that was never fought – the Cold War. In terms of technology, there were huge changes over time. If we look at the RAF in Germany and taking a very broad spread, you have the Sabre, Swift and Hunter wings of the 50s, the Canberras and Lightnings of the 60s, the Phantoms, Buccaneers and Jaguars of the 70s, and finally the Tornado, Phantom and Jaguar wings of the 80s. It would also be unfair to say there was a complete stultification of doctrine in the Cold War period, as that was not the case at the tactical level.

But I would suggest that the GDP, or citadel, mentality did nothing to foster any general thought about the development of air power at the operational level and higher. Indeed, one only has to look at the fourth edition of AP1300, the Royal Air Force Operations Manual; published initially in March 1957, reprinted in September 1964, withdrawn in 1971 but still in use 4 years later as a primer for flight lieutenants taking the C promotion exam. It was not until 1991, in the aftermath of the Gulf War, that the first edition of AP3000, Royal Air Force Air Power Doctrine, was published.

Now whilst both Trenchard and Mitchell had written about the concept of 'strategic paralysis', this idea was to re-emerge in the 70s and 80s in the theories of Boyd and Warden. Most will be familiar with Boyd's OODA Loop, but his underlying theory was that the target was the mind of the enemy command; the desired result was moral collapse and imposed policy change, and this was to be achieved through mental paralysis. Boyd never wrote on the subject but lectured extensively including to the USAF Checkmate Team which in the lead-up to the Gulf War was headed by Col John Warden. The main thrust of Warden's seminal book *The Air Campaign* is that air power possesses the unique capability to achieve the strategic end state with maximum effectiveness and at minimum cost. His 'five ring' construct is a method for analysing Centres of Gravity and he makes much of the concept of 'ends, ways and means' as a campaign planning framework. Not surprisingly as Commandant of the USAF Command and Staff College he was known as the 'Lord of the Rings'.

So what of air power in the current context? Only 7 years after Operation CORPORATE the Berlin Wall fell and in the following September Iraq invaded Kuwait. The main point about the Gulf War was the actual scale of it. It was a genuinely expeditionary conflict, for which we had a 4 month breathing space to build up the ramp capacity of the airfields in the region and to configure our forces for the conflict. Following Operation DESERT SHIELD, which provided that breathing space, Operation DESERT STORM, which was primarily an air campaign, lasted 43 days and culminated in a 100 hour ground offensive. The air force that accomplished this comprised 2,640 aircraft from 11 different nations. However, we were enormously fortunate that for the previous 13 years we had been participating in Exercise RED FLAG; the Gulf War was, in terms of packaging and air command and control, RED FLAG writ large. It was in that respect a validation of all our tactics developed in the central region during the Cold War.

On the other hand, there were some significant differences from the central region. Firstly, there was a major tactical change in the move from low level operations to medium level where aircraft could operate outside the AAA threat envelope. To do so relied on extensive suppression of enemy air defences to achieve the required level of control of the air. Next, there was the use of stealth technology in the form of the American F-117s which, with precision weapons, the innovative use of attack helicopters to take out some air surveillance radars, and the extensive use of Cruise missiles, provided the opening waves of the air war. The Gulf War also saw the first extensive use of PGMs; although they only accounted for some 7% of the weapons dropped, they were responsible for 80% of the targets destroyed. At the operational level, the Gulf War was the catalyst for the formation of the Air Warfare Centre and for the Royal Air Force the start of formal training in air campaign planning and air battle management.

I would now like to move on to the role and the contribution of air power today, and I will do this by taking the core capabilities of air power and using examples from Afghanistan and other recent operations to show what air power can deliver as we reach the end of the first century of powered flight. The core capabilities of air power, and by capability I mean the ability to achieve something, rather than the mechanism by which it may be achieved, are laid out in AP3000. And it is worth emphasising that it is entitled *British Air Power Doctrine* and has joint endorsement.

The first core capability is information exploitation. The fundamental value of this capability has been very clear in Operation ENDURING FREEDOM where the products from strategic intelligence assets,

including the RAF's Nimrod R.1 and Canberra PR.9 aircraft, of unmanned aerial vehicles and of multinational Special Forces on the ground were integrated by the Americans to achieve a level of information superiority that was far greater than that of previous campaigns. The Americans describe this as Network Centric Warfare, and their aspiration is to have total information superiority, through technological means, over any battlespace. But the overarching function of information exploitation is to provide that linkage between the sensor, decision-maker and shooter, to enable the required effect to be achieved in a timely manner.

The second core capability is control of the air. Achieving that control, or a significant degree of it, has been critical in all the operations, to which I have previously referred. The achievement of air supremacy, or even air superiority, cannot be assumed. The loss of 2 US helicopters on Operation ANACONDA earlier this year, the significant air threat posed during Operation ALLIED FORCE over Serbia in 1999, and the considerable effort put into the opening SEAD campaign during the Gulf War were all evidence of this. Moreover, control of the air does not just mean fighters and SAMs, it is all about achieving that degree of freedom required to operate in terms of both time and space. Furthermore, like all aspects of air power, it is entirely joint in its application. Again, it is a matter of smart targeting through a fully integrated command and control system.

However, what do we mean by strategic effect? Here I think the concept of the levels of war, whilst falling out of favour with some commentators on the grounds that the information age has made them redundant, still have some utility. But the strategic level is different from the operational and tactical. It is that level at which senior military leaders and politicians set the end states that they expect their forces to achieve. This is exemplified in Afghanistan, for which the United States' strategic objective was the removal of the Taliban Government in its entirety. In the event this was achieved in just 78 days largely by the use of air power. It is a commonly held view that the role of air power is to support maritime and, in particular, land power – only land power can hold ground. But what we saw in Afghanistan was a reversal of that in which air power was dominant and land power was an enabler. Air was in this case the supported rather than the supporting command. The same was true in Operation DELIBERATE FORCE and in the majority of the Gulf War and Kosovo campaigns. But if proof were needed of the ability of air power to achieve strategic effect, one has only to look at the Berlin airlift where the Allies' determination to retain their control over West Berlin thwarted Stalin's plans to reunify and demilitarise Germany using the fall of Berlin as the lever to break the Allies' resolve.

The next core capability is that of air power to shape both the maritime and land battlespace to enable surface manoeuvre. Again, Operation ENDURING FREEDOM provides contemporary examples. In terms of the direct support to land forces, we saw B-52 bombers providing close air support, to troops in contact, under the direction of a forward air controller. This mechanism was also used against what the Americans described as 'emerging targets'; those which were not threatening at the time but would be so in the future, or those which, because of the strategic end state of destroying the Taliban, would lead to that effect. What we actually saw then was the use of forward air control procedures to target CAS, air interdiction and strategic effects missions.

All the post Cold War air operations that I have described, highlight the importance of combat support air operations, the fifth core capability. Operation ENDURING FREEDOM could not have been mounted in the time, and at the level it was, without the extensive use of strategic and tactical airlift; and one has only to look at the speed with which we achieved an operating capability on Kabul airbase to see that. Furthermore, support helicopters played a key part in the deployment of Special Forces of all nations, and in the deployment of combat formations in offensive land operations such as ANACONDA. But it was air-to-air refuelling, perhaps, that was the key supporting element. B-1 aircraft operated from Diego Garcia and B-2 bombers flew 40 hour sorties; missions that required substantial AAR support. Furthermore, all the fast jet sorties from the US carriers in the first 3 months of ENDURING FREEDOM,

which comprised 45% of all the sorties flown, required extensive air-to-air refuelling to enable them to reach and remain within the operating area. The longest of those sorties was some 15 hours duration and anyone who has sat on an ejection seat for any length of time can only sympathise with the pilot concerned.

A related capability is that of force protection. One has only to remember the Khobar Towers and the USS COLE incidents to realise that the protection of bases, personnel and supplies is absolutely vital in this new era of expeditionary warfare. This does, I suggest, mean far more than just subsuming the old concepts of combat service support and ground defence into a more all-embracing concept. Rather it means all members of armed forces likely to be deployed on expeditionary operations being trained, equipped and having the self-sufficiency and attitude of mind to enable them to look after both themselves and their comrades at all times when deployed into a hazardous situation.

The last core capability is sustainability; this was adopted a few years ago by the UK as a principle of war. Sustainability is more than just logistics, as it embraces equipment, personnel and training and, to a certain extent, links back into force protection as I have just described. But the continuing presence of air forces in the Balkans, over the no-fly zones of Iraq and, indeed, the continuing presence of troops in Afghanistan, shows that sustainability does not just extend to the initial, often short, periods of combat but to the long haul. To take but one example – weapon stocks, the use of Precision Guided Munitions for reasons of minimising of collateral damage, increased mission effectiveness and relatively low cost has meant that there has been a steady proportional increase in the use of these weapons from the Gulf War through to Afghanistan, and indeed an absolute increase in that number in the Afghanistan conflict itself. This requires both adequate ready use stocks and the manufacturing base to replace those used in short order.

Whilst Afghanistan has featured highly in my analysis of the employment of air power capabilities today, we have to be very careful that we don't draw specific lessons from individual conflicts, especially when the scale of the conflict and the level of enemy response is significantly different to that which has been seen previously. But what comes out of the above analysis, particularly in the expeditionary context, is the increasing value placed on the essential characteristics of air power. Those are: responsiveness, reach, range, rate, flexibility and ubiquity, evidence of which was present throughout my brief historical and contemporary survey.

But as I said at the beginning, the employment of air power is all about harnessing technology, and I would now like to take a brief look in equipment terms at what the RAF in particular, and also the Army and Navy, are going to be able to bring to any future conflict which will undoubtedly involve the major use of air power. From a Royal Air Force perspective, the decisions in the Strategic Defence Review of July 1998 to confirm the purchase of 232 Eurofighter Typhoons and the mid-life upgrade of the Tornado bomber to a GR4 standard were extremely welcome. The decision to purchase Storm Shadow, the conventionally armed stand-off missile which will be carried on Tornado, Typhoon and Harrier, will provide a rapidly deployable war fighting capability to complement the Tomahawk missile carried by Royal Navy submarines.

In weapon terms we are also awaiting a decision on the replacement of our depleted stocks of the older Paveway 2 and Paveway 3 laser guided weapons with a more adaptable weapon which may be guided by laser, miniaturised inertial navigation or GPS systems, or a combination thereof. In the meantime, and learning from our experience in Kosovo, we have brought into service an autonomously guided bomb, using laser and/or GPS guidance. This is working extremely well, as is the ASRAAM which, while a little late, has given the F3 force a step change in IR capability. But, of course, the most recent decision has been that we will procure the STOVL version of the Lockheed Martin Joint Strike Fighter to replace both the Harriers of the Royal Air Force and the Royal Navy. The STOVL variant will enable us

to operate not only from the future carrier but also from austere land bases. The attack helicopter has brought a new dimension to the Army's deep fire power and a concept of air manoeuvre is now being developed by the Joint Helicopter Command and the Doctrine Centres. But if the AH's true potential is to be realised, then it is essential that it is considered along with all the other offensive air systems to be integrated with all the other joint forces to achieve the effects desired by the Joint Task Force Commander.

Whilst the emphasis on blue water operations has reduced, Nimrod MRA4 when it enters service will be a world leader in terms of its sensors and processing systems and will reflect another significant technical improvement, in this case against the SSK in littoral waters. It has also been designated MR**A**4 to reflect a greater surface attack capability than its predecessors with its ability to detect and attack a range of surface contacts with a far broader range of weapons than just the Harpoon as at the moment. But I also see the MRA4 as a multi-role platform with enhanced capability in the ISTAR arena.

In terms of strategic and tactical lift, the C-130J is now well established in service and, with its defensive aids suite, is proving to have far more utility in theatres such as Afghanistan than did the earlier Mark. And, of course, we are currently employing four C-17s for strategic lift, pending the introduction of the Airbus A400M to replace both the C-17s and the remainder of the Hercules fleet. Additionally, the Future Strategic Tanker Aircraft, which is a PFI solution to replacing our ageing VC10s and Tri-Stars in both the strategic transport and tanker role, will provide us with a routine number of 'hoses in the sky' for daily training and operations, with a surge capacity to generate additional aircraft should the operational tempo increase. If the provision of tankers is one critical path for future operations then I think the other is the provision of support helicopters. The Merlin has now entered service and the Chinook fleet is in the process of being upgraded. Finally, in terms of aircraft, our information exploitation capabilities, which currently comprise the Nimrod R.1, E-3D Sentry and the Canberra PR-9, are being augmented by the formation at Waddington of a jointly manned ASTOR squadron which will provide a stand-off battlefield surveillance capability similar to that of the US JSTARS.

So what of the future? The capabilities of air power I've just outlined will still be valid and the essential attributes of air power – reach, range, rate, responsiveness, flexibility and ubiquity - will be even more so. The fundamental role of air power will continue to be offensive, often as the sole or certainly the primary mechanism for delivering controlled force in support of political objectives. More than anything, the advent of stealth technology and precision weapons have enabled air forces to deliver destructive force onto a designated point of impact with levels of confidence that the early theorists could only dream of. And the achievement of regime change in Afghanistan in just 78 days, and the coercive effects of ALLIED FORCE on Milosevic would seem to vindicate the Strategic Effect theorists. Indeed, technology has now enabled us to fulfil the 1917 Smuts Report prophecy concerning air power as the principal means of delivering force.

But there are issues which we cannot easily dismiss and I suggest they are these. Firstly, there is the problem of access to a theatre, not only in terms of range, strategic lift and basing, but also in terms of achieving the required level of control of the air at the earliest time. Then there is the ballistic missile threat and the issue of force protection. Finally, there is the linked issue of weapons of mass destruction, particularly when the adversary is immune to deterrence, as in the new wave terrorist organisations, or uses them as a last resort rather than submit to coercion. Indeed, this last consideration may drive us away from coercive strategies to ones involving the rapid and overwhelming use of destructive force.

Setting to one side the use of ballistic missiles, the offensive use of space-based systems is the exclusive domain of the United States. However, its use as an enabler, for communications, some forms of reconnaissance and for navigation and weapon aiming is far broader. UAVs, I suggest, have the

potential to become affordable substitutes for space-based reconnaissance and for some air-breathing systems in the future. The challenge will, therefore, be firstly to integrate sensors and shooters, operating in all three environments, through what we in the UK are calling a 'network enabled capability', rather than the US concept of Network-centric Warfare. The second, and much more important challenge, will be how we fit the decision makers into this architecture. On the one hand, networking all participants should make it easier to follow the principle of 'centralised command and decentralised execution' with decision making delegated to the lowest practical level – genuine 'mission command'. However, and ENDURING FREEDOM is a case in point, it can also lead to 'centralised execution' where decisions are taken at the highest possible level, particularly as a result of concerns about legality, and quite simply because technologically they can be. The danger is that the inherent flexibility of air power is eroded or even negated by a centralised command and control structure that can not cope with the deluge of data and is incapable of making sufficient timely decisions to function properly. This is, of course, an issue to do with the scale of a conflict and the critical path will be ensuring that an effective and robust command structure is in place before the start of any operation.

Now, if air power is inherently a strategic, offensive force I don't think it a contradiction to say that it is also inherently joint in nature. Maritime, land and air power all have their strengths and weaknesses, and the dominant partner can change as a campaign progresses. But the increasingly expeditionary nature of warfare does place more emphasis on the supporting applications of air power, both to land and maritime forces, to the offensive aspects of an air campaign and to the joint campaign itself.

As I come to the end of this presentation, I have been conscious of trying to answer the question of what Sir Andrew Humphrey would have thought about the developments that I have just outlined. Andrew Humphrey was a consummate aviator, determined, aggressive in combat, skilful, able to turn his hand to flying a wide range of aircraft and able to put over his knowledge to the benefit of others. He had the ability to grasp new technical concepts, and had experienced the ability of air power to project itself globally. As a Group Captain in Operational Requirements, he had flown the aircraft he was responsible for – the Lightning – something that few if any in MOD get the opportunity to do these days! Nevertheless, I think he would have hugely enjoyed the challenge that delivering any of the RAF's operational capabilities I have just outlined, would have given him.

As AMP, I think he would have been most concerned at the challenge we face in recruiting and, more importantly, in retaining the numbers of dedicated and professional young men and women that we require to operate those equipments. As CinC Strike Command, he saw his most important task as reversing the run-down of the UK's air defences that had taken place in the 60s, obtaining not only more and better fighter aircraft but also updating the command and control system and addressing the requirement for an airborne early warning system. In that post today his concern would have been to enhance the RAF's expeditionary capabilities.

He would be pleased, therefore, to see the additional measures being applied to deployability through the enhancements in the AT Force, reversing the reductions made in the 1970s as we withdrew from our overseas garrisons to focus our efforts on the NATO task. Above all, he would be delighted to see how the effectiveness of airpower has been significantly improved through advances in technology but supported by the skill, leadership and courage of today's young men and women who remain the practitioners and must distil and fuse the data, both in the air and on the ground, in order to make the decisions that make the difference between success and failure in the timely and effective delivery of airpower in the 21st Century. Thank you.