

RAF AIR POWER REVIEW

Vol 6 No 2

2003

THE ROYAL AIR FORCE

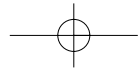
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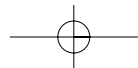




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Cover Picture:
The Lockheed-Martin US-UK Joint Strike Fighter was developed to meet the UK's need to replace the Harrier and Sea Harrier. Production of the first UK aircraft is planned to start in 2008, with the first UK aircraft due to enter operational service in 2012.



INTERVIEW WITH THE
CHIEF OF THE AIR STAFF
31 MAR 03



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

Sir, when you first joined the RAF did you ever think you would be CAS?

Certainly not. I was far too busy at the time actually aiming to pass the course at Cranwell. While I don't think I fared too badly, it certainly was not my aim at all to be at the top of the Air Force 37 or so years later, not least because I don't think I was a star in any one respect; I was much more of an all-rounder. Notwithstanding, I had a fierce determination to do as well as I could whilst I was at Cranwell. And I think that has been my approach throughout my service career – to do as well as I can at the job in hand, whether that is 30 minutes on the range, when you are really concentrating as hard as you possibly can, or in a staff appointment or whatever. While I have set my cap at certain appointments, this was not one of them, but it has been a huge privilege to have held this post.

Do you think it was particularly valuable to do the 3 years' professional education?

I found it so. To an extent it was part of my upbringing. I had been thinking about going to Cranwell for a long time. I got what would now be called a sixth form scholarship in that I was awarded an RAF scholarship at Cranwell at the 'O' Level stage, which gave me automatic entrance on the back of two 'A' levels. To an extent, that did condition my last 2 years at school. I got my two 'A' Levels (albeit modest ones) in the lower sixth year because of an experiment that the school tried, and was then able to do a lot of things in my last year which didn't improve the grades that much. If Cranwell had stopped taking 'A' level entrants, I might actually have been quite poorly placed because I am not sure that I would have got into too many universities at that stage. But those 3 years for me were excellent. It was a bit like a boarding school for 18–21 year olds, albeit freer than a boarding school and therefore more like a university. And we did a reasonable amount of academic work – aerodynamics, electronics, thermodynamics and war studies – as well as the flying and general service knowledge, the drill and leadership training. Indeed, I have no doubt in my mind now that, had we applied ourselves better to the process of gaining for the course an external degree recognition, we could have achieved that. At the time, potential academic partners said it would take a fourth year, but the Service was not prepared to countenance that on the grounds of cost. And they were probably right, but with the approach now to external accreditation, I am sure they could have done it; although they may have had to tweak the syllabus slightly.

Obviously you have had a very successful career as an aviator and a commander, but how did you adapt in the later years to your more political role?

You develop through experience. I don't think you suddenly become political, with a small 'p', or anything of that nature; it's a bit like moving from being a first tourist on a squadron to being a flight commander. Progressively, as you have watched others do it – as shag you have listened to the crew room chat, as an MOD officer you have shared in erudite discussions over lunch in the Whitehall Mess – you absorb it; you learn by experience. You don't actually have to be political either. But you do need to have a political nose; you have to have the nous to know what will play well and what won't run. That doesn't mean to say that you don't give contrary advice, but at least you can put it in a way that recognises what the outcome might be, or in a better way to achieve what you want. At the end of the day, I firmly believe that at every level in the MOD it is for the serviceman or woman to give the best military advice, and it is for others to say either no, I can't do that for political reasons; we are going to march in a different direction; or get on with it. In terms of equipment procurement, for example, it is for others to overlay military advice with the European or industrial dimension.

Obviously one of the main experiences you had was commanding a squadron in the Falklands. How did you view this from a personal perspective?

It was a very interesting experience, and one learnt a lot of things about military capability and about human response. At the time I was immensely fortunate. A lot of people were involved in Operation CORPORATE, but not many from the RAF deployed to war as a formed unit and operated in the unusual environment of an aircraft carrier. In terms of the application of air power, rather than the personal lessons, then certainly I came away convinced that joint operations were something that we needed to be better at. I came away persuaded, if I hadn't been already, that this country needs to have a carrier force of some sort, but that we had the ability to use RAF offensive assets from the sea provided the maritime platform was properly organised to accept them. That was not the case in 1982. Hermes was not prepared for offensive operations, it had no effective ground intelligence support, and the tasking organisation was structured solely for air defence operations. These deficiencies have been put right in the Invincible class carriers and such capabilities must be an absolute prerequisite for the CV(F). Secondly, there was the need for reach. We had focused for so long on the central European Front that, other than buddy-buddy tanking to get the Buccaneers to some of their areas of operation, the only reason we had tankers was either for extending QRA or getting aircraft across to Canada for exercises. Air refuelling wasn't seen as a strategic capability, and the Falklands reminded us of the advantages of strategic reach. We all came away firmly of the view that we should never buy an aeroplane again that couldn't either take on fuel or give away fuel, depending upon its primary role. I am disappointed, therefore, that Astor is not going to have an air-to-air refuelling capability because I think we have missed a trick. I know it was going to be technically demanding, and in theory the platform meets the key operational requirements without air refuelling, but I think we will rue the day that we decided against incorporating an air refuelling capability. Next, the importance of support helicopters was absolutely clear. We lost 6 Wessex and 3 Chinook in Atlantic Conveyor, which meant that the mobility of our own forces was severely constrained. Since then, we have seen that, wherever we are deployed – Northern Ireland, Bosnia or Afghanistan – SH are an essential asset. Finally, the need for precision weapons. After a number of attempts to self designate from the Harrier, because there were no target markers in Theatre, I lofted the first successful weapon against a pinpoint target. Before that we were dropping dumb weapons using a fixed sight, because we couldn't align the IN on a moving deck, and I believe that in the high winds that are prevalent in the South Atlantic, many of the weapons that we dropped were wide of the mark. We dropped 4 LGBs on the penultimate day of the War – 2 were direct hits and 2 dropped short, but I have always believed that those 2 precision attacks showed the Argentinians that we now had a weapon of extreme accuracy and that this may have been something of a catalyst for the Argentine surrender.

You mentioned formed units Sir. Did you have a view on that in the Gulf War of 1991, because I think we caused problems with trying to get an 'A-team' together.

I believe that it is very easy in hindsight to make comments. But I think probably we did get it wrong for DESERT SHIELD by putting together an 'A-team' which then subsequently had to be 'rouled' when we went from DESERT SHIELD to DESERT STORM. That is not in any way to denigrate those that went on DESERT STORM because, in the event, they did a superb job. In 1982, I was severely restricted in the number of pilots I could take – 8 for 6 aircraft – and while I was offered the opportunity to choose from across the Harrier Force, I elected to take only from my own Squadron, including one who had very recently achieved combat ready status. Because we now deploy 12 or 18 aircraft, often at a ratio of 2 to 1, that cannot be done with a single squadron. So we now approach it very much on a wing basis, which mirrors the way we are operating our peacetime MOBs, mainly because of under-manning a year or so ago. The Wing concept has worked extremely well, with elements of 3 or 4 squadrons involved at both Ali Al Salem and Al Udeid.

Can you see us going a little bit further along that route Sir – having a Base Commander and a Wing Commander, like the Americans, where we deploy a Wing Commander and leave the Base Commander behind to look after the families at home?

I think the way we are doing it at the moment works pretty well. We have nominated DOB commanders who deploy with their command team often formed from their own stations, normally leaving OC Operations Wing to run the rear party. If more than one flying squadron is represented, then an individual – normally the senior squadron commander – runs the flying operations. This structure has worked well in the past and again during Op TELIC.

But it is interesting that we are talking about a war fighting air force, isn't it? It is probably what neither of us thought we were joining in the late sixties/early seventies.

At that time, we were exclusively focused on the Cold War – one which we trained hard for but thankfully never came – and, as a result of TACEVAL and our single-minded approach, we were probably as well-prepared as we could be for that war. In the 10 years since the collapse of communism, we have transformed the Air Force into one with expeditionary capability, which isn't the same as being deployable. The Harrier and the Jaguar Forces were, of course, deployable as has been the Support Helicopter Force, but largely they went to pre-planned options. When I was OC 1 Squadron we had options all the way through Europe but we regularly practised North Norway, Denmark and Germany as the most likely of our DOBs. Now the front line has to be capable of going almost anywhere, and I think the transformation has been extremely well achieved; no one should be surprised that it has taken 10 years to achieve.

You obviously see a lot of the young airmen and women, the younger aircrew, who have come from a different generation. How do they seem to you, compared to earlier generations?

Taking first the aircrew, they are different in some ways, largely because their approach to flying is more professional than ours was at the same stage. Much of this has to do with training – Red Flag and similar high value training was not available to first tourists in my day. If selected for PAI or subsequently QWI training, then that certainly taught you to be more professional in the application of air power. Combined with training, there is of course the impact of technology. To understand the technology and to get the most out of modern weapon systems there is a lot of private study to be done, whereas on my first squadron we did not do a lot of swatting, other than in preparation for the visit by CFS Agents – the trappers. Those that applied themselves most probably got the best results, but the pressures were very different. In other ways they are not so very different. My contemporaries were just as committed to the Air Force and a desire to fly, but we weren't equipped or trained to the same degree. As far as the airmen and women are concerned, I find that they are also very similar in terms of why they are in the Air Force. But again, they have been trained differently and so their experience and levels of training are different as we have changed, for example, our apprentice schemes. For the future the concept of multi-skilling in technical trades is extremely exciting, and will result in increased flexibility across the Service. It will also provide for them a greater challenge as they master 2 specialisations; moreover, when they do come to leave the Service it will give them very much better qualifications with which to transfer to the civilian environment. At the same time, I believe very strongly that we need a second line of servicing and a deep servicing structure which is not totally contractorised and that they have access to. This is not just for the reason that we want to be able to give them a break from the front line – although that is vital for retention – but it is also important that they can develop their technical skills in deep servicing, which they cannot do at first line where they are very much into repair by replacement. It will also protect the intelligent customer capability. In my view, this can best be achieved by locating a deep servicing facility close to the front line where individuals can still have access to SFA, sports facilities and Messes.

How do you see us achieving that Sir?

I had no difficulty with the thought that we develop deep servicing through a partnership with industry. Equally, some of it may continue to be done through the Defence Aircraft Repair Agency. However, the partnership must give us what we need in terms of surge capability, intelligent customer knowledge and a working environment which is conducive to return of service. I suspect there will be an additional cost to this formula in comparison to embedding the servicing facility with industry as currently configured. However, what we save in the DLO could easily be outweighed by extra recruiting and training costs in Personnel and Training Command if we get retention wrong. This will not necessarily be an easy argument to win but we cannot afford to sacrifice levels of retention.

Soldiers are trained to fight and seamen to go to sea, but, with the exception of the RAF Regiment and some other areas, it is really only aircrew who deliver air power. Are we in danger of diluting our professionalism by creating a single GD Branch for wing commander and above?

I am alert to the issue but, equally, we cannot fill all the historically tagged GD posts with aircrew, because there just aren't enough of them; the front line isn't big enough to support that full range of appointments. At the same time, we have a responsibility to maximise the use of the competencies that people have. It is wrong to say that, no matter how good you are, we are going to restrict your career profile. Nevertheless, I believe that non-aircrew recognise that there are some jobs for which you have to have a flying background; in coalition terms, the Americans will not accept non-aircrew in certain posts. For the same reason, we have said that our MOBs must be commanded by aircrew. Similarly there are annotated jobs at 1, 2, 3 and 4-star level for which I think that aircrew will be required. My predecessor, I remember, was asked by Secretary of State Robertson at a Defence Council meeting if he could ever see the Chief of Air Staff being non-aircrew. He said, yes he could, but I don't know how far ahead he was looking. My concern, if I had one, is far more that we have got to find a way of grooming aircrew officers. As we tend to keep more and more of them in the cockpit, their opportunities for broadening are becoming less.

Obviously Strike Command and PJHQ are the providers of military force, but how do you see your role at the moment with the current operations going on?

The Chief's role must be, first and foremost, to provide advice on the application of air power to CDS. For that, I rely on personal experience, knowledge of what is going on and what is reported to me through either the air staff in MOD or from CINCSTC. I am responsible for the fighting effectiveness of the Service and for its morale and confidence, so I must clearly take those points into account in giving advice. Outside of that, I act as part of the corporate body of the Chiefs' committee, the Defence Management Board and the Defence Council, in giving advice to either CDS, PUS or Ministers on more general matters.

Just continuing the theme of the current conflict, could you comment on the first use of Storm Shadow in the last couple of days?

Clearly we await the more developed BDA and it would be wrong to jump to conclusions too quickly. But on the face of it, the weapon and its introduction has gone extremely well indeed. It was brought into use quickly as the conflict began and therefore industry has more to do before we achieve a full operational capability. But on the initial evidence, it has gone remarkably well, in terms of reliability and accuracy. However, it will be some time before we know what has gone on inside the structures that it has hit. In the meantime, it provides a war fighting capability to complement the coercive capability that is offered by TLAM.

If you had your time as CAS again Sir, would you do anything differently?

I don't think I would make any fundamental change. Naturally, there are some debates and decisions which have gone in a way that is not what I might have hoped. With hindsight, I might have slanted arguments in a different way in order to achieve a better outcome. But I don't think I would do anything fundamentally different. I have not been a person for shaking an organisation from top to bottom if that has not been required. Coming into this post, I had known and worked with my predecessor for many years, indeed, ever since he was a squadron commander and I was a flight commander. I have succeeded him on a number of occasions and shared many of the same ideas. It has been much more a question of adjustment of direction as opposed to radical change.

Moving on to air power and looking at it in the broader frame. We are within a few months now of the centennial of the first powered flight – do you think air power has lived up to its promises?

I think it has. We have proved beyond a shadow of doubt that control of the air is essential to the successful outcome of any conflict. Those who said the bomber will always get through have eventually been proved correct, as a result of the combination of stealth, precision and stand-off capabilities. Also in the role of reconnaissance, which was after all one of the first tasks that people required of air power, the technical capabilities of modern sensors – whether IR, EO or SAR – mounted in platforms from the tactical right the way through to UAV and beyond to the satellite, contribute hugely to the whole business of network enabled capability: getting inside the decision-making cycle of the opposition. Even in its earliest form, that is what people wanted when they sent up balloons and then early aircraft; it was to see what the opponent was up to. In sum, control of the air, which I don't think anybody would dispute is essential, the power of the bomber, and the contribution of reconnaissance, I would say are 3 key areas where air power has come good.

One of the other things we are seeing in the post Cold War world is that air power seems to be the weapon of first choice, or indeed the only choice, for the politician. Do you see this as a welcome development, or just an inevitable one?

It is a phrase which I have used because of the success of air power, in shaping the battle space, in particular the Gulf in 1991 and Kosovo in 1999. We then had Afghanistan, and now we are into Gulf II. These have all been serious war fighting scenarios but there will be circumstances where it wouldn't necessarily be the force of first choice. Sierra Leone, for example – although we needed air power through support helicopters, it was not an operation for which we needed a lot of air power to be able to resolve the crisis. In a relatively benign environment, therefore, air power may not be required to shape the battle space, albeit it was essential to carry out the task. At the same time, even in a non-benign environment air power is very rarely, if ever, likely to be the only choice. I suspect one will always want a land and/or maritime component, but air will always be an early entry force. When the record is written, it will be interesting to see in the aftermath of Operation TELIC whether it was right to go in with ground forces first, or whether it would have been better to have used air power first. But that will be for debate. Nevertheless, my view remains that air power is the force of first choice in anything but a benign environment, but it will very rarely be the only choice.

You have just touched on coalitions, and I think the next thing to come out of that is to look at the American dimension. Obviously air power is getting much more expensive, and there is a definite technology gap growing between us. What contributions do you think air forces like ours can make to the development of air power, given that we are definitely one or two steps behind the Americans?

In terms of the development of air power, there is no doubt America is putting huge sums of money into research and technology, and it will not be easy to hang on. But, as long as we maintain interoperability with our US counterparts, which we can do without buying everything that they buy, then I believe we will

always be able to join forces in coalition with them. Moreover it is a fact that, in some specialist areas, we are leading – in tactical reconnaissance we are certainly out ahead. Some European weapons are every bit as good as the US equivalents – for example ASRAAM, which it is about as good as you can get anywhere in the world. Storm Shadow has also to be a weapon system which is right up there in the van of stand-off precision capability. There are specialist areas which I think we are certainly well able to contribute to, in capability terms, and therefore perhaps in development terms as well. That said, it is unrealistic to expect that we are ever going to get involved to the same degree as the Americans with space, and there will be other C4 ISTAR capabilities that we won't be able to afford. My greater concern is that there will be some air forces in Europe and elsewhere that won't maintain interoperability with us, and that could be a danger for NATO and for Europe.

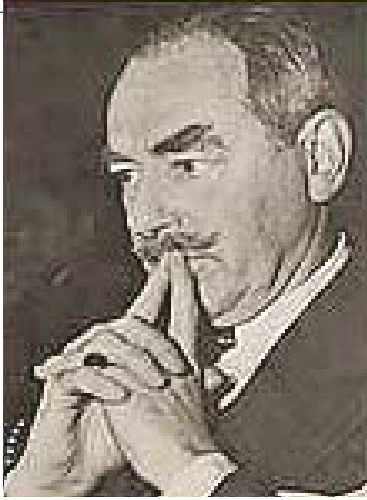
At the same time, we have not got a perfect record of properly investing in capability. For too long, we concentrated on platforms with the prospect that we would fit the weapons, the datalinks, or ECM at a later date – i.e. getting the platform first and sorting it out afterwards. Now we genuinely are taking a much more combat-effectiveness approach to the procurement of capability, and are using the additional funds gained in SR03 to improve the overall capability of our assets.

You must be sad and proud Sir to be retiring from the position as professional head of your chosen Service. Have you any other thoughts or observations that you would like to make, either in relation to the air power picture as a whole or to the Air Force itself?

It has been a huge privilege and there will be many aspects of the job that I will miss enormously when the time comes. It will be people and their contribution that I will miss most. When I visit stations, I see the pride that individuals and units take in their performance. Such levels of commitment are impressive by any standard. For example, my tour to the Gulf just prior to the outbreak of hostilities in the middle of March was an uplifting experience. The responsiveness of units to late changes in deployment locations, the professionalism of all those involved either in expanding extant facilities or starting from scratch at new DOBs confirmed to me the high quality of all those involved – from DOB Commanders right the way down to those on their first productive tours. It was quite remarkable to see what had been achieved. Equally, here in UK those remaining at the MOBs have applied themselves remorselessly to the task of supporting those in the field. The sum of these efforts – at DOB and Home Base – has been quite superb in the execution of the task.

While this has been a very specific scenario, the dedication of individuals both in primary and in secondary duties and the sense of team work that binds us to a common cause, requiring people frequently to put Service before self, is for me the hallmark of our servicemen and women. It is a gold standard that sets them apart from many of their contemporaries outside of the Armed Forces. I hope that sense of duty will never change. I see nothing to suggest that it will.





Secretary of Defense Marshall



Admiral Radford



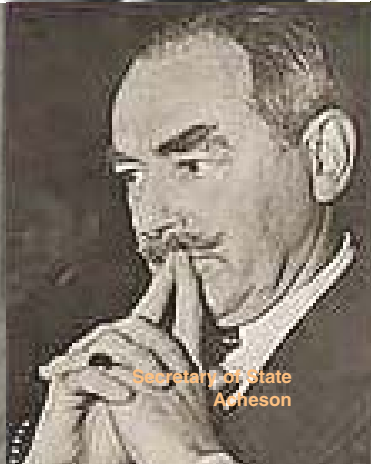
President Eisenhower



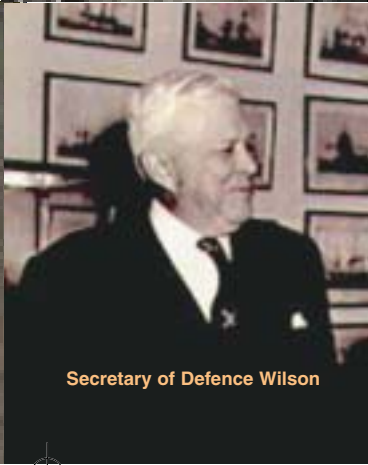
General LeMay



General Weyland



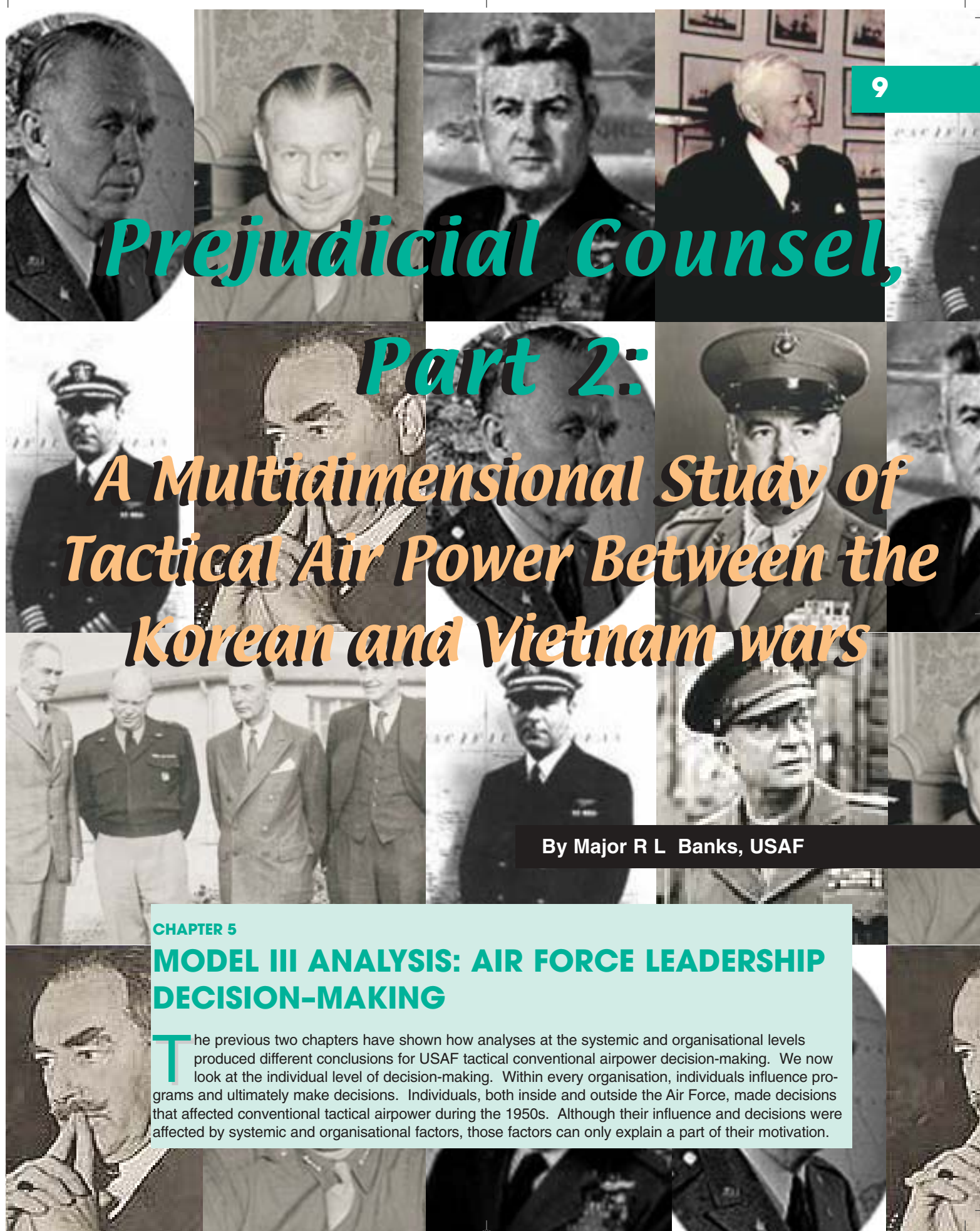
Secretary of State
Acheson



Secretary of Defence Wilson



Air Force Chief of Staff Twining



Prejudicial Counsel,

Part 2:

A Multidimensional Study of Tactical Air Power Between the Korean and Vietnam wars

By Major R L Banks, USAF

CHAPTER 5

MODEL III ANALYSIS: AIR FORCE LEADERSHIP DECISION-MAKING

The previous two chapters have shown how analyses at the systemic and organisational levels produced different conclusions for USAF tactical conventional airpower decision-making. We now look at the individual level of decision-making. Within every organisation, individuals influence programs and ultimately make decisions. Individuals, both inside and outside the Air Force, made decisions that affected conventional tactical airpower during the 1950s. Although their influence and decisions were affected by systemic and organisational factors, those factors can only explain a part of their motivation.

At the highest level, National Security Policy falls to the President. From 1953 to 1961, President Eisenhower was assisted by two advisory bodies: the National Security Council (NSC) and the Joint Chiefs of Staff (JCS).¹ Throughout this period (and since), readiness was paramount in the US military's agenda. The USAF Chief of Staff (as with the other service chiefs) was expected to provide advice on readiness and security based primarily on his experience and knowledge and not based on Air Force parochialism. Unfortunately, this was not always the case.

Between Korea and Vietnam, the USAF Chief of Staff and other senior Air Force leaders presented advice to both the President and Congress that may not have been in the best interest of the Air Force and the United States in general. Advice given and decisions made by Air Force leaders during the 1950s tended to be more a result of bureaucratic competition and personal motivations than pure military advice without parochial biases. Using Allison's Model III decision-making construct, I will show how various leaders within the Air Force influenced and directed USAF policy, directly affecting development and procurement decisions for tactical conventional airpower. This chapter begins with an overview of Allison's third decision-making model, then describes how the various individuals in key positions within the Air Force influenced tactical conventional airpower. Finally, there will be a summary and analysis.

MODEL III DECISION-MAKING

Allison's third decision-making model is based on the premise that governmental decisions are made by individuals in key positions who view the nation's problems from different perspectives and backgrounds. They possess extensive and distinct responsibilities and must fight for what they believe is right. Often, bureaucratic infighting results in decisions that may be vastly different from what any person or organisation intended. The moves in this chess game are a consequence not of rational choice or organisational routines, but rather of 'the power and skill of proponents and opponents of the action in question.'² Allison states that the actions and decisions of government are 'intranational political resultants' and further explains that the decisions are:

resultants in the sense that what happens is not chosen as a solution to a problem but rather results from compromise, conflict, and confusion of officials with diverse interests and unequal influences; political in the sense that the activity from which decisions and actions emerge is best characterised as bargaining along regular channels among individual members of government (emphasis in original).³

To completely comprehend this paradigm, Allison offers four questions that must first be answered: Who plays? What determines each player's stand? What determines each player's relative influence? How does the game combine players' stands, influence, and moves to yield governmental decisions and actions?

WHO PLAYS?

The players in a Model III paradigm are neither a unitary actor nor a group of organisations. The Model III framework states that individuals (people in key jobs) are the players in the national security game.⁴ These individuals include the Chiefs, (the President, the Secretaries of State, Defense, and Treasury, and the Joint Chiefs of Staff); Staffers (the Chiefs' immediate staffs); Indians (the political appointees and permanent government officials within each organisation); and Ad Hoc Players (actors in the wider governmental game such as Congressmen, members of the press, and spokesmen for interest

groups).⁵ Each player is defined by his position or job. The job, in turn, has certain advantages and restrictions that influence what the individual may and must do to fulfil his duties.

WHAT DETERMINES EACH PLAYER'S STAND?

Several factors influence where an individual player stands in relation to an issue that must be decided upon. The first factor is parochialism. This can be good or bad depending on how organisational prejudices affect decision-making. Key individuals within each organisation must be sensitive to the organisation's orientation, but not so sensitive that vital decisions adversely affect the unit overall.⁶ This orientation leads to parochial priorities and perceptions that bias how the individual approaches possible problems and decisions. By understanding a person's position, one may better explain how or why that person decides the way he does. The second factor that affects decision-making is the individual's goals and interests. The goals and interests an individual may have include national security, organisational, domestic, and personal concerns. Each concern will have varying levels of emphasis and therefore weigh on the individual differently. The third factor that influences individual decision-making is stakes and stands. From the goals and interests, an individual will evaluate how each goal and interest overlaps and determines what is at stake with respect to a particular issue. Once the stakes are established, then the individual will determine what his stand should be. The fourth factor is deadlines and faces of the issues. Oftentimes, solutions to problems are not found through detailed analysis, but rather may be forced upon the individual as a result of a deadline. Additionally, the forum in which the issue was raised may impact how the individual decides a solution within a given deadline.⁷

WHAT DETERMINES EACH PLAYER'S IMPACT OR RESULT?

Power is the primary way individuals influence a decision or policy. Allison defines power as effective influence on government decisions and actions and consists of 'an elusive blend of at least three elements: bargaining advantages, skill and will in using bargaining advantages, and other players' perceptions of the first two.'⁸ The advantages may be derived from formal authority and job responsibilities; aptitude and control of information that define the problem, identify options, and estimate feasibility; control of how decision may be implemented; the ability to be persuasive (personal charisma); and access to and persuasiveness with other players who have bargaining advantages listed above.⁹ Over time, if power is wisely used, then a reputation for effectiveness is gained. Additionally, individuals tend to pick the issues which can be successfully influenced and avoid those which cannot in order to maintain a positive reputation. A positive reputation translates to increased power and a negative reputation does not.

WHAT IS THE GAME?

How are the individual's stands, influence, and moves linked to produce governmental decisions? Games that require individuals to bargain and compromise are neither random nor unintentional. The people with the stands and decisions of most influence, are the individuals whose positions link them to 'action-channels' (a regularised means of taking governmental action on a specific kind of issue).¹⁰ In the Air Force, the Chief of Staff and the commanders of the major organisations are some of the individuals with the greatest influence due to the fact that they have the final say in decision-making.

Governmental decisions arise not from simple choice of a unified group, or as result of a commander's predilection. Rather, decisions are made in light of shared power and separate judgements

Action-channels shape the game by determining who the major players are and how they will participate. Advantages and disadvantages based upon job position will vary the potential influence each individual may have on the decision. Typically, action is taken within established channels.

The Constitution, laws, regulations, and even culture govern the rules of the game. Some rules are restrictive, while others are lenient. In either case, the rules define positions within the game and the manner in which individuals gain access to it. Likewise, the rules 'constrict the range of governmental decisions and actions that are acceptable.'¹¹ Governmental decisions arise not from simple choice of a unified group, or as result of a commander's predilection. Rather, decisions are made in light of shared power and separate judgements. 'Each player pulls and hauls with the power at his discretion for outcomes that will advance his conception of national, organisational, group, and personal interests.'¹²

Model III's explanatory power stems from the ability to define the game by the key positions, the individuals concerned, the action-channel used, and the pulling and hauling (jockeying for power) involved to make the decision. The dynamic variable of human interaction by key individuals constitutes the third level of analysis that completes this examination of governmental decision-making.

TACTICAL CONVENTIONAL AIRPOWER MODEL III DECISION-MAKING DURING THE NEW LOOK

In July 1953, President Eisenhower directed members of the Joint Chiefs of Staff to meet with top civilian and military officials. Their mandate was to 'make a completely new, fresh survey of our military capabilities, in the light of our global commitments.'¹³ At a meeting on 24 July, Secretary of Defense Wilson indicated to the group his confidence in nuclear weapons to deter any nation from attacking the United States, reflecting a general feeling throughout the defense community. The Chairman of the Joint Chiefs of Staff, Admiral Radford, subsequently asked the National Security Council for guidance as to the nature of war that the United States was likely to fight in the near future, adding that the preparations to contend with 'every kind of war would be unnecessarily costly and that no mobilization planning would be realistic or useful unless it was founded on a proper strategic outlook.'¹⁴

In response, the NSC issued a paper designated NSC-162, which indicated that the Soviet Union was the primary threat and nuclear weapons delivered by strategic airpower should provide for America's first (and last) line of defense. Furthermore, NSC-162 recommended that the JCS should be authorised to use these new weapons when and where feasible.¹⁵ President Eisenhower approved the paper and envisioned a defense establishment that could meet a 'twofold requirement—preparedness for the essential initial tasks in case a general war should be forced upon us, and maintenance of the capability to cope with lesser hostile actions—and aimed to satisfy this requirement with less drain on our manpower and financial resources.'¹⁶

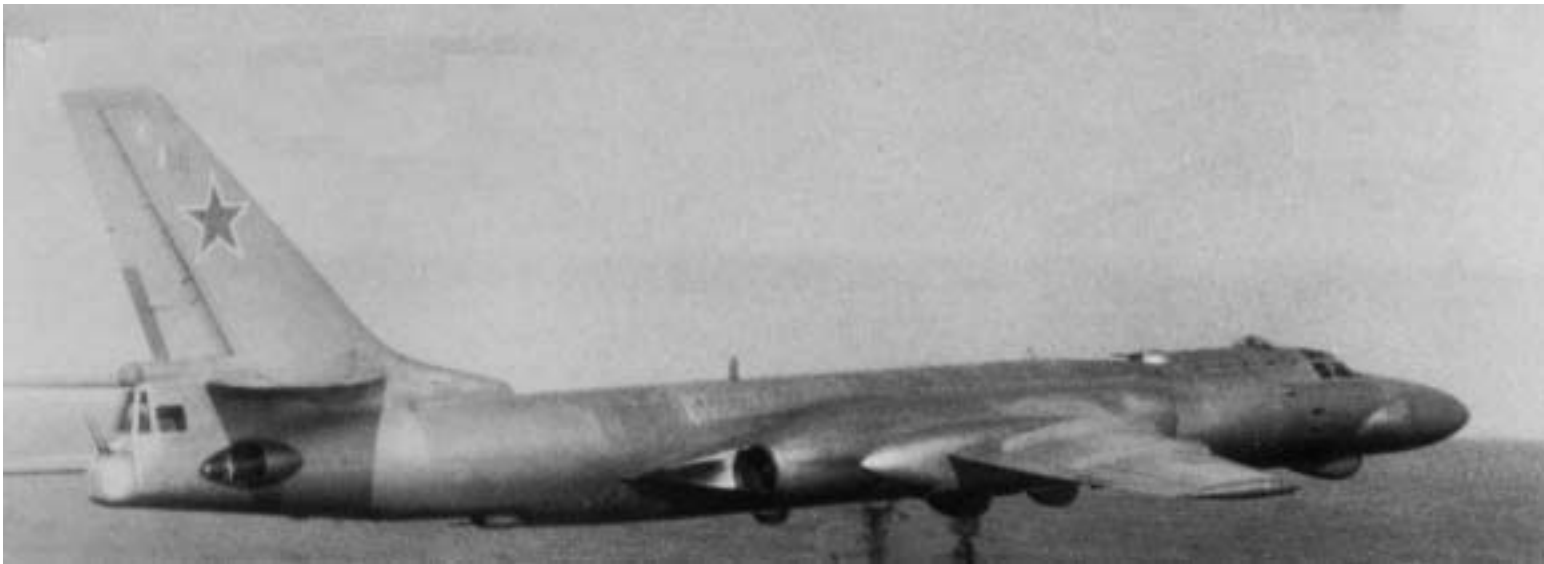
The Chairman established an ad hoc committee led by Air Force Lt Gen Everest, including senior representatives from each service, to make recommendations to the Joint Staff on force structure. Each service was not only to construct their respective force structure recommendations, but was to

comment on the other services' plan. The Air Force's plan was already arranged. Earlier in July of 1953, Air Force Chief of Staff Twining reported to Congress that the USAF was seeking a force structure goal of 143 wings.¹⁷ The Everest Committee, however, recommended goals of 127 wings for the fiscal year of 1956 and 136 by the end of fiscal year 1957. These reduced goals were in part due to the expected high costs of nuclear weapons and other service force structure requests.¹⁸ The committee could not agree to an overall force structure strategy and subsequently presented four different views to the Joint Staff.

The action channel in this decision framework flowed from the President down to the JCS, who in turn requested guidance from the NSC. After receiving NSC direction (with presidential approval), the action-channel flowed down to an ad hoc committee. Furthermore, when the military service chiefs briefed Congress (who controlled the purse strings), another group of individuals became involved. Every individual had his/her own set of issues, of which military force structure was just one of many. Additionally, each individual had different levels of power to influence the decision, and alternative motives. The net result (which continues today) was a series of hauling and pulling (often called 'logrolling') in order to find a compromise for a final solution. The final force structure strategy would directly relate to the distribution of the DoD budget, which every chief was especially concerned with. The greater the share of the budget each chief received, the greater the power base he had.

During the 1950s, the actual budget process constituted a major action-channel that kept power within each service and not in a central agency such as the JCS. Every year, the Department of Defense programmed budgets and forecasted expenditures for the upcoming year. The Joint Chiefs of Staff as a body did not take part; rather, the Secretary of Defense gave each service the responsibility to formulate its own budget independently.¹⁹ Although the JCS was expected to provide advice on budgetary matters to Congress, they were not directly part of the formulation process. The JCS did have a long-range planning tool, titled the Joint Strategic Objectives Plan (JSOP),²⁰ designed to provide guidance for the development of forces needed in the years ahead. The JSOP, unfortunately, did not achieve its intended purpose during the 1950s, primarily because of an 'inability of the service Chiefs to agree on the best combination of forces supportable by the financial outlays, which the Secretary of Defense considered feasible for planning.'²¹ Consequently, each service was able to stipulate how its share of the budget was programmed for force structure, which in turn gave the service chiefs enormous power—more so than the JCS. As the central co-ordinating body for national defense issues, the JCS did not co-ordinate the JSOP and budgetary issues.

The Joint Chiefs of Staff were also required to provide national military strategy guidance to the President, which would directly affect how the military should structure itself for war. NSC-162, which Admiral Radford had asked for, was based on the 1950 quintessential national security policy—NSC-68 (discussed in Chapter Two). A Model III examination of the development of NSC-68 reveals a process that was developed by only a few State and Defense individuals. According to Clarfield and Wiecek, four individuals (Secretary of State Acheson, Nitze from State, General Landon, and Major General Burns from Defense) managed to create a policy (NSC-68) that showed the Soviet threat to be greater than it actually was.²² They postulated Soviet intention to be world domination and therefore destruction of the United States. Furthermore, NSC-68 advocated the use of nuclear weapons to deter this 'grotesquely oversimplified caricature of Soviet purposes.'²³ Moreover, the authors of NSC-68 were able to convince the chiefs of staff of the validity of this policy while bypassing Secretary of Defense Marshall, who Secretary Acheson knew was opposed to such a policy.²⁴ Acheson and the others were not interested in engaging in a discussion of the true nature of Soviet Communism. Rather, NSC-68 was solely intended to vindicate a rearmament policy that emphasised nuclear weapons. Consequently, the policy, which launched the New Look and NSC-162, was based on data contrived by a select few to advocate American political and nuclear supremacy.



A Russian Tu-16 BADGER reconnaissance aircraft operational during the Cold War

Whatever the Soviets' true intentions were, the net result of the Korean War and NSC-68 was the escalation of the Cold War

Prior to the start of the Korean War, support among the chiefs of staff for NSC-68 began to fade, but the commencement of the war changed everything. Opposition to rearmament vanished and funding increased dramatically for combat operations. There was now a reason to justify nuclear arms development. America was at war again and needed military strength. Despite the non-nuclear flavour of the Korean War, senior Air Force leaders were worried about general war. Nuclear advocates looked to Europe and intimated that Korea was just a diversion—the Soviets were likely to start a general war in Europe at any time. Whatever the Soviets' true intentions were, the net result of the Korean War and NSC-68 was the escalation of the Cold War.

In 1953, President Eisenhower asked the Joint Chiefs of Staff for advice not only on military issues, but also domestic and international ones. Senior Air Force leaders demurred, providing instead only professional military counsel that tended to favor Air Force interests.²⁵ The first of those interests was the continued build-up of the Air Force to the 143-wing goal within budgetary and security constraints. But to achieve this goal, the Air Force Chief of Staff would have to contend with interservice rivalries. Air Force Vice-Chief of Staff from 1953 to 1957 (and later Chief of Staff 1957 – 1961) General White later recalled, 'Strategic planning was not done well because of interservice rivalry.'²⁶ In fact, interservice rivalry at the Chief of Staff level was a significant hurdle not only for strategic planning within the Department of Defense during the 1950s, but also for providing unified advice to the National Security Council.

Since World War Two, and indeed before it, strategic bombing was the principal method the Air Force used to employ airpower and validate its independence as a service. The New Look and the ascendancy of nuclear weapons were the catalysts for primacy of the Air Force within DoD. In fact, nuclear weapons became so important that at a senior Air Force planning meeting conventional air weapons were considered for elimination,²⁷ a proposal successfully opposed by General Weyland because of his reputation as a respected war leader and position as TAC commander.

The perceived Soviet threat was such that only nuclear weapons were financially prudent to deter and, if necessary, win a general war. Senior Air Force leaders stated that all efforts within the United States military should be devoted to ensuring the survival of America from Soviet aggression. SAC Commander General Curtis LeMay stated, 'Offensive air power must now be aimed at preventing the launching of weapons of mass destruction against the United States or its Allies. This transcends all other considerations because the price of failure may be paid with national survival.'²⁸ Most individuals in the Defense and State Departments did not disagree with the necessity of building a nuclear force to provide for US national security, but to focus solely on them at the exclusion of conventional forces was a matter of serious contention among senior US defense and policy-making members.

Contentious debate at the highest military levels revolved around the likelihood of general war and whether or not nuclear weapons could deter both general and limited war. As for general war, NSC-68 and the New Look described the enormous (inflated) Soviet forces positioned in Eastern Europe and postulated the potential for an invasion there. No matter how inflated the intelligence reports were, the potential remained and as such had to be considered. Moreover, communist aggression in Korea, Lebanon, Formosa, Egypt (the Suez Canal Crisis in 1956), and Vietnam in the 1950s provided general war advocates with the impression that conflict on a massive scale was likely.

Those same hot spots indicated to the limited war advocates that general war was less likely. TAC Commander General Weyland, stated that growing nuclear parity with Soviet Union 'would neutralise the utility of general war' and 'permit, indeed encourage, 'brushfire' or limited wars.'²⁹ US Army Chief of Staffs General Ridgway in 1954 and General Taylor in 1956 both argued that limited war was more probable than general war. General Ridgway postulated that Massive Retaliation might trap the United States into using nuclear weapons to prove that America was not bluffing. 'Consequently', he concluded, the Soviets would attempt to fight a level below nuclear war.'³⁰ Similarly, General Taylor stated that the future would likely witness more conflict on the periphery and not a general war with the Soviet Union. Additionally, the fact that the United States threatened but did not use nuclear weapons in Korea, Vietnam (in 1954), and Egypt, indicated that political considerations might prevent both the use of nuclear weapons in limited conflicts and the escalation of those conflicts into general nuclear war.³¹

The US Navy leadership could envision either general or limited war, but thought the latter more likely. In 1953, Admiral Burke (who would become Chief of Naval Operations in 1955) intimated that the Defense Department needed a strategic concept for the 'preparation for vast retaliatory and counteroffensive blows of global war and of the preparations for the more likely lesser military actions short of global war.'³²

We can assume that each senior military individual believed in his view as to the proper strategic national security policy direction. Further analysis, however, reveals that each had different motivations and biases that led him to believe and advocate what he did. For the US Army, General Taylor discussed his motivations in his book, *Uncertain Trumpet*. Taylor mentioned his concern for proposed manning cuts for the Army in the fiscal year 1956 and 1957 budgets. Furthermore, in the mid-1950s, the Army had only minimal nuclear forces and was relegated to second string in the eyes of the Air Force, since the next war was likely to be general nuclear war.³³

Only a foolhardy nation would ever base its power strategy upon the doubtful assumption that what started as a localised conflict would remain localised

For the Navy, Admiral Burke's motivation can be understood by an increase in aircraft carriers and overall strength of the US Navy. Following the crisis in Formosa in 1954, where Navy carriers were sent to provide assistance, the Joints Chiefs of Staff decided to raise the number of aircraft carriers from 14 to 15.³⁴ Moreover, the Navy was attempting to procure forces that could support both general and limited war, and was presumably content to talk of both types since there was no threat to naval funding.

For the Air Force, Generals Twining and White's motivations may be grounded in their belief that air power was best employed against strategic targets and that nuclear weapons provided a realisation that strategic airpower could have greater effects beyond any World War Two or Korean War airpower results. Furthermore, given the level of emphasis of strategic nuclear missions within DoD, the Air Force rose to the top of fiscal year funding (see chapter 3) and primacy with regards to employment in war plans. Repeatedly, SAC Commander General LeMay went before Congress to argue for greater funding for bombers and nuclear weapons and usually received what he asked for. For several years (beginning in the Korean War), SAC grew and modernised to become the most destructive force in human history.

General LeMay grew in stature and power both within the Air Force and throughout the JCS. His influence and reputation allowed him to determine operational limits and strategy.³⁵ The net result for the Air Force was additional funding and prestige that insured its primacy. Additionally, LeMay was convinced that Strategic Air Command's (and his own) growing power would not only deter general war with the Soviet Union (or any other state), but also deter aggression at levels of war lower than general war.³⁶ Many military leaders put their arguments in print so that both political leaders and the public were aware of the issues, and in 1956 General LeMay stated his beliefs on deterring both general and limited war in an article:

*Only a foolhardy nation would ever base its power strategy upon the doubtful assumption that what started as a localised conflict would remain localised. The only condition under which this assumption could apply would be for one nation to be absolutely and positively guaranteed that the other lacked either resolution or intelligence. For if a nation is determined to survive and preserve its way of life, it must avoid risk of extinction, regardless of how that extinction might be brought about and if a nation is intelligent, it must realise that the objectives can be won just as surely in piecemeal advances and by one all-out blow. Therefore, combine both intelligence and resolution in a nation, and you have a nation against whom you dare not instigate limited actions unless you are ready to accept the possible consequences of all-out war.*³⁷

In a co-authored book, he further elaborated:

*It is my belief that our strategy and forces for limited war should not be separated from our over-all strategy and force structure. The artificial distinction of limited war forces for this war and general war forces for that war destroys the interacting strength of our military stance that will provide superiority and continued deterrence at any level of conflict (Emphasis in original).*³⁸

Air Force Chief of Staff, General Twining, echoed LeMay's opinions. Not only did he state that nuclear force could deter both levels of war, but he indicated that strategic nuclear forces could win both. In his book, *Neither Liberty Nor Safety*, he thought nuclear war was winnable³⁹ by employing them in limited quantities and yields. He considered the introduction of nuclear weapons a controllable process. In 1957, General Twining was promoted to Chairman of the JCS, while Air Force Vice-Chief of Staff White



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The launching of Sputnik forced the United States to realise that the Soviets were ahead in rocket technology, meaning they had a capability to deliver a payload (e.g. nuclear warhead) to the United States without the military being able to defend against this threat or duplicate it

was promoted to Chief. General White also favored the view of Generals Twining and LeMay. In an interview, White stated the importance of not taking away resources from the capability to wage general war in order to increase the Air Force's conventional war-making capability.⁴⁰ He did not wish to see the Air Force's strategic nuclear bomber mission reduced at any cost.

When General White became Chief of Staff, he selected LeMay to be his vice. White understood how much power LeMay had with both the JCS and Congress and needed that influence to aid Air Force policy decisions.⁴¹ Even after becoming Vice-Chief of Staff, LeMay continued to promote SAC's mission. In a 1957 speech, LeMay told the major commanders that America 'could no longer afford the luxury of devoting a substantial portion of our Air Force to support ground forces.'⁴² In fact, the new Vice-Chief was so enamoured with the strategic nuclear mission that he mandated the vast preponderance of Air Force research and development funding be directed towards strategic airpower projects in order to further Strategic Air Command. Similarly, he promoted a far larger proportion of SAC officers to the rank of general over the officers of TAC (or any other command).⁴³

General LeMay's influence reached as high as the Secretary of Defense (if not higher). Although required to advise his superiors, LeMay only recommended advancements to the strategic nuclear missions. That advice was mirrored in a 1957 speech given by Secretary Wilson who stated that the free world had to rely upon the strength of its allies 'not only to beat back any local aggression but to deter the aggressor from broadening the conflict into global war...the problem of deterring small wars cannot be considered separately from the problem of deterring war generally...the capability to deter large wars also serves to deter small wars.'⁴⁴ Secretary Wilson fully endorsed LeMay's views. From a

Model III perspective, LeMay's influence on both the Air Force and the Department of Defense demonstrated his power. His personal and organisational biases and priorities influenced decisions during the 1950s. Given that the stakes in the national security game were extremely high, LeMay, through the development and procurement of nuclear weapons and their delivery systems, was placed within the key action-channel for airpower development. Moreover, LeMay possessed a strong personality and desire to use his position, which made him extremely influential.

THE EFFECT OF THE LAUNCH OF SPUTNIK

The Soviet's launch of Sputnik in 1957 was seen as an increased threat to America's survival. The launching of Sputnik forced the United States to realise that the Soviets were ahead in rocket technology, meaning they had a capability to deliver a payload (e.g. nuclear warhead) to the United States without the military being able to defend against this threat or duplicate it. The result was an increase in effort of the US Space program to match the Soviets' progress. US rockets were developed to respond in kind to the Soviet missile threat. For the Air Force, its missiles became part of SAC. The necessary funding for missile development further advanced SAC over the other Air Force commands. Tactical airpower suffered as a result.

General LeMay was again influential in gaining additional funding for strategic missions. Not only did the Air Force reluctantly create an Intercontinental Ballistic Missile (ICBM) fleet, but LeMay and his SAC successor (General Thomas Power) were able to increase the number of bombers procured during the latter half of the 1950s. Despite increased interest in ICBMs, LeMay and his generals were still unsure of their capabilities. In any event, Generals White and LeMay did place too much emphasis upon the fledgling ICBM force and continued to promote strategic bombers over any other weapon system.⁴⁵ Senior Air Force leaders wanted those portions of airpower not associated with or overlapping the strategic mission to be eliminated or reduced. In 1958, General Twining reported to Congress that the missions of SAC and TAC overlapped in some capabilities to deliver firepower. Senator Symington asked if TAC could be cut in the interests of the taxpayers. General Twining replied 'We are cutting some. We cut several wings out this year, and it may go down further.'⁴⁶ Senior Air Force leaders favoured one aspect of airpower (strategic bombers) to the detriment of others; tactical airpower did not contribute to their interpretation of contending with the perceived threat. In an effort to gain more power, LeMay went so far as to suggest that SAC absorb TAC. It is uncertain whether this suggestion would have contributed to the advancement of SAC, but TAC leaders may have viewed the suggestion as a threat to tactical airpower. Commenting on General LeMay, General Weyland stated:

*Well, old Curt LeMay...He's a pretty strong character in his own right. So he's got this outfit shortly, and discovered to his pleasant surprise, perhaps, or perhaps not, that he had most of the chips. So he wasn't satisfied with having most of them; he wanted all of them. I'm telling you, he worked like a beaver and was pretty successful in many areas. I was just fighting to preserve a force structure in the tactical air forces.'*⁴⁷

Even within the Air Force, it is evident that conflict between the key decision-makers was present. Those with the greatest power had the largest influence. The key players mentioned above were four-star generals, but they all did not carry the same weight or impact the decision-making process with the same effect. A combination of personality, charisma, and position factored significantly into airpower procurement policies and national security.

THE INTRODUCTION OF FLEXIBLE RESPONSE

Army Chief of Staff General Taylor first presented the concept of Flexible Response at a Joint Chiefs of Staff conference in Puerto Rico in March 1956. He posited how inflexible Massive Retaliation was because it focused solely on general nuclear war and ignored limited, non-nuclear contingencies.⁴⁸ The other chiefs read Taylor's paper and politely disregarded it. The decision was made to continue with the status quo.

On 9 July 1956, the Chiefs met with then Chairman of the JCS, Admiral Radford, to discuss the future procurement of each service's weapon systems. Once again, General Taylor offered his ideas on Flexible Response.⁴⁹ The other chiefs responded to his presentation with total silence, and even the Secretary of Defense did not offer a reply. Consequently, nothing happened. Later that year Secretary Wilson presented to the services a plan to reduce the upcoming DoD budget. Two billion dollars and ten percent of the overall manpower level were to be cut by the next fiscal year, causing concern for each service chief.

The issue came to a head in a National Security Council meeting with the President in attendance on 25 July 1957. After a presentation of the overall trend in military manpower and spending, each service chief spoke of his plan for the near future. Once again General Taylor proposed a change in national security strategy. He outlined the earlier threats and warnings that the Soviets had made concerning NATO issues related to Norway, Denmark, Greece, and Iceland. Taylor then elaborated on the increased likelihood of limited conflict with USSR. He recommended that each force be restructured to contend with both the possibility of general nuclear war and conflicts below nuclear war.⁵⁰ Each of the other service chiefs briefed their plans. At this meeting, no consensus could be reached and no decision was made. Consequently, the status quo remained.

General LeMay voiced his opinion on the subject of Massive Retaliation and superiority over the Soviet Union. He later wrote about his military philosophy and war-fighting doctrine during this time:

Of course, military superiority is itself subject to a great deal of judgement. How do we determine what superiority really means? We must first judge how a war is likely to be fought and, more important, how can we win that war. Then we can make valid judgements on superiority itself.

In this connection, I lean toward certain doctrines of warfare because my experience and study have taught me their validity. One such doctrine is that of the offensive. Victory far more often smiles on the side that attacks.

When the issue is joined there are five fighting doctrines I would suggest. First, take the war seriously. No business-as-usual attitude is worthy of a country willing to expend the lives of drafted young men. Second, fight to win as quickly as possible. Third, be as rough as necessary in order to win. Immaculate war is an impracticable dream. Fourth, be prepared to escalate to a general war. If not, stay out of limited war. A final overriding principle is that we must devote our major resources and attention to the most serious threat. To do otherwise is to gamble with our national and social existence.⁵¹

General LeMay believed he had America's best interests at heart, but his rationality was based on his parochial perceptions of when the United States would engage in armed conflict and how nuclear weapons would be employed by the political masters. LeMay was correct to place the highest emphasis on survival of the nation and to take that job seriously. However, he could not envision

America entering a conflict where there would be less than survival issues at stake for the United States and consequently, he could not comprehend a war where political leadership might have very little inclination to use nuclear weapons to resolve the conflict. By not advocating for forces other than strategic nuclear airpower, LeMay was gambling with those same young men he spoke of.

In October 1957, Secretary of State Dulles wrote in Foreign Affairs suggesting the inadequacies of the policy he had announced to the world only a few years earlier. He lamented the inflexibility of Massive Retaliation, suggesting that it was only suitable as a means of last resort. Finally, he posited 'In the future it may thus be feasible to place less reliance upon deterrence of vast retaliatory power.'⁵² Dulles's words forced several key players to re-evaluate their views regarding national security.

In February 1959, General Weyland spoke to the USAF Air War College about Flexible Response. In his opinion, total war represented the greatest danger to the United States, but was extremely unlikely. Rather, it was his opinion that limited war in areas of the world where the United States was least prepared was the most probable.⁵³ Weyland went on to describe the flexibility of tactical airpower to contend with limited wars. Furthermore, he postulated that only tactical airpower could deter limited war and that the 'forces of Strategic Air Command are dedicated to a single and inflexible purpose—the prosecution of an All-Out War. Their people and their equipment simply are not capable of or familiar with the many contingencies which arise short of that general conflict.'⁵⁴

Despite Weyland's position, TAC forces diminished throughout 1958 and 1959. In a letter to Chief of Staff General White, Weyland indicated that 'we must continue to maintain a capability for the use of conventional weapons, thus rounding out our ability to deal with any contingency which might arise...'⁵⁵ Furthermore, Weyland dissented from a recent Air Force Cold War Conference and wrote to White that:

*If he were willing to think solely as an Air Force officer he could not join a policy of replacing conventional weapons with nuclear weapons because it would make the Air Force job so much easier, but as an individual charged with upholding national policy Weyland could not accept a course of action that could eventually undermine national policy.'*⁵⁶

On retirement in 1959, Weyland stated that TAC could no longer support its missions. He also warned 'that the Pentagon's preoccupation with strategic bombing and long-range missiles may soon leave us unprepared to fight a limited war.'⁵⁷ General Weyland's power had dropped substantially and he could no longer influence decisions related to tactical airpower procurement.

By the spring of 1958, both the Navy and Marine Corps leadership shifted their security policy position to that of Generals Taylor and Weyland. Navy leadership agreed in principle to Taylor's premise, but was reluctant to commit. US admirals had seen great potential in nuclear-powered submarines and underwater-launched nuclear missiles.⁵⁸ Notwithstanding this, the three services agreed to the national policy change that reflected nuclear parity with the Soviets and established finite limits on nuclear power. According to Taylor, the Air Force still rejected the idea and clung to the policy of Massive Retaliation.⁵⁹ The ensuing debates were again elevated first to the Secretary of Defense and then the National Security Council. Again, General Taylor presented his views in both meetings, this time with the support of the Navy and Marine Corps. Generals Twining and White supplied the Air Force position. The Air Force point of view remained the status quo as far national security was concerned. Secretary of State Dulles did not provide the strong support that Taylor thought was likely.⁶⁰ The final decision was no change in the national security strategy. The 1960 budget was to be based on the same strategy as the previous years. The Air Force and strategic nuclear primacy prevailed as the dominant force until the end of the Eisenhower Administration. In 1961, General LeMay became Chief of Staff of the Air Force. By October, LeMay had replaced the last of the fighter

general commanders with bomber advocates such as General Everest (TAC) and General Smith Jr. (USAFE). The outcome was an Air Force whose operational commanders and most of the key Air Staff were 'ardent bomber generals.'⁶¹ Consequently, tactical airpower saw no increase in funding or emphasis until the Kennedy Administration took office.

MODEL III ANALYSIS

A Model III analysis reveals that the key decisions related to the development and procurement of airpower (tactical or otherwise) were significantly affected by prominent individuals whose jobs placed them in critical action-channels. Those four-star generals with duties directly related to the current national security strategy of Massive Retaliation had the greatest influence. Furthermore, a strong personality, combined with wartime experience and assertiveness, produced substantial results for General LeMay. Although General Weyland possessed both wartime experience and a strong personality, he was not in a position to significantly influence decision-making that corresponded to the strategy of Massive Retaliation.

The strong parochial biases and perceptions of an institution that emphasised strategic bombing also favored SAC and LeMay. Tactical airpower, although an important contributor to both World War Two and the Korean War, did not neatly fit into current airpower theory. Moreover, given the stakes of national security, it is easy to understand why Air Force leadership was principally concerned with deterring the worst-case threat to America. It is less easy to comprehend, however, why Generals Twining, White, and LeMay continued to support a force structure of predominantly strategic nuclear assets vice a balanced force structure as President Eisenhower had requested. There was plenty of evidence to show that Massive Retaliation had failed to provide credible deterrence for war below general nuclear war. Furthermore, the Air Force Chiefs of Staff stood alone against the other services in their view as to the correct course for American defense strategy. One plausible Model III explanation can be found in the central premise of Allison's third construct—power to control not only the action-channels, but also the key issues that flowed along those channels matter the most. To acquiesce on the policy of Massive Retaliation meant that the chiefs had to relinquish a portion of their strategic nuclear power for more conventional tactical power. The Army generals and Navy admirals stood to gain from a change in policy. By permitting a policy change, the chiefs of staff would be saying that forces other than strategic airpower were essential for deterrence. This change would then entail a reduction in money and emphasis for strategic airpower resulting in a decrease of power and influence. Moreover, to give up power would also result in questioning the rise to power and the independence that the post-World War Two Air Force leadership had propagated so vigorously. Too, the rise of Soviet nuclear power had much to do with these changes.

Finally, although President Eisenhower possessed the ultimate responsibility for ensuring the survival of the United States, he relied upon his service chiefs to provide advice for national security issues. He had a twofold requirement for the Defense Department—preparedness for general war and lesser hostile actions. He also strongly desired a balanced budget. The Air Force chiefs of staff focused solely on general war and presumed that strategic nuclear airpower could also contend with limited wars. By dogmatically following the strategy of Massive Retaliation and denying the strategy of Flexible Response during the later half of the 1950s, the Air Force chiefs largely disregarded conventional tactical airpower, which would become so vital in the Vietnam War. In spite of strong counter-arguments from TAC and the other services, the USAF chiefs of staff maintained their position and therefore their power to the detriment of conventional tactical airpower.

One can speculate that had senior Air Force leaders advocated a more balanced approach for developing and procuring airpower (strategic and tactical), a more comprehensive deterrence and

war-fighting strategy might have evolved during the 1950s. Furthermore, had the Air Force (and the other services) approached strategy making with the premise of equality among the services, there may have been less of a desire to be the dominant service. In General Weyland's words: 'All fighting services are essential in a theatre of operations. No one service exists solely for the support of another. Rather each force—air, ground or sea—contributes its optimum and specialised capabilities toward achieving the over-all mission of the theatre commander.'⁶² If one accepts the mandate that the Air Force Chiefs of Staff (Generals Twining, White, and LeMay) should have provided the best possible advice to national command authorities, then the parochial advice (or with-holding of balanced advice) that the Chiefs provided can only be considered at best prejudicial counsel. Balanced guidance would have meant developing forces that could contend with a broader spectrum of conflict, which would have translated into a more credible deterrent and war-fighting capability similar to that procured by the Air Force after 1965. By not providing balanced guidance from 1953 to 1961, senior Air Force leadership restricted the development of conventional tactical airpower, which proved lacking during the initial stages of the Vietnam War and consequently resulted in unnecessary loss of life and resources.

CHAPTER 6

CONCLUSIONS

The question of whether or not and to what extent the United States Air Force neglected tactical airpower between the Korean and Vietnam Wars has been examined from three different analytical perspectives. While each chapter alone does not complete the answer, each provides supportive evidence as to the reasons that contribute to an overall answer. In an attempt to explain why a decision occurred during the 1950s, each of Allison's three models offer alternative methods of investigation or points of view. Each construct consists of a set of assumptions and categories that influence the approach to an answer. Three levels of examination produce varying conclusions, which combined furnish a more comprehensive answer than any one framework taken individually.

The Model I analysis offered conclusions based on choices made at the grand and strategic levels. The decision-making process of the 1950s caused the United States to accumulate alternative courses of action and rank them according to their value or consequence. America's rational choice consisted of simply choosing the best-perceived alternative and that choice was nuclear deterrence. Only the strategy of Massive Retaliation could provide viable deterrence against communist aggression while minimising the overall price to the United States, which contributed to President Eisenhower's stated policy. In such a national security strategy, a Model I answer postulates that conventional tactical airpower was too expensive and not likely to contribute substantially to the national policy. Therefore, tactical airpower was given lower priority than the dominant strategic airpower weapon systems.

Allison's second model provided substantially different conclusions from the first. In spite of the strategic emphasis on Massive Retaliation, a plethora of organisations positively (albeit minimally) influenced tactical airpower as a result of their standard operating procedures. Organisations such as TAC, the NACA, and the ARDC offered several improvements to tactical conventional airpower. During the 1950s, aircraft and weapons were developed and produced that contributed to the tactical missions. The Model II examination also showed how many of the Air Force organisations also tended to satisfice or compromise on their decisions regarding tactical aircraft and weapons, which resulted in the production of weapon systems that may not have contributed best. Although the F-105 and AIM-4 Falcon (as with others) were marginally successful, they were not designed for conventional warfare.

More importantly, the standard operating procedures that were in place or created during the period in question led to the ability to rapidly shift emphasis to these weapons systems and produce more viable systems witnessed in the latter 1960s and 1970s. Tactical training (although tailored toward a European conflict) increased in frequency and enabled tactical airpower to achieve noteworthy advances during the 1950s and early 1960s. Despite interservice rivalries at the organisational level, the Air Force's routines helped ensure that conventional combat power was equal to if not better than any other air force at the tactical level. A Model II inquiry indicated that at the organisational level, tactical conventional airpower was not entirely neglected.

A Model III analysis suggested yet a third conclusion, unlike the first two. This examination showed that the key decisions related to the development and procurement of airpower were significantly influenced by the prominent individuals whose job positions placed them in the critical action-channels. Of the four-star generals discussed, those who had duties directly related to the current national security strategy of Massive Retaliation had the greatest influence. Furthermore, a strong personality combined with wartime experience and the willingness to use his power produced substantial results for General LeMay. The strong parochial biases and perceptions of an institution that emphasised strategic bombing as the proper application of airpower also favoured SAC and LeMay. General LeMay and the other USAF chiefs of staff during the period in question were able to maintain their power despite credible alternatives proposed by the other service chiefs and TAC Commander General Weyland. Power to control not only the action-channels, but also the prevalent issues and funding that flowed along those channels matter most. Despite President Eisenhower's twofold objective on possessing forces to contend with general nuclear war and conflicts below general war, the Air Force leadership primarily promoted strategic airpower to handle the worst-case scenario. In an effort not to diminish their power, the Air Force chiefs of staff during the 1950, and early 1960s presented prejudiced counsel to the National Command Authorities and Congress. That biased advice resulted in airpower decisions, which overwhelmingly favoured strategic missions and led to the decline of not only tactical airpower, but also the leaders who advocated tactical conventional airpower.

From the above summary of the three levels of analysis, one can safely conclude that tactical conventional airpower was impeded between the Korean and Vietnam Wars. At the systemic level, national security policy and constrained fiscal expenditures prevented conventional tactical airpower from maintaining its past position of importance within the Air Force composition. Even at the organisational level, emphasis on strategic nuclear weapons drew much-needed specialists and funding away from conventional tactical airpower programs (tactical airpower received from two to four percent of the Air Force budget between 1955 to 1958). Of the weapon systems that did support tactical conventional missions, many sub-organisations tended to compromise on their final products, resulting in systems which nominally advanced conventional tactical airpower. Moreover, the tactical training, which was TAC's finest accomplishment, did not occur often enough nor adequately emphasised conventional weapons, resulting in only marginal advances for tactical airpower employment. Finally, at the individual level, the parochial biases on the three USAF chiefs of staff led to the slanted counsel offered to the national command authorities and Congress. Despite the fact that Eisenhower requested forces to contend with both general war and limited war, the Air Force generals (with the exception of Weyland) were deficient in their duties to sufficiently advise the NCA on the proper Air Force structure, which should contend with the entire spectrum of conflict. Unfortunately, this biased advice repressed tactical conventional airpower in order to promote strategic nuclear missions. From 1953 to 1961, tactical conventional airpower was placed a distant second behind the strategic nuclear missions of the day. However, more than any other factor, senior Air Force leadership bears the responsibility for the impedance of tactical conventional airpower, which resulted in a greater than necessary loss of lives and resources during the opening months of the air war in Vietnam.

IMPLICATIONS FOR THE FUTURE

Current military strategists and leaders oftentimes do not possess the necessary experience or vision to accurately plan for future contingencies or war. Therefore, these individuals must study the past in order to learn history's 'lessons' within the context of the time studied. By studying historical lessons, current students of the military art may gain a portion of the experience that is necessary for planning and avoid the pitfalls of the past. This thesis offers several (but not all) of the lessons from the period in question, which have implications for the future. The 1950s offer valuable insights into the development and procurement of airpower, which provide lessons for future policy planning.

First, policy decisions constructed in peacetime have significant impact on procurement outcomes, which in turn affect wartime operations. With the growing perception that future conflict will tend to be short (weeks or months versus years), there may not be time during war to obtain weapon systems needed for that war. Therefore, Air Force weapon systems should be procured so as to be able to contend with the broadest spectrum of conflict within the fiscal constraints of the DoD budget. Invariably, military fiscal desires will be greater than the Congressionally mandated financial outlays. Consequently, Air Force strategists should ensure that peacetime procurement decisions are crafted to balance war-fighting capabilities within the limits of airpower. Air Force capabilities should be structured to deter and win military contingencies from general war to limited or small-scale conflicts.

Second (and related to the first implication), Air Force policy should not be based upon only one weapon system or concept of war. During the period of Massive Retaliation, the Air Force solely relied upon that policy to guide its decision-making for war; its senior leaders postulating that nuclear forces were all that were necessary to contend not only with general war, but also anything less than general war. The lack of emphasis on tactical conventional airpower caused deficiencies in fighter aircraft designs, inadequacies in conventional munitions, and sub-optimal tactical training. These deficiencies resulted in a greater than necessary loss of life and resources. Future strategists should not base over-all procurement policy on weapon systems that restrict future airpower employment options, which in turn constrain airpower's contribution to national security strategy. For example, if future Air Force procurement decisions include exclusive investments in stealth technologies and weapon systems at the expense of non-stealth alternatives, then those decisions risk possibly constraining airpower's capabilities in war when a counter to stealth is developed. Similarly, investing predominantly in unmanned combat aerial vehicles (UCAVs) as the sole replacement for manned aircraft may also risk limiting the future application of airpower in some portions of the spectrum of conflict.

Third, parochial priorities can hinder strategic operations that are designed to achieve national security objectives. There should not be a desire to place the Air Force (or any service) above the rest in order to ensure funding priority. Rather, each service should work jointly to ensure the Department of Defense as a whole can meet the objectives of National Command Authorities. The JCS should be the primary agent responsible for overall DoD strategic procurement policy, which should be divorced from parochial service biases. There are areas where one service may have an expertise over the other services (e.g. air superiority, amphibious employment, or underwater operations), but that expertise is only one aspect of warfare. To ensure the preparation for the broadest spectrum of warfare, each service should contribute to the total spectrum in various, specialised ways.

Fourth, and most important, the individual (such as LeMay) remains the vital element in the Air Force war-making capability. In this case, Model III explanations appear to be the key factors affecting tactical conventional airpower decision-making during the 1950s. At the highest levels, USAF generals determine the policy of the service and therefore the weapon systems developed and procured. These

individuals should base their decisions on past combat experience, future capabilities, and the needs of the nation. At lower levels, individuals should continue to exhaustively research the possible improvements to current systems. Standard operating procedures are great for ensuring complex processes are conducted on a routine basis, but that is the minimum effort required. All means should be sought to improve current capabilities. At the lowest level, every individual who contributes to the war-fighting ability of the Air Force should practice and train in the most realistic manner feasible. In each war during the twentieth century, training (not technology) set American airpower above its rivals. Reduced realistic training opportunities as a result of extended operations in 'no-fly zones' or diminished funding for exercises decreases American airpower's *raison d'être*. Often, realistic training ensures US airpower remains far above any potential rival.

If the United States Air Force is committed as an institution to continued excellence, then we should study our history and learn both the commendable and unsound aspects of our past in order to succeed in the future. War is a contest of extreme importance; the survival of the nation may be at stake. At the minimum, valuable lives and resources may be lost. Preparation for war in peacetime is equally momentous. The weapon systems developed and procured will influence the outcome of future wars. The achievement of nationally directed military objectives deserve the most balanced advice and approach for successful accomplishment. The individual remains the critical link in the long chain of developing and employing complex weapon systems. Victory depends on exceptional people, technology, and concepts. Humans are not perfect. Combat provides the best school for learning—and without combat, history endures as the first step toward gaining that experience. Every military strategist should study history so those past mistakes do not become repeated in future conflicts.

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NOTES

- 1 The NSC consisted during the 1950s of the President, Vice President, the Secretaries of State, Defense, and Treasury, the Directors of the Office of Civil and Defense Mobilization and the Bureau of the Budget. The Chairman of the JCS is normally the only military member to attend NSC meetings. The JCS is comprised of a Chairman, and the Chiefs of Staff of each respective Service. Maxwell D. Taylor, General, US Army, The Uncertain Trumpet (New York: Harper and Brothers, Publishers, 1959), 80.
- 2 Graham T. Allison, The Essence of Decision: Explaining the Cuban Missile Crisis (New York: Harper Collins Publishing, 1971), 145.
- 3 Ibid., 162.
- 4 Ibid., 164.
- 5 Ibid.
- 6 Ibid., 166.
- 7 Ibid., 168.
- 8 Ibid.
- 9 Ibid., 169.
- 10 Ibid.
- 11 Ibid., 170.
- 12 Ibid., 171.
- 13 As quoted in Futrell, Ideas, 424.
- 14 Ibid., 425.
- 15 Ibid.
- 16 Department of Defense, Semiannual Report of the Secretary of Defense, January to June 1954 (Washington D.C.: United States Government Printing Office, 1954), 6.
- 17 Senate, DoD Appropriation Hearing for 1954, Part 2 (Washington D.C.: United States Government Printing Office, 1954), 1890-94.
- 18 The 137-wing goal was based on 7 heavy bomber, 28 medium bomber, 4 heavy reconnaissance, 5 medium reconnaissance, 2 fighter reconnaissance, and 8 strategic fighter wings in the strategic air forces; 34 fighter-interceptor wings in the air-defense forces; and 2 tactical bomber, 4 light bomber, 21 fighter-bomber, 6 day-fighter, 5 tactical reconnaissance, 4 heavy troop carrier, and 7 medium troop carrier wings in the tactical air forces. Futrell, Ideas, 426.
- 19 Maxwell D. Taylor, The Uncertain Trumpet (New York: Harper & Brothers, Publishers, 1959), 69.
- 20 Ibid., 85.
- 21 Ibid., 86-7.
- 22 According to the authors, Acheson and Nitze were the principal creators of NSC-68. Gerard H. Clarfield and William M. Wiecek, Nuclear America: Military and Civilian Nuclear Power in the United States 1940 – 1980 (New York: Harper & Row, Publishers, 1980), 139 – 40.
- 23 Ibid.
- 24 Ibid., 137.
- 25 Mike Worden, Col, USAF, Rise of the Fighter Generals: The Problem of Air Force Leadership 1945 – 1982 (Maxwell AFB, Ala: Air University Press, 1998), 67.
- 26 History, Interview with Gen. Thomas D. White on 27 June 1961 by Joseph W. Angell, Jr. and Alfred Goldberg, 1, located at the United States Air Force Historical Research Agency, Maxwell AFB, Ala, call number, K239.0512-606.
- 27 History, Interview with Gen. O. P. Weyland by Dr. James C. Hasdorff and Brig Gen Noel F. Parrish on 19 November 1974, 255 – 6, located at the United States Air Force Historical Research Agency, Maxwell AFB, Ala, call number, K239.0512-813.
- 28 Gen Curtis E. LeMay, address to Major USAF Commanders' Conference, 28 – 30 June 1957, in History, Strategic Air Command, July – December 1957, vol. 2, chap. 1, doc. 2, located at the United States Air Force Historical Research Agency, Maxwell AFB, Ala.
- 29 Futrell, Ideas, 448; Worden, 76.
- 30 Worden, 74.
- 31 Taylor, 23 – 6.
- 32 As quoted in Futrell, Ideas, 448.
- 33 Taylor, 48 – 55.
- 34 Futrell, Ideas, 448.
- 35 Walton S. Moody, Building a Strategic Force (Washington D.C.: Air Force History and Museums Program, 1996), 365; Worden, 79.
- 36 General Curtis E. LeMay and Major General Dale O. Smith, America Is In Danger (New York: Funk and Wagnalls Publishing, 1968), 157; Futrell, Ideas, 464.
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- 41 Worden, 81.

- 42 Futrell, Ideas, 398.
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44 House, Department of Defense Appropriations for 1957, Hearings, 84th Congress (Washington D.C.: United States Government Printing Office, 1957), 120 – 21.
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46 Senate, Department of Defense Appropriations for 1958, Hearings, 84th Congress (Washington D.C.: United States Government Printing Office, 1957), 341.
47 History, Interview with Gen. O. P. Weyland by Dr. James C. Hasdorff and Brig Gen Noel F. Parrish on 19 November 1974, 100, located at the United States Air Force Historical Research Agency, Maxwell AFB, Ala, call number, K239.0512-813.
48 Futrell, Ideas, 455.
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50 Ibid., 48 – 51.
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52 John F. Dulles, "Challenge and Response in United States Policy" in Foreign Affairs, October 1957, 24.
53 General O. P. Weyland, "Air War College Presentation" given on 18 February 1959, text located at the United States Air Force Historical Research Agency, Maxwell AFB, Ala, call number, K239.716259-19.
54 Ibid.
55 As quoted in Futrell, Ideas, 461.
56 Ibid., 461 – 2.
57 As quoted in Worden, 85.
58 Taylor, 58.
59 Ibid.
60 Ibid., 65.
61 Worden, 89.
62 General O. P. Weyland, "Tactical Airpower Worldwide" in Air Force Magazine, July 1955, 38.

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Unmanned Systems:

A Genuine Revolution in Military Affairs?

By Major S G Heath

The thing was incredibly strange, for it was no mere insensate machine driving on its way. Machine it was and...it picked its road as it went striding along. I began to ask myself what they could be. Were they intelligent mechanisms? Such a thing I felt was impossible....The decapitated colossus reeled like a drunken giant; but it did not fall over...and the thing was now but a mere intricate device of metal whirring to destruction. It drove along in a straight line incapable of guidance¹
(H G Wells *The War of the Worlds*)

In the early 1980s theories were put forward, by Soviet General Ogarkov amongst others, that NATO, in particular the United States, was undergoing a Revolution in Military Affairs (RMA).² It was argued that the precarious balance of conventional forces in Europe and the fact that the use of nuclear weapons was immoral and practically impossible, was causing the US to bring the Cold War to an end, by developing high technology conventional weapons that its Warsaw Pact adversaries couldn't match.³

The ability of protagonists to conduct military operations, without danger to one's own personnel in the medium term, is not such a fanciful notion and one which merits careful examination

Twenty years later, it is believed that this revolution is still ongoing and whilst a precise definition of the RMA continues to elude analysts, there is no doubt that warfare is conducted in a manner very different from that envisaged during the Cold War, due in most part to a military-technological revolution. Indeed, US forces continue to seek 'dominant battlefield knowledge, dominant manoeuvre, precision strike capability at long range and full dimensional protection.'⁴ However, these are still activities conducted largely by human beings, manning a wide array of platforms in three environments (maritime, air and land), based on decisions made by human commanders.⁵ In turn, those decisions are based on a wide array of factors ranging from the strategic to the tactical and include Rules of Engagement (ROE), the need for minimum casualties and the nature of the operating environment. But what if we were to remove human beings from the battlespace altogether?

The aim of this paper is to examine the extent to which the current RMA will be transformed by the introduction of unmanned systems, from the remotely operated to the genuinely autonomous. In doing so, it conducts a re-appraisal of our most basic and fundamental military concepts, given that the reality of risk-free war will pose serious questions about the nature of future conflict. While combat as envisaged by H G Wells is beyond the scope of this paper, the ability of protagonists to conduct military operations, without danger to one's own personnel in the medium term, is not such a fanciful notion and one which merits careful examination. As noted by the Pentagon in 1984:

*'Instead of fielding simply guided missiles or remotely piloted vehicles, we might launch completely autonomous land, sea and air vehicles capable of complex, far ranging reconnaissance and attack missions...Using this new technology, machines will perform complex tasks with little human intervention, or even with complete autonomy...The possibilities are quite startling, and could fundamentally change the nature of human conflicts.'*⁶

The analysis will commence with some definitions, then examine of the future spectrum of conflict. The paper will then outline the type of unmanned systems that are likely to be operational in each of the three environments within a specified timeframe, in order to assess their impact on a number of considerations including force structures, human resources and doctrine. Two scenarios will be studied to see if the utility of unmanned systems remains constant throughout the spectrum of conflict and whether their resulting employment is likely to alter our accepted beliefs and modus operandi. From this examination will be determined the extent to which the introduction of such systems will transform the ongoing RMA.

Of course, the idea of revolution as opposed to evolution is that the change is rapid and fundamental in nature, rather than a gradual development. What will become clear from the analysis is that, despite radical technological advances, unmanned systems will not be introduced wholesale and overnight, but will be gradually introduced as overall system technologies and enablers mature. This process will still cause fundamental alterations to our structures and doctrine, but the ethical debates stimulated by the introduction of unmanned and particularly autonomous systems will also ensure that the human is not totally removed from the battlespace within a matter of a few decades. Therefore, it can be said that the unmanned RMA will be of a continuous type rather than a discontinuous event, as experienced with the introduction of gunpowder, aircraft and nuclear weapons.

DEFINITIONS

Many different descriptions of the RMA exist, encompassing not only doctrinal and technological aspects, but also requirements for organisational and industrial structures, as well as political and information factors.⁷ It is not this paper's task to comment on the merits of these arguments, but it is essential to give the revolution a basic definition. Andrew Marshall, Director of the Office of Net Assessment in the US Department of Defense, usefully defines the RMA as follows:

*'...a major change in the nature of warfare brought about by the innovative application of new technologies, which combined with dramatic changes in military doctrine and operational and organisational concepts, fundamentally alters the characteristics and concepts of military operations.'*⁸

Similar levels of debate concern the definition of an unmanned system. It has been argued that cruise missiles, navigating themselves to a pre-designated target after launch, or brilliant munitions which can loiter above an engagement area and then seek and destroy targets, are examples of such systems.⁹ However, these are weapons, and no human beings apart from suicide bombers and kamikaze pilots are likely to ride a missile or munition all the way to the target. What is more helpful is the definition that an unmanned system is one where human beings have in the past been required to operate the platform, but can now be replaced. Maritime vessels, both surface and sub-surface, land vehicles or aircraft, both fixed and rotary wing can be supplanted either by human operators remotely controlling platforms or by utilising autonomous technologies.

In addition, new systems that are smaller than human beings are under development and could fundamentally impact the way in which war is conducted. Systems such as micro Unmanned Aerial Vehicles (UAVs), insectoids and mini Unmanned Ground Vehicles (UGVs) will, given advances in computer processing power, energy sourcing and Novel Physical Properties (NPP), be able to carry out tasks that are impossible for human beings to conduct and with their introduction, the dimensions and scale of warfare are likely to change. The paper will thus restrict its consideration to these unmanned 'platforms' and, to the smaller-than-man-technologies rather than 'weapon systems'.

It is the introduction of machines devoid of human control, which poses the greatest threat not only to our accepted notions of warfare, but of life as a whole

Additionally, it is necessary to define autonomous systems. Systems with Artificial Intelligence (AI) attempt to replicate human cognition, behaviour and the capability to learn from mistakes. A number of techniques are used to achieve this, but the result is potentially an autonomous system that is capable of going out and achieving an assigned mission without further human instruction. It is the introduction of machines devoid of human control, which poses the greatest threat not only to our accepted notions of warfare, but of life as a whole. As de Landa recognised:

*'...the moment autonomous weapons begin to select their own targets, the moment the responsibility of establishing whether a human is friend or foe is given to a machine, we will have crossed a threshold and a new era will have begun for the machinic phylum.'*¹⁰

However, there is little consensus on a definition of 'autonomous system', despite much academic debate.¹¹ For the purposes of this paper, we shall define it as a system that 'will be equipped with sophisticated computers and sensor systems that will allow the robot to make its own decisions without any direct human involvement' and obviously, systems can have differing degrees of autonomy, based on the micro-processing power available.¹² It is they along with 'remotely controlled systems' that may be described as the two main subsets of the more generic 'unmanned system'.

SPECTRUM OF CONFLICT

Any consideration of the impact of these new and revolutionary unmanned systems must be carried out against the conditions provided by the full spectrum of conflict. British Defence Doctrine recognises a 'spectrum of tension' that stretches from warfighting at one extreme to conflict prevention at the other, in a linear arrangement.¹³ However, the Army's Directorate General of Development and Doctrine sees a rather different spectrum existing from 2015 onwards.¹⁴ Firstly, it recognises that 3 different types of operation may be in progress in a theatre of operations at any one time and that secondly it is possible to move rapidly about the spectrum without recognisable increases or decreases in intensity. This reflects the fact that warfighting can take place within peace enforcement and peacekeeping scenarios, while those types of operation may take place on the periphery of a high intensity engagement.

Today's conflicts may become, and in the near future will certainly be, far too deadly for human beings to survive on the battlefield

This thesis is supported by General Krulak's vision of a "three block war".¹⁵ Opponents will be similarly diverse: they may be conventional armed forces, or groups of 'soldiers' in loose organisations, with tenuous allegiances and asymmetric modus operandi and may be indistinguishable from non-combatants.¹⁶ Both types of opponent will be well equipped, given the proliferation of advanced technology and a global arms market and thus will present a very credible threat. Nevertheless, they will also seek to offset any technical advantage by breaking moral and ethical codes, through use of civilian infrastructure and society to hide military equipment and activities. Furthermore, an increasing number of operations will take place in complex terrain, particularly urban and semi-urban areas, making the effective targeting of military campaigns and protection against enemy action all the more difficult, as events in Former Yugoslavia, Somalia and Afghanistan have demonstrated. Therefore, unmanned systems will be required to operate in a diverse spectrum of conflict against capable opposition, demonstrating utility across a range of military operations, without having to re-adjust force structures as the scenario evolves.

It is thus the requirement of this paper to look beyond 2015, into an era when operations are taking place within this new spectrum of conflict. While writers have prophesised a world in which warfare is conducted solely by robots, this remains science fiction and is not a realistic reflection of the technological advances that will be made in the foreseeable future. Given that a number of important UK equipment programmes will be approaching the latter stages of their useful lives in 2030 and require replacement capabilities, then it is sensible to use that as the date at which serious consideration should be given to the widespread employment of unmanned systems.¹⁷

UNMANNED SYSTEMS

Following early attempts to deploy pilotless aircraft in both World Wars, unmanned systems were largely disregarded by equipment designers until the 1960s and 1970s, when the Israelis and Americans led a resurgence in their development, as a result of the Arab-Israeli and Vietnam wars. With parallel advances in remotely controlled submersible craft for underwater exploration and attempts at building crewless tanks and robotic legged-vehicles, interest in unmanned systems has continued to grow and given the necessary enabling technology, the opportunities afforded by such platforms are multiplying rapidly. Fulsang cites four major factors as causes of the unmanned revival:

‘Demographic and economic trends, the balance between quantity and quality in conventional forces, the increasing lethality of modern weapons, and the spread of international terrorism.’¹⁸

Firstly, due to ageing populations and the negative effects of increasingly liberal and affluent societies, the recruit base of most developed countries is shrinking. It is believed that the introduction of unmanned systems could offset this, by reducing the levels of manpower required. Secondly, these systems are viewed as one of the most effective methods of maintaining the qualitative edge over numerically superior opponents and in doing so will contribute to the ‘full spectrum dominance’ that the US Armed Forces aspires to, in the 2020 timeframe.¹⁹ Thirdly, the battlefield of the future is not one in which human beings can be expected to operate effectively. Not only will the tempo of operations created by the information explosion be such that they will be unable to operate for sustained periods, but as Shaker and Wise point out:

Today the U.S. Navy has a deep submergence unmanned vehicle in Hawaii helping to recover the Ehime Maru from crushing depths far too deep for humans to work



Tomorrow's soldier will go to war with tiny aircraft in his backpack that he will be able to fly ahead of him to smell, see and hear what lies over the hill or inside the next building

*'If unconstrained, today's conflicts may become, and in the near future will certainly be, far too deadly for human beings to survive on the battlefield. The lethality of modern weapons, including NBC munitions, hypervelocity missiles, smart bombs, lasers and other high-technology killing mechanisms, are rapidly eroding what an individual soldier's initiative or heroics can contribute towards winning or losing....Clearly, much of the future battlefield will be too hazardous for people to operate in.'*²⁰

At the same time, the tolerance of Western societies towards casualties, combatant and non-combatant, friend and foe alike, is decreasing. While recent campaigns have encouraged the idea that risks in conflict can be minimised, high intensity warfare can quickly generate a considerable number of casualties. In this scenario, the advantages of unmanned systems are obvious. Finally, the spread of international terrorism, more relevant now than ever, has meant that there are an increasing number of mundane and routine security responsibilities to be undertaken. These could be carried out by unmanned systems. As US Navy Secretary, Gordon England, has stated, they are exactly suited to conduct what are termed the D3 tasks:

*'In my judgment, unmanned systems have the same transformational potential as space. We already have unmanned systems typically doing the dull, dirty and dangerous [D3] activities that humans shun or are unable to perform, and they have generally performed well in these roles. For example, today the U.S. Navy has a deep submergence unmanned vehicle in Hawaii helping to recover the Ehime Maru from crushing depths far too deep for humans to work.'*²¹

TECHNOLOGY

Based on this renewed interest, unmanned systems will take advantage of progress in a number of technology areas. Firstly, the development of Micro Electro-Mechanical Systems (MEMS) means that miniature systems could soon be used in a wide range of applications. As James Adams has stated:

*'MEMS opens a window on to a new generation of technology that will literally transform the battlefield. Tomorrow's soldier will go to war with tiny aircraft in his backpack that he will be able to fly ahead of him to smell, see and hear what lies over the hill or inside the next building. Additional intelligence will be supplied by sensors disguised as blades of grass, pockets of sand or even clouds of dust.'*²²

Whilst sensors the size of dust particles will not be available in this paper's time frame, micro UAVs have already been developed which could be used to give individual soldiers their own unmanned surveillance capability allowing them to 'look around the corner', without being exposed to danger.

We are faced with the prospect of equipment that does not require soldiers to operate it, but may be defeated if humans do attempt to exert control in any direct way

By 2030 these UAVs will still only be capable of short duration and distance operations, due to the immaturity of NPP and power source technology. However, as Knoth has pointed out, this area of micro development is not just restricted to UAVs:

*'A new concept for land-based military operations using small autonomous vehicles or 'insectoids' has weapons applications which cover both the lethal and non lethal weapons sectors, but also reflects trends in civilian technology and parallel developments already underway for air and space borne systems. Such robot systems are smaller, less complex and cheaper than their manned equivalents.'*²³

Secondly, this proliferation of micro systems and the development of numerous other platforms will generate the requirement for continued advances in microchip technology. Its continued development will be necessary, because human beings will no longer be able to deal with the amount of data being presented to them. They will have to give increasing amounts of authority to machines in order to make fully informed decisions and as Thomas Adams has stated:

*'...the military systems (including weapons) now on the horizon will be too fast, too small, too numerous, and will create an environment too complex for humans to direct....Weapons and other military systems already under development will function at increasingly higher levels of complexity and responsibility and increasingly without human intervention....We are faced with the prospect of equipment that does not require soldiers to operate it, but may be defeated if humans do attempt to exert control in any direct way. It is easy to see a steadily decreasing role for humans in direct combat as the 21st Century progresses.'*²⁴

Thus computers capable of conducting millions of calculations per second, far in excess of the abilities of the human brain, will be required, so that unmanned systems can carry out very complex tasks and decision-making, without reference to human operators. It is in this development of smart computers and AI systems that the greatest steps towards genuinely autonomous platforms will be made. However, there is a considerable debate as to the speed at which advances in AI will be achieved, although in the mid term, its utility in 'surveillance, target acquisition, autonomous combat vehicles, navigation, multi-sensor fusion, terrain analysis, signal processing, weapons maintenance aiding devices, training devices, logistic support, image interpretation, tactical decision aids and simulation' is undisputed.²⁵ Whilst a fully autonomous system, capable of replicating human thought processes in their entirety could not be fielded by 2030, their limited introduction over the next 30 years will generate considerable ethical debate.

The third important technological area is that of communications. As Henley has observed: 'It is taken for granted that such devices [unmanned systems] will be tied into our battlefield information networks'.²⁶ This will hugely increase the demand for bandwidth, in order to relay information around the battlespace. Whilst data compression techniques, allied to the use of burst transmission, will go some way to satisfying this requirement, remote control of some systems such as Unmanned Underwater Vehicles (UUVs) will be difficult, given that water is a difficult medium through which to pass radiowaves and light and acoustic signals are relatively limited in range and available bandwidth. The result will be an increasing trend towards semi-autonomous systems that will reduce the requirement for Command and Control (C2) information to be passed from controlling stations to the platforms themselves. It is also widely recognised that C2 links are vulnerable to interference, both from opponents' intentional jamming and other factors such as range, weather and atmospheric. As a result, maintaining guaranteed control over systems, especially those with a degree of autonomy or with weapons payloads, is of particular concern and therefore will require:

*'...a pilot's associate, an onboard expert system...[that] if the datalink is lost, it could make logical decisions to keep the aircraft [or any other unmanned system] safe until the electronic tether is restored.'*²⁷



Autonomous Underwater Vehicle (AUV)

It is believed that semi-autonomous sub-surface craft will be in service by 2030 and will fundamentally alter the nature of maritime warfare

MARITIME SYSTEMS

In the maritime environment, developments in unmanned systems have focused on sub-surface operations. Currently, submarine operations are constrained by the physical size of craft required for placing personnel underwater, as well as the physiological and psychological effects imposed by long periods of isolation and sensory deprivation. Unmanned sub-surface operations would involve Autonomous Underwater Vehicles (AUVs) or UUVs undertaking missions of reconnaissance, sensor and weapon deployment, minefield mapping and clearance, as well as acting as intelligent anti-submarine warfare decoys.²⁸ Small craft capable of long duration deployments could be deployed singly or in fleets and be controlled by either surface vessels or manned submarines. Therefore, the initial fielding of UUVs will focus on operational scenarios in which submarines are particularly vulnerable, such as littoral operations where waters are shallow and targets are usually protected by minefields. They could also be deployed as part of the escort group to a high value asset such as an aircraft carrier and be able to 'provide a broad spectrum of data to the battlegroup'.²⁹ Furthermore, the US Navy is developing the 'Manta', an AUV relying on AI to conduct many of its operations.³⁰ Therefore, it is believed that semi-autonomous sub-surface craft will be in service by 2030 and will fundamentally alter the nature of maritime warfare. Nevertheless, there will still be a requirement for manned submarines, particularly for the control and launch of nuclear weapons.

Progress is not restricted to the sub-surface. Until 1997, the US Navy was actively pursuing the arsenal ship concept. Such a vessel would carry 500 missiles of varying types and launch them in support of both air and land operations, whilst only having a crew of 50 personnel. Some go further and state that



Northrop Grumman's X-47A Pegasus UCAV

It is the development of Unmanned Combat Aerial Vehicles (UCAVs) that will form the basis of the unmanned revolution in 2030. These systems could fundamentally change the way in which airpower can be employed and will relieve manned aircraft of the need to conduct such D3 tasks as 'monotonous long-range flights, high-risk raids on enemy air defenses and forays into areas contaminated by biological or chemical weapons'

the vessel could be fully automated. However, reservations exist about the employment of so few personnel on such a valuable asset:

*'the concern has been expressed that small crews could seriously degrade damage control capabilities. Immediate damage control measures are often essential to the survival of a combat vessel in the event it sustains damage during combat. With a minimal crew on board the arsenal ship, questions remain unanswered as to its capability to effectively control combat damage or fire and flooding.'*³¹

Therefore, the arsenal ship would need to be protected as part of a naval battlegroup but, correctly positioned and defended, could contribute considerable firepower to both tactical land fires and strategic air operations. The advantage of operating such a vessel lies in a reduction in costs. A cut of over 70% or indeed the total elimination of crew would produce 'a life-cycle cost 50% less than that of a naval combatant' as well as simplify operational replenishment routines.³² However, it is not believed that an arsenal ship would fundamentally change the nature of naval operations. While the vessel could go

some way to replacing the aircraft carrier, as the US National Defense Panel pointed out,³³ the introduction of the JCA and the US conversion of existing Trident submarines to carry cruise missiles, would indicate that it is unlikely the arsenal ship will be deployed in the mid term.³⁴

AIR SYSTEMS

Conversely, the future for UAVs is bright, with systems employed in a wide variety of roles. These range from providing the individual soldier with an immediate over-the-hill surveillance capability, to the conduct of very high-level, long-endurance operations from fixed home territory sites, fulfilling a number of intelligence-gathering, communications and offensive and defensive electronic warfare tasks. Additionally, short-range surveillance and reconnaissance UAVs, which have been operating from naval vessels since before the Gulf War, will continue to do so. However, it is the development of Unmanned Combat Aerial Vehicles (UCAVs) that will form the basis of the unmanned revolution in 2030. These systems could fundamentally change the way in which airpower can be employed and will relieve manned aircraft of the need to conduct such D3 tasks as 'monotonous long-range flights, high-risk raids on enemy air defenses and forays into areas contaminated by biological or chemical weapons',³⁵ as well as 'anti-access missions'.³⁶ As Andrew Krepinevich, the head of the Center for Strategic and Budgetary Assessments has explained:

*'The term refers to an enemy's ability to use cruise missiles to target U.S. air bases or sea lanes near a battle ground, blowing up planes or missiles before they even take off. That would nearly cripple short-range U.S. fighter planes, which need access to forward bases to be effective. UCAVs might be part of the answer for how you deal with that, to the extent that you take the person out of the aircraft, you should be able to build these things to go much greater distances.'*³⁷

UCAVs will be able to operate at speeds and manoeuvre in ways that manned aircraft cannot. Human pilots can endure a maximum force of 9G, whilst remotely piloted versions of manned aircraft, such as the F102 target drone, can achieve 12G. Purpose-built UCAVs on the other hand, will be able to pull in excess of 20G, giving them the ability to out-maneuvre both manned aircraft and anti-aircraft missiles.³⁸ Additionally, the removal of the pilot will reduce the size of the aerial vehicle by up to 40%, giving it increased stealth and thus survivability.³⁹ This could lead to a decrease in the number of systems required and therefore reduce overall costs. Given such advantages, it is likely that UCAVs will begin to replace manned aircraft towards the end of the useful life of JCA. Indeed, the Dutch government has ordered 100 JCA, of which the 2nd batch will be what is termed 'Unmanned Tactical Aircraft'.⁴⁰ However, it has also been noted that while duration, survivability and costs favour the development of UAVs and UCAVs, complex systems such as Global Hawk should not be considered as throwaway, simply because they do not have a pilot on board:

*'(Global Hawk) will likely be employed as the U2 is - outside of high threat environments such as long range SAMs. At approximately \$50m each, the Global Hawk is too expensive to be considered expendable.'*⁴¹

Therefore, it could be argued that the doctrine for the employment of these systems may not change radically from their manned counterparts and thus not transform air operations in the fundamental manner demanded by a genuine RMA.

One contentious area of UCAV development is that of authority for weapon release. Although it is recognised that in today's manned aircraft, much work is done automatically by the system, weapon release remains a human judgement.⁴² For example, UAVs identified numerous targets during Operation Allied Force in 1999; however such was the concern over collateral damage and non-

combatant fratricide, all targets had to be confirmed by manned aircraft. This concern is likely to endure and as a result:

*'It is likely that unmanned vehicles will not be able to fulfil all of the missions now performed by manned aircraft. A fundamental technological problem is that UAVs have a limited ability to deal with ambiguity....To be truly valuable in military operations, UAVs should be able to deal with ambiguity, but this ability exceeds the existing technological capabilities of sensors and computers.'*⁴³

Even if in the next thirty years the available computing power continues to rise at the rate predicted by Moore's Law, and if progress in sensor resolution is also maintained, there is likely to be a fundamental ethical conundrum facing commanders: are they willing to trust an autonomous UCAV to select and engage the correct target in a complex environment, where the distinction between combatant and non-combatant is at best blurred and in the worst case almost indiscernible? Additionally, the enemy will seek to capitalise on this dilemma by means of deception and until AI systems can recognise when they are being deceived, then it is unlikely that the authority for weapon release will be delegated to a machine alone. As the US Defense Advanced Research and Projects Agency (DARPA) has made clear of its UCAV programme:

*'The degree of autonomy permitted to the vehicle is expected to vary throughout the mission, and lethal operations will require human authorisation...'*⁴⁴

Nevertheless, in 2030 we are likely to see both manned aircraft and a mix of UAVs and UCAVs undertaking a wide variety of tasks. Long range and duration reconnaissance will be the sole preserve of UAVs, while 'Suppression of Enemy Air Defences (SEAD), politically sensitive missions, interdiction, battle damage assessment, theatre missile defence and high altitude strike' may be carried out by either autonomous or remotely controlled systems.⁴⁵ Support to the tactical formations of the land component will also be unmanned. As Vickers has stated:

*'A deep-strike brigade might comprise a long-range missile regiment, a stealthy attack helicopter regiment, and an information warfare regiment equipped with unmanned aerial vehicles.'*⁴⁶

However, what is also clear from this analysis is that human beings will remain in the loop for the engagement of targets in Close Air Support missions and those conducted in complex scenarios, even if the ordnance is itself delivered from a UCAV. In doing so, this will confirm the belief that the impact of these systems on the RMA will be of a more evolutionary rather than revolutionary nature.

LAND SYSTEMS

Given the relatively simple nature of their respective environments, the development of unmanned systems for the maritime and air components has progressed well. However, the same cannot be said of UGVs. To date, only small numbers have been produced, with in-service equipments restricted to remote controlled mine and bomb/ordnance disposal devices. These vehicles are not technically complex and the operator has to have sight of the terrain over which the UGV is operating. This is a limiting factor, given that either a physical link or considerable bandwidth required. Thus there is a need for autonomous terrain navigation, but the ability of UGVs to determine the nature of the obstacles in their path and how to negotiate them requires the integration of sophisticated sensor recognition, micro-processing and mechanical reactions. As has been stated:

The best choice for a (future) MBT for the 2010 time frame is a vehicle system consisting of a manned control vehicle 'armed' with a variable number of semi-autonomous tele-directed robotic surrogates as its main weapon

*'there is a requirement for a high level of image understanding by the vehicle's vision system. Achieving this and making the whole process of route planning and cross country driving autonomous is the most difficult aspect of the automation of fighting vehicles.'*¹⁴⁷

Sixteen years on from this quote, there is still a great deal of development to be carried out before vehicles of the same mobility and flexibility as today's manned systems, can be fielded. Nevertheless, DARPA remain committed to developing UGVs with further prototyping of small Unmanned Ground Combat Vehicles (UGCV) in the next two years.⁴⁸ However, these vehicles weigh less than 2000Kg and do not seek to replace the capability offered by current platforms, but could augment the combat power available to early entry expeditionary forces. Despite these limited aspirations, considerable debate centres on whether the next generation of MBTs and combat vehicles should be unmanned, given the range and lethality of modern anti-armour weapons. Notwithstanding advances in Defensive Aids Suites, MBTs and other vehicles will still be highly vulnerable. Therefore cheaper high-volume UGVs may be an alternative. However, given the continuing challenges posed by autonomous terrain navigation, it is likely that the first fielded variants of UGVs will be platforms requiring control by a manned variant. As Dobbs stated:

*'I would propose that the best choice for a (future) MBT for the 2010 time frame is a vehicle system consisting of a manned control vehicle "armed" with a variable number of semi-autonomous tele-directed robotic surrogates as its main weapon.'*¹⁴⁹

Thus a tank squadron could consist of a small number of manned C2 vehicles and a larger number of UGVs. These could be sent ahead of manned formations to 'motor down strategic roads where soldiers fear mines or ambushes'.⁵⁰ Alternatively, manned vehicles could be sent forward to determine a route for a column of unmanned systems to follow. This greatly simplifies the terrain recognition required of the UGV and is termed 'Non-line-of-sight leader-follower'.⁵¹ However, considerable challenges to fielding an unmanned ground force remain. The C2, logistic resupply, friend/foe recognition and ROE are but a few of the issues that would need to be resolved before a force with a mix of manned and unmanned systems could be deployed. Thus it is hard to be optimistic about the employment of UGVs in the 2030 timeframe, except in specialist roles such as combat engineering and long range strike, both of which can utilise remotely controlled systems to conduct operations.

CONSIDERATIONS

In the analysis of future developments, a number of major considerations have emerged. Firstly, the concept of what constitutes a combatant will change. As Finkelstein has pointed out:

*'Operators need not have the youth and strength of combat troops (although co-ordination might be important); tele-robots can be operated by older men or women, or perhaps by civilians working in shifts. Vehicles can be kept moving, limited only by fuel and maintenance constraints. Shifts of alert, rested operators would be at the controls.'*¹⁵²

Thus the established notion of combatants wearing uniform and accepting the contract of unlimited liability will be challenged, as will the de-lineation between combatants, unlawful combatants and civilians. From an enemy perspective, there will be no demarcation between the service personnel

commanding operations and the civilian controlling the unmanned systems that are operating in a different continent. This is despite the Geneva Convention laying down strict criteria for combatant status.⁵³ As the current law makes clear:

*'...civilians are considered as non-combatants. They are not entitled to take part in belligerency or to use arms, even in self-defence against the enemy. In return they enjoy protection under international law.'*⁵⁴

As a result of their involvement in military operations, civilians risk losing their protected status and as Dunlap has observed, it likely that:

*'Once civilian technicians or contractors become involved as "operators" in "combat operations," they risk being characterised as "unlawful combatants" under international law.'*⁵⁵

Thus as Cohen has summarised: 'One's function counts more heavily than one's status as a civilian' and thus there will be a requirement to review the law, as the boundaries between combatants, non-combatants and civilians become blurred.⁵⁶

What must also be considered is the impact of the introduction of unmanned systems on the types of personnel employed by the Armed Forces. The employment of increasingly autonomous systems, will undoubtedly lead to a shift in emphasis from operators to facilitators and from soldiers to logisticians and technicians, whose responsibility is not to bear arms, but to prepare and maintain the unmanned combat systems that will undertake that task. Therefore, tomorrow's soldiers will require different skill sets and this will demand a new approach to the selection of suitable personnel. As a result, there is also likely to be an alteration of the military's traditional hierarchical structures. Such a change has been described as a re-working of the old blue/white collar descriptions of officers and NCOs into a more complex iron/blue/white and gold colour division.⁵⁷ This will inevitably lead to a re-evaluation of the need for regimental structures and the applicability of the unique ethos and culture displayed particularly by British Armed Forces.

The third issue is that of information management. It has already been stated that computers will be increasingly relied upon, to manage the vast quantities of data available to commanders, who will have access to information across traditional component and chain of command boundaries, from an all informed grid.⁵⁸ By linking the output of every battlespace sensor, commanders at every level will have the ability to view any product throughout an entire area of operations. This will radically change the way in which operations are controlled and demand a doctrine where the achievement of information superiority will become as important as gaining physical superiority. Joint Vision 2020 realises this, by stating that full dimensional protection is in part achieved by information superiority.⁵⁹ Thus campaign planners will seek to employ a variety of unmanned platforms to provide the most accurate information possible, before and during the committal of their manned counterparts. In turn this encourages the employment of numerous, expendable and low cost unmanned sensors. As Libicki has stated:

Tomorrow's soldiers...may go armed with devices 20 to 50 times more powerful than today's laptops, digital radio-based communications capable of exchanging video data, and electronic image quality maps updated in near real time by UAVs and other sensors



The tacit contract of combat throughout the ages has always assumed a basic equality of moral risk: kill or be killed. Accordingly violence in war avails itself of the legitimacy of self-defense. But this contract is void when one side begins killing with impunity

*'Tomorrow's soldiers...may go armed with devices 20 to 50 times more powerful than today's laptops, digital radio-based communications capable of exchanging video data, and electronic image quality maps updated in near real time by UAVs and other sensors.'*⁶⁰

Thus the contribution of unmanned platforms to the Global Information Grid (GIG) will impact fundamentally on the conduct of operations and supporting doctrine, and it is partly on this basis that it could be argued that unmanned systems will transform the nature of the ongoing RMA.

While accepting this proliferation of unmanned systems, but also acknowledging that they will not replace all of their manned counterparts, there must now be an examination of how the employment of such technology will alter our accepted definitions of war, casualties, success, endstates and Centres of Gravity (CoG). The Oxford English Dictionary defines war as 'armed hostilities between esp nations or

hostility or contention between people, groups etc'.⁶¹ If we assume that by 2030 unmanned systems will not have the ability to make the conscious decision to go to war by themselves, then it can be said that the dictionary definition of war should remain valid. War will still be hostility between individual people or groups, although its conduct may not involve human beings in the same manner. The nature of war may have changed, if not the meaning.

If war remains the same activity, but conducted by different means, the ability to fight a 'proxy war' through the use of unmanned systems may lead to an increased willingness to conduct military operations. The seeds of this have already been seen in the campaigns conducted in the Gulf, Kosovo and Afghanistan, where technological superiority meant that once an opposition's air defences had been destroyed, allied air forces could operate with relative impunity throughout the adversary's battlespace. By increasing the use of unmanned systems, protagonists could be more willing to engage in combat, because the threat of human casualties and the associated negative repercussions would diminish. However, the probability of unconstrained, unmanned warfare taking place in the 2030 timeframe is extremely low, given the cost and complexity of the technologies involved. Additionally, as our analysis of the spectrum of conflict has shown, warfare will take place in a politically, geographically and operationally complex environment. The result is likely to be a situation where unmanned systems are being opposed by manned systems and dismounted troops and it is within this context that some powerful ethical and moral concerns have already been raised. In his analysis of the 1999 Kosovo campaign, Ignatieff stated that:

*'The tacit contract of combat throughout the ages has always assumed a basic equality of moral risk: kill or be killed. Accordingly violence in war avails itself of the legitimacy of self-defense. But this contract is void when one side begins killing with impunity.'*⁶²

Therefore, if one belligerent uses unmanned systems to fight and kill human beings without fear of death, are they then acting unjustly? Furthermore, will they gain and maintain the support of their population? As has been pointed out:

*'In Kosovo in 1999 NATO was accused of fighting the conflict using the lowest common denominator, that of making the campaign a moral crusade that had to be fought at any cost, except that of Allied casualties. What sort of message, then, would an unmanned air campaign on a civilian population give out? Could a UCAV campaign imply we care enough to kill your population to change your behaviour but not enough to risk our lives?'*⁶³

This debate is certain to grow over the forthcoming decades, but it is interesting to note that the use of Hellfire missile-equipped Predator UAVs against the Taliban and Al Qaeda fighters in Afghanistan generated no comment of a moral or ethical nature.

The concept of what constitutes a casualty must also be examined. Current Operational Analysis predicts casualty rates in terms of both men and equipment. However, as Barnaby has stated:

*'Is it necessary for blood to be spilled in war?... Victory in an automated battle may well go to the side that can keep up battle for the longest time.'*⁶⁴

Therefore, decision-makers would not have to concern themselves with maintaining the moral component amongst their troops and civilian populations in the face of mounting human casualties. Instead, efforts would focus on being able to produce sufficient replacement systems and getting them deployed into the battlespace. This would necessitate a re-evaluation of our current doctrine, and mass may once again become a predominant line of development while force protection, except for the most

Soon technology, particularly mini or micro robots, may allow military planners to select which individual or physical object in a building is to be destroyed. For the first time, it might be possible to target only the aggressor's leaders, leaving non-combatants untouched

complex and expensive of systems, would no longer be considered an issue. At the same time, loss of human life, when it does occur, would have more strategic significance and thus the definition of a casualty is likely to remain one restricted to human beings.

The paper has determined that human beings will still conduct fundamental decision-making in an era of unmanned systems and will remain the casualties in any future conflict. It follows then, that national leaders or influential individuals who seek to precipitate conflict will be our opponent's CoG and the focus for targeting efforts. CoG is currently defined as 'that aspect of the enemy's overall capability, which if attacked and eliminated, will lead to either the enemy's defeat or his wish to sue for peace through negotiations'.⁶⁵ Currently, this tends towards military resources, but developments in unmanned micro systems may allow more direct targeting of individuals. Thus nations fielding such capabilities will be able to strike swiftly at the aggressor's strategic CoG and potentially curtail conflicts, with limited damage to military forces or civilian infrastructure. As Metz suggests:

*'Soon technology, particularly mini or micro robots, may allow military planners to select which individual or physical object in a building is to be destroyed. For the first time, it might be possible to target only the aggressor's leaders, leaving non-combatants untouched.'*⁶⁶

Conversely, those without such unmanned capabilities may resort to asymmetric style attacks on economic infrastructure and civilian populations, because targeting military systems is unlikely to destroy our will to fight. Furthermore, unmanned systems might not be controlled from the 'immediate' battlespace, but at a distance from buildings or aircraft, many miles from the target area. As a result, the battlespace will expand to encompass the control stations, which could be sited on home territory. Given that these are one of the most vulnerable elements of the unmanned system, then opponents may seek to neutralise them, rather than try to destroy the mission vehicle or interrupt the C2 link. Therefore, these two factors may extend the area of conflict, with the requisite implications for 'homeland security'.

Finally, success also needs to be redefined. Currently, to defeat one's adversary is defined as 'To diminish the effectiveness of the enemy, to the extent that he is either unable to participate in combat or at least cannot fulfil his intention.'⁶⁷ In manned conflict, once a belligerent's effective ability to fight had been reduced, then he would normally withdraw from battle. However, the same cannot be said of autonomous systems, as they will not recognise that they have been defeated, unless they are programmed to do so. By 2030 technology will be sufficiently mature for systems to have a degree of autonomy and once launched, they could conduct operations unfettered, within a set of given parameters. This doomsday scenario, however fanciful, means that there is a requirement for human beings to retain an element of control over such systems. This is likely to generate considerable complications for the employment of such platforms as have already been described within the context of UCAVs and, as Metz has argued:

*'The idea of a killing system without direct human control is frightening. Because of this, developing the "rules of engagement" for robotic warfare is likely to be extremely contentious.'*⁶⁸

Two strands can be drawn from this. Firstly, success is likely to remain a human concept. In 2030, it will still be leaders who initiate and direct conflict and thus it will be they who will continue to define what constitutes a favourable campaign outcome. Depending on the capabilities of both belligerents, it could be achieved by eroding the adversary's will to fight by destroying his military capability, targeting his civil infrastructure or eliminating the political hierarchy. However, only human beings will be able to determine whether objectives have been achieved and that the conflict can be concluded.

Secondly, it is evident that the laws of warfare need to be updated, with ROE drawn up to allow autonomous systems to operate, but these will probably remain quite restrictive. Colonel Boone of the USAF reconnaissance-systems division has suggested that they would only be allowed to engage 'on their own', when human controllers have assigned ROE such as 'Fire in this square area only.'⁶⁹ This simply reflects the difficulties in identifying friend from foe in a continuously changing tactical situation within a complex scenario. A further complication is if the human controller were to issue an unlawful order to a system equipped with AI. The system may be able to recognise the command as unlawful, but would it be programmed to disobey or could the system alternatively choose to obey? Not only does this have serious operational implications, but legal ones as well. While primarily dealing with human responses to such questions, Osiel's table of error types goes some way to describing the programming challenges facing those designing AI equipped weapons systems.⁷⁰ No neat answers exist and it is doubtful if by 2030 they will.

SCENARIOS

Operations in 2030 will encompass a range of tasks from humanitarian assistance to warfighting and thus, in order to test the unmanned RMA theory, we should look at scenarios at these extremes of the spectrum of conflict. In warfighting, it is expected that future adversaries could deploy both conventional weapons and WMD, but would operate using orthodox doctrine, whilst at the same time maximising deception, camouflage and concealment to offset their technological disadvantages. Opponents could also employ their own unmanned systems, possibly to deliver WMD.⁷¹ For our part, UUVs would be used to set the conditions for any amphibious operations, while UAVs and UCAVs would fulfil a wide range of missions from attacking strategic and operational CoG and tactical targets, as well as providing enabling activities in the form of Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) and SEAD to support manned air activities. Engaging forces deployed in an orthodox manner, we would be able to take advantage of the ability of unmanned systems to undertake the D3 tasks more efficiently and with less risk than their manned counterparts. Indeed, it could be said that the deployment of UCAVs and a wider range of UAVs during the Gulf War for example, would have reduced the risk to allied pilots and Special Forces operating inside Iraq. Nevertheless, the deployment of UGVs in the Gulf would still have brought immense difficulties. Despite the terrain being the least complex an autonomous system is likely to encounter, the depth and sophistication of the Iraqi defences would have proved difficult for any such vehicle to breach, without significant manned support.

Furthermore, the Gulf War raises questions about how considerable numbers of surrendering combatants would be handled by such systems. The example of Iraqis trying to surrender to a UAV exposes just one of the difficulties that need to be resolved when formulating the doctrine required for such systems.⁷² Additionally, it could be said that this incident emphasises that unmanned systems will be most effective when operating alongside manned counterparts. Indeed, Black argues that the most successful use of a new piece of equipment occurs when it is integrated with old technology.⁷³ Furthermore, the friction and uncertainty introduced by the actions of human beings on the battlefield means that even in 2030 it is difficult to envisage autonomous systems being effectively employed, except against other autonomous or remotely controlled systems.

The situation is even more complex in a peace support environment. The inability to recognise combatant from non-combatant makes it extremely unlikely that autonomous systems would be given authority to fire weapons, whilst operators of remotely controlled platforms will be required to demonstrate a very high degree of certainty before they engage the 'enemy' in these scenarios. Furthermore, peace enforcement is in part a matter of demonstrating intent, and the deployment of unmanned systems to conduct patrols, in urban areas instead of foot soldiers may not engender the requisite compliance amongst the local population. As Hahn and Trezior noted:

*'In the future, peacekeeping and, to a lesser extent, peace enforcement operations will remain essentially police actions, requiring a long term, highly visible, traditional infantry "presence" to create an aura of normalcy and stability.'*¹⁷⁴

However, an alternative view has been put forward. By playing on people's innate fear of robots, it is argued that such systems would be particularly effective and as a result peacekeeping could become a less manpower intensive activity:

*'Most people have a "Frankenstein complex": a fear of potentially lethal devices not directly under human control. The ploy of stopping convoys by sitting down in front of them would require more nerve, and any casualties would have less propaganda impact, if they had to sit in the path of an unmanned vehicle.'*¹⁷⁵

This argument is supported by the RAND Corporation who have made it clear that their strategy is one 'that removes the soldier from the street as much as possible, by instead of sending patrols and vehicles through the streets, sending UAVs and robots'.⁷⁶

Additionally, there is a requirement for hugely sophisticated sensors in peace support operations, and remotely controlled systems currently lack the 'situational awareness' of human beings. Unless a technology package can be developed that fully replicates and integrates the visual and hearing senses, then the human being will remain the best sensor available to the commander in such scenarios. However, the Kosovo campaign demonstrated that UAVs are extremely useful in locating military positions and equipments. Additionally, they continue to

The destructive potential of contemporary weapons should rather provide incentive to make human control over them more positive and the more deeply informed by an understanding of moral value



contribute to the ISTAR activities undertaken in support of the ongoing peace keeping operation.⁷⁷ Nevertheless, in such scenarios adversaries rapidly become 'surveillance aware' and the utility of overt systems steadily diminish. Until such a time as James Adams' sensors disguised as clouds of dust become reality, then it is believed that the most effective use of unmanned systems will be restricted to the early stages of a peace support campaign, near the warfighting element of the conflict spectrum.

CONCLUSION

This paper has established that very substantial technical and ethical challenges need to be overcome by 2030 before we can assert that the unmanned RMA will be truly revolutionary in nature. In this



timeframe, there will be an array of air and maritime unmanned systems in service. However, UGVs will remain relatively small and slow, demonstrating poor mobility and limited protection, and as a result are unlikely to form the basis of the land component. Furthermore, until autonomous systems within any environment are able to meet the three criteria of discrimination, then they are unlikely to be allowed to engage without human authority.⁷⁸

Nevertheless, the proliferation of unmanned systems will undoubtedly make the future's extended battlespace more deadly. This will present leaders with complicated moral judgements and as Shore has articulated, minimising technical risk can only be achieved if we marshal 'social forces' and not just 'technical forces'.⁷⁹ Turner Johnson develops this theme further by stating:

*'The destructive potential of contemporary weapons should rather provide incentive to make human control over them more positive and the more deeply informed by an understanding of moral value.'*⁸⁰

If these arguments are accepted, then limitations should be placed on the development and employment of autonomous weapon systems. However, this will only occur when society recognises the need for restrictions to be placed on the wholesale spread of AI systems in their widest sense. Therefore, it remains to be seen if human beings will be able to retain effective control of unmanned systems in the longer term. Whatever the result, there will still be a fundamental impact on military affairs and whilst war itself may not change in definitive terms, its

conduct and the way it is supported, will. Today's definitions of CoG and combatants will change and although casualties and success will remain human concepts, unmanned warfare could re-introduce the ideas of mass and attrition as preferred military doctrine. This in turn could generate a further development of the military industrial complex, with the emphasis being on high volume, low-cost systems rather than the 'silver bullets' currently being developed. Furthermore, as adversaries seek to neutralise the unmanned threat and those employing such systems target individuals rather than military forces, then the size of the battlespace will be significantly extended. All of this supports the contention that the introduction of unmanned systems en masse will produce an unparalleled RMA. It will not by 2030 be conflict of the type envisaged by H G Wells and other authors such as Isaac Asimov, but it will be well advanced, with the greatest stumbling blocks being those of mobility for UGVs and the ethical implications of deploying lethal autonomous systems.

However, as has been pointed out, war is dominated by uncertainty and because of this, in the 2030 timeframe at least, human beings will continue to play the key role in military operations. AI will not be sufficiently developed to allow battlefield robots to conduct a campaign based on the loosest of parameters defined by human computer programmers. Therefore, as Lieutenant Colonel Schultze-Rhonof prophesised in the early 1980s:

*'...only soldiers and not machines can respond to previously unforeseen situations....since innovation, surprises and friction are typical symptoms of any war, the human capacities for analysis, synthesis and initiative acquire particular importance. Finally, only the human being has the ability to make decisions based on factors which are not comparable merely in mathematical terms.'*¹⁸¹

Therefore, it is asserted that the unmanned RMA of 2030 will be a technical revolution rather than one of a more fundamental sociological nature, with all of the profound consequences for warfare that that would entail.

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The Decisive Role of Air Power in the Pacific Campaign of WWII

By Wing Commander S Richards

'In my view, air power is an immense entity in itself, but it is interlocked with sea and land power, and all three are interdependent.'
Lord Tedder.¹

When the Japanese opened the war in the Pacific on 7 December 1941, they did so with a dramatic and shocking display of air power. Within a matter of minutes, Japanese naval aircraft had struck a mortal blow to US naval strength in the Pacific. In the days and months that followed, Japanese forces were to advance in an all-conquering swathe of success, each time employing air power in pre-emptive operations that left the ill-prepared defenders reeling and exposed. The Allies heeded these lessons well, as they began their equally dramatic path to victory during 1942. With the vast distances involved in the Pacific theatre and with the omnipotence of the Japanese forces, air power was a vital arm of Allied fighting power. Faced with a fanatical enemy, Allied forces soon learnt that without air power, they could be left critically exposed, with ensuing loss of materiel and lives. As the Japanese weakened, the full might of US industrial effort and manpower reserves began to show, as vast numbers of men, together with new and improved equipment, were able to shape the campaign towards victory. Not least in this effort was the introduction of new and more capable aircraft, particularly the B-29 heavy bomber. It was from this aircraft that the final acts of the war were carried out: the dropping of two atomic bombs on the Japanese Home Islands.



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This article will analyse the contribution that air power made to Allied success in the Pacific, set against contemporary doctrinal attributes and principles concerning air power. These essential components, together with the influence of technology, will be examined within selected phases and campaigns of the Pacific theatre. Flexibility, which allowed the ubiquitous nature of air power to be fully realized, will be argued as the key enabler of success, within this campaign. Never standing still, the aggression and inventiveness of Allied air power, coupled with technological innovation, allowed it to be employed at all levels of war, across the campaign. Space precludes a detailed analysis of the weaknesses of Japanese air power, but some specific points will be brought out. An examination of the strategic bombing of the Japanese Home Islands, including the dropping of the first atomic bomb, will show how arguments over suitable target sets were as prevalent in the Pacific theatre as they had been in the European theatre of WWII. Equally, the continuing belief that air power alone could 'win the war' will be highlighted; an expectation that can still plague airmen today. Finally, this article will conclude that air power was the decisive, dominant factor in the Pacific theatre of WWII, illustrating how key attributes and enablers contribute to the ubiquitous nature of air power, with its all-encompassing ability to operate at all levels of war, in support, in joint operations, or as lead arm.

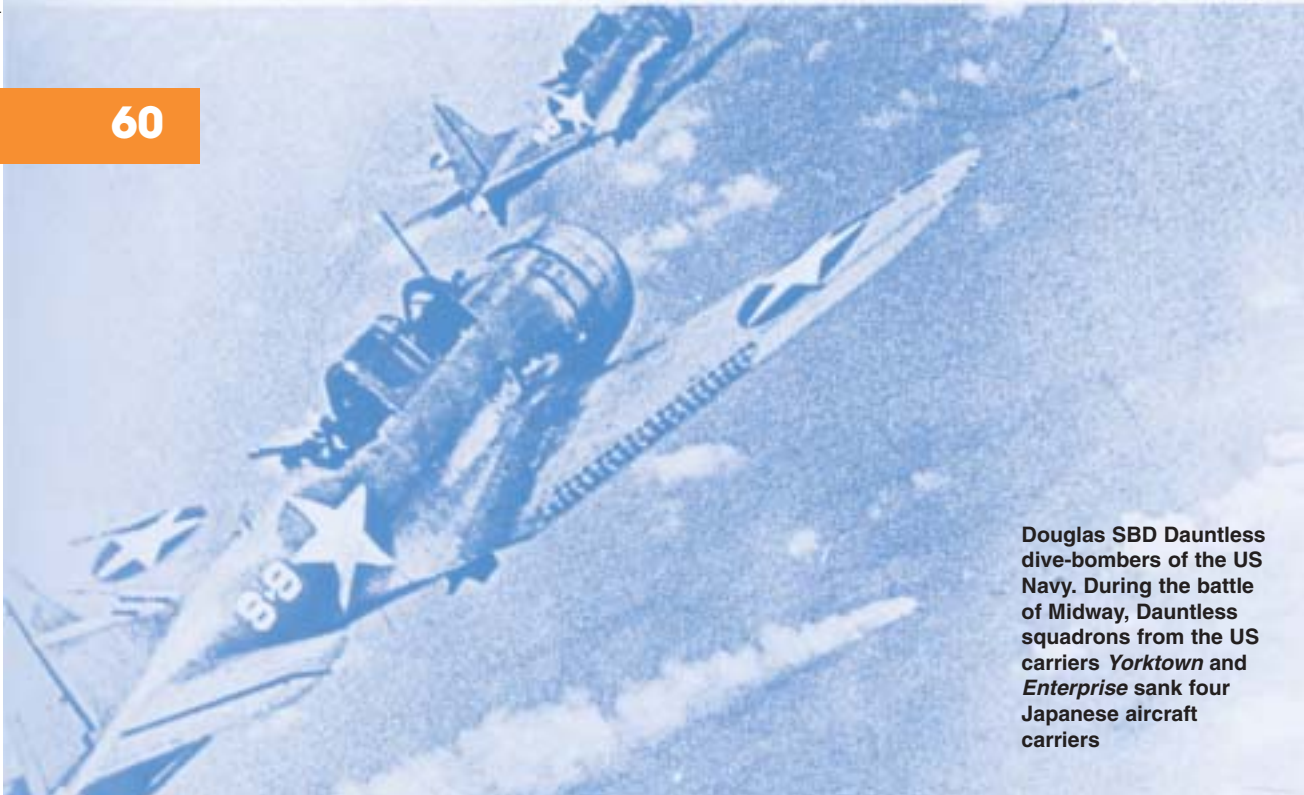
Surprise

Contemporary historians have argued that the Japanese attack on Pearl Harbor was not a surprise at all.² At the operational level, their arguments are irrelevant – whatever the degree of expectation, preparations to meet any attack were woefully inadequate.³ The Japanese commander, Vice-Admiral Nagumo, sailed to a point 200 miles to the north of Oahu, before launching two strike waves at Pearl Harbor on the morning of 7 December 1941. Over 350 bomber and fighter aircraft achieved complete tactical surprise.⁴ Japanese torpedoes were able to cope with the shallow waters of Pearl Harbor's Battleship Row, in an early demonstration of the importance of technological innovation in relation to air power.⁵ As a result, the American Pacific Fleet was effectively neutralized, though crucially, the US carriers were not at Pearl Harbor that day and escaped destruction.



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Douglas SBD Dauntless dive-bombers of the US Navy. During the battle of Midway, Dauntless squadrons from the US carriers *Yorktown* and *Enterprise* sank four Japanese aircraft carriers

The Japanese carrier forces had received a deadly blow, from which they never recovered. All this had been achieved through the medium of air power

On the morning of 8 December 1941, aircraft of the Imperial Japanese Navy (IJN) and Japanese Army Air Force (JAAF) struck at targets in the Philippines from the carrier *Ryujo* and from forward operating bases on Formosa. Surprise was a key factor, in part enabled by the extended range of the Japanese Zero fighter. Experimentation with fuel mixes had yielded the potential to improve the fighter's range out to about 1,000 miles – where it was least expected – in another demonstration of the important marriage of technical innovation and air power.⁶ By the close of the day 'half the heavy bombers and one third of the fighters of the United States Far East Air Force had been destroyed and many of the remainder were heavily damaged'.⁷ Within a few days, the Japanese were 'in complete control of the air over the Philippines at very small cost'.⁸ Once again, the shocking and overwhelming application of air power had triumphed through the simple application of surprise. This ability of air power to act as a force multiplier, to deliver a crippling blow, in a short space of time and for relatively little effort, was to be dramatically demonstrated by the US Navy at the Battle of Midway in June 1942.

The Japanese devised an elaborate plan to both capture the island of Midway and to destroy the remaining capital ships of the US Navy.⁹ Cognisant of these plans (through signals intelligence), the US bolstered the defences of Midway and positioned three carriers to the north of the islands. US carrier aircraft eventually attacked the enemy carriers, catching the Japanese off-guard. Despite horrendous losses, due to outclassed aircraft, slow torpedoes and uncoordinated attacks, 3 Japanese carriers were destroyed in the space of 5 minutes by 37 US dive-bombers.¹⁰ Fighting continued throughout the day, resulting in the loss of the fourth Japanese carrier, and the US carrier *Yorktown*. The results of this surprise attack on the Japanese forces had far-reaching strategic importance. The invasion of Midway was abandoned, thus halting Japanese expansion across the Pacific. The Japanese carrier forces had received a deadly blow, from which they never recovered. All this had been achieved through the medium of air power, which had shown that a handful of aircraft, despite

desperate odds, could achieve a surprise victory out of all proportion to their weight of effort. Thus were air power and the attribute of surprise united in the early days of the Pacific War. Without doubt, air power had demonstrated its potential as a force multiplier, with its ability to strike decisively and overwhelmingly. The role of technology was also evident; Japanese success was mirrored by early US failure, with the US Navy Torpedo and its delivery aircraft committing scores of US airmen to an early grave. The vulnerability of both land and surface forces to air attack was now obvious and the first lessons in the requirement for air superiority had been learnt.

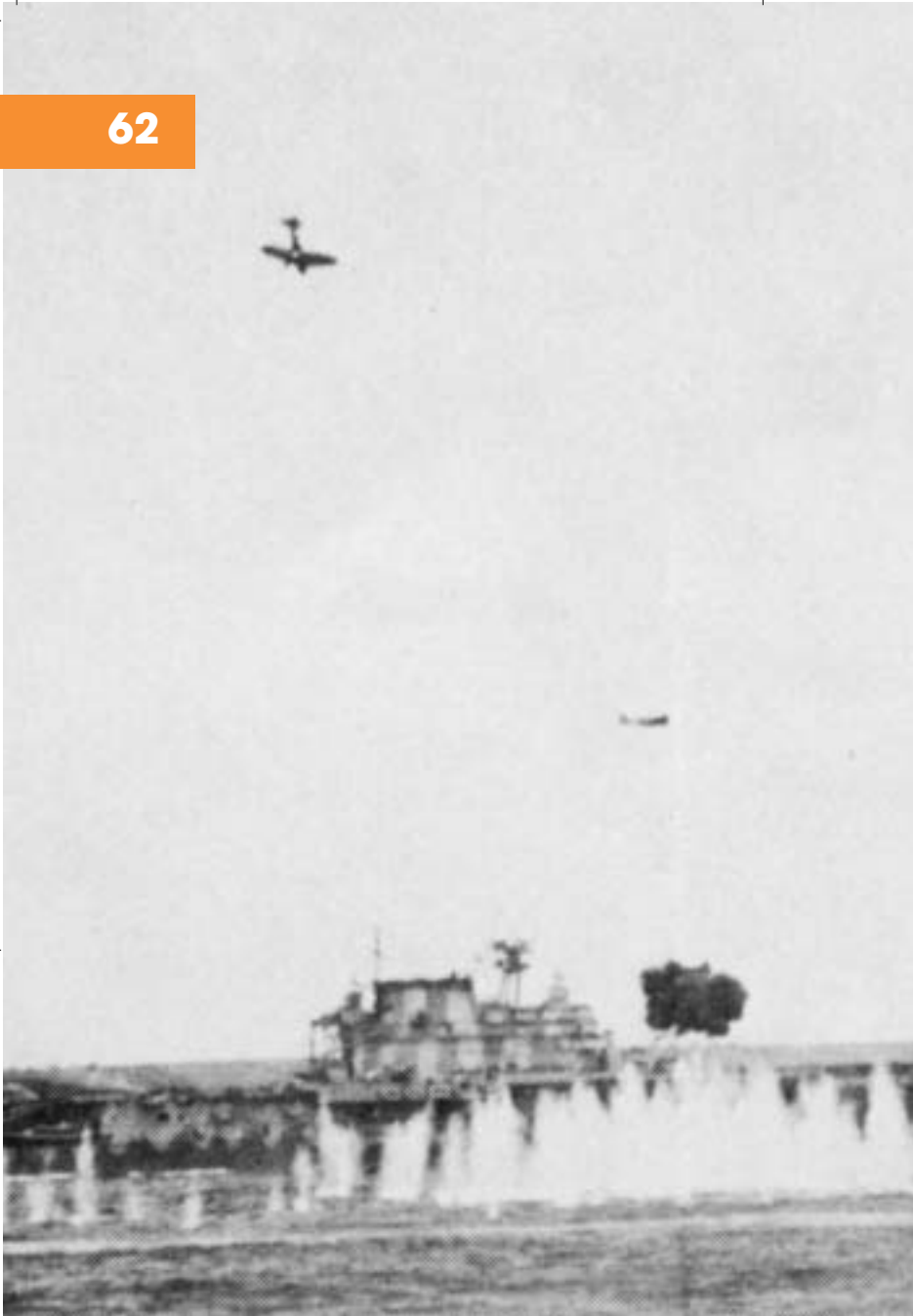
Pace, Tempo and Concentration of Effort

In early August 1942, US Marines landed on Guadalcanal in the Solomons and occupied the newly constructed Japanese airfield. By late August, small detachments of carrier aircraft and US Army Air Force (USAAF) aircraft were operating from the newly named Henderson Field on Guadalcanal. Thus began a desperate holding action, which hinged upon possession of Henderson and the continued success of Allied air power in the region. B-17 bombers from the New Hebrides Islands (now Vanuato)

In 2 days, air power had completely wrecked the last Japanese hopes of retaking Guadalcanal, through its ability to concentrate its effort on a single objective and to maintain a high tempo of operations

ranged far and wide, carrying out harassment raids on Japanese shipping and forces across the Solomons, as well as providing long range reconnaissance information. The most desperate struggle occurred at Henderson itself. Bombed daily from the air, attacked on the ground by Japanese troops and shelled at night by Japanese naval forces, the airfield was constantly under threat of being lost. Neither side could claim air superiority; the US forces were too small and disparate, whilst the Japanese air bases were too far away and the Japanese dared not risk their carrier forces in the area on a permanent basis. Somehow the field was kept open and US aircraft flew daily, able to inflict damage to Japanese forces in the air, on the ground and at sea. It was this tempo of operations, this persistence, that began to wear down the Japanese. Both sides recognized the vulnerability of their naval assets and despite strong naval presences leading to several surface battles, neither side was able to dominate the area from the sea. But air power was able to deliver constant effect, thus keeping the Japanese attempts to dislodge the US from Guadalcanal at bay. A powerful example of this is revealed during the period 14 to 15 November 1943, with the last Japanese attempt to re-take Guadalcanal. An invasion force of 12 troop transporters with warship escorts, estimated to be carrying up to 35,000 troops, was discovered by a reconnaissance B-17. Concentrated attacks by US aircraft throughout the day left only 4 transporters able to continue to Guadalcanal – the Japanese abandoned these on the beach as aircraft from Henderson Field destroyed them on the morning of 15 November. Thus in 2 days, air power had completely wrecked the last Japanese hopes of retaking Guadalcanal", through its ability to concentrate its effort on a single objective and to maintain a high tempo of operations.

This pace of operations had another telling effect upon the Japanese air arms. They began to lose the war of attrition, despite having aircraft, such as the famous Zero, which could out-perform their US equivalents. There was however, a flaw in Japanese thinking. Whilst the Zero was a highly manoeuvrable aircraft, capable of long-range flight, it achieved these results through its lightweight



*Bushido.
According to
this culture,
death was
preferable to
surrender. It
was a harsh
discipline that
pervaded all
aspects of
military thinking*

build. Thus it proved vulnerable in combat, a problem compounded by its lack of self-sealing fuel tanks.¹² Allied pilots found that by careful tactics, they were able to survive longer than their Japanese opponents, helped by more robust aircraft. It was a slight technological advantage, but it furnished the high attrition rates meted out against the Japanese. The results were at times spectacular; on a raid against Henderson on 23 October 1943, the US fielded 28 fighters against a Japanese force of 16 bombers and 25 fighters. In the ensuing fight, 22 Japanese aircraft were destroyed, for no Allied loss.¹³

The Japanese willingness to commit to such losses and to fritter away their best pilots was in part a reflection of their strict military code – Bushido. According to this culture, death was preferable to surrender. It was a harsh discipline that pervaded all aspects of military thinking.¹⁴ In particular, the Solomons and New Guinea became the bleeding ground of Japanese air power. After Bougainville, experienced IJN pilots were thrown into the defence of Rabaul, such that final losses amounted to 70%

of the Navy's most valuable pilots. By the time the Allies had destroyed the Hollandia base on New Guinea, the 'JAAF had been eliminated as an effective fighting force with 90% of its pilots with 300-600 hours flying experience lost.'¹⁵

There were many other examples of tempo, persistence and concentration of effort across the Pacific campaign. Despite harrowing odds, air power could still bring effective firepower to bear and hold the enemy at bay, through its ability to regenerate and reappear, to survive and re-attack, and to move swiftly from one task to another across the spectrum of offensive and defensive tasks required. Although land forces held the bases, and naval forces battled for supremacy, it was air power that time and again reached out and struck the enemy, concentrating sufficient firepower to achieve decisive results.

REACH

'Air vehicles can project military power over great distances, unconstrained by the physical barriers of topography.'
AP 3000¹⁶

Reach is a key enabler of air power. The Japanese attack on Pearl Harbor opened the Pacific war with a classic display of the joint effect of naval and air power reach. Thereafter, the ability of air power to be the decisive arm, through the attribute of reach, was proven repeatedly. Reach enabled aircraft to seek out and engage opposing forces, and to observe and report from far and wide, often unchallenged and undetected. Reach enabled the carrier aircraft of both sides to rove across the oceans seeking out targets, whilst the carriers themselves stood-off under the protective screens of fighters and surface units. Finally, in the latter part of the war, the impressive range of the B-29 bomber allowed this new and untried aircraft to reach out and rain destruction upon the Japanese Home Islands. This was raw air power.

Moving on from the obvious example of Pearl Harbor, the battles of the Coral Sea in May 1942, and of Midway, give further proof of how the quality of reach can enable air power to deliver a decisive result. In both cases it was aircraft that located each side's opposing force and it was aircraft, not surface vessels, that carried out the attacks. Opposing sailors never sighted each other, but they were vulnerable to attack nevertheless.¹⁷ In the Solomons and Papua New Guinea, aircraft from both sides used the attribute of reach to enable long-range strikes and reconnaissance. Japanese floatplanes and specially adapted bombers carried out reconnaissance; their efforts were mirrored by Allied PBY Catalina flying boats and B-17 bombers. Despite being stationed over 500 miles away, Japanese bombers from Rabual regularly attacked Henderson Field on Guadalcanal, often augmented with aircraft from Japanese carrier forces. They came close to rendering Henderson unusable. US B-17

The whole purpose of the invasion of the islands of Saipan, Tinian and Guam, was to establish air bases from which B-29 bombers could strike at Japan. The fall of these islands was regarded as so serious by the Japanese Government that the Premier, Gen Hideki Tojo, resigned

bombers similarly ranged up and down the Solomons, constantly harrying the Japanese. As the Pacific campaign unfolded, it became a battle for the next suitable airfield. With each step forward, air power was able to reach out further and further. This was typified during the fighting for the Solomons in 1943, and for the Marianas during the summer of 1944. In the former campaign, Allied forces made deliberate progress up the Solomons, capturing and repairing enemy air bases, before springing forward from these bases with ever increasing air cover. The further the Allies advanced, the further was the reach of their air power. In the Marianas, the whole purpose of the invasion of the islands of Saipan, Tinian and Guam, was to establish air bases from which B-29 bombers could strike at Japan. The fall of these islands was regarded as so serious by the Japanese Government that the Premier, Gen Hideki Tojo, resigned.¹⁸ On November 24 1944, the first B-29 bomber raid to strike at the Japanese Home Islands from the Marianas was launched. With such strikes representing a round trip of 3,000 miles¹⁹, the strategic reach of air power would now be employed in earnest.

The enabling concept of reach was therefore another vital contribution that air power made to the Pacific campaign. Reach enabled air power to search out and attack the enemy, to bring to bear the attributes of surprise, tempo and concentration of effort already mentioned. Boosted by the projection of naval carrier power at times, it was still air power that played the dominant role – so much so that the whole construct of the advance towards Japan, was one of advancement from airfield to airfield, until at last US bombers could strike at the Japanese Home Islands direct.

STRATEGIC EFFECT

'So we had won after all!...As for the Japanese, they would be ground to powder.'
Winston S Churchill.²⁰

When writing his celebrated memoirs: The Second World War, Churchill clearly recalled the strategic importance that the Japanese attack on Pearl Harbor signified. Setting aside the afterglow of victory, it is a clear statement of the global consequences of that one precipitous act. A few hundred aircraft, with one bold stroke, had tipped the military balance of the war by bringing the US into the conflict. The very decisiveness that air power could deliver was to continue to alter the strategic balance in the Pacific, throughout the length and breadth of the conflict.

Stung by the Japanese success at Pearl Harbor, President Roosevelt sought to strike at the Japanese homeland and boost the morale of an outraged American society. A daring one-way raid against Japan was executed on 18 April 1942, led by a USAAF pilot, Lt Cdr James Doolittle. Sixteen B-25 medium bombers were launched from the carrier Hornet, at a point 800 miles from Tokyo, in a unique combination of maritime and air power strategic reach. Bombs were dropped on Tokyo, and other Japanese cities.²¹ Whilst the damage inflicted by the bombing was minor, the raid yielded important strategic results: the Japanese immediately diverted aircraft into a home defence force; they felt even more persuaded to attack Midway – a disastrous action from a strategic viewpoint; and they overran the airfields in China where the American B-25s had planned to land (but had not been able to reach). Again air power had precipitated events of far-reaching strategic consequence, despite, on this occasion, having delivered little military effect.²²

Admiral Isoroku Yamamoto, Commander of the Japanese Combined Fleet, was widely known to have masterminded, at least in part, the successful Japanese advances across the Pacific. He was viewed as a strong and resourceful leader. On 18 April 1943, following signals intelligence, a flight of P-38 Lightnings flew over 400 miles from Henderson Field to shoot down and kill Yamamoto. Air power alone was able to strike such a strategic blow.²³ It is difficult to quantify what effects the loss of Yamamoto

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brought about, but the morale of the IJN suffered a 'significant' blow.²⁴ That it was the P-38 Lightning that achieved this success was not insignificant – this fighter had recently been introduced into the Pacific theatre. With the ruggedness, range and firepower to survive in the demanding environment of the South Pacific, this aircraft was another example of successful Allied technological innovation – adapting air power to the needs of the battle in order to gain important advantage.

As the strength of the US Navy carrier forces grew, their striking power and air dominance increased. Through 1944, both sides recognized that a culminating fleet action would have to be attempted at some point. When the US began the invasion of the Marianas, Japanese Admiral Ozawa knew that the time had come. On 19 June 1944, in an action that became known as the 'Great Marianas Turkey Shoot', US carrier aircraft destroyed approximately 300 attacking Japanese aircraft, at a loss to themselves of 26 aircraft, with insignificant bomb damage to one US battleship.²⁵ On this and the following day, US aircraft and submarines sank 3 Japanese carriers.²⁶ It was a strategic blow to the IJN from which it could not recover. The battle marked the 'destruction of Japanese carrier air groups as a conventional air force...'²⁷

From Japan's opening gambit onwards, air power was crucial to the delivery of strategic effect in the Pacific campaign. The battles at the Coral Sea and Midway relied on air power to halt Japanese territorial expansion. Small isolated acts such as the Doolittle raid produced strategic consequences out of all proportion to their military effect – effects that were only possible through the flexibility and reach of air power. Finally, it was chiefly air power that left the Japanese carrier forces impotent, robbed of their strategic potential in the face of overwhelming US air power.

Flexibility and Versatility

On 3 June 1942, a Catalina flying boat on a maritime patrol mission located the Japanese transport group heading for Midway. That same day, 4 Catalinas completed the 9-hour flight from Pearl Harbor to Midway. The newly arrived aircraft were immediately tasked with attacking the Japanese ships – all the more remarkable since Catalinas did not, at that time, carry torpedoes. Nevertheless, within a few hours of landing, the Catalinas were heading out towards the Japanese with one torpedo loaded to



From late November 1944 onwards, with secure bases in the Marianas, the USAAF's B-29 bombers began the systematic bombing of the Japanese Home Islands, in a true display of the flexibility of air power

each aircraft.²⁸ This innovative and flexible outlook, which resulted in the sinking of one of the transport group²⁹ (or possibly just damage³⁰), revealed the flexible nature of air power to the Americans. It also affected Japanese tactical thinking during the ensuing battle, causing them to put too much emphasis on the destruction of Midway, and thus to be caught unprepared by US carrier aircraft.³¹ The strategic consequences of the Midway battle have already been noted; how the flexibility of air power contributed from the very start is highlighted by the Catalina attack.

Flexibility and versatility were key ingredients of Allied success at Guadalcanal. USAAF P-40 fighters began operating from Henderson Field in late August 1942. Their performance as fighter aircraft was soon in question – the Japanese Zeros easily out-maneuvred them from above. The solution was to reverse the roles of the aircraft at Henderson: Marine F4F aircraft assumed more fighter responsibilities, whilst USAAF pilots learned how to bomb and strafe with the P-40 – a role at which they soon proved very useful, in both anti-ship and Close Air Support tasks.³²

This versatility was mirrored in the employment of Allied light and medium bombers across the breadth of the Solomons campaign. B-17s reconnoitred far and wide, staging through Henderson to increase the range of their cover. This had not been a role envisioned for this medium bomber, but it was to provide a vital service, keeping Allied forces constantly informed, and thus ready to counter Japanese attempts to overrun Henderson. As the Allies advanced across the Solomons and New Guinea, air

power assets increased in numbers and strength. Skip-bombing of Japanese ships was introduced by the B-25 force and proved to be a deadly form of attack. B-25s and A-20s were fitted with extra forward firing guns, making them fearful ship-strafting assets. The USAAF developed a blind radar bombing aircraft, the SB-24. First appearing in August 1943 in the Solomons theatre, these aircraft contributed greatly to the overwhelming attrition of Japanese surface vessels around the Solomons. By October 1943, 'the enemy could no longer sustain his barge losses.'³³ Equally able to bomb ground targets with new parachute retarded bombs, the versatility of Allied air power in the South West Pacific, often enabled through technological innovation, became its strongest quality, as highlighted by the historian Rohlfleisch, in Craven and Cate's *The Army Air Forces in World War II*:

By mid-December [1943]...Allied air forces so completely dominated the entire area that enemy commanders could scarcely risk daylight movement of their troops in any manner of surface craft ...No aircraft could be left on bases outside of Rabaul and Kavieng, nor could air installations be repaired, without continuous fear of surprise air attacks.³⁴

Air power flexibility was key to the Allied invasion of the Marianas. The operation began with a massive fighter sweep by US carrier aircraft. The total Japanese air strength was reduced by about a third and before the battle proper, the carriers 'had won control of the air'.³⁵ Air superiority was now seen as an essential prerequisite to amphibious operations. Subsequently, prior to the landings on Saipan, carrier aircraft bombed and strafed Japanese defensive positions. During the landings themselves, combined surface shelling, aerial bombing and strafing reduced the ferocity of the Japanese defences. Carrier aircraft acted as spotters, directing naval gunfire onto appropriate targets. When the IJN sought to engage the invasion forces, a massive defensive effort, the 'Marianas Turkey Shoot', took place. At the same time, carrier aircraft bombed and destroyed Japanese aircraft that had landed at Guam.³⁶ Without the presence of air assets and the variety of tasks that they could perform, the Saipan and subsequent Marianas landings could not have gone ahead without prohibitive losses. The importance that the US Navy attached to the provision of air power at this stage of the war, may be judged by the fact that no less than 15 fleet and escort carriers were assigned to the Marianas operation.³⁷

From late November 1944 onwards, with secure bases in the Marianas, the USAAF's B-29 bombers began the systematic bombing of the Japanese Home Islands, in a true display of the flexibility of air power. No other force had the reach, tempo, or concentration of effect, to carry out such a campaign at this stage of the war. In March 1945, B-29s began the aerial mining of Japanese waters, contributing to the maritime blockade of Japan. Such operations were not regarded as orthodox strategic missions; however, the USAAF commander, General Curtis E LeMay, a strong proponent of aerial strategic bombardment, supported the mining operations as a further demonstration of the versatility of air power.³⁸

With vast distances separating Allied forces across the theatre, and with hostile jungle terrain serving to isolate various fighting elements, re-supply became a vital role of air power in the Pacific. The epic struggle over Henderson Field on Guadalcanal would have been lost but for air re-supply.³⁹ Across in Papua New Guinea, Allied troops fought a difficult holding action against Japanese ground forces heading for Port Moresby, and relied upon aerial re-supply, reinforcement and medical evacuation as they progressed.⁴⁰ A year later, on 5 September 1943, the Allied airborne assault against Nadzab, in New Guinea, demonstrated the extent of the Allied effort, and of the versatility of air power. Over 300 aircraft took part in the assault, including 96 C-47 transport aircraft, carrying paratroops, supplies and some artillery.⁴¹

Flexibility and versatility were therefore crucial attributes of air power, which allowed it to contribute so emphatically to the Pacific campaign. Air power was vital across the theatre – it allowed Allied

commanders to maintain the initiative and apply constant pressure on the Japanese, aided by the ability of their air power assets to switch roles rapidly and to be used for a variety of tasks at all levels of the conflict. Finally, the ability of individual commanders and of the Allies in general, to innovate, improvise and invent solutions to maximise the versatility of those assets, proved to be a key factor in the drive towards Japan.

THE STRATEGIC BOMBING OF JAPAN

'Without strategic bombing, a landing on Japanese shores would have been costly, in spite of all the weaknesses of the defending forces.'
United States Strategic Bombing Survey.⁴²

With B-29s becoming available for use in 1943, the only viable choice of base at that time was central China.⁴³ Eventually, sixty-three B-29s raided Japanese steel works on Kyushu on 15 June 1944, marking the beginning of the strategic bombing campaign against Japan.⁴⁴ But, according to the United States Strategic Bombing Survey (USSBS), these operations proved to be 'not decisive'.⁴⁵ Technical problems bedevilled the new aircraft, crews were inexperienced and the technique of high level bombing remained difficult to implement accurately, exacerbated by the effects of winds at high altitudes. Senior commanders had not yet adjusted to the balance of expectation versus reality and continued to wrangle over the best targets to strike and methods to use – an enduring conundrum for air power commanders.⁴⁶ Worst of all was the logistic burden of operating from China, resulting in an average of about one sortie per month per aircraft.⁴⁷ The important attributes of pace, tempo and concentration of effort could not be applied. The B-29s were withdrawn from China in January 1945, as operations from the Marianas gathered pace.

As the number of B-29s increased, new techniques were introduced along with improved incendiary devices. This flexibility, so crucial to air power, yielded dramatic results, helped by the wooden construction of much of Japan's urban dwellings

Despite equally poor results at first, the strategic message conveyed by the first B-29 sortie from the Marianas was powerful and prophetic – the US was now in a position to launch attacks against Japan, and in particular Tokyo, with 'relative impunity'.⁴⁸ As the number of B-29s increased, new techniques were introduced along with improved incendiary devices. This flexibility, so crucial to air power, yielded dramatic results, helped by the wooden construction of much of Japan's urban dwellings. The prime example was a raid against Tokyo on 10 March 1945. The resultant firestorm burnt out 63% of the city's commercial zone, destroyed 18% of the industrial area, killed over 83,000 people and left over 1 million homeless. By the end of the war, US attacks had caused significant levels of destruction to a total of 66 Japanese cities. In parallel to the firebomb attacks, precision attacks by day against industrial, oil and infrastructure targets were carried out, though the weather significantly hampered the missions.⁴⁹ Finally, it should not be forgotten that the bombing complemented the maritime blockade of

The atomic bombs dropped on Japan, fearful though they were, caused less damage than the previous firebombing campaign

Japan that was already in progress. With the shortages in raw materials that this blockade produced, the industrial destruction wrought by the bombing campaign was made more potent. The mining operations conducted by the B-29s in 1945 simply added to the Japanese woes. In the last 12 months of the war, 49.7% of all Japanese merchant-shipping losses were due to aircraft attack, and a further 12.7% were due to aerial mining.⁵⁰

The results of the bombing surpassed all expectations – air power alone had delivered such a devastating blow. Destruction and dispersal of the aircraft industry reduced output by 57% in the last 10 months of the war and worker absenteeism was between 40% and 52% in July 1945 across key production facilities.⁵¹ The results were compelling at the time, and with loss rates, for example, in the order of 2%, LeMay began to believe that an invasion of the Home Islands could be avoided – that air power could end the war by October 1945.⁵² The post-war USSBS lends credence to this view, stating that:

*The bombing offensive was the major factor which secured agreement to unconditional surrender without an invasion of the home islands.....The atomic bomb and Russia's entry into the war speeded the process of surrender already realized as the only possible outcome.*⁵³

The atomic bombs dropped on Japan, fearful though they were, caused less damage than the previous firebombing campaign. However, their terror stemmed from the fact that only one or two aircraft were needed to deliver such effects and Japan had no idea how much more instant destruction was about to be meted out – she had had enough already. Coupled with the Russian invasion of Manchuria and Korea on 8 August 1945, the Japanese finally yielded to the inevitable, surrendering despite the presence of 2.5 million undefeated troops on the Home Islands and 9,000 Kamikaze airframes still available.⁵⁴

US airmen had wrangled over target selection throughout the bombing campaign. With cool hindsight, the USSBS stated that 'a concentration of air attacks exclusively on railroads and urban areas...would in all probability have led to an earlier surrender...'⁵⁵ This statement highlights the difficult choices facing a commander who seeks to employ strategic air power. However, the B-29 campaign undoubtedly contributed towards the ending of the war; there can be few other explanations for the final capitulation of Japan. The bombing formed a powerful adjunct to the economic blockade of Japan, delivering the coup de grâce, which finally tipped the balance. The atomic bombs simply reinforced the hopelessness of Japan's situation to her ruling bodies. The bombing campaign highlights many of the areas already considered in this paper and shows how the attributes of reach, strategic effect, tempo, concentration of effort, flexibility and technological innovation are all crucial to the proper delivery of strategic bombing and strategic air power. It also illuminates the key dilemmas that face the air commander: those of matching expectation with results and of selecting those targets that are likely to yield the most telling strategic effect upon the enemy.

CONCLUSIONS: LESSONS IN AIR POWER

'If I were to give you one factor as the leading one that led to your victory, I would give you the air force.'

Japanese Fleet Admiral Osami Nagano.⁵⁶

This article has argued that air power did indeed play a decisive role in the Pacific campaign of WWII – that it was a vital force multiplier, crucial to the success of the war. From the tactical to the strategic, air power was the driving force behind the Allies' eventual victory, so much so that the whole campaign was driven by the need to spread the influence of air power back across the Pacific towards Japan.

With the help of air power, the enduring principle of surprise yielded spectacular results from the start. Pearl Harbor and Midway showed that results of far-reaching strategic importance could be achieved through carefully planned surprise attack. Air power was able to deliver this through its unique qualities of speed and reach; neither result would have been possible without air power. The key attributes of pace and tempo, together with the principle of concentration of effort, allowed Allied air power to begin the war of attrition in the Solomons and beyond. Day after day, Allied aircraft ranged across the Southwest Pacific, aggressively searching out and engaging the Japanese, on the sea, on land and in the air. Surface forces proved too vulnerable; it was air power that dashed in and dashed out, continuously pushing the enemy back. When the bombing of Japan began, it was concentration of effort that yielded the terrifying results.

Tactical and strategic reach were enduring attributes of air power throughout the war. From the assassination of Yamamoto to the B-29 bombing campaign, the reach of air power proved crucial, allowing pre invasion strikes, blockade and mining operations to succeed. Submarines also had reach, and the provision of tactical air assets was repeatedly, though not exclusively, delivered through naval carrier power in the central Pacific. Nonetheless, these latter points emphasize the joint nature of air power; it was the maritime blockade and air power which brought Japan to her knees, enabled in no small way through the attribute of reach. This attribute is so fundamental to air power that it will always have a part to play. Strategic effect is often associated with reach and it was air power that delivered strategic effect most obviously in the Pacific, from Pearl Harbor and Midway to the bombing campaign against Japan. The capture of the Marianas was made possible by air power and it was from there that the bombing campaign began. Invasion of the islands without comprehensive air operations would have been unthinkable. The strategic bombing of Japan was clearly an air power preserve. The submarine blockade was the only operation that might be said to challenge the assertion that it was air power that ended the war. This article has argued that both campaigns contributed to the final surrender, but that it was air power that delivered the most shocking blows, and that accelerated the final outcome. Strategic bombing remains a valid consideration today, given the clinical precision that can be achieved with modern technology, but airmen must be careful not to promise what they cannot deliver, and they must be clear in their selection of target and expected strategic effect. These are not easy challenges, as General LeMay discovered in 1945, and they remain a challenge for the future employment of air power.

Finally, it was the flexibility and versatility of air power, coupled with the application of technology, which gave the allies a vital lead in the Pacific campaign. Innovative and aggressive, the fighting spirit of the air power arms in the Pacific meant that even inferior equipment found a use and that no platform stood idle for want of a role. The Japanese could never rest; the ability of air power to operate at all levels of war, from the tactical to the strategic, harnessing technology in increasingly effective ways as it did so, meant that air power proved to be a ubiquitous enemy to the Japanese. The conservative outlook of the Japanese air arms, their lack of strategic vision, their slow rate of technological advance, and their adherence to the Bushido ethos, meant that the Japanese simply lost the technological race and that Japanese air power was eventually outclassed. Backed by superior economic strength, Allied air power dominated the skies over the Central Pacific and Japan in the latter stages of the conflict. Flexibility and versatility are unique attributes of air power; in the Pacific they were the dominant qualities that provided air power with its decisive edge – decisive over the Japanese forces and decisive as the leading arm in the campaign. The ubiquity of air power must be recognised as its greatest strength – its ability to operate across the disciplines and layers of war with technology as its shield. Thus was air power the decisive weapon of defeat for the Japanese in the Pacific. That it was air power that began and ended the conflict is no insignificant fact. Our understanding and application today, of the enduring principles of air power, owes much to the courage and innovative fighting spirit of the Allied air arms in the Pacific campaign.

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‘Air Rollback’: Tactical Targets... Independent Air Power?

By Captain Paul Johnston, CAF

Imagine a situation in which an aggressor invades a small province that borders no friendly or allied state. Western statesmen decide that they want to see the aggression reversed, but not only are they loath to commit ground forces, for political reasons they are also unwilling to sanction a strategic air campaign against the aggressor's homeland. Instead, they call for an air campaign to evict the aggressor, but one that is directed only against purely military targets within the disputed territory itself. Such a combination of no ground component and no strategic air offensive may represent a military worst case, but this is precisely the possibility suggested by recent events, beginning with the 1991 Gulf War, but seen more particularly in Operation ALLIED FORCE¹, and to a lesser extent in the more recent Operation ENDURING FREEDOM². Indeed, we now see the argument being made that using air power



We may have stumbled into another model for air power — a model that is ‘independent’ from ground power, but focused on ‘tactical’ rather than ‘strategic’ targets

in this way – neither ‘strategically’ in the classic sense nor ‘tactically’ in the supporting sense, but rather as the sole means of attack against an enemy army in the field – is a new form of ‘asymmetric attack.’³ Why might this idea be gaining momentum? Is it viable?

For good or ill, three trends – many of which first appeared in the 1991 Gulf war, and all of which were far more pronounced in ALLIED FORCE and ENDURING FREEDOM – are driving events towards such a role for air power. First of all, there is a trend towards avoiding ground commitments and instead preferring action by air power alone.⁴ This is clear and widely remarked upon. However, there is a related trend of direct relevance to air power that has received less attention, and that is the prospect of a growing Western aversion to strategic air attack, in particular attack upon targets not perceived as purely military. Finally, this comes at a time when various technologies are finally giving air forces the ability to contemplate focusing their targeting upon very discrete targets deep in hostile territory.

Together these three trends suggest the possibility of a new approach for air power. For generations theorists have dreamt of an independent war-winning role for air power’s very own, but this ‘independent’ role has always been associated with ‘strategic’ attack. Now, in light of the three trends identified above, and the recent experience of air campaigns such as ALLIED FORCE and ENDURING FREEDOM, we may have stumbled into another model for air power — a model that is ‘independent’ from ground power, but focused on ‘tactical’ rather than ‘strategic’ targets. Indeed, this is positively the modern trend, at least for minor wars.

However, any such independent-but-tactical model for air power seems to leave the vested interests in both the ground or air power communities uneasy. It is an idea that may well remain an unwanted orphan – at least until the next time the politicians call for an air campaign within a limited war. Perhaps the air power community should begin thinking about this possibility before it is once again suddenly demanded of us by our political masters.

Air power rather than ground or naval power is the most useful instrument of coercion in the new post-Cold War era



FIRST NEW TREND: AIR POWER ALONE

The growing preference, amongst Western governments at least, for action by air power alone is clear and widely remarked upon. Air power is perceived as a quick, easy and clean way to take direct action against hostile states. The noted US strategic theorist Edward Luttwak even went so far as to write (before ALLIED FORCE no less) that, 'political constraints make ground forces effectively unavailable.'⁵ Not only was ALLIED FORCE an operation by air power alone, but it featured very public declarations from the highest levels expressly ruling out any ground component.⁶ Indeed, many enthusiasts of air power make this a central point of their theories, arguing that air power rather than ground or naval power is the most useful instrument of coercion in the new post-Cold War era.⁷ Recent events in Afghanistan further underscore this – the nasty ground fighting there was left to the native levees of the Northern Alliance.

SECOND NEW TREND: GROWING AVERSION TO STRATEGIC ATTACK?

As yet, the evidence for a trend away from strategic attack is less clear than that away from ground action, but there are signs. As many as ten years ago, in the aftermath of DESERT STORM, the respected theorist of strategic attack Lawrence Freedman noted that the strategic air campaign against Iraq – successful as it was – elicited enough unease in the West over Iraqi (not Coalition) suffering that decision-making at the highest levels may have been affected.⁸ One of the clearest examples of this was the al-Firdos bunker incident – in which several dozen civilians who happened to be sheltering in a command bunker were killed in an air strike upon that facility.⁹ As a direct result of that incident, strategic attacks on Baghdad proper were halted.¹⁰ More recently, the legality (not to say morality) of



The Japanese port of Hiroshima after a single atomic bomb was dropped from a B-29 on 6 August 1945

Clearly, what the international community is prepared to consider an acceptable target for strategic air attack has evolved since the days of Dresden and Tokyo

the strategic campaign against the FRY has set off considerable controversy, including some legal actions.

The first of these was made by the Yugoslav government itself. On 29 April 1999, even while the air campaign was still underway, Slobodan Milosevic's lawyers filed a request with the International Court of Justice (ICJ) at the Hague for emergency court orders against ten NATO countries to stop the bombing. The ICJ declined to attempt an injunction, on the convenient grounds that they lacked the jurisdiction to do so, but did express 'profound concern about the use of force,' which 'under the present circumstances ... raises very serious issues of international law.'¹¹ They also reserved the right to consider further the question of whether international law had been violated.

Such a suit from the FRY government is only to be expected, but they have not been the only ones. At least three suits have been brought against NATO, with both the ICJ and the International Criminal Tribunal for the former Yugoslavia.¹² All of these suits have fizzled out. Indeed, neither the FRY's interlocutors nor self-appointed gadflies of international law are likely to make any headway with their various suits. But the issue is not limited to such partisans. There is unease with the legality of the offensive within the mainstream as well.¹³

Even amongst those prepared to countenance an air campaign of some description, there is unease with certain aspects of the strategic attacks. For instance, NATO attacked not only purely military targets, but also such things as power lines that also served hospitals. Serious commentators have wondered aloud whether or not at least some of these attacks did not violate Article 14 of the 1977 Protocol to the 1949 Geneva Convention, which bars attacks on 'objects indispensable to the survival of the civilian population.'¹⁴ All in all, the inevitable effect of strategic air campaigns upon the civil populace is attracting growing attention and concern, as do newer concerns about environmental effects.¹⁵



American F-15 Eagles and inset an AGM-130 missile

Advanced sensors in platforms such as the PREDATOR Unmanned Aerial Vehicle (UAV) were able to combine with PGMs such as the AGM-130 on F-15Es to put weapons onto targets such as Serb military vehicles hidden in the forested hills of central Kosovo

These may only be specific questions about the specific circumstances of ALLIED FORCE, but one cannot help but wonder if a larger trend is not at work. Buster C. Glosson, a retired US Air Force (USAF) General who played a key planning role in DESERT STORM, once noted that the US 'has developed a keen intolerance for casualties – even enemy casualties.'¹⁶

Clearly, what the international community is prepared to consider an acceptable target for strategic air attack has evolved since the days of Dresden and Tokyo. Indeed, NATO's air forces realized this even before they launched their campaign over Yugoslavia. ALLIED FORCE included some of the most tightly vetted targeting of any air campaign. Lawyers, for instance, were an integral part of the targeting process.¹⁷

All of this suggests that in future there may well be a greater reluctance by Western governments to allow a wide ranging strategic air campaign that targets civilians, or even air attacks that although not specifically meant to target civilians, nevertheless result in their suffering. But quite aside from all of that, there is the historical precedent of the Korean war, when strategic air attacks on China were ruled out for geo-political reasons. Who can say with assurance that whenever an air campaign is being mounted, the politicians will allow strategic attack upon the enemy homeland?

THIRD NEW TREND: TECHNOLOGY

Effectively hitting the tactical elements of enemy ground forces dispersed in their rear has always been air power's most difficult potential task. This is so for various reasons. The targets – individual vehicles and their crews, or individual emplacements – are small, dispersed, and camouflaged. They are hard to find, except when moving in mass, and even if found their pinpoint size makes them hard to hit. For these reasons, air power has always experienced its least success at this sort of thing,¹⁸ and air doctrine has always emphasized that this role is the least effective way to employ limited air resources and should not be made the priority mission.¹⁹

However, the new capabilities introduced by Precision Guided Munitions (PGMs) and modern sensor technology are widely heralded as beginning to change those traditional limitations. Indeed, many argue that 'precision strike' – the combination of sophisticated sensors and targeting with PGMs – fundamentally alters the capabilities of air power. The first real example of this came in DESERT STORM, when the USAF discovered that although designed for operational or strategic targets, F-111s could readily use their swivel-mounted forward-looking infrared (FLIR) cameras to pick out individual Iraqi armoured vehicles and then hit them with PGMs such as the GBU-12 laser-guided bomb.²⁰ Continuing developments have furthered this trend. In ALLIED FORCE, advanced sensors in platforms such as the PREDATOR Unmanned Aerial Vehicle (UAV) were able to combine with PGMs such as the AGM-130 on F-15Es to put weapons onto targets such as Serb military vehicles hidden in the forested hills of central Kosovo.²¹

Thus, for the first time, these new technological capabilities give air power the capability to concentrate upon the pinpoint destruction of very discrete targets deep in hostile territory. Or at least, they put such a capability into prospect. As we shall see below, there are some fierce disputes about the effectiveness of such systems in attacking tactical targets. Nevertheless, the trend is clearly towards an increasing capability to do such things and further improvements are on the way.²²

Despite repeated attempts at 'strategic' applications of air power, the efficacy of such efforts has remained hotly contested

THE HISTORY OF INDEPENDENT AIR POWER: DOUHET'S HOLY GRAIL?

So, where might the combination of these three trends be pointing air power theory? As we said, traditionally, air power theorists have equated 'independent' air power with attack on 'strategic' targets. This has a long history that stretches from the First World War down to modern theorists such as John Warden. Nowadays, intellectual credit for this argument is usually accorded to the Italian soldier/pilot and fervent air power propagandist, Giulio Douhet.²³ His vision, famously, was to use air power not on the battlefield, but rather to strike directly at the enemy homeland, in particular the enemy capital.²⁴ This, Douhet believed, would result in damage no nation could sustain, forcing it to sue for peace.

More recently, a somewhat updated version of this argument has been made by the retired USAF Colonel John Warden.²⁵ Warden's theory is that any enemy state can be conceptually divided into five concentric 'rings.' The outermost of these rings is the military forces of the target state, the innermost the national leadership itself. The decisive ring, in Warden's view, is this inner leadership ring. In the past – i.e. before air power – ground and naval forces could only reach this ring by fighting their way through the four outer rings. Warden's main point, of course, is that air power is able to leap over those four outer rings and attack the innermost ring directly.²⁶ In other words, Warden is in favour of using air power against strategic rather than tactical targets.

Despite repeated attempts at 'strategic' applications of air power in this way, the efficacy of such efforts has remained hotly contested.²⁷ The Germans tried it in the Battle of Britain and were forced to abandon the effort. The Allies tried it in reverse from 1943 on, but a costly land invasion of the continent still proved necessary. Similarly, down to the Gulf War of 1990-91, a ground operation always seemed to play the conclusive, or at least concluding, part. As we shall see, even in Operation ALLIED FORCE, a case in which it was air power alone that brought the enemy state to concede, there has been disagreement about the results. On this basis, ground power advocates have long argued that air power is unable to win wars independently, and army generals in campaigns have long argued for claim to a greater apportionment of the available air power for their direct support.

BIFURCATED AIR CAMPAIGNS

This traditional dispute between air and ground commanders has resulted in bifurcated air campaigns, a pattern in evidence at least since World War II. In that war, British and later American air forces argued that direct bombing of the German homeland could win the war alone and consequently they adamantly opposed any 'diversion' of air power away from this 'decisive strategic effort'.²⁸ Nevertheless, in the end, they were forced to dedicate considerable resources to supporting ground campaigns. The result was two air efforts – a strategic bombing campaign over the Third Reich and a tactical campaign associated with the invasion. The commanders of the heavy bomber force famously resisted diversion from the former to the latter, and even when placed under General Eisenhower's command specifically to ensure that they would furnish such support, they persisted in maintaining a separate strategic effort.²⁹

This pattern – concurrent strategic and tactical air campaigns – has repeated itself since World War II, reappearing in both Korea and Vietnam, and even more strongly in DESERT STORM. In that conflict John Warden himself was sent to the planning staff in Riyadh, where he quickly produced a plan known as INSTANT THUNDER which proposed a strategic bombing campaign specifically focused against the Iraqi leadership, while almost completely ignoring the large Iraqi ground force in Kuwait itself.³⁰ This was not entirely well received, either by the Army which wanted more focus on tactical targets to their immediate front, or even by the Commander of the Ninth Air Force, Lieutenant General Chuck Horner, who apparently resented what he saw as meddling from Washington. He also had reservations about the wisdom of focusing solely on the supposedly decisive 'inner ring' of the Iraqi leadership.³¹ Even more pointedly, General Schwartzkopf directed that emphasis would have to be given to Iraqi army targets in Kuwait. The end result was two almost entirely unrelated air campaigns – one against strategic targets in Iraq and one against tactical targets in Kuwait.³²

This phenomenon of bifurcated air campaigns was even more pronounced in ALLIED FORCE, which actually consisted of two quite separate air campaigns: a strategic one against all of Yugoslavia and a tactical one within Kosovo itself. Indeed, air planners formally distinguished between two categories of targets: strategic ones in Serbia proper and tactical ones in Kosovo itself – in particular those Yugoslav forces conducting the ethnic cleansing which had suddenly produced a massive wave of refugees.³³

The strategic campaign was relatively orthodox (albeit spasmodic). Clearly the aim was to strike classically 'strategic' targets in order to hurt the Milosevic regime until they would concede – classic air coercion theory

The first target set was termed 'fixed targets of unique strategic value.' This included all of the classically Douhetian sorts of targets of which John Warden might approve: national command and control; military headquarters; and infrastructure such as bridges and the electric power grid. The second target set included the Yugoslav 'fielded forces' in Kosovo, such as the actual Yugoslav army elements deployed there, their command and control machinery, and their supplies and concentration areas.

The strategic campaign was relatively orthodox (albeit spasmodic). Clearly the aim was to strike classically 'strategic' targets in order to hurt the Milosevic regime until they would concede – classic air coercion theory.³⁴ The tactical effort inside Kosovo itself was more unusual. Here was an attempt to use air power alone, without any associated ground forces, to stop enemy ground operations (i.e. Yugoslav ethnic cleansing), or at least to destroy enemy ground forces. This last effort was intended

There is 'clear evidence that the 11-week NATO bombing campaign did almost no damage to Serb fielded forces in Kosovo



The B-2A Spirit first saw operational service during operation ALLIED FORCE

not to soften the enemy up for a subsequent ground offensive, but to convince him to retire even without a ground offensive.

Now that is novel, perhaps unprecedented. It should also be noted that most of the disputes about air power in ALLIED FORCE centre around this effort against tactical forces in Kosovo – how many armoured vehicles and guns the NATO air offensive actually destroyed there. Initially, NATO claimed to have degraded thirty percent of Serb heavy weapons in Kosovo.³⁵ The well-respected Jane's magazine summarized the widely circulated claims that by the end of the war the Alliance had struck some 270 armoured personnel carriers and approximately 150 tanks.³⁶ It now appears, however, that the Serbs made widespread use of deception efforts, including impressive numbers of dummy artillery pieces and armored vehicles.³⁷ Other criticisms have claimed that only 12 destroyed armoured personnel carriers have been found in Kosovo.³⁸ Press accounts of the Royal Air Force initial after-action report for ALLIED FORCE have even gone so far as to claim that there is 'clear evidence that the 11-week NATO bombing campaign did almost no damage to Serb fielded forces in Kosovo.'³⁹ NATO – and air power enthusiasts – have disputed these claims, arguing that the destruction or damage in Kosovo of at least 93 tanks and 153 armoured personnel carriers can be confirmed.⁴⁰ How many tanks did NATO really destroy?⁴¹

The Douhetian reply to all of this talk is to argue that it is irrelevant, because the decisive issue was the strategic campaign against Serbia proper. Indeed, Jane's quotes senior Royal Air Force sources as opining that Yugoslav Army losses in Kosovo were 'largely academic.' 'The decisive factor that forced Milosevic's hand was the rapidly mounting material and political damage being inflicted on his regime by the NATO air campaign.'⁴² This was certainly the view of the air campaign's operational commander, USAF Lieutenant General Michael Short, who publicly denigrated what he called 'tank plinking' in Kosovo.⁴³

Spoken like a true Douhetist; doubtless John Warden would agree. In fact, throughout the conflict there was a now well-known tension between NATO's Supreme Allied Commander Europe, General Wesley Clark – an Army officer – and the Air Component Commander Lieutenant General Short. Clark wanted less strategic bombing and more emphasis on tactical operations in Kosovo. Short, on classic Douhetian grounds, considered the effort inside Kosovo at best subsidiary and at worst a dangerous diversion from a 'decisive' strategic campaign.⁴⁴ Indeed, so frustrated was Short with the limitations on strategic targeting and the pressure to concentrate on tactical targets in Kosovo that he has suggested that rather than a campaign, ALLIED FORCE should be considered a 'random bombing of military targets'.⁴⁵

TACTICAL TARGETING

The simple truth is that no one in any Western military planned to be conducting an air campaign as we found ourselves doing in ALLIED FORCE, whatever colour uniform they wore. For years Western military doctrine has stressed jointness, synchronicity and top-down campaign planning. Air attacks meant to kill individual tanks – field deployed deep in enemy territory – were never envisioned being mounted alone, completely separate from an integrated ground campaign.⁴⁶ Yet this is exactly what Western militaries wound up attempting over Kosovo. Few of the classic military schools of thought appear to have been happy with this state of affairs. The neo-Douhetists, such as General Short, fumed that operations against tactical targets in Kosovo were a diversion from the decisive strategic ones. The more mainstream believers in jointness, such as General Clark, suggested that foregoing fully joint operations that included a ground component was folly, contrary to venerable principles of war. Either or both of those schools of thought may be right, but what they both miss is that a limited air-only

campaign may be exactly what the politicians will ask Western air forces to do again, even if it is recognized that doing so is not militarily optimal (from either a ground or air power perspective).

HALT OR AIR ROLLBACK: INDEPENDENT AIR POWER AT THE TACTICAL LEVEL?

This returns us to the imaginary scenario of the introduction. Can strategic aims be achieved by attacking what would classically be considered 'tactical' targets? A relatively new idea that to a certain extent bridges the gap between strategic and tactical targets is the concept of 'decisive halt', 'rapid halt' or simply 'halt phase' operations.⁴⁷ The 'halt' idea is the argument that modern capabilities – in particular PGMs – can allow air power alone to halt an invading aggressor, especially a mechanised one. This, the argument goes, can stop the aggressor's offensive in its tracks and buy time for friendly forces to be assembled. This is a new idea because it obviates the need for ground forces in theatre (at least initially), and given the strategic mobility of air power could allow intervention against an aggression anywhere in the world on extremely short notice.

The independent application of air power against tactical targets on a battlefield is probably not something that Douhet would have approved of and, as we have noted, in so far as Western air doctrines have considered the independent use of air power, it has generally been envisioned as strategic attack. Halt theory is thus innovative in its vision of air power being applied independently of friendly ground forces, but against tactical targets rather than strategic ones. Nevertheless, as the very word 'halt' implies, implicit in most of this talk is the idea that these operations would only halt the aggressor, to buy time for friendly ground forces to assemble. An eventual friendly ground offensive, it appears, is still required by halt theory. This seems even more true of the term 'halt phase', which surely implies that there would be further succeeding phases, presumably ones in which the aggressor is forced back by ground action.

In other words, there has been no real theoretical consideration of the independent use of air power against tactical level enemy ground forces, except as just one part of a strategic campaign, or as a preparatory phase to a ground campaign. However, if recent experience suggests the possibility of independent but tactical air operations then this raises the prospect of going halt theory one better, and using air power alone not just to halt the aggressor's offensive, but to force him to withdraw. Call it 'air rollback' operations. What might such operations look like, and what considerations might they involve?

AIR ROLLBACK

The *sine qua non* of air rollback operations would be a political decision to forego at the outset any prospect of either friendly ground operations or strategic attack on the enemy homeland, presumably due to political considerations. The politically mandated aim would then be to destroy the enemy's military forces in the target area, both to punish the enemy and to thereby force him to withdraw.

This possibility suggests that Western air forces need to broaden their skill sets a bit. To be sure, the sort of independent yet tactical air campaign we are speaking of here is only applicable in strictly limited wars. But quite frankly, a major high intensity war of the sort for which Western joint warfighting doctrine was designed is unlikely in the foreseeable future. While that may not herald the end of warfare as we have known it, it is true that over the next decade or two Western militaries are more

Our politicians appear to have concluded that recent air campaigns have worked, and got them what they wanted

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likely to be asked to do something like ALLIED FORCE (complete with all its political constraints) than to fight a major conventional war.⁴⁸ This will be true especially as our politicians appear to have concluded that recent air campaigns have worked, and got them what they wanted.

THE LIMITATIONS OF ORTHODOX DOCTRINE?

Currently, doctrine stresses either jointness or independent strategic attack. But what if it is to be neither of those? What if we are ordered to destroy individual armoured vehicles in a remote and inaccessible region by air power alone in an operation that has no ground component and no strategic attack? What indeed? As we saw in Kosovo, doing so is a very difficult proposition.⁴⁹ In particular, targeting is a central problem – air force targeting and intelligence tend to be focused upon traditionally 'strategic' or 'interdiction' type static facilities. As Lieutenant Colonel Haun of the USAF astutely pointed out in a recent article in this very journal 'intelligence expertise against enemy armies resides within ... [armies].'⁵⁰



The question will not be what – in the abstract – is the most ideal way in which we could apply air power? It will be, what – within our political constraints – is the optimal way that we can apply air power?

But even as these (formidable) problems are solved with new tools such as 'flex targeting' and precision strike, there are still many questions. We will need doctrine for the best way to utilize these tools. What sorts of targets should be struck first? Are tanks or artillery more important? How about bridges or other such choke points? And perhaps most importantly, how should air forces be organized to conduct this sort of a campaign? These are the sorts of questions that need hard answers. Without such answers, do we have doctrine for the mounting of an air campaign designed – in complete isolation from any theatre campaign with a ground component – to destroy discrete, tactical level, ground forces dispersed in the field? Do we, in short, have doctrine for an air rollback operation?

Could air forces meet the challenge posed in the introduction's imaginary scenario? Regardless of the answer to that question, it will be difficult for 'air rollback' – or something like it – to attract supporters in any of the established military communities. Ground power enthusiasts can scarcely be expected to endorse an independent role for air power specifically meant to exclude their participation.⁵¹ But neither are the traditional air power constituencies necessarily keen to take up this particular torch. As can be seen in General Short's fulminations,⁵² air power enthusiasts remain critical of any effort to divert air power from strategic to tactical targets. And to be sure, as Lieutenant Colonel Haun's arguments show, efforts to make air forces more effective in this sort of independent tactical role would require reorganization of traditional air force forms – always something likely to generate resistance from established interests.

Within the air power community, those established interests are likely to argue that unbridled strategic attack is the most effective form of air power, and that any reorganization to permit more effective tactical targeting is a mistake. The argument of this paper is not that air rollback would be more militarily effective than strategic attack. Indeed, it is almost certain to be markedly less so. But one of the clearest lessons from the application of air power in the modern era – since Vietnam at the very least – is that there will be political constraints. Railing against this while pining for some sort of neo-Douhetian ideal is moot. Especially when limited wars are Western air forces' assigned task, the question will not be what – in the abstract – is the most ideal way in which we could apply air power? It will be, what – within our political constraints – is the optimal way that we can apply air power?

Given all of the inevitable political considerations, who can say with assurance that Western air forces will never be asked to mount an air campaign with no element of strategic attack, even if such an option is recognized as being less than the military ideal? If one accepts the proposition that Western politicians are, in fact, likely to try the application of force at a distance by air power alone again, then surely we ought to think about how best to do that, a certain professional distaste for the diversion of air power to tactical targets notwithstanding. In those circumstances – and it is this article's contention that trends point towards such circumstances – then something like air rollback could be another tool in the box, for use when other options are hamstrung politically. This need not displace the current – absolutely sound – emphasis on jointness. Nor need it be a repudiation of the advantages of true strategic attack. The politicians are likely to ask for something like ALLIED FORCE again, and next time they may not want to allow a wider strategic air campaign. What then? Perhaps we should be thinking about this – about ways to independently hit a conventional army in the field.

Notes

1. This was NATO's 1999 air war over the Federal Republic of Yugoslavia (FRY). Properly speaking, the FRY includes only two constituent 'republics': Serbia and Macedonia. (Kosovo is a region within Serbia itself.) Because the Serbs dominated Yugoslavia in general and President Milosevic regime's in particular, this paper will use 'Yugoslav' and 'Serb' interchangeably.
2. The US led war against the Taliban regime in Afghanistan.
3. See for instance Lieutenant Colonel 'Goldie' Haun, USAF, 'Air Power Versus a Fielded Army: A Construct for Air Operations in the 21st Century' (RAF: Air Power Review, pp 64-91).

4. Some commentators have suggested that in ALLIED FORCE the Kosovo Liberation Army constituted a de facto ground component on the Allied side, but this appears to be a stretch. Afghanistan is a clearer example of the same point though; the Northern Alliance certainly constituted an allied ground component there.
5. Edward N. Luttwak 'A Post-Heroic Military Policy' *Foreign Affairs* Vol. 75, No. 4, (July/August 1996), pp 33-44.
6. The wisdom of this is heatedly debated. See for instance Earl H. Tilford, jr, 'Operation Allied Force and the Role of Air power' *Parameters*, (Winter 1999-2000) pp. 24-38.
7. For example, John Warden 'Employing Air power in the Twenty-first Century' in *The Future of Air power in the Aftermath of the Gulf War* (Air University Press, 1992) pp 57-82, or the USAF position on air power's possibilities as expressed in 'Global Reach, Global Power'.
8. Lawrence Freedman and Efraim Karsh, 'How Kuwait Was Won: Strategy in the Gulf War,' *International Security* 16, no. 2 (Fall 1991): 5-41. 'The only factor that began to create pressure to get the land campaign underway was unease in the West over the judgment, implicit in the massive air campaign, that any number of Iraqi deaths was worth the reduction of risk to coalition forces' (p 31).
9. Williamson Murray, 'The Air War in the Gulf: The Limits of Air power' *Strategic Review* Vol. XIV, No. 1, (Winter 1998) pp 28-38, p 34.
10. Ibid.
11. International Court of Justice - Press Communiqué 99/23, 2 June 1999.
12. The 'Movement for the Advancement of International Criminal Law' (MAICL), has compiled a submission for the International Criminal Tribunal for the former Yugoslavia, requesting the indictment of British Prime Minister Tony Blair and Foreign Secretary Robin Cook and Defence Secretary George Robertson. MAICL is a group set up in 1998 by international lawyers in Cambridge, UK, 'to work to bring state leaders and officials who have committed unlawful acts of violence against the human person to justice in a court of law.' They have a website at <http://ban.joh.cam.ac.uk/~maicl/> Professor Michael Mandel, of the Osgoode Hall Law School, York University, Canada and The American Association of Jurists, in cooperation with others, have brought a similar suit citing all of the NATO leaders. Finally, a similar Scandinavian group has also brought forth a suit.
13. For instance *The Economist* magazine, hardly a bastion of anti-establishment criticism, wrote that 'the unpalatable truth is that, though [the Yugoslav] government is in gross breach of international law, so, as the law stands, is NATO. The alliance's bombing campaign may have been undertaken to protect a nine-tenths majority of Kosovo's population, but without a Security Council mandate it breaches the UN charter, the most important agreement in international law. This is no mere technicality. Even legal experts who want to see humanitarian law more widely enforced are queasy.' *The Economist*, 13 May 1999 'Gowned Warriors' (p 31).
14. Michael Mandelbaum 'A Perfect Failure' *Foreign Affairs*, (September/October 1999).
15. Air attack upon industrial targets that results in the release of pollutants could constitute a violation of international environmental law.
16. 'Impact of Precision Weapons on Air Combat Operations' *Air power Journal* Vol. 7 No. 2 (Summer 1993) pp 4-10.
17. For a lucid and compelling explanation of how lawyers are integrated into air planning – which interestingly enough came out just before ALLIED FORCE – see Lt Col Terrie M. Gent, USAF, 'The Role of Judge Advocates in a Joint Air Operations Center: A Counterpoint of Doctrine, Strategy, and Law' *Aerospace Power Journal* (Spring 1999) pp 40-55.
18. On the effectiveness of Allied air attack on individual German armoured vehicles in Normandy, 1944, see for instance Ian Gooderson *Air power at the Battlefield: Allied Close Air Support in Europe 1943-45* (London: Frank Cass, 1998) pp 75-76 and Chapter 5 'Allied Fighter-Bombers vs German Armoured Forces: Myths and Realities' pp 103-124.
19. This has often led to disputes with ground commanders.
20. See for instance Richard Hallion's description of this in *Storm Over Iraq* (Washington: Smithsonian, 1992).
21. James Kitfield 'Another Look at the Air War That Was' *Air Force Magazine* Vol. 82 No. 10 (October 1999).
22. See for instance John Tirpak 'The State of Precision Engagement' *Air Force Magazine* Vol. 83 No. 3 (March 2000).
23. Almost certainly, the RAF did not in fact derive its doctrine from Douhet, but rather independently developed what were essentially the same ideas. This issue was perhaps first broached by Robin Higham, *The Military Intellectuals in Britain: 1918-1939* (New Brunswick NJ: Rutgers University Press, 1966) pp 257-259. The United States Army Air Forces, on the other hand, appear to have been more directly influenced by early translations of Douhet in use at the Air Corps Tactical School; see for instance Michael S. Sherry *The Rise of American Air power: The Creation of Armageddon* (New Haven: Yale University Press, 1987).
24. Giulio Douhet, *The Command of the Air*, translated by Dino Ferrari, (New York: Coward-McCann, 1942), in particular Chapter 1 of Book I, pp 3-33, and Chapter IV of Book II, pp 187-207.
25. In 1988 as a student at the US National Defence University, Colonel John A. Warden III produced a thesis, subsequently published as a book, *The Air Campaign* (Pergamon-Brassey's, 1989), arguing for strategic air power (amongst other things). This heralded something of a renaissance in USAF thinking about conventional strategic attack. Just before the Gulf War, Warden was chosen to head the strategic analysis section of the Air Staff, and he was subsequently sent to Riyadh as head of the planning team known as 'Checkmate.' After the war, he became Commandant of the Air Command and Staff College, where he preached his theories to a whole generation of officers.
26. Warden's clearest exposition of these theories is probably found in his short paper 'Employing Air power in the Twenty-first Century' (see note 7 above).
27. See in particular the recent book by Robert A. Pape *Bombing to Win: Air power and Coercion in War* (Ithaca: Cornell University Press, 1996) which examines WW II, Korea, Vietnam and Iraq and concludes flatly that 'strategic bombing does not work.' (p 314). An opposing view is given by John Warden (see note 25 above) in *Security Studies* issue 7.2 'Success in Modern War: A Response to Robert Pape's Bombing to Win'.
28. The RAF for instance, went so far as to argue in 1941 that 'the Army has no primary offensive role ... We aim to win the war in the air, not on land.' Memo from RAF Chief of the Air Staff Portal to the Combined Chiefs 'The Air Programme' 21 May 1941,

- quoted in W.A. Jacobs 'Air Support for the British Army, 1939-1943' *Military Affairs*, Vol. XLVI No. 4, (December 1982, pp 197-198) p 175.
29. See for instance John Terraine *The Right of the Line: The Royal Air Force in the European War 1939-1945* (London: Hodder & Stoughton, 1985) pp 608-609.
30. For a readable and illuminating account of air campaign planning in Desert Storm, see Col Richard T. Reynolds, *Heart of the Storm: The Genesis of the Air Campaign against Iraq* (Maxwell AFB, Ala.: Air University Press, 1995).
31. Williamson Murray 'Air War in the Gulf: The Limits of Air power' *Strategic Review* (Vol. XXVI, No. 1, Winter 1998, pp 28-38), p 32.
32. The tactical air campaign in Kuwait was, in Murray's words 'almost entirely separate' from the strategic campaign against Iraq itself. *Ibid*, p 32.
33. Actually, to be more precise, NATO appears to have begun the war in the hope that a demonstration alone would suffice. The first air strikes were made on the night of 24 March 1999 against fifty carefully screened and agreed targets, mostly components of the Yugoslav integrated air defence system. While this was an essential first step to breaking into Yugoslav airspace for any sort of air campaign, the initial intent appears to have been less preparation for a long campaign than an attempt to deliver a short sharp response to the collapse of talks at Rambouillet. Only 214 aircraft were committed, and the prevailing belief in NATO apparently was that a night or two of strikes would convince President Milosevic to concede (see for instance [US] Air Force Association, *The Kosovo Campaign: Aerospace Power Made it Work 'Operation Allied Force Begins'* (The Air Force Association, 1999) p 1). This initial gamble having failed, more aircraft were committed to the operation, and the target set was broadened. On 28 March, US Secretary of State Madeleine Albright publicly announced the new approach towards Milosevic — he would be made to pay 'a very heavy price.' A renewed air plan was drawn up (or perhaps more accurately, an actual campaign plan was finally drawn up for the first time), and it was at that point that the bifurcated nature of the campaign became prominent.
34. For an excellent (albeit contentious) scholarly overview of air coercion theory, see Pape's *Bombing to Win*.
35. Nick Cook, 'Special Report: War of Extremes' *Jane's Defence Weekly* (7 July 1999, pp 20-23), p 21.
36. *Ibid*.
37. *Ibid*.
38. Richard J. Newman 'The Bombs that Failed in Kosovo' *U.S. News and World Report* (20 September 1999), 29.
39. *The Sunday Telegraph*, 25 July 1999.
40. William Drozdiak 'Kosovo Success Confirmed, NATO Chief Says' *The Washington Post* (17 September 1999) p 22.
41. Anthony H. Cordesman, *The Lessons and Non-Lessons of the Air and Missile War in Kosovo* (Washington: Center for Strategic and International Studies, 1999) contains some interesting food for thought, arguing that NATO's claims are largely unsupported.
42. Nick Cook, 'Special Report: War of Extremes' *Jane's Defence Weekly* (7 July 1999 pp 20-23), p 23.
43. See his comments in a speech published in *Air Force Magazine* (September 1999), p 43.
44. Dana Priest 'The Battle Inside Headquarters: Tension Grew with Divide Over Strategy' *Washington Post* (21 September 1999) p A01. This debate is rather reminiscent of the Second World arguments about diverting the strategic bombers to support for OVERLORD. (See notes 25 & 26 above.)
45. Lieutenant General (retired) Michael Short, interview on the PBS show *Frontline*, 22 February 2000. Transcript available online at <http://www.pbs.org/wgbh/frontline/shows/kosovo/interviews/short.html>
46. For more on this see Peter F. Herrly's thoughtful article 'The Plight of Joint Doctrine After Kosovo' *Joint Forces Quarterly* (Summer 1999).
47. The concept of the decisive halt is described in AFDD1, pp 42-43, but goes back at least as far as a USAF sponsored RAND study *The New Calculus: Analyzing Air power's Changing Role in Joint Theater Campaigns* (Santa Monica: RAND, 1993). For a recent sample of some optimistic discussion of decisive halt's possibilities, see D.A. Ochmanek, E.R. Harshberger, D.E. Thaler & G.A. Kent 'Find, Hit, Win' *Air Force Magazine* April 1999, pp 50-59. The official status of 'halt phase' operations has recently become highly controversial at the Joint Chiefs level, where the older services have been successfully lobbying to expunge the term from official US joint doctrine. See Elaine M. Grossman 'The Halt Phase Hits a Bump' *Air Force Magazine* Vol. 84 No. 4 (April 2001) pp 34-36.
48. The Korean peninsula being perhaps an exception.
49. Recall that most of the controversy about damage claims centres around the tactical targets in Kosovo.
50. Haun, 'Air Power Versus a Fielded Army' p 81.51. See for instance the recent article in the US Army journal *Parameters* 'What Not to Learn from Afghanistan' William R. Hawkins (Summer 2002, pp. 24-32). Hawkins argues that the real lesson 'is the need to operate in combined arms teams to win decisive victories that yield beneficial political change' and goes on to say that 'there are no 'silver bullets' that can win wars by themselves, even if fitted with satellite guidance.'
52. See note 45 above.

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Will Bandwidth be the Major Limiting Factor of Future Air Operations?

By Lt Col Kurt A Klausner, USAF

Joint Vision 2020 asserts that a steady infusion of new technology is required to obtain the goal of full spectrum dominance.¹ Information superiority is a key enabler for much of that new technology. In a positive sense, the Quadrennial Defense Review Report (QDR) identifies the rapid advancement of military technologies and other key military-technical trends that will provide that infusion.² However important these trends and capabilities are to full spectrum dominance, one must remember that the complexity of the war fighter's mission increases as each new weapon system or technology is added to the battle space. Currently mission planners optimize air refueling assets, electronic warfare (EW) capabilities, and airspace management to satisfy operational demands. Many of the new technologies will compete with current systems for the same limited bandwidth, and technical issues previously taken care of by mission planners and functional communities (communications, intelligence, and battle management) will require more attention by air and space commanders.



Reconnaissance systems like the U-2 aircraft collected data in-theater, which was transmitted stateside, processed, and returned to the theater as information for the appropriate C2 and operational nodes

New weapon systems will place a significant strain on the finite bandwidth (limits in the radio-frequency [RF] spectrum and its associated data throughput or capacity) available within the battle space. As an example, the Office of the Secretary of Defense's (OSD) Unmanned Aerial Vehicles Roadmap 2000–2025, published in April 2001, identified 57 requirements associated with 15 related mission areas for unmanned aerial vehicles (UAV).³ Weapon-system developers and campaign planners must analyze these requirements to integrate UAV capabilities effectively into the overall theater concept of operations. As their unique capabilities are recognized, the number of UAVs employed in future joint campaigns will continue to increase and drive a significant increase in required bandwidth. To the degree this need is not fully satisfied, commanders will be forced to make choices and trade off various systems when employing future forces.

War-fighting concepts will also place a significant strain on the finite battle-space bandwidth. The global strike task force (GSTF) concept of 'reachback' leaves much of the support operations behind in an effort to reduce the forward-deployed footprint. In addition to reachback, Air Force Doctrine Document (AFDD) 2-8, Command and Control, describes distributed operations as independent or interdependent nodes that participate in the operational planning and decision-making process to accomplish missions for engaged commanders.⁴ A split operation is a type of distributed operation usually used to describe a single command and control (C2) entity that is physically split between two or more geographic locations. The commander must have the same degree of control over these operations as if they were collocated. The communications between the forward-deployed forces and their C2 and support centers place a heavy demand on C2 systems — particularly communications capabilities. The employment of these new war-fighting concepts, like that of UAVs, is possible only if they have access to sufficient bandwidth. For instance, the federated intelligence support for Operation Allied Force (OAF) required connectivity between American key centers of excellence throughout Europe and the United States. Each of these centers contributed a portion of the total support requirement, and all pulled together through robust communications systems. At a more tactical level, reconnaissance systems like the U-2

aircraft collected data in-theater, which was transmitted stateside, processed, and returned to the theater as information for the appropriate C2 and operational nodes.⁵

A commander must have a good understanding of what 'bandwidth' represents to make trade-off decisions on different types of capabilities. However, for purposes of this discussion, one needs to understand only the basic concept. Logisticians, for example, express the number of short tons of logistic throughput as C-5 aircraft equivalents. The vision of a C-5 conjures up three important aspects of transportation: capacity (an aircraft load), overall capability (total number of available airframes and sortie rates), and cost. Using this analogy, a commander immediately understands what it takes to move his or her requirement forward in terms of time, cost, and level of effort. Unfortunately, a similar analogy does not exist for bandwidth although one could use the airlift comparison to illustrate some aspects of bandwidth. For example, the complexities of getting diplomatic flight clearances are very similar to those of getting host-nation or several nations' approval to use specific signals and frequencies. Likewise, the maximum number of aircraft allowed on the ground is similar to the restriction on ground-terminal communications capabilities. Simply put, the greater the volume of information to be transmitted, the larger the requirement for bandwidth to move it – higher bandwidth allows faster transmission of information. To help understand the discussion below, one should consider a megabit per second (1 Mbps) as a bandwidth yardstick to represent data throughput in much the same way the C-5 equivalent analogy is used to quantify logistic throughput.

UAV BANDWIDTH ISSUES

Combatant commanders identify and prioritize their war-fighting shortfalls and requirements on the integrated priority lists (IPL): 'Of the 146 requirements submitted in the combined 1999 Integrated Priority Lists for funding in the FY02–07 Future Year Defense Plan (FYDP), 57 (39 percent) identified needed capabilities that have previously been associated in some form ...with UAVs... These 57 requirements can be organized into 15 mission areas' (fig. 1).

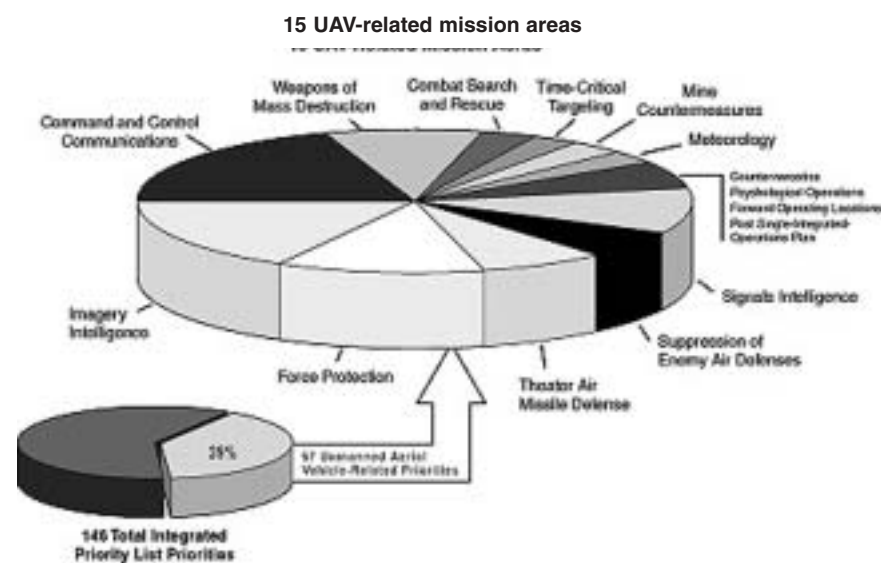


Figure 1. IPL Priorities Link to UAV Missions (From Office of the Secretary of Defense Unmanned Aerial Vehicles Roadmap 2000–2025 (Washington, D.C.: Department of Defense, 6 April 2001)



Hunter UAV

Even with only a few UAVs operating in Kosovo, communications systems were stressed to the point that operational trade-offs were required and some activities had to be delayed or cancelled

UAVs will clearly become critical weapon systems in the future. Mission-area proponents will compete for UAV capabilities, and all will need bandwidth to support vehicle operations and payload processing. Likewise, UAVs will compete with other systems for their place in the battle space.

European Command (EUCOM) operated two Predators simultaneously from Bosnia during OAF. Each needed 6 Mbps to support video dissemination within the theater and the United States, a requirement that severely stressed the Defense Information Systems Network architecture and necessitated preemption of lower-priority channels while the UAVs were in flight. Maintaining a quality link with Beale AFB, California (the site where the Predator achieved its initial operational capability), remained problematic throughout the campaign.⁷ In addition to Predator, two Hunter UAVs flew from Macedonia, and each one required an additional 6 Mbps of bandwidth. When both Predator and Hunter moved from reconnaissance to targeting roles, communicators scrambled to increase the reliability of the Very Small Aperture Terminal (VSAT), a satellite communications system that handles data, voice, and video signals.⁸ Even with only a few UAVs operating in Kosovo, communications systems were stressed to the point that operational trade-offs were required and some activities had to be delayed or cancelled.

The combatant commander of US Central Command (CENTCOM) deployed both the Global Hawk and Predator systems to support Operation Enduring Freedom (OEF). Because the operation is ongoing, details of the supporting architecture are classified. However, one can conclude that bandwidth requirements are far greater than those required for Kosovo operations. Lt Gen Harry Raduege Jr., director of the Defense Information Systems Agency (DISA), observed 'Today, in Operation Enduring Freedom, we're supporting one-tenth the number of forces deployed during Desert Storm with eight times the commercial SATCOM bandwidth.'⁹ Additionally, 'Global Hawk consumed five times the total bandwidth used by the entire US military in the Gulf; and operations in Kosovo used 2.5 times what was used in the Gulf War.'¹⁰ The OSD UAV Roadmap adds support for additional bandwidth: 'The shortage in long haul, wideband over-the-horizon communications will be exacerbated as future intelligence, surveillance, and reconnaissance (ISR) platforms, manned and unmanned, are fielded. . . . This shortage takes two forms, insufficient bandwidth and lack of coverage in some geographic areas, which can directly constrict global UAV deployment. This infrastructure needs to be increased as these platforms, including UAVs, are fielded.'¹¹

The frequency spectrum is a battleground between competing interests. Governments who control the use of the spectrum are under increasing pressure to ‘sell off’ additional bandwidth to commercial interests. The remaining smaller portions of the spectrum have become more difficult to deconflict. One such conflict exists between the Federal Aviation Administration (FAA) and the Department of Defense (DOD), the latter successfully obtaining 51 channels within the 960–1215 megahertz (MHz) band from the former to use for the Joint Tactical Information Distribution System (JTIDS). These channels, located within the L-band of the spectrum, were normally reserved for aeronautical radio navigation equipment.¹² The bandwidth capacity at this frequency range is limited between roughly 600 bits per second (bps) and 300 kilobits per second (Kbps) (roughly a C-130 aircraft equivalent if one uses the C-5 analogy) and, therefore, is not capable of fully supporting UAV ISR payloads.¹³ Competition within DOD for the same limited bandwidth, particularly to support each service’s JTIDS, indicates that the network will be near saturation when key weapon systems are deployed (fig. 2).

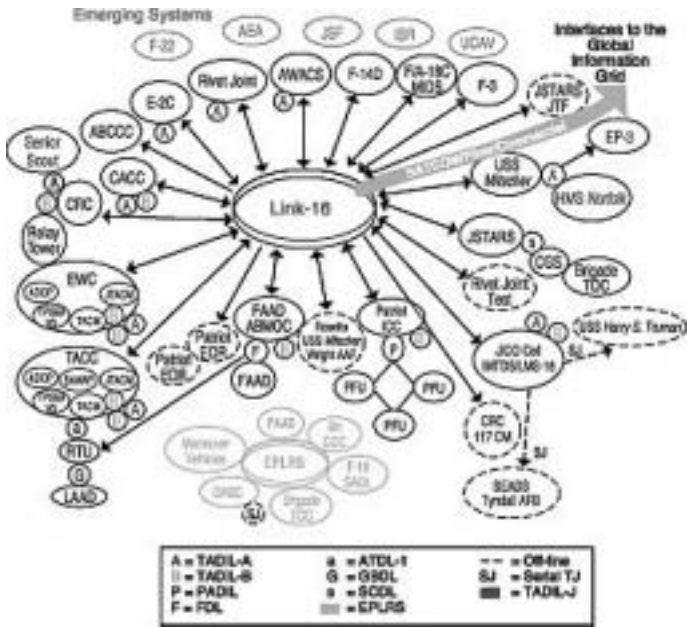


Figure 2. Proliferating Data Links, Protocols, and Systems (From briefing, Col Michael B. Leahy, PhD, USAF, subject: Unmanned Combat Aerial Vehicle [UCAV] Day-in-the-Life, UCAV C4ISR Overview, May 2001)

Frequency management also plays a critical role when one supports operations that rely on using the RF spectrum. During OAF, frequency coordinators deconflicted 44,000 frequencies — a monumental task.¹⁴ Additionally, the Kosovo campaign revealed that the safe and effective employment of UAVs required that they fly at the same time, be able to adjust their mission timing and targeting (rolexing), and expand the UAV sensor's field of view to give the operator greater situational awareness.¹⁵ Deconflicting frequencies becomes even more problematic when the bandwidth requirements to support these operational needs are added together. Anticipating the increasing number of possible UAV and unmanned combat aerial vehicles (UCAV) missions in the future, planners must place special emphasis on dynamic bandwidth management.

Despite impressive military systems and capabilities, many of today's requirements can be met only by the use of leased commercial satellite systems

KICKING DOWN THE DOOR REQUIRES BANDWIDTH

Providing sufficient bandwidth to support forward operations has always been a challenge. Communications satellites have become the workhorses in this area due to their effectiveness and efficiency. The Defense Satellite Communications System (DSCS) serves as the mainstay of DOD satellite communications by providing dedicated superhigh frequency (SHF) capacity. Geostationary ultrahigh frequency (UHF) satellite systems also play heavily in DOD's C2 arena. Despite these impressive military systems and capabilities, many of today's requirements can be met only by the use of leased commercial satellite systems.¹⁶

OPERATION DESERT STORM

Satellites were the most important factor in extending communications to the Persian Gulf area of operations. During peak capacity, DSCS provided 75 percent (68 Mbps), and NATO furnished an additional 5 percent of the SHF bandwidth. The final 20 percent of the required bandwidth needed to support the theater's over 2,000 ships, submarines, aircraft, and ground forces was leased from commercial systems.¹⁷ The key point is that very little communications infrastructure existed in the theater prior to initiation of the conflict.

OPERATION ALLIED FORCE

Communications systems supporting the combat operations in Central Europe remained saturated throughout the conflict. Kosovo air operations required more than twice the bandwidth used to support all the forces in Operation Desert Storm. The growth in these demands required extensive coordination among all participants to optimize the allocation of the available bandwidth. Just as Desert Storm was dubbed the 'first information war,' so OAF was labeled the 'first video war' by the European Command's director of Command, Control, Communications, and Computer Systems (ECJ6). OAF extensively used video teleconferencing and videotaped Predator operations.¹⁸ To provide the data throughput to make this possible, DISA contracted for over \$20 million worth of commercial bandwidth during the 87-day conflict.¹⁹

OPERATION ENDURING FREEDOM

Current OEF operations in the CENTCOM's area of responsibility (AOR) have similarities to OAF, Desert Shield, and Desert Storm. As in OAF, OEF operations have elements of forward deployed operations, distributed operations, and reachback operations. Global strike missions that originated from the continental United States (CONUS) also required connectivity. As was the case in the Persian Gulf conflict, the Afghan theater had little existing bandwidth capacity or satellite infrastructure. The requirement to support extensive video and ISR data rates challenged the responsible parties.

The GSTF concept provides a lethal joint-battle-space capability by combining stealthy aircraft employing advanced weapons with a multisensor command and control constellation (MC2C). The MC2C is a horizontally integrated architecture of C2 and ISR capabilities.²⁰ Bandwidth is a key enabler for communications connectivity and fundamental to the GSTF concept. Coupling this MC2C requirement with the considerable amount of bandwidth consumed by UAVs, makes apparent the fact



The USAF concept ‘One Air Force, One Network’ envisions an information-transport capability that integrates the links – from the kill-chain to reachback for the expeditionary air and space force

that bandwidth allocation and management are now as operationally important as airspace control and the allocation of tanker, jamming, and defense-suppression assets.

The USAF concept ‘One Air Force, One Network’ envisions an information-transport capability that integrates the links – from the kill-chain to reachback for the expeditionary air and space force.²¹ In addition, the concept seeks to enhance the connectivity from the last switch to the actual end user, the last aerospace mile, with improved data links to weapon and ISR systems. This concept’s objective is to provide a seamless, streamlined communications infrastructure that uses bandwidth efficiently.²²

Operational concepts and new systems have been developed with the assumption that adequate bandwidth will be available. The emerging employment concepts for UAVs and the GSTF reflect this assumption and reinforce the need for commanders to become more aware of the demands being placed on bandwidth and the finite frequency spectrum. Unfortunately, commanders will have to establish priorities, oversee bandwidth allocation, make decisions on trade-offs, and understand the operational consequences.

BANDWIDTH AND THE JFACC

The joint force air component commander (JFACC) orchestrates the theater air campaign to support the combatant commander’s overall campaign plan. To help understand why the JFACC must help shape the bandwidth architecture, the reader should be aware how this service is provided today. Once that picture is clear, it should be easy to understand why it is necessary for the JFACC to be involved in the

trade-offs necessary to reconcile future bandwidth requirements and limitations, and how that process should become an integral part of the planning routine.

The senior representative of the communications and information community (A-6) makes today's bandwidth available to the JFACC, just as other specialists make other capabilities available. Numerous supporting organizations facilitate this process, but the overall architecture is handled mainly within the communications channels. Fortunately, most of the current issues regarding limited bandwidth can be worked at lower levels. One JFACC, commenting on his recent war-fighting experience, suggested that he never had to worry about trade-offs because his senior communications (A-6) and intelligence (A-2) representatives figured it out at their level.²³ Unfortunately, the complexity of future bandwidth requirements will not be so easily dismissed.

Communications architectures perform best when they are stable, the reality is that technology is very dynamic and that the current electronic environment (as well as software) does not appear structured to cope with the inevitable change

The A-6 serves the JFACC or the commander, Air Force forces (COMAFFOR) by providing communications as well as electronics and automated information systems. One significant responsibility of the A-6 includes establishing the theater architecture to support operational and command requirements. Other critical responsibilities include coordinating with representatives of other command and supporting organizations such as the joint force commander's director of command, control, and communications systems (J-6) and DISA. The A-6 must ensure that users of allocated and assigned bandwidth are deconflicted, that they meet technical parameters, and that interface requirements are satisfied. In addition to advising the air operations center (AOC) on communications architectures that support the joint air operations plan, the A-6 extends required communications to subordinate units and other components.²⁴ Thus, the A-6 performs vital roles throughout the planning and execution processes, but he or she is not typically part of the joint air operations plan and master air-attack-plan development process – which is currently not a limitation.

Providers of communication systems form a key joint air operations center (JAOC) support team and are organized as the communications focal point, help desk, JAOC networks and system administration, and communications equipment support. This support team typically provides not only systems and services to the JAOC divisions but also helps select the frequencies to be used in the air tasking order, air control order, and the communications tasking order. The team coordinates all JAOC command, control, communications, and computer (C4) requirements; manages C4 activation, restoration, and performance; interfaces with all JAOC C4 system users; controls network functions; and keeps the Theater Battle Management Core Systems (TBMCS) running. Requests for more bandwidth, additional frequencies support, or other C4 support are made to the communications focal point, who then forwards the requests to the responsible agencies.²⁵

Several additional issues associated with JAOC operations should be considered in the discussion of bandwidth. One must give some thought to managing the increasingly complex data-link architecture as



Bandwidth and frequency requirements are increasingly global in nature as evidenced by the nonstop Global Hawk flight from the CONUS to Australia

additional types and numbers of assets are added to the networks. The current manager—the joint interface control officer—has his or her hands full reconciling the requirements associated with providing situational awareness throughout the system (see fig. 2). Likewise, successful management of intelligence-collection processes ensures that the right resources look at the right targets at the right times, deconflicts unnecessary overlap, and fills gaps in coverage. The increased resolution and fidelity of future collection systems not only will require greater bandwidth but also will compete for access to the limited number of common ground stations. While communications architectures perform best when they are stable, the reality is that technology is very dynamic and that the current electronic environment (as well as software) does not appear structured to cope with the inevitable change.

Additionally, bandwidth and frequency requirements are increasingly global in nature as evidenced by the nonstop Global Hawk flight from the CONUS to Australia. This significant capability and mission duration can also exceed the current Air Tasking Order 24-hour day. JAOC processes should be changed to accommodate the long flight times associated with UAV mission capabilities.

RECOMMENDATIONS

Bandwidth and infrastructure must be expanded or used more efficiently (by changing processes and organizations) to implement new technologies and war-fighting concepts successfully. Currently, UAVs represent challenges and incredible opportunities, while new operational concepts such as the GSTF also create paradigm-changing possibilities.

However, both require bandwidth resources and infrastructures that exceed current capabilities. Adding more bandwidth through the use of satellites is expensive at best and still might not solve all the problems associated with GSTF and UAV operations (landing rights and so forth). Making trade-offs to accommodate UAV operations within the current bandwidth is a technical challenge. The fact that multiple UAVs will need to share the same frequency bands over time forces the JAOC to trade one mission for the next. Because only a finite number of UAVs can be operated at the same time, to get an additional UAV mission airborne, one has to be terminated. Actually, there is nothing new here other than advising the JFACC of the limitations and providing recommendations on how best to manage these resources to increase the effectiveness of the JFACC's efforts to meet the joint force commander's objectives. Another approach might be to develop a dynamic frequency and transponder allocation plan that would allow transfer of resources for different purposes. For instance, the commander could choose to allocate bandwidth to a UCAV mission and hold off on the video teleconference until the UCAV no longer needs the bandwidth. Finally, one could conceive of a JTIDS-type structure to support multiple UAVs, but it would have to be at a much higher frequency range to allow for adequate data rates. An ongoing effort by the Defense Airborne Reconnaissance Office (DARO) may overcome some of the obstacles associated with finding a frequency spectrum and agile communications equipment. That office sponsored a study to integrate a common data-link, high-bandwidth capability for airborne platforms. Possible solutions include laser communications technology that has transmission speeds in the 1-gigabit-per-second realm.²⁶ In addition, DARO is looking at a program to lease more satellite communications capacity and is attempting to develop an onboard UAV moving-target indicator that can be used to cue other onboard sensors, thereby reducing the demand for bandwidth.

Automation tools should be developed to help planners orchestrate the allocation of available bandwidth to achieve the best possible result. These tools would be similar to the airspace deconfliction tool used in TBMCS. The bandwidth-allocation tools would help planners to 'what if' various hypothetical scenarios and to point out problems (conflicting frequency assignments, not enough capacity, etc.). This capability not only is needed at the JAOC but also could be used at higher planning echelons where theaterwide — even worldwide — bandwidth allocations must be planned.

Increasingly, war-fighting capabilities depend on bandwidth for success. As GSTFs deploy and engage an enemy, greater coordination will be required between the communications and information professionals, the joint interface control officer, battle-management specialists, and the collection-management community. JFACCs must be aware of all of their forces' vulnerabilities as they integrate this knowledge into their planning and execution efforts. For example, the loss of a satellite that provides bandwidth could have a devastating impact on the ability of an engaged GSTF to operate UAVs. The commander must weigh these risks in much the same way he or she would assess the risks associated with EW vulnerabilities. While Mbps correctly specifies data-transmission rates, it does not readily translate an understanding of operational capability to the layman. It would be helpful to have a simple, well-understood unit with which to convey bandwidth requirements so that even those without an electrical engineering degree can readily understand them. The search should continue for an +- analogy similar to the logistics 'C-5 equivalent' expression of capability.

CONCLUSIONS

New weapon systems and war-fighting concepts, like UAVs and the GSTF, place significant demands on future battle-space bandwidth. Commanders must be aware of this growing dependence on bandwidth and the limitations in the RF spectrum and data-throughput capacity. As a consequence, significant trade-offs may be required when employing forces in the future. Developers of new weapon systems that will require bandwidth should also design tactics and techniques to minimize the demands on this limited resource. New organizational processes and tools are required to manage the complexity of optimally allocating bandwidth. JFACCs must also understand the risks and the opportunities involved with operations that depend heavily on bandwidth.

Successful employment of military force in the future will require the optimum use of bandwidth. Now is the time to put the bandwidth tools and processes in place that will make victory a certainty.

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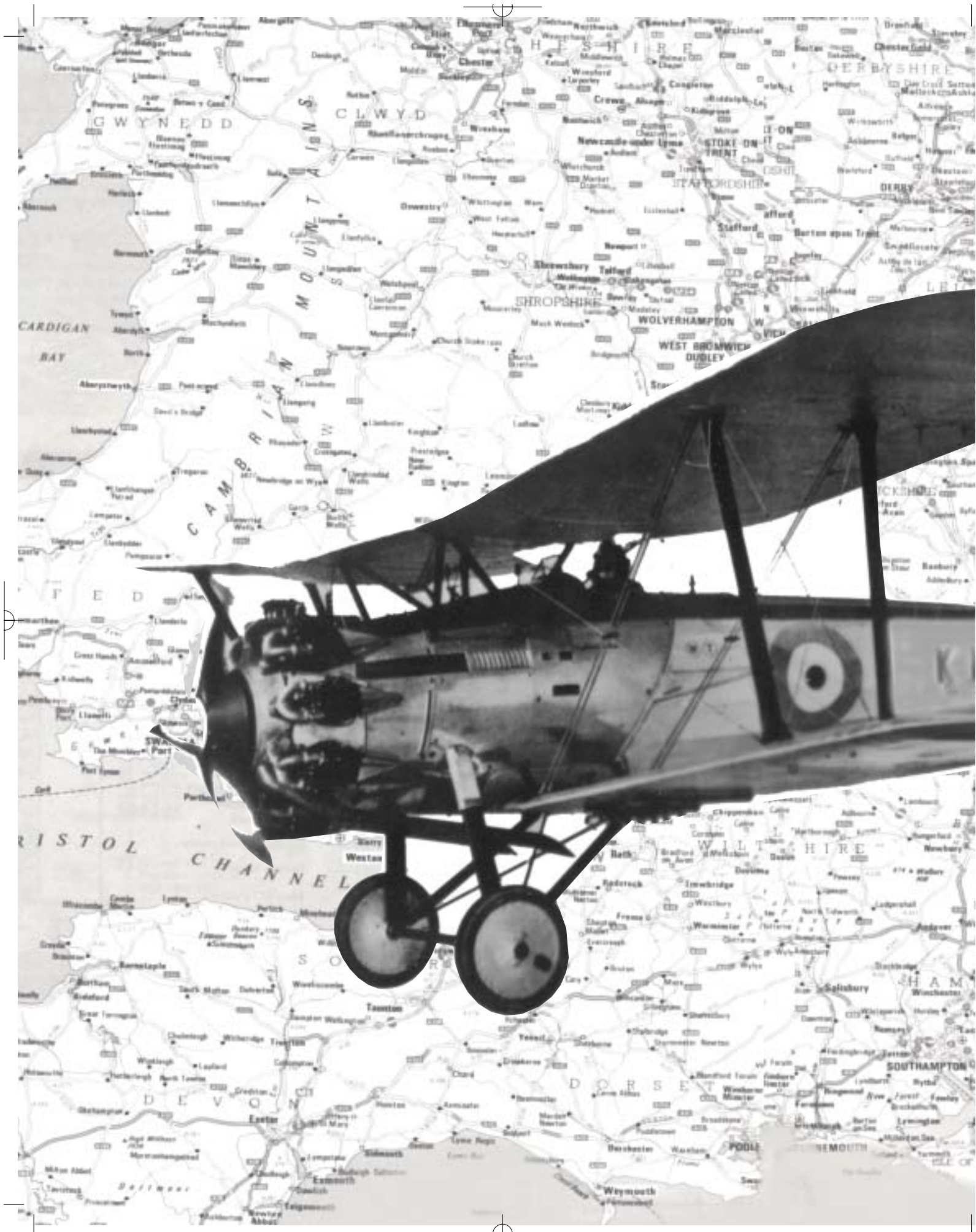
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Some Lessons of the Air Exercises 1930

By a 'Blue Force' Staff Officer

This article does not pretend to be a complete summing up of the lessons of the Air Exercises from a Directing Staff point of view. It is a brief summary from the point of view of a Blue Force Staff Officer, but I hope it will be found reasonably impartial in tone.

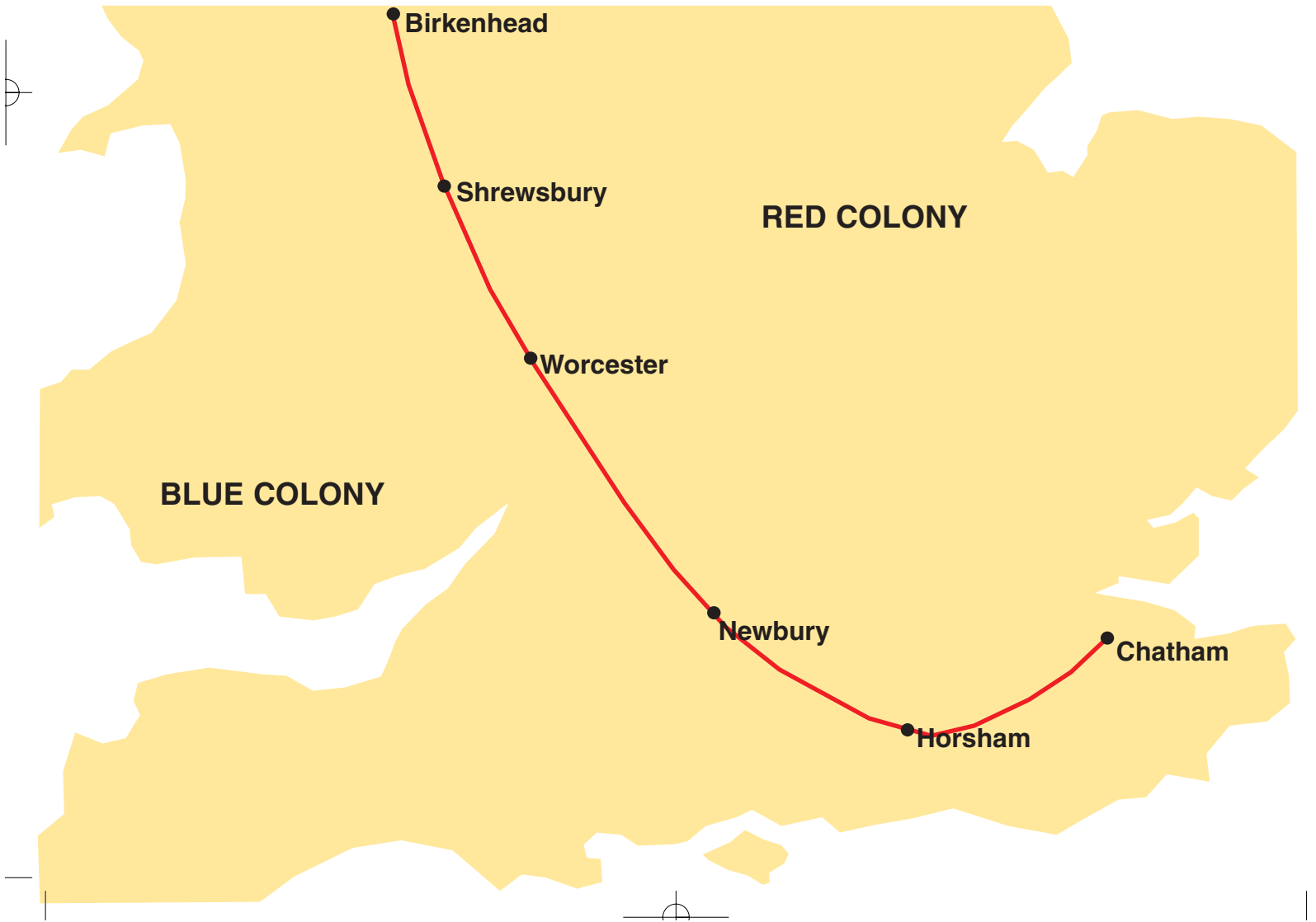
Most people, when the Air Exercises are mentioned, ask at once who won, as though it were a horse race or a cricket match. Most newspapers published a daily account of air casualties, which certainly, if taken as the only criterion, would have awarded the victory to Red Colony. But the intention of the Blue Commander was not the destruction of the Red forces, and such a comparison is misleading.

My aim is to discuss the exercises with a view to finding out what lessons can be learned from them, and I must emphasise that the views and conclusions set forth are purely my own personal ones.

I have not attempted to deal with the tactical lessons of the exercises, as they are numerous, complicated, and very much bound up with local circumstances.

IMPORTANCE OF THE EXERCISE

The Air Exercises of 1930 were of unusual interest for several reasons, but principally because, for the first time in the history of the Royal Air Force, the 2 opposing commanders were given complete liberty of action. Each commander was allowed to appreciate the situation and to form his own plan. The Directing Staff only interfered with the conduct of the operations to a very minor extent in order to ensure that the 1st AA Searchlight Battalion RE, obtained a reasonable chance of using their searchlights against night bombers. All previous exercises on a large scale have been to test the defence, and particularly its intelligence and administrative systems, and the offence has been made to work to a pre-arranged timetable.



GENERAL IDEA OF THE EXERCISE

For the benefit of those who are not familiar with the scheme I will briefly explain the general idea.

A glance at the accompanying map will show that this island is divided into 2 colonies by a curved frontier running from just west of Birkenhead, through Shrewsbury, Worcester, Lechlade, Newbury, Basingstoke, Horsham, Chatham. The northern part is Red Colony, and the southern, Blue Colony.

Redland and Blueland are on the brink of war, and Red Colony is of great importance to Redland owing to its mineral resources. In the neighbourhood of Hucknall and Bircham Newton are copper mines, with power stations, electric furnaces, and all the apparatus necessary to produce metallic copper. This copper is then sent by single line railway via Cranwell, Catfoss and Skipsea to Catterick, which is a ship-canal port. The export of metallic copper is about 1,000 tons a day.

Blue Colony has no towns or industries of importance, and is merely the base for Blueland's air forces from which they are enabled to threaten the copper resources of Redland. The frontier has several great mountain ranges along it, over which aircraft cannot fly, and there are passes known as Sealand, Gloucester, Reading, Chelmsford and Norwich.

The whole island is rocky and fairly barren, and no landing facilities exist other than the aerodromes shown on the map. The inhabitants are in a low state of civilisation, and in Red Colony, at any rate, are unreliable in temper and likely to cause trouble in the event of war. The copper mines and furnaces are largely operated by native labour.

BLUE FORCES

Blueland has built up a powerful striking force in Blue Colony, consisting of the following units:

- (Virginia) No 7 (Night Bomber) Squadron, Worthy Down
- (Virginia) No 58 (Night Bomber) Squadron, Worthy Down
- (Virginia) No 9 (Night Bomber) Squadron, Manston
- (Fox) No 12 (Day Bomber) Squadron, Andover
- (Hart) No 33 (Day Bomber) Squadron, Tangmere
- (Sidestrand) No 101 (Day Bomber) Squadron, Andover
- (Wapiti) No 600 (Day Bomber) Squadron, Tangmere
- (Wapiti) No 601 (Day Bomber) Squadron, Lympne
- (Wapiti) No 605 (Day Bomber) Squadron, Manston
- (Siskin) No 1 (Fighter) Squadron, Upavon
- (Siskin) No 25 (Fighter) Squadron, Upavon
- (Siskin) No 43 (Fighter) Squadron, Upavon
- Aircraft Depot (imaginary), Tangmere

One cannot fail to be struck by the very unfavourable strategic disposition of the Blue capital and aerodromes, and particularly of the Blue aircraft depot at Tangmere. Geographical considerations may have dictated the situations of the aerodromes, but it is hard to believe that a better site for the depot could not have been chosen. The Blue Commander can hardly have been satisfied with its location, but no doubt considerations of economy, and possibly the apathy of the Blueland Government, caused its removal to a more suitable position to be postponed until too late.



Armstrong Whitworth Siskins

Vickers Virginia



There are no searchlights or AA guns in Blue Colony, but the aerodromes are defended by well-trained machine gunners.

RED FORCES

The Red Forces have been organised with a view to the defence of their industrial areas and communications, and consist of eight Fighter Squadrons, three Day Bomber Squadrons, and two Night Bomber Squadrons, equipped and disposed as under:

(Hinaidi) No 99 (Night Bomber) Squadron, Waddington, operating from forward aerodromes after dark
 (Hyderabad) No 10 (Night Bomber) Squadron, North Coates Fitties, operating from forward aerodromes after dark
 (Fairey IIIIF) No 35 (Day Bomber) Squadron, Upper Heyford
 (Horsley) No 100 (Day Bomber) Squadron, Bicester
 (Fairey IIIIF) No 207 (Day Bomber) Squadron, Duxford
 (Bulldog) No 3 (Fighter) Squadron, Hornchurch
 (Bulldog) No 17 (Fighter) Squadron, Hornchurch
 (Siskin) No 19 (Fighter) Squadron, Bircham Newton
 (Gamecock) No 23 (Fighter) Squadron, Kenley
 (Siskin) No 32 (Fighter) Squadron, Kenley
 (Siskin) No 41 (Fighter) Squadron, Northolt
 (Siskin) No 29 (Fighter) Squadron, Cranwell
 (Siskin) No 111 (Fighter) Squadron, Cranwell
 Aircraft Depot (imaginary), Catfoss

No 1 AA Searchlight Battalion RE, had its searchlights so disposed as to light an area to the south of Cranwell.

There were no effective telephones in Blue Colony and very few in Red Colony, and all point-to-point communication had to be by W/T. This meant extensive use of cyphers, though, in reality, the Red

Colony signal system was so congested that Blue Colony might have made fairly free use of signals in clear.

COMMENCEMENT OF THE EXERCISES

The exercise began at 2359 hours on Friday, August 8th, and from that moment no communication was permitted across the frontier. The early stages of war were not devoid of humour, as opposing squadrons were considerably mixed up. A Red fighter squadron No 111, was at Andover, having just completed a period of affiliation with No 101 (Bomber) Squadron. The presence of these enemy officers in Blue Force HQ mess made the preservation of secrecy a matter of some difficulty. They were to move under sealed orders on the Saturday, but foggy weather delayed their departure until about 1400 hours on the Sunday. As three Blue squadrons on the move were expected to pass through Andover about Sunday, midday, and it was highly undesirable to let the enemy know of this, steps had to be taken to hold them up on the road, if necessary, till the enemy had departed.

Similarly, No 33 (Bomber) Squadron was at Upavon, affiliating with a fighter squadron, when the exercise commenced. The bomber squadron and the two Red fighter squadrons, who had to leave Upvon, as it became a Blue station, had much ado to keep each other in ignorance of their destinations. At the time of the outbreak of war at 1100 hours on Tuesday, August 12th, each side had no positive information of the war plan and disposition of the enemy.

THE BLUE WAR PLAN

The aim of the Blue Force Commander was obvious and simple. It was to stop the export of copper from Red Colony. To do this he could attack the industrial areas themselves, the railway, and Catterick, the port of shipment. A ship-canal port, with its lock-gates and restricted channel of communication from the sea, seemed to offer a favourable target to air attack. It was, unfortunately, out of reach of Blue day bombers.

The Blue Force Commander possessed the great advantage that his objectives were fixed, and not very amenable to concealment from the air. The chief disadvantage from which Blue Colony suffered was the difficulty of obtaining security. The aerodromes and centres were scattered at some distance from each other, and all fairly close to the frontier and to the enemy's forward aerodromes. The three fighter squadrons possessed by Blue Colony were quite inadequate to secure the defence of the Blue aerodromes and depot. The Blue depot was only 19 miles from the frontier, and only 44 miles from Kenley, the nearest Red aerodrome. Nothing but the most inexcusable negligence or stupidity could have been responsible for such a site being selected for the aircraft depot. The defence of the depot was practically impossible, and this being so, the Blue Commander was forced to rely on obtaining a quick decision. He had to attain his aim before the loss of his depot could affect his striking power.

The Blue war plan, briefly, for the first day and night of war was as follows:

- a. Reconnaissance by single fast day bombers of all enemy aerodromes
- b. A daylight attack by 12 night bomber aircraft from Worthy Down on Catterick via the Sealand Pass and Preston
- c. Sustained attacks by day bombers on Hucknall, Cranwell, and Bircham Newton

- d. Continuous offensive patrol during daylight hours in squadron strength by fighters on the line Andover–Worthy Down
- e. Sustained attacks by night bombers on Hucknall, Cranwell and Bircham Newton.

It was considered that Red Colony would probably regard Blue night bombers as his first objective, as he might suppose them to be in their hangars, so No 9 (Bomber) Squadron was moved temporarily, with aircraft crews only, from Manston to Andover and concealed in the hangars. No 9 (Bomber) Squadron, as a consequence, escaped a series of very heavy attacks made on Manston during the first day and night.



Hawker Horsley

THE RED WAR PLAN

The aim of the Red Commander was also obvious and simple. It was to secure the export of copper to Redland. To effect this he had to destroy the Blue air forces before they could effect their aim.

The Red Commander had a choice of two broad policies, which we may call the 'forward' and the 'backward' policies. He might move most of his units to his forward aerodromes and attack the Blue aerodromes with both fighters and bombers, or he might concentrate his fighters near his vital points, and, relying on a sound intelligence system, attempt to intercept the Blue forces in the air. The 'forward' policy is mainly offensive, the 'backward' one mainly defensive. He adopted the 'forward' and offensive policy, and this decision was amply justified by results.

The Red war plan was to allot three fighter squadrons to the defence of Cranwell and Bircham Newton, and, with the exception of a number of day bombers engaged on reconnaissance duties, to employ the

rest of his force, from forward aerodromes, to attack with bombs and machine-gun fire the Blue air forces wherever they could be found.

This policy took advantage of the weak point in Blue Colony's armour – the unfavourable strategic disposition of his aerodromes and depot.

Thus the Red Commander, though his task was a strategic defensive, succeeded in employing the bulk of his forces in a very active offensive role.

Westland Wapitis



THE WAR

It is not necessary to go into the details of raid and counter-raid, nor to follow the operations step by step. It is sufficient for our purpose to note that the raid on Catterick was successful, and that by the second day practically all work had stopped in the industrial areas. By the end of the third night all hope of exporting metallic copper to Redland for several months had passed away. The Red capital had ceased to exist as a capital, the population was in open rebellion, and the High Commissioner had been forced to remove himself to a neighbouring village. The Blue Commander had attained his aim, but at the cost of his Air Force. When day dawned on August 15th, Blue Colony had only 13 day bombers, 6 night bombers, and 12 fighters left serviceable, while the Blue depot at Tangmere was obliterated. Blue Colony had gained her object, but had destroyed herself in the process.

Red Colony had not attained her aim, her copper industry lay in ruins, and her port was out of action, but she still had 20 day bombers, 12 night bombers and 40 fighters serviceable, and her depot was

intact. She could therefore have revenged herself by making Blue Colony capitulate, but only time could rebuild her industries and her port. Her failure to supply Redland with copper might have had so serious an effect on the main theatre of war between Redland and Blueland as to contribute largely towards an adverse decision.

As Blue Colony was of no value save as a base from which to attack the Red Colony industries, it is arguable that, as the Blue Commander had attained his aim, the loss of his Air Force was not a very serious matter, and the results achieved were well worth the cost.

So much for the results of this interesting colonial campaign. Now let us consider what we may learn from the operations.



Gloster Gamecock

LESSONS: SECURITY

The first obvious point that springs to mind is that the Blue Force Commander apparently neglected to bear in mind the sixth principle of war – security.

On the face of it, there may appear to be some truth in this contention, but the Blue Commander was placed in a very unfavourable position. The temptation to divert a large portion of his striking force from its task of fulfilling the aim, to the destruction of the enemy air force, was severe. It may be that, owing

to some extent to its dangerous attractiveness, the idea was sternly rejected, and the Blue squadrons kept on their true task of destroying the copper industry. The impossibility of defending the Blue aircraft depot may have influenced the Blue Commander to rely on obtaining a quick decision by bombing the vital centres with maximum intensity.

But Mahan has said: 'Bases are the indispensable foundation upon which the superstructure of the offensive is raised'. This is very true, and it is also true to add that the bases must be secure ones, or the foundation will not bear the weight of the superstructure.

Blue Colony's offensive would have practically collapsed on the fourth day of the war, because her bases were not secure.

We may ask ourselves if it was possible for Blue Colony by any means to attain her aim and yet to avoid this fate. It may be argued that Blue Colony should have destroyed the Red Air Force as a necessary preliminary to turning her attention to the Red industries. An army would certainly have to defeat the opposing army before it could proceed to control the enemy industries. But this is a dangerous doctrine for an Air Force Commander to adopt. It is very difficult to obtain a decisive defeat of an enemy air force. The article on 'Air Strategy', by Wing Commander A G R Garrod, in the Quarterly of last January, puts the case admirably in the last paragraph under the heading of 'The Air Objective'. He points out that an Air Force Commander cannot afford to wait for a decisive victory over the armed forces of the enemy before proceeding to his ultimate aim in war. I cannot do better than quote from his concluding sentences:

'If he were to wait, he might do so until the war was over, only to find that his own people had forced the government to sue for peace. At the same time, the air strategist will have to exercise the soundest judgement throughout the air operations to ensure that his squadrons are not unduly interfered with by the enemy, and if an opportunity presents itself for the quick destruction of enemy air forces he will have to seize it as a temporary and profitable diversion from his main purpose'.
The last sentence is the key to the problem.

On the third night of the war the Blue Commander, feeling that his aim was well-nigh attained, sent most of his night bombers against the enemy aerodromes, with the result that 29 enemy aircraft were destroyed, and 44 damaged, with the loss of four Blue night bombers. At the same time, 8,504 lb of bombs were dropped on Cranwell, completing the panic already in existence, and in the words of the umpires, 'the morale of the inhabitants was so shaken that they demanded peace at any cost'.

This was a most successful night's work, and it is probable that Blue Colony might with advantage have employed from the beginning a fair proportion of her night bombers against enemy aerodromes. We must remember, however, that for safety reasons all aerodromes during the exercises were lit by flares and were therefore quite easy to locate and bomb. Possibly, in real war, the enemy aerodromes would be much more difficult to find, though it is probable that in a barren country the aerodromes would be sited near rivers and roads which might make them fairly easy to locate. The lighting-up of all aerodromes also made it easier for the Red night bombers to destroy the Blue Air Forces, and it may have over-emphasised the effectiveness of night bombers in attacking aerodromes. It was one of the unavoidable unrealities of the exercises.

The great bomb-carrying capacity of night bombers makes it possible to employ them in diversions of this sort and yet keep up a fairly continuous bombardment of the principal objectives. It is also an advantage to employ them against objectives undefended by searchlights, as they are then almost immune from attack. In addition, as soon as it was clear that the Red Commander had adopted a

'forward' policy, the Blue fighters might have been used offensively against his forward aerodromes. The difficulty here was the uncertainty of finding the enemy on the ground during daylight hours. Three low-flying fighter attacks at dusk and dawn were made on Bicester and Upper Heyford with good results, but it is doubtful if the blue fighters would have achieved more by such attacks than they did by means of their offensive patrols.

My conclusion is that, if security cannot be obtained by strategic disposition, a commander must achieve it by diverting a proportion of his striking force from the prosecution of his aim.

THE EMPLOYMENT OF FIGHTERS

The exercises brought out very clearly the difficulties inherent in the interception of bombers by fighters. The three Red fighter squadrons detailed for the defence of Cranwell and Bircham Newton made so few interceptions as to be almost negligible. They were kept on the ground standing by and were sent up on receipt of raid warnings.

These raid warnings were sent by forward ground observation posts which proved very ineffective, and by bomber aircraft which flew about over Blue aerodromes and sent W/T information of the take-off of a raid. These reconnaissance aircraft then shadowed the raid until their destination was certain, and sent information to Red Headquarters by W/T. It is extremely doubtful if it is possible for reconnaissance aircraft to sit over enemy aerodromes in real war, and in the exercises the policy proved expensive.

In any case it was not very effective in securing interceptions, but it worked well in informing the forward Red fighter squadrons when Blue squadrons were returning from raids. The regularity with which Blue squadrons were attacked by fighters as soon as they had landed was remarkable. The failure of the Red fighter squadrons to intercept, combined with the shortness of the nights and bad weather during the hours of darkness, made it profitable for Blue Force to use night bombers for daylight raids.

As the Red Commander used most of his fighter squadrons to attack Blue aerodromes with bombs and machine guns, we may ask ourselves whether better results would not have been achieved if they had been bomber squadrons instead of fighters. We must remember that a commander will seldom find the enemy aerodromes within fighter range. The war plan of Red Colony seems to reaffirm the soundness of the home defence organisation, that is to say, two-thirds of the force should be bombers and one-third fighters. The Red Commander, when given a large number of fighter squadrons, immediately used two-thirds of his fighters as bombers.

Blue Colony, on the other hand, when appreciating the situation, felt very weak in fighters. This weakness led the Blue Commander to concentrate his fighters at Upavon, and, because of the nearness of his aerodromes to the frontier and the lack of any raid-warning system, to employ them on continuous offensive patrols. This imposed a heavy strain on the squadrons, but the results were satisfactory. Over fifty interceptions were made, the majority in superior force. The line defended (Andover – Worthy Down) was admittedly a very restricted one, but any extension of it would have at once reduced the number of interceptions. The lesson seems to be that fighters can effectively defend a vital point of limited size unless the enemy is able to concentrate against them.

It is clear that, in these exercises, the Blue Air Force was very much more vulnerable on the ground than in the air, and this is likely to be true in terrain which has a limited number of suitable aerodromes. When the ground offers many suitable landing places, an air force, with some loss of efficiency, can move from place to place, and may be almost as difficult to intercept on the ground as in the air.



Bristol Bulldogs

In the exercise, the Blue squadrons used various aerodromes for refuelling, and the Red Commander was far from certain of the location of some units, even on the third day. Manston, for example, was several times heavily attacked when practically no aircraft were on the ground.

My conclusion is that the only correct role of single-seater fighters is the defence of a restricted area, and that unless very rapid and accurate raid warnings can be organised, the system of continuous offensive patrol, though uneconomical, must be adopted. Such a system, at least, will compel the enemy to concentrate in order to avoid being intercepted by superior forces, and thus will prevent his achieving continuity in attack.

THE CONTROL OF BOMBING AIRCRAFT

A commander who is operating day and night bombers must have an air staff capable of working at full pressure 24 hours a day. There is no doubt, therefore, that the peace establishment of such an Air Force Headquarters must be greatly expanded to meet the demands of war. It is not clear from what source these additional staff officers will be procured. Large staffs are, quite rightly, so unpopular in peace that I feel that there is more than a possibility that it will be found, in war, that the staffs are inadequate.

Some unit officers are not inclined to regard an overworked staff with very sympathetic eyes. They should, however, realise that an over-worked staff means muddled orders, inadequate administrative arrangements, late arrival of operation orders, and lack of personal contact between staff and unit officers. It may mean that the staff are so immersed in unavoidable routine that no one has time to study the situation, to make plans, and to make the best use of the intelligence available. It leads to paralysis of the higher functions of command, and, possibly, to defeat.

COMMUNICATIONS

The communications in these exercises, as mentioned above, were entirely by W/T. A vast amount of traffic was caused by umpire messages, such as departure signals, raid and combat reports. On the other hand, in these exercises there was no 'E' and 'P' Staff traffic which would assume large dimensions in a real war. Therefore, if we accept the Press and umpire traffic as representing the 'E' and 'P' Staff traffic we shall probably not be far wrong.

In war it will be an advantage to use separate operational and administrative wavelengths, and it will probably be found possible to send some operational and much administrative traffic in a simpler, or, at any rate, a more quickly operated cypher.

Every effort was made by Blue Force to reduce the number and bulk of operational signals. In this they were more successful than Red Force, whose signal system appears to have become very seriously congested. The method adopted by Blue Force was to issue to each type of wing, day bomber, night bomber and fighter, a set of Standing War Instructions. These were not bulky, and covered all reasonable points.

The delay caused by cyphering even short messages about doubles the time of transmission, and it is a matter for consideration whether cyphering is necessary in many cases. The use of low power transmission makes interception a matter of some difficulty, while short-wave working decreases the accuracy of directional wireless position finding. Rapidity of communication is a very great asset to a commander, and the rival claims of secrecy and rapidity must be considered with due regard to the actual circumstances.

My conclusion is that everything possible should be done to reduce and simplify the signal traffic and that cyphering should only be employed when absolutely necessary.



Hawker Horsley

INTELLIGENCE

We have seen that the Air Force Commander must be prepared, in the interests of his own security, to seize an opportunity for the quick destruction of enemy air forces. It is also clear that, when he thinks he has attained his aim, he must make a new appreciation of the situation. To enable him to do these things, he requires the best possible intelligence system. Speed and reliability are the essentials of air intelligence, for the great hitting power and mobility of aircraft are wasted if the commander does not know when and where to strike.

Armstrong Whitworth Siskin



In these exercises, the Blue Commander had little or no information, at the time, about the effect of his air attacks. Had he known then what the umpire narrative has revealed since the exercises he would no doubt have appreciated the situation anew on the second or third day and decided that his new aim was to destroy the enemy forces, while bombing the industrial areas and the capital sufficiently to stop any attempt at repair and reconstruction.

No doubt, in war, a commander will have great difficulty in discovering in time the effect of his bombing, but the bombing will at least be real and the squadrons will be able to say what damage they think they did, while subsequent raids should be able to form some estimate of the effects of previous bombing. Air photography will also assist a commander to assess the damage.

It would not have been difficult for the Blue Commander to have arranged a system of intelligence in Red Colony, for the frontier was almost undefended. It is not too much to say that the whole existence of Blue Colony might have depended upon the soundness of its intelligence system. The importance of good intelligence to the defence is generally realised, but I feel that, in peace, we are apt to forget how much the offence depends upon intelligence, and to imagine that a sound intelligence system will be improvised somehow or other on the outbreak of war.

CONCLUSION

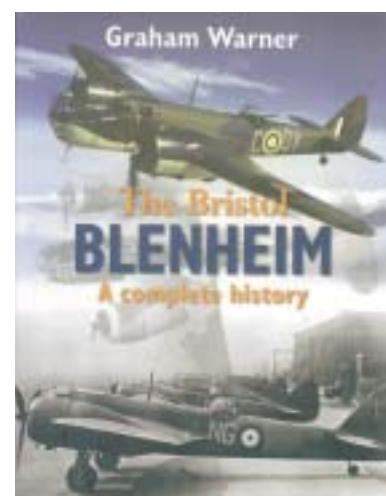
This survey of the lessons of the Air Exercises does not claim to be exhaustive, although an attempt has been made to sum up the results of the campaign. They are merely the thoughts and reflections of an Air Staff Officer who necessarily saw the war from an individual angle. I hope, however, that others may be stimulated to the study of these problems, if only as a result of the violent state of disagreement with my conclusions in which they may find themselves.

Book Reviews

The Bristol Blenheim A complete history

By Graham Warner

Published by Crecy Publishing.
ISBN 0 947554 92 0. HB 639 pages.
Many black and white photographs with a short colour section.
Price £34.99



Reviewed by G R Pitchfork

Some aircraft have received a great deal of attention from authors, yet others that made a significant contribution to the air war have virtually been neglected. One such aircraft is the Bristol Blenheim, an aircraft that fulfilled many roles and operated in just about every theatre of operations during the Second World War. Many will have looked forward with eager anticipation to the publication of Graham Warner's book – they will not have been disappointed.

The Blenheim was an innovative design that was well ahead of its time when it first appeared in its initial civil guise as the Type 135. Developed as a bomber, it entered RAF squadron service early in 1937 and, by the beginning of the war, over 1,000 were in service – more than any other aircraft. In Europe, Blenheims flew operations on the first day of the war, and they bore the brunt of the daylight bombing campaign and attacks against convoys against murderous anti-aircraft fire.

At a time when Fighter Command was winning the Battle of Britain, Blenheim squadrons were attacking targets in France and the Low Countries, including Hitler's invasion fleets, suffering terrible losses amongst their aircrew. Their role and contribution to the air war during those desperate times deserves to stand alongside their fighter colleagues, some of who flew the fighter version of the aircraft. The Blenheim went on to give excellent service in Bomber, Fighter and Coastal Commands until replaced after over two years of operations.

The Blenheim was just as active with the overseas Commands, having to remain in service for longer, and they were the first to attack the Italians in the North African desert and the Japanese in Malaya before returning to make a significant contribution during the early phase of the battles in Burma. The gallantry of the crews flying from Malta, in Greece, the Middle East and in the Far East was rarely, if ever, surpassed and the casualties were amongst the highest of any force.

The author's long association with the restoration and operation of the only airworthy Blenheim is well known. His interest in the aircraft, however, goes much deeper and he has researched the history of the Blenheim with meticulous care. He describes the background and development of the aircraft in great detail before relating its operational history. At the end of each chapter there are copious notes and details of losses providing the historian with a unique reference. The book is superbly illustrated throughout with many photographs, the majority appearing in print for the first time.

This book is primarily for the aviation historian and researcher, yet it also provides a fascinating insight to operations and the supreme gallantry of those who flew the aircraft. Much has been written about the Spitfire, Mosquito, Lancaster and others, and detailed accounts of the 'forgotten' aircraft are long overdue. Graham Warner has addressed this as far as the Blenheim is concerned and done so in superb fashion. This is, and is likely to remain for a very long time, the authoritative book on the much under-rated Blenheim. It is a fitting memorial to all those who gave their lives flying the aircraft, and is an absolute must for every aviation historian. Very highly recommended.

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ROYAL AIR FORCE HISTORICAL SOCIETY

Formed in July 1986 to study the history of air power, the RAF Historical Society examines such topics as the Strategic Bomber Offensive of World War II, the V-Force, various air campaigns, and further aspects of modern air power. The Society holds lectures, seminars and discussions, bringing together those involved in RAF activities past and present, at a membership fee of £15 a year.

Please contact:

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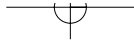
Notices/ Reunions

ST. CLEMENT DANES, STRAND, LONDON CENTRAL CHURCH OF THE ROYAL AIR FORCE

This beautiful Wren Church, which is also the Royal Air Force Central Church, has a world-wide following and is open daily from 08.30 am – 4.30 pm. There is Choral Eucharist or Matins every Sunday at 11.00 am, sung by the famous choir. Civilians and all members of the Armed Forces are welcome to visit the church and attend the services.



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