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Review

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Royal Air Force Air Power Review

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General Dynamics F-111K British prototype ordered
by the UK Royal Air Force, but cancelled. Fifty were
to be built, but ultimately the government cancelled
the purchase on grounds of cost.

Image of the 5 (AC) Sqn Sentinel aircraft arriving
at Gioia del Colle where they operated from
10 October 2011, as part of Operation Ellamy.

Final checks take place before a Harrier GR-7
embarks on a sortie in the Gulf.

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A Royal Air Force Reaper aircraft of 39 Squadron pictured here on 2 March 2012 at Kandahar Airfield in southern Afghanistan.
(Picture by Corporal Andy Benson (RAF))

Drone with GoPro digital camera mounted underneath, 22 April 2013.
(Image courtesy of Don McCullough)

RQ-4 Global Hawk flying over mountains.
(Image courtesy of Northrop Grumman)

Foreword

by Squadron Leader Paul Baroni

Welcome to Air Power Review (APR) Autumn/Winter 2015. This edition sees a return to a more traditional APR offering after publication of two themed editions earlier this year (the Conceptual Component and Battle of Britain in Spring and Summer respectively). It offers an eclectic mix of air power analysis that spans the Cold War era through to the possible future challenges that we will face in the air, space and cyber environments. As ever, the aim of this seasonal 'selection box' is to provoke thought and debate amongst air power professionals, defence and security practitioners as well as academics and analysts across APR's diverse readership. All of our selections, including the historical articles, are guided by an editorial ethos which strongly promotes 'relevance' to the contemporary and potential future operating environment for air power employment.

Our first article is written by Dr Richard Moore, a Visiting Research Fellow at the King's College London (KCL) Centre for Science and Security Studies, part of KCL's Department of War Studies. *F-111K: Britain's Lost Lost Bomber* is a revealing study of Britain's ultimately aborted attempts to purchase a tactical strike bomber in the 1960s. Moore sets out to dispel some of the myths and misunderstandings around the F-111K's complex and turbulent procurement following the decision not to pursue TSR.2 for the RAF. The controversial TSR.2 decision, with its associated negative effects on the UK's organic, military aerospace industry has long overshadowed the planned F-111K procurement project. For today, there are clear technical, economic as well as political parallels to be drawn from that period of budgetary pressure at a time when the UK was looking to decrease its global commitments. With a change of the UK government in 1964, TSR.2 was effectively axed, but it also ultimately sounded the death knell for F-111K with government priorities eventually whitling away F-111K numbers until the procurement was no longer seen as cost-effective. As political landscapes change, the potential knock-on effects for air power delivery can be very significant.

In our second article, Dr Seb Ritchie of the RAF's Air Historical Branch (AHB) presents a narrative account of the RAF's involvement in the Second Gulf War in 2003. *The RAF in Operation Telic: Offensive Air Power, March – April 2003* uses still classified records of events to produce a compelling account of the RAF's contribution to coalition air operations over Iraq at that time. The author describes how Operation Telic was, in fact, the culmination of over a decade of uninterrupted air operations in the region, from the First Gulf War in 1990 to air policing operations and enforcement of a no-fly zone including punitive attack operations throughout that decade, until finally the invasion of Iraq in 2003. Fielding an air contribution of 88 fast jets and 38 support aircraft, Ritchie suggests that it is difficult to envisage a time when the RAF will deploy on such a scale again. Crucially, the author explores some of the broader lessons that are identifiable from the RAF's involvement in the coalition during this period, including the realisation that Air-Land Integration (ALI) was an

area requiring further development and reinvestment. Subsequent UK military operations in Afghanistan would be the testing ground for these improvements. If ALI was the most prominent issue, other critical lessons were also identified, such as the tensions between Air and Land primacy to lead the initial assault and shape the early stages of the overall Joint operation and questions over the effectiveness of the Air-Special Forces Counter Theatre Ballistic Missile mission in tying-up valuable air assets. Most interesting perhaps, are the author's remarks about the use of air power as an effective containment strategy, demonstrated during the 1990s in enforcing the Southern and Northern No-Fly Zones. He argues that this strategy achieved more than the subsequent decade of military occupation and its associated regional overspill of conflict and instability we are dealing with today.

In a departure from the air campaigning of the Gulf Wars, our third article is written by practicing Barrister and RAF Reservist, Flt Lt Andrew Otchie. *The Art of Article 5: The Utility of NATO's Jus ad Bellum in the Face of Ambiguous Warfare* examines the legal complexities faced by air power practitioners in the contemporary operating environment. In doing so, the author provides a detailed examination of the recent developments and shifts in political and military affairs within the current international legal framework. Placing the issue of hybrid or ambiguous warfare front and centre for NATO states, Otchie considers whether the premise of NATO's Article 5 – sanctioning the use of force in the face of armed attack on a member state – remains valid or is in need of reform to better achieve its aim. The author highlights the current paradigm of NATO power being one of international dominance and prominence, but with its greatest challenge being how to ensure a sound, workable, legal basis for its future military operations.

RAF Chief of the Air Staff's (CAS) Fellow, Wing Commander Jim Beldon provides the first Viewpoint for this edition of APR. In *Lethal Autonomous Weapons Systems – Warfare's Best Humanitarian Hope?* the author suggests governments could be moved to embrace a future of Lethal Autonomous Weapons Systems (LAWS) as an inevitable technology development cycle begins to unravel. In the spirit of encouraging informed debate and seeking to move beyond the false characterisation of the current generation of Remotely Piloted Air Systems (RPAS) as 'autonomous, killer-machines beyond human control', Beldon looks to move the debate forward to the (seemingly not too distant) point in time when advances in artificial intelligence and robotics will be able to, as he puts it: 'form reasoned judgements and then decide and act on them without human input'. Many argue, including Beldon, that just as the long-bow was developed and used on the field of battle, counter to the shared moral and ethical standards of the 14th Century, so humans will seek to exploit advantages of current and future technological revolutions. As with Flt Lt Otchie's assertion that NATO's greatest challenge will be ensuring a legal basis for future NATO operations, Beldon envisages the legal, moral and

ethical challenges of weaponising truly autonomous systems as being many and complex. He suggests that the justification, in the fullness of time, for retaining such weapons, could be the high levels of reliability, predictability and absence of human error or judgement in their decision making processes. Beldon leaves the reader to ponder on man's long and unimpressive track record of committing crimes against humanity.

Squadron Leader Joe Doyle - also a CAS' Fellow - provides our second Viewpoint with *Future Mission Training in the Royal Air Force: The Utility of Live, Virtual and Constructive (LVC) Technologies*. In a fascinating look at the future of tactical training in the RAF, Doyle discusses the move towards blending the live and virtual environments, eroding the distinction between the two and improving training outcomes for the Service and the individual as a result. Using the RAF's developing LVC capabilities that are already employed in the Hawk T2 as a starting point, Doyle examines the potential benefit in rolling these out to the RAF front line. The author raises some interesting points in considering just how far synthetic and hybrid training can be pushed by the Service, potentially using the synthetic environment for development, evaluation and test purposes. The author concludes by highlighting the conceptual and cultural challenges required of the RAF's people in moving towards more of a balanced blend of LVC and suggests that they will be the decisive factor in exploiting its benefits to the full in the future.

We conclude APR with three book reviews which span the First World War, the Cold War and a possible future world war. *Ghost Fleet: A Novel of the Next World War*, written by P.W. Singer and August Cole, is reviewed by Wing Commander Keith Dear. Written in the genre of Clancy's *Red Storm Rising* or Hackett's *The Third World War*, *Ghost Fleet* gives a fictional account of how the next world war is triggered. Despite its basis as a fictional thriller, Dear finds it to be a deeply researched and credible book with resonance for policymakers, military practitioners, academics as well as the casual reader.

Dr David Jordan then reviews Ian Hall's *Jaguar Boys: True Tales from Operators of the Big Cat in Peace and War*. Focusing, predominately, on the RAF's use of the Jaguar aircraft the book is said to offer a valuable insight into its introduction into service, through to its eventual operational use in the Persian Gulf in the 1990s. We conclude this edition with a review of Gary Sheffield's *A Short History of the First World War*. Squadron Leader Paul Withers suggests that amongst the many titles produced during the centenary commemoration period, Sheffield's book provides an excellent and broad overview that manages to include a great deal of analysis within its relatively few 239 pages.

Notes on Contributors

Dr Richard Moore is a visiting research fellow at the Department of War Studies, King's College London, working on the history of the British nuclear weapons programme. His second book *Nuclear Illusion, Nuclear Reality: Britain, the United States and Nuclear Weapons 1958-64* was published by Palgrave Macmillan in 2010.

Dr Sebastian Ritchie is an official historian at the Air Historical Branch (RAF) of the Ministry of Defence. He obtained his PhD from King's College London, in 1994, and lectured at the University of Manchester before joining the Air Historical Branch. He is the author of a number of official histories covering RAF operations in Iraq, the Former Yugoslavia, Libya and Afghanistan, and has also lectured and published widely on aspects of air power and air operations, as well as airborne operations, in the Second World War and post-war periods. His published books include *Industry and Air Power* (1997), *Arnhem: Myth and Reality* (2011), and *The RAF, Small Wars and Insurgencies* (two volumes, 2011).

Flight Lieutenant Andrew Akuafo Otchie was called to the Bar by the Honourable Society of Gray's Inn in 2005 and has practised as a self-employed Barrister in Chambers for the past 5 years. In addition to maintaining a full-time, mixed common law practice at the Bar, he has contributed to the Royal Auxiliary Air Force as a Reservist since 2008. A member of 600 (City of London) Sqn, and based at RAF Northolt, on completion of the Reserve Officers' Initial Training (ROIT) course at the RAF College at Cranwell, Otchie was commissioned as the RAF's first Reserve Legal Officer in June 2015. Otchie was also recently awarded a Master in Philosophy degree by The University of Hull for an extended dissertation on NATO, International law and the Use of Force.

F-111K: Britain's *Lost* Lost Bomber

By Dr Richard Moore

For several years in the mid-1960s, the US-built F-111K strike/reconnaissance aircraft was the RAF's future "spearhead". It was to replace the TSR.2 and saw off the Navy's new generation of aircraft carriers in a bitter political battle. This article explores the technical, military and political history of the F-111K up to its dramatic cancellation in 1968. It also throws light on the Air Staff's view of the TSR.2.

Introduction

For three years between 1965 and 1968, the Royal Air Force's future plans were built around a "spearhead" force of 50 US-built F-111K strike-reconnaissance aircraft.[1] Although much has been written about Britain's defence policy and planning in these years, the F-111K tends to be mentioned sketchily or in passing, as a footnote to the better known stories of TSR.2, aircraft carriers *versus* island bases, and the withdrawal from east of Suez. Paddy Menaul's history of the British nuclear deterrent, for example, gives a short and partisan account of the TSR.2 cancellation before suggesting that Labour Defence Secretary Denis Healey "had no intention of buying the F-111 for the RAF" as a replacement.[2] In fact, as we shall see, Healey fought tooth and nail for the F-111K. Chris Bartlett's excellent history of postwar British defence policy notes that, after 1968, "no special capability for operations east of Suez would be preserved, which meant that the order for F-111s … could be cancelled."[3] In fact the Air Staff had made strong arguments for a European role for the aircraft, in the context of NATO's flexible response strategy.

TSR.2 is described nostalgically as "Britain's lost bomber".[4] But so much has been written about TSR.2, and so little about the F-111K, that the description better fits the latter aircraft. Moreover the eventual cancellation of the F-111K was, I shall argue, more traumatic for the RAF.

As the RAF again looks forward to introducing an American-built frontline combat aircraft, this article introduces the technical and acquisition issues surrounding the F-111K, and its intended role in some of the never-to-be nuclear and conventional wars of the 1970s, before describing the political drama of cancellation.

Tactical Fighter Experimental

The F-111 story began in the late 1950s, when Tactical Air Command (TAC) of the US Air Force (USAF) was looking for a new flagship high-performance nuclear strike aircraft.[5] The US tactical nuclear arsenal was growing and TAC saw the need to replace its F-105 strike fighters. Originally, the replacement was to have vertical take-off and landing (VTOL) to aid dispersal, because only a dozen or so airfields in the whole of western Europe could support the heavy F-105. In the summer of 1959, however, TAC HQ staff were briefed by NASA researchers at Langley Field in Virginia on their research into variable geometry or "swing wings". The research had been stimulated, to some extent, by studies in late 1958 of the exotic and impractical Swallow aircraft conceived by British designer Sir Barnes Wallis.[6]

Variable geometry was of immediate interest to the new TAC commander-in-chief, General Frank F Everest USAF, because it offered the chance of excellent performance in different flight regimes – in particular short take-off and landing, high speed at high and low level, and long ferry range. Hence requirement number SOR.183 was issued by TAC in July 1960, calling for an advanced variable-sweep, turbofan-engined strike fighter with a two-man crew, capable of M2.5 at 60,000 ft, with an 800-mile combat radius at low level, including 400 miles terrain-following at M1.2, and a 3300-mile trans-Atlantic ferry range.

From December 1960 the aircraft was known as TFX, or Tactical Fighter Experimental. Famously Robert S McNamara, Kennedy's new Defense Secretary from January 1961, forced the USAF and US Navy to work together on the TFX programme to meet their nuclear strike and carrier air-defence requirements in one airframe, hoping for economies of scale in a long production run. Also famously, in 1962 he chose General Dynamics (GD) to build the aircraft, against the repeated strong recommendations of the services for the competitor design from Boeing. The Senate Permanent Subcommittee on Investigations, chaired by Democrat Senator John L McClellan of Arkansas, held a long series of hearings on this decision during 1963, requiring McNamara to testify in person but failing, ultimately, to establish any wrongdoing. In fact, the decision was perfectly justifiable on the basis of the competition rules set by McNamara: the GD design had more commonality between the Air Force and Navy versions, as required, and GD's Convair division had a great deal more supersonic fighter and bomber experience at this time than Boeing. GD's partner Grumman had even built a variable-geometry prototype for the Navy.[7]

From an early date, the British knew a fair bit about the plane that would come to compete directly with their own TSR.2. The operational requirements branch of the Air Ministry opened a file on TFX in April 1960, comparing in detail the UK and US requirements – three months before the latter was formally issued.[8] This and other comparisons issued over the following years highlighted the pros and cons of the two aircraft.[9] The TFX – known formally as the F-111 from December 1961 – would have better airfield performance, range, and speed at both high and low altitude. It would also be cheaper, mostly because the production run would be longer. But variable geometry was a big technological leap, and the Air Ministry was therefore sceptical about delivery timescales. It was also very worried about the navigation and attack avionics of the F-111, which were less advanced than the TSR.2's. TSR.2's nav/attack system was based on a relatively simple inertial guidance platform but with frequent fixes from forward and sideways-looking radar and doppler, and calculations made in a digital computer. F-111's guidance fixes, from external radio navigation aids and forward-looking radar only, would be less frequent and useful, and its computer was analogue. F-111 was also less suitable for quick-reaction alert (QRA) scramble, because its better inertial platform needed longer warm-up on the ground for gyro alignment. As a result, 200ft weapons accuracy and blind attack, as in the TSR.2 requirement, were judged impossible for the F-111.[10]

In October 1963, to the consternation of many in the UK, the Royal Australian Air Force (RAAF) chose the F-111 over the TSR.2 to meet its own requirement for a tactical strike/reconnaissance aircraft.[11] By the start of 1964, the UK Air Ministry was also seriously questioning the TSR.2 and especially its rising cost – perhaps £5M per unit, compared to £2M for the F-111.[12] On 9 January Hugh Fraser, the Secretary of State for Air, wrote to Defence Minister Peter Thorneycroft. Fraser was "appalled", he said: "to put it brutally, the British aircraft industry is destroying our military air power ... unless the new cost figures for the TSR.2 can be drastically reduced, we should, I believe, seriously consider looking elsewhere ... the only alternative I see to the TSR.2 is the American TFX". This appears to have been bluster on Fraser's part, in advance

of taking a "tough line" with BAC, the makers of the TSR.2, at a meeting two days later.[13] Still, these were strong words for a minister in a Conservative government, traditionally very supportive of the domestic aircraft industry.

The Air Staff knew its concerns about TSR.2 were unlikely to be resolved politically at this stage. Frank Cooper, at the time a senior Air Ministry official, recalled that the Chief of the Air Staff (CAS), Air Chief Marshal (ACM) Sir Charles 'Sam' Elworthy, "after discussion with a very limited circle, took a note from himself to ... Fraser, who showed it to Thorneycroft expressing doubts about the project. The paper was torn up and CAS told that this was not a matter to be discussed before an election."[14] The Air Ministry was anyway in the process of being reorganised out of existence, as the central Ministry of Defence (MOD) took over the functions of the single-service ministries on 1 April.

Nevertheless in September, just before the election, a long paper appeared on the "Short Comings of the TSR.2". This seems to have been written by Joe Croshaw, the Wing Commander in the Air Staff responsible for the TSR.2 requirement, with the encouragement of his boss Air Commodore (Air Cdre) Alan Frank. In this hard-hitting assessment, the "outstanding and all-pervading short-coming of the TSR.2" was "its high cost ... which results mainly from inept management and an almost total lack of value engineering. The country will be able to afford only a small force which, at best, will hardly meet our commitments in NW Europe, the environment to which the TSR.2 is best suited, and will be numerically, and to some extent operationally, incapable of being effective elsewhere at the same time". Other listed weaknesses included conventional strike capability at night and in bad weather, reconnaissance, navigation outside accurately mapped areas mainly in Europe, weight, ferry range, and engine tunnel and wing design.[15] Air Cdre Frank had previously written despairingly that "virtually no attempt has been made to keep down costs ... this can only complete our loss of faith not only in BAC's word but in that of MoA [the Ministry of Aviation], who are supposed to see that we get value for money ... The fact is that MoA have no interest in getting production costs down".[16] It is abundantly clear that at least some RAF officers were prepared during 1963 and 1964 to think the unthinkable about TSR.2.[17]

Labour in Power: TSR.2 *versus* F-111

Prime Minister Harold Wilson, newly elected in October 1964, had three overriding objectives in defence: first, to cap the annual defence budget at £2bn/year by 1969/70, down from the projected £2.4bn (the target was reduced further to £1.85bn after the sterling crisis of July 1966); second, to reduce commitments overseas; and third, to reform Britain's aircraft industry. Labour firmly believed the industry was tying up too much R&D money – over £250M each year, mostly on military projects – and too many people who should have been working instead in the civilian export economy.[18] The industrialist and former UK Atomic Energy Authority Chairman, Lord Plowden, was appointed to conduct a long study into the future of the aircraft industry but meanwhile Sir William Cook, Deputy Chief Scientific Advisor for Projects in the MOD, also wrote a more specific report in March 1965 on military aircraft

procurement and the pros and cons of a "buy American" policy. In a clear-sighted report, he recommended a balanced approach, with some American purchases, some home production and some European collaboration. An all-American approach, as he noted with considerable foresight, "would put vital areas of our defence policy at the mercy of balance-of-payments crises".[19]

One of Healey's first actions as the incoming Secretary of State for Defence, well in advance of seeing these conclusions, was to call for specific studies of US alternatives to the three big UK military aircraft projects then current: the P.1154 VTOL fighter and the HS681 tactical transport were to compete with two of the most successful military aircraft of the late 20th Century, the McDonnell-Douglas F-4 Phantom and Lockheed C-130 Hercules; and TSR.2 was pitted against the F-111.[20] Wilson and Healey were in Washington when McNamara told them he thought TSR.2 was "an expensive and nearly worthless project". On 9 December, Healey explicitly asked him for a price quote for the F-111.[21]

A blow-by-blow account of the politics of the TSR.2 cancellation would be out of place here.[22] I should like, however, to draw attention to the position on TSR.2 of the RAF and Air Staff, which many previous writers have neglected. The junior service mounted no determined last-ditch defence of TSR.2, as the aircraft's supporters in industry and the MoA certainly did. Nor however did the RAF whole-heartedly change horses; rather, the Air Staff diligently researched the options. They desperately wanted a high-quality, supersonic strike aircraft, but they were concerned about the F-111's avionics and its lack of reconnaissance capability. Air Marshal (AM) Sir Christopher Hartley, responsible as Deputy Chief of the Air Staff (DCAS) for RAF equipment, took a team to the US in December 1964, and his report explored these issues in detail, with a front line force of 74 F-111s in mind and a total buy of 110.[23]

Anticipating controversy, the Air Staff began to prepare defensive lines on their own part in the TSR.2 story. By 30 December, Air Cdre Frank had finished a paper on what went wrong, blaming the MoA for dismal cost and time estimation and failure to consider design trade-offs early enough. A further paper addressed the charge that the RAF's requirements had doomed the TSR.2. The conclusion – that there had been no 'requirements creep' over time – avoided the more basic question of over-ambition in the original specification.[24] Elworthy certainly felt defensive about press and public criticism in this regard, writing on 19 January that "the services should not be allowed to absorb the unjust impression that professional advice to Her Majesty's Government in the air force field is provided by a bunch of short-sighted and vacillating spend-thrifts".[25]

On 15 January 1965, aircraft industry workers marched in London in support of TSR.2 and to protect their jobs. The previous day, however, at a Defence Council meeting of ministers and officials, Elworthy had already spoken in favour of a version of F-111, needing both improved Mk.2 avionics, known to be under consideration in the US, and a UK reconnaissance pallet. At a meeting of the ministerial Defence and Overseas Policy Committee on the day of the

march, Healey recommended an order for 10 F-111s and an option on 100 more.[26] Roy Jenkins, as Minister of Aviation, loyally defended TSR.2 and opposed the F-111.[27] Political compromises were suggested between Healey and Jenkins – a mixed TSR.2/F-111 force, perhaps, or F-111 with Rolls Royce Spey engines, or with British avionics. The Air Staff tended to oppose these ideas on practical grounds. For example Michael Quinlan, Elworthy's Private Secretary, described British avionics as "an absolutely rotten idea".[28] Ministers, at this time, were keen to emphasise east-of-Suez roles for a strike/reconnaissance aircraft, and this had the effect of undermining the technical advantages of TSR.2, which had been optimised for long-range low-level penetration against targets deep in east European and Soviet airspace.

Labour minister Dick Crossman, observing the politics of the cancellation, claimed in his diary that the Chiefs of Staff "hate[d] TSR.2".[29] This is an overstatement, at least of Elworthy's views. Surviving correspondence between Quinlan, Elworthy and other senior officials shows that the CAS agonised over expressing an opinion against the British aircraft. Eventually, however, as the air chief himself recorded on 30 March, the balance of opinion within the Air Staff was indeed in favour of the F-111. Quinlan had told Elworthy that Healey wanted to hear a clear military preference for the F-111, also that "on present evidence you yourself slightly favour the TFX Mk.2". But the CAS would endorse only a more neutral formula, listing many pros and cons of the two aircraft and favouring the F-111 "simply on grounds of cost".[30] TSR.2s would probably cost £5.8M each, and F-111s £2.1M. The Cabinet finally decided on 1 April to cancel TSR.2 and explore an option to purchase the F-111. On 6 April this decision was announced in Parliament.

Operational Roles

The RAF now had the opportunity, therefore, to acquire the F-111. What operational roles were envisaged for the aircraft worldwide? Many misleading maps were produced in the years 1965-68 showing the range and capability of the F-111. Large parts of the world were graphically threatened in these maps by means of circles, drawn around current or proposed RAF bases. In one example, appended to a February 1966 paper for the Defence and Overseas Policy Committee, the world was coloured air force blue from Brazil and the Azores through southern European Russia and Tibet to the Solomon Islands, these areas being within range of an F-111 flying a High-Low-Low-High attack profile with 2000lb of nuclear or conventional bombs. The inferiority of the Royal Navy's subsonic carrier-borne aircraft, the Buccaneer – which the Air Staff was *determined* not to have – was shown by means of smaller, inner concentric circles.[31] But there were no plans to strike so widely, least of all with nuclear weapons. Such maps were a product of the staffs battling over carriers and island bases, not of operational planners.

Far more interesting in this regard is the March 1965 report of a group chaired by the Vice Chief of the Air Staff (VCAS), AM Sir Brian Burnett.[32] Burnett had been asked to set out the requirement for a strike/reconnaissance aircraft of the TSR.2/TFX type. He envisaged the front line of 74 aircraft deployed as follows: 24 for strike and 12 for reconnaissance in the UK,

earmarked for NATO in war but otherwise available to reinforce overseas theatres; 16 and eight based permanently in the middle east; and eight and six in the far east.

The main role of the overseas-based aircraft would have been conventional non-nuclear strike. Addington, for example, was the name given to the C-in-C Far East's plan to destroy the Indonesian air force on the ground, in the event of air attacks on Malaysia, in a strike against 40 airfields and air defence targets.[33] Similar plans were drawn up to defend Libya and Kuwait against Egypt and Iraq. This was a very Trenchardian concept of strategic air power: first wipe out the enemy's air force, then ask questions. Sir Solly Zuckerman, the government's powerful Chief Scientist, was unimpressed with such plans, noting that US destruction of the North Vietnamese air force, and much else besides, was having little effect on the war in Indo-China.[34] Sir Burke Trend, the Cabinet Secretary, was also sceptical: "Against whom are we likely to be carrying out deep (and pre-emptive) strikes of the kind which this aircraft will make possible?"[35]

Burnett's report, however, went further, arguing that:

> It is unlikely that non-nuclear potential enemies would believe that we would employ nuclear weapons against them. However it is a factor that they must take into account, particularly if our vital interests are threatened or if they envisage relying on overt support from third parties. Furthermore, we cannot at this stage be certain that world pressure for some form of non-dissemination agreement will be strong enough to prevent nations such as Egypt and Indonesia from obtaining nuclear weapons ... nuclear deterrence is necessary. This capability can be provided by tactical strike aircraft equipped with kiloton weapons (which we already possess).[36]

Very few other documents are known which express an interest in nuclear deterrence of Indonesia, and there was no wider official or political approval for such a concept.[37] However, there *was* also a specific plan to use nuclear weapons in south-east Asia, as a part of South-East Asia Treaty Organisation (SEATO) Plan 4. This plan was the reason 48 Red Beard nuclear bombs were stored by the UK in Singapore between 1963 and 1970, for potential use by RAF Canberras based locally and V-bombers reinforcing from the UK. Small numbers of Red Beards were also held aboard Royal Navy carriers deployed to the far east. Plan 4 envisaged a Chinese and North Vietnamese invasion of the SEATO countries, directly and through Burma and Indo-China, with over 30 divisions. British nuclear strikes would have been mounted, in this unlikely scenario, against airfields and other military and communications targets in southern China including Hainan Island, also in North Vietnam and, it seems, neutral Burma.[38] Up to the entire UK-based force of 36 F-111s might have had to reinforce the far east for either Addington or SEATO Plan 4 to be carried out.

Burnett's report also had F-111s replacing the four Canberra squadrons (32 aircraft) then based at RAF Akrotiri on Cyprus. As well as their conventional role, these aircraft too had Red Beards

stored locally. They were the only nuclear forces of any nation declared to the Central Treaty Organisation (CENTO). A map in the report showed that the targets for these aircraft in "general war" were in the USSR. In case of unilateral British action there were "national" targets – probably cities – in Ukraine and southern Russia; there were also CENTO targets – probably military – in Soviet central Asia.[39] Twelve of the Canberras would attack from Akrotiri itself, ten others would disperse to Muharraq on Bahrain, four to Sharjah in the then Trucial States and six to Masirah in Oman. The aircraft would recover to Sharjah, Peshawar in Pakistan or Mehrabad in Iran.

Technical and Cost History

F-111 was a complex aircraft, still under development in these years and incorporating a great deal of new and ambitious technology – most obviously variable geometry and turbofan engines, but also some new materials, to which we shall return later. As we have seen, the Air Staff always knew the basic USAF version, the F-111A, would fail to meet the UK requirement for nav/attack accuracy. As the US and UK both explored modifications and new versions over the years between 1965 and 1968, the Air Staff had constantly to revise its ideas, and therefore also its cost estimates. Industry and the MoA, meanwhile, pressed for the incorporation of various items of British equipment including Spey engines, a Ferranti nav/attack system and various British weapons. The Air Staff, and indeed GD, resisted these ideas.

The Air Staff's operational requirement for TSR.2, number OR.343, was redrafted several times with the F-111 in mind before being reissued formally at Issue 3 in October 1965.[40] In almost all cases, US equipment was eventually preferred over British but there remained a number of important differences between the USAF's standard aircraft and the UK variant, formally designated F-111K in June 1966. The second aircrew member would be a navigator, not a co-pilot. There would be British nuclear weapons – not US weapons under a "dual-key arrangement" – and with British nuclear wiring. This meant, specifically, one or two high-yield WE177B bombs for UK-based aircraft; or the same number of low-yield WE177As for aircraft east of Suez.[41] The Anglo-French Martel, a conventional air-to-surface missile, would also be carried.[42] A UK reconnaissance pallet would be fitted to some aircraft, and all would have British flight-refuelling and communications equipment.

By the start of 1966, negotiations with the US for a firm price for the F-111 were no longer complicated by the possibility of Spey engines, but there remained questions over the final avionics fit required on both sides of the Atlantic. The US Mk.2 avionics would include a digital nav/attack computer and other improvements to the inertial guidance platform, now with astro and doppler fixes, and to the forward-looking radar and terrain-following. Even in 1967 and 1968, the British Mk.2K avionics fit was still to be finalised and tested.[43]

In addition to uncertainty over detailed specification, the F-111 was plagued during flight testing in 1965 and 1966 by engine compressor stalls – interruptions in the flow of air through the engines. As a result the engine air intakes were in a constant flux of redesign.

The afterburners were also problematic. These problems, however, mostly affected high-Mach, high-altitude and high-manoeuvring flight, and therefore the US Navy's F-111B fighter version. The F-111A was clear by November 1965 for flight at low level in the penetration role in which the RAF was most interested. Hartley himself flew the fifth aircraft in the US in May 1967, and managed to create and recover from a compressor stall in a 3G turn at 22,000ft without incident.[44]

Specification changes and technical setbacks naturally affected the cost of the F-111K. The Air Ministry's earliest guess, in March 1963, had been a unit price of £1.15M ($3.22M) plus a contribution to the overall US research and development (R&D) programme.[45] When a letter of offer was first received from the US in September 1965, £2.125M ($5.95M) was the unit price given, plus an estimated £470k ($1.316M) for UK modifications, although no contribution to R&D was required.[46] By September 1967, with no certainty still about the final avionics fit, unit price had crept up to £2.95M.[47] Despite this cost escalation, F-111K was still far, far less expensive than the cancelled TSR.2, and the overall deal with the US was seen as an excellent one, with a fixed price including R&D, eventually a ceiling price for UK modifications, long-term credit repayments and – a recent innovation, relating also to the purchase of Phantoms and Hercules – provision for 'offset' deals. The US agreed, for example, to buy salvage tugs from Brooke Marine of Lowestoft, UK catapults and arrester gear for aircraft carriers, Jetstream passenger aircraft from Handley Page and even $1.3M worth of barbed wire from Tinsley Wire of Sheffield.[48]

Despite the difficulties of finalising a specification – and, as we shall see, the background of an ongoing defence review and the related temptation to put off any and every specific decision – Healey was able to use the provisions and deadlines of his agreement with McNamara to turn options into firm orders for F-111K. Twisting the arms of his ministerial colleagues, he placed ten orders in February 1966 and 40 more in March 1967.[49]

Politics and Changing Roles

Harold Wilson presided over an almost non-stop process of defence review upon review for the first four years of his premiership, and the political story of the F-111K project weaves together debates on dollar cost, the future of the British aircraft industry, the east of Suez role, and bitter interservice battles with the Navy.

Industry and the Ministry of Aviation – later of Technology – fought a continuing rearguard action against American procurement. Thus the F-111 found itself, throughout these years, battling in a continuing series of studies against other aircraft: a developed Buccaneer known as the 2* or "Two-Star", a Spey-engined French Mirage IV, a version of the Phantom, etc. In one ministerial discussion these alternatives to the F-111 were described, revealingly, as representing "a dying generation of fixed-wing subsonic aircraft". Industry and its supporters in government were far keener to preserve and encourage work on supersonics, VTOL and variable geometry.[50]

Although none of the alternative aircraft was attractive in the short term, especially to the RAF, concerns about the dollar cost of F-111 and the determination in some quarters to promote home-grown alternatives did lead to a rapid erosion of planned F-111 numbers. Of the 110 originally envisaged, and the 20 more wanted by Elworthy as a bonus to replace the Fleet Air Arm, by October 1965 only 50 could be agreed, for a front line force of 36: 14 based in the far east, and 22 at RAF Honington in Suffolk.[51] These were the 50, as we have seen, that Healey was able to order by the spring of 1967. The 1966 Defence White Paper, because of dollar cost and industrial policy concerns, described the F-111 essentially as a niche, interim aircraft, now required in small numbers alongside existing V-bombers, and moreover only until the mid-1970s when almost 200 of a new strike aircraft would enter service. This was the smaller, shorter-range Anglo-French Variable Geometry plane (AFVG), intended to be built by BAC, Rolls-Royce and their French counterparts.[52]

Meanwhile the Navy's aircraft carrier programme CVA-01 was cancelled in 1966, which was good news for F-111K; and Britain's east of Suez role gradually eroded, which was not.[53] Healey steadily undermined the case for the new carrier by throwing doubt upon the need for any truly independent UK intervention east of Suez, without allied support and basing. From at least June 1965, he also talked specifically about withdrawal from the far east at some future point when the Confrontation with Indonesia was over. This idea gained ground after Sukarno's anti-communist coup in October 1965 and the formal end of Confrontation the following August.

In parliament and the press, the F-111K attracted controversy. As *Flight International* put it in February 1966, "it is doubtful whether any previous aircraft in history has created such a furore … In Britain in recent months it has been a divisive subject in the MOD (and anathema to those who wear the darker blue, for reasons not connected strictly with the aircraft's virtues); a contentious topic during frequent references in parliament, a never-failing story for the press and as much of a household word as any aircraft can become".[54] Conservative MPs tabled regular questions about cost, performance, delivery timescales and details of weapons and other equipment.[55] On 1 March 1967, the *Financial Times* asked sceptically: "Do we need the F-111s?" A full-scale debate on the aircraft followed in the Commons on 1 May. Enoch Powell, opening for the opposition, went over a great deal of ground, challenging the government on rising prices before moving on: "So much for cost. I now come to performance. Here there has been the opposite of an escalation". Healey and his junior minister John Stonehouse defended stoutly.[56]

Originally firmly committed to east of Suez, Labour ministers had been stung by a significant back-bench revolt after the defence debate in the Commons in February 1967. Two months later, the Cabinet agreed to end the east of Suez role some time in the mid-1970s. Suddenly therefore, with the publication of a new Defence White Paper in July 1967, the F-111K became an aircraft with a European rationale.[57] All 36 in the front line would now be assigned fully to SACEUR and based in the UK at Honington and perhaps, for the reconnaissance version, Wyton. Interestingly, as we have seen, the F-111 had originally been

judged somewhat less suitable than TSR.2 for a European role, although the USAF certainly planned to use the aircraft in Europe.

These were the years when NATO's flexible response doctrine was being developed in detail, and so the F-111K was focused on conventional deep strike and reconnaissance which, it was thought, could be especially important either to help crisis management in a time of tension or for escalation control in a conventional, pre-nuclear war. In addition, as the new CAS, ACM Sir John Grandy, noted in December 1967, the F-111K "could broadly cover SACEUR's nuclear target zone" as far east as Moscow.[58]

In January 1968, VCAS, AM Sir Peter Fletcher, described this European role in more detail. The F-111K, he emphasised, was "in an entirely different class from the Phantom and other lesser brethren" – and it had a nuclear capability. Advanced F-111Ks fitted with electronic counter-measures could make a conventional or nuclear first strike against bomber airfields in the Eastern bloc, with V-bombers and other less capable aircraft following up.[59] For the Air Staff, the recent Arab-Israeli conflict had reinforced once again the value of strategic air superiority and therefore of attacking the other side's airfields. In the minds of some ministers, however, the F-111K had become closely associated with east of Suez, and the shift in emphasis towards Europe seemed a little too politically convenient.[60]

Crisis and Cancellation

In autumn 1967, there was a further sterling crisis and finally, on 18 November, the shame of devaluation. Wilson famously claimed on television that devaluation didn't affect "the pound in your pocket". It did, however, affect the pound in Denis Healey's pocket, because overnight the F-111K became 14% more expensive (around £50M over its lifetime). Also the Chancellor, Jim Callaghan, lost his job and Roy Jenkins – the chief opponent of F-111 back in 1964-5 – was appointed on 30 November to replace him and push through a deep new round of spending cuts.[61] Some of the most uncomfortable ministerial meetings of the late 20th Century followed. Wilson had been weakened personally by devaluation and, for a time, most unusually, the British Cabinet started voting on decisions – including the future of the F-111K.[62]

By the end of December Jenkins was pushing for, amongst other things, an early and complete withdrawal from east of Suez and the cancellation of the F-111K. His opponents were divided: the Foreign Office and Commonwealth Office were the most recalcitrant on east of Suez, raising fears of communist subversion and disorder in which "British subjects … may be killed".[63] Healey prepared instead to defend the F-111K. On 3 January 1968, he lost his temper at a meeting with Tony Benn, the Minister for Technology; it was "f... this and f... that", as Benn primly recalled.[64]

The Crossman, Benn and Castle diaries beautifully capture the mood in Cabinet as left-wingers spotted an opportunity for – as Crossman put it, with typical generosity of spirit – "a vote of

no confidence in the four pygmies on the other side of the table – Michael Stewart, George Brown, James Callaghan and Denis Healey – who had been running our foreign policy for the last three years".[65]

Cabinet met "in an icy atmosphere" on 4 January, the first of a gruelling series of eight meetings on Jenkins' cuts, totalling 32 hours over eleven days. Healey "made the most formidable case in favour" of the F-111 – "the last thing we should cancel if we paid due regard to defence needs".[66] Cancellation charges would amount to $140M, mostly up-front in the next financial year.[67] In the end, however, it was ten votes to nine *against* the aircraft, on Wilson's casting vote, although with the decision so close Healey was given leave to regroup. Various ministers also went away to consult overseas partners. Hence on 12 January, Cabinet discussion resumed and Foreign Secretary George Brown reported on what he called "bloody unpleasant" meetings in the US on east of Suez and the F-111: "the most awful experience of his life".[68] Barbara Castle recalled that "we listened in silence as he thundered on for half an hour, merely raising an eyebrow at his more purple passages ... 'They want us to keep the bird'. 'The what?' we chorused. 'The bird – the F-111'".[69] Wilson's annoyance with the US, however, in particular with President Lyndon Johnson's implied threat to use financial pressure to get his way, was clear. His response showed, for a postwar British prime minister, a surprising belligerence:

> It was important to our future relations that both we and the United States should recognise, especially now that we were both seeking to eliminate our external deficits, that we must each look after our own interests. They might be able to damage us economically if they wished; but it should not be thought that we were not in a position to reply in kind by, for example, withdrawing our investments from the United States.[70]

As Jenkins spoke, Brown passed a note to Healey: "I am fed up with this Jesuitical bastard".[71] After "an interminably long speech" on the F-111K from the Defence Secretary, who promised to find alternative cuts to the same value as cancellation, one vote went over to him: the 7th Earl of Longford, the Lord Privy Seal, was now pro-F-111.[72] But there was a further twist. As Crossman recounted gleefully to his diary, Jenkins had got at Cledwyn Hughes, the Welsh Secretary, and Patrick Gordon Walker, the Education Secretary, behind the scenes. Both therefore now voted against the F-111. Healey had been "no match for Roy ... we tottered out of Cabinet".[73]

Still, however, the Defence Secretary wasn't finished. One last time, on 15 January, Healey argued for (now just 35) F-111s, and even appeared to be winning the argument. As the minutes record, "it was argued that, in view of the new information which the Cabinet had been given on the F-111 situation, it would be right to consider the matter further. It was clear that the governments of the United States and Australia in particular attached the very greatest importance to our having this aircraft".[74] Crossman almost despaired: "if the future of the plane had been reconsidered on its merits, we couldn't possibly have won". But Wilson

refused to reopen any aspect of the cuts package without reopening the whole, an exercise for which ministers had no remaining strength. By this prime-ministerial tactic, therefore, the F-111K was finally cancelled.[75] Later that day David Bruce, the US Ambassador in London, melodramatically described the whole episode, in a telegram to Washington, as demonstrating "the most deplorable resolve, except for Munich, that any British [government] had taken during the last 150 years".[76]

The RAF and Cancellation

The protests of the RAF in general, and Grandy in particular, were shrill, and the contrast with Elworthy's careful treading of the line over TSR.2 three years earlier is clear. Grandy had been conspiring very closely with Healey in the run-up to these Cabinet meetings.[77] On 15 January, he presumed to write that he "deplore[d] the Cabinet decision" and that "the military consequences are of an altogether different order from other recent major and painful decisions on capabilities such as Skybolt ... and the carrier replacement programme ... we find ourselves with a void". He made a final plea: "in the knowledge that there are only hours to go before the PM's statement tomorrow ... *any* F-111s would be vastly better than none at all, in that even 16 aircraft would at least give a steel tip to our strike and recce forces for the 1970s".[78]

A very gloomy paper followed a week later: "There is no need for me to emphasise the effect of the void left in our defence policy by the loss of the advanced strike reconnaissance capability represented by the F-111, a void which reduces the effectiveness of our remaining land, sea and air forces to an extent out of all proportion to its size ... we have begun to think how to respond to the situation created by the disastrous decision to cancel the F-111".[79] DCAS, now AM Sir Peter Wykeham, wrote a sombre note of thanks to his own staff: "With the cancellation of the F-111K project the service has suffered, in the words of CAS, a severe blow ... Except that this was no fault of anyone in the Royal Air Force I have no comfort to offer".[80]

The first two F-111Ks had been nearing completion at Fort Worth, with the first flight planned for 28 March 1968 – a date which had caused problems with protocol because most very senior RAF officers would have been unable to attend, being otherwise occupied at a dinner with the Queen to mark the 50th birthday of their service.[81] With the unexpected resolution of this dilemma, the two F-111Ks were dismantled, and components used in testing and production of USAF aircraft.[82]

A letter exists from John T 'Bing' Cosby, a Vice President of GD, to Merlyn Rees, junior minister for the RAF, dated 21 February 1968 and highlighting ways in which the British might still get their F-111s. The aircraft might be completed as F-111As or as Australian F-111Cs and then loaned or leased to the RAF, or RAF crews might fly USAF aircraft, or "fly now pay later" terms might be agreed.[83] No such deals were politically realistic. Instead the RAF had finally to face the unwelcome prospect of introducing more of its least favourite strike aircraft, the Buccaneer, into front line service, as well as prolonging the life of the now outdated Vulcan. A paper from Grandy on plans for life "After the F-111" complained again that "the decisions of last month

made matters very much worse. Not only was the spearhead force excised, but as a result of the change ... we now find ourselves having to depend on Vulcans for conventional operations in the much tougher operational environment of Europe ... [meanwhile] no amount of investment in the Buccaneer would give us the options, in terms of both operational viability and reliability that a more modern aircraft [would] offer".[84]

It is curious that, given their recent success in seeing off the Royal Navy's carriers, the Air Staff seems to have made no attempt, even in the final months, to set its cherished nuclear-capable strike aircraft against another naval project, and major dollar expenditure, the Polaris submarine. The likely strategic role of the TSR.2 had repeatedly been mentioned by the Air Ministry in Whitehall debates on nuclear deterrence, especially in 1960 and again in 1963, either as a supplement or an alternative to other delivery systems, including Polaris.[85] In 1968, a choice between Polaris and the F-111K was certainly real in the minds of some ministers, and on 4 January at least one of these ministers argued in Cabinet that "we could not afford to provide both Polaris and the F-111 for NATO when our partners were providing neither".[86] Treasury officials also made the link.[87] Cancelling Polaris, however, was a step neither Wilson nor Jenkins was prepared to take. The Air Staff perhaps accepted, by this time, that its days in charge of the nuclear deterrent were over: a "child's guide" [sic] intended for use in briefing MPs on the F-111K stated that "the age of the strategic bomber as the hard core of the RAF's thinking and the big club in its offensive power has passed. The V-force is converting to the tactical role". Even if these words were a little disingenuous, the Polaris programme was now almost complete and the Air Staff must have calculated that a final grab for the strategic nuclear deterrent role would have been doomed.

Perhaps, with hindsight, 1968 was a good year to cancel. The F-111 was eventually to enjoy a long and successful career in US and Australian service. Its early years, however, continued to be dogged by technical and political problems. McClellan remained an inveterate opponent, and parts of the US media continued to run the 'costly failure' story. The US Navy cancelled its F-111B variant as soon as McNamara left office in 1968. Operational deliveries of the F-111A to the USAF began in July 1967 and in March 1968 the plane was deployed to Vietnam, only to be withdrawn soon after following a controversial series of losses. Serious fatigue problems then emerged, especially in the crucial parts of the aircraft structure which attached the wings to the fuselage: the wing carry-through box and wing pivot fittings, both made of a new steel which turned out not to be as high-tensile as intended. The Australian F-111C first flew in July 1968 and was formally accepted by the RAAF at a ceremony in September, but at this point the wing carry-through box had already failed in testing and *all* F-111Cs were grounded for most of the next *five years* – Australia didn't get its "F-trouble-one" until 1973.[89] Meanwhile the Mk.2 avionics intended for the F-111K and other variants did not become fully operational, on the USAF's F-111D, until 1974.[90]

We have seen that the F-111K was no footnote but a serious programme, and its loss a bitter blow for the RAF. Denis Healey's support for the aircraft had been strong, and he used it to

defeat the Royal Navy over carriers. In the aftermath of cancellation, he briefly considered resignation.[91] A combination of political factors had conspired against him: support for the British aircraft industry, wounded only superficially by the TSR.2 affair; anti-Americanism and opposition to post-imperial commitments within the Labour party; Cabinet tactics; and sheer economics. As Roy Jenkins sought to cut education and health in the aftermath of devaluation, defence had to bear a proportionate burden. During the 1970s and 80s, in common with the other services, the RAF refocused its attention on Europe and eventually, in the Tornado, it got a supersonic aircraft with low-level strike capability. Meanwhile the USAF, as so often, filled the gap, successfully basing F-111Es and Fs for over 20 years at Upper Heyford and Lakenheath, in just the roles previously envisaged by the RAF.

Notes

[1] The RAF variant of the F-111 was known officially as the F-111K from June 1966, although contemporary documents and sources did not use this designation consistently. Despite extensive correspondence on possible names including Richmond, Merlin, Taipan and even Thanggamau (see e.g. papers in UK National Archives (formerly Public Record Office) (PRO), AIR 20/11751), no name for the aircraft was adopted at the time and the US Air Force did not use the name Aardvark until many years later.

[2] AVM Stewart Menaul, *Countdown: Britain's strategic nuclear forces* (Robert Hale, London 1980), p. 152.

[3] C J Bartlett, *The long retreat: a short history of British defence policy 1945-70* (Macmillan, London 1972), pp. 224-5.

[4] See e.g., Damien Burke, *TSR2: Britain's Lost Bomber* (Crowood Press, Marlborough 2010).

[5] The best overall history of the F-111 development is the Masters thesis by Maj Brian L Reece USAF, *Development of the TFX F-111 in the Department of Defence's search for multi-mission, joint-service aerial platforms* (US Army Command and General Staff College, Ft Leavenworth KA 2011). Mark Lax, *From controversy to cutting edge: a history of the F-111 in Australian service* (Air Power Development Centre, Canberra 2010) focuses on the RAAF story but also has excellent general background, and there are useful accounts online by Joe Baugher and Peter Grant: respectively www.f-111.net/JoeBaugher.htm (accessed 21 Oct 2014); www.bayourenaissanceman.blogspot.co.uk/2010/11/weekend-wings-37-f-111-aardvark-part-1.html (accessed 21 Oct 2014). Enthusiasts will enjoy Don Logan, *General Dynamics F-111 Aardvark* (Schiffer, Atglen PA 1998).

[6] NASA Langley Research Center, 'Summary of NACA/NASA variable-sweep research and development leading to the F-111 (TFX)', Langley Working Paper LWP-285, Dec 1966, pp. 12-13; Reece, *Development of the TFX F-111*, pp. 16-17.

[7] Robert J Art, *The TFX decision: McNamara and the military* (Little Brown, Boston 1968).

[8] PRO, OR24 to ACAS(OR), 8 Apr 1960 and DOR(A) to OR17b, Apr 1960, AIR 2/18112. I am grateful to Lorraine Yeamans at the MOD for reviewing and declassifying this file.

[9] PRO, PS/VCAS to ACAS(OR), 13 Mar 1963 and DOR(A) to PS/VCAS, Mar 1963, AIR 2/16555; DDOR1 paper, Sep 1963, AIR 2/18112; ACAS(OR) to PS/SofS, 12 Nov 1963, AIR 19/1055; DOR3 to ACAS(OR), 27 Jul 1964, AIR 2/17776.

[10] PRO, OR24b note, 4 Feb 1964, AIR 2/18112; DAP(RAF) report on avionics, May 1965 and DOR3 note, 2 Jun 1965, AIR 2/17309.

[11] Richard Moore, 'A proliferation of Royal Air Forces: bombers and bombs down under, 1956-63', *Nonproliferation Review* 21/2 (June 2014), pp. 169-87.

[12] PRO, anon draft of 24 Jan 1964, AIR 2/17776; note of meeting in PUS MOD's office, 28 Jan 1964, DEFE 19/80.

[13] PRO, Fraser to Thorneycroft, 29 Jan 1964, DEFE 25/50.

[14] Sir Frank Cooper, 'TSR.2 and Whitehall', *RAF Historical Society Journal 17B: TSR.2 with hindsight* (1998), pp. 43-64.

[15] PRO, OR29 paper, 7 Oct 1964, AIR 2/17210. This must be the "devil's advocate paper" referred to by Frank in DOR3 to ACAS(OR), 14 Oct 1964, AIR 2/17776.

[16] PRO, DOR3 note, 17 June 1964, AIR 2/17210.

[17] Further evidence is provided by Wg Cdr George Wilson, 'A system study of TSR.2', *RAF Historical Society Journal 17B: TSR.2 with hindsight* (1998), pp. 16-26.

[18] Harold Wilson, *The Labour government 1964-70: a personal record* (Weidenfeld and Nicolson, London 1971), pp. 39-44; Bartlett, *The long retreat*, pp. 197-9; Andrew Pierre, 'Britain's defense dilemmas', *Proceedings of the Academy of Political Science* 29/2 (Nov 1968), pp.64-79; David Edgerton, 'The "White Heat" revisited: the British government and technology in the 1960s', *Twentieth Century British History* 7/1 (1996), pp. 53-82; Sean Straw and John W Young, 'The Wilson government and the demise of TSR.2, October 1964-April 1965', *Journal of Strategic Studies* 20/4 (Dec 1997), pp. 18-44; Saki Dockrill, *Britain's retreat from east of Suez: the choice between Europe and the world* (Palgrave, Basingstoke 2002), pp. 56-7.

[19] Cmnd. 2853, *Report of the committee of inquiry into the aircraft industry appointed by the Minister of Aviation under the chairmanship of Lord Plowden* (HMSO, London Dec 1965); PRO, DRE(65)15, 4 March 1965, AVIA 65/1768.

[20] Anthony Bennell, *Defence Policy and the Royal Air Force 1964-70*, p.1.2 (I am grateful to Sebastian Cox for arranging access to this MOD Air Historical Branch narrative); PRO, Private Office letter, 19 Oct 1964 and AUS(AS) to CAS, 21 Oct 1964, AIR 8/2428.

[21] Bennell, *Defence Policy*, p.1.9.

[22] See e.g. Straw and Young, 'The Wilson government and the demise of TSR.2'; Dockrill, *Britain's retreat*, ch. 4.

[23] A report of Hartley's visit on 15-17 Dec 1964 is the third appendix to a sheaf of working papers in PRO, AIR 20/11438; see also ACAS(OR)'s commentary, 29 Dec 1964, AIR 20/11510.

[24] PRO, DOR3 to PS/DCAS and DTSR2 to DCAS, both 30 Dec 1964, AIR 2/17777.

[25] PRO, CAS to MinRAF, 19 Jan 1965, AIR 20/11510.

[26] Bennell, *Defence Policy*, pp. 2.4-5.

[27] Jenkins was not a particular enthusiast for TSR.2 himself. In his memoirs, he describes it incorrectly as a swing-wing aircraft and recalls that "TSR.2, good plane though it was, had few friends outside the aircraft industry and the military chauvinist political lobby. I did not think that we should keep it going, although I was not convinced that the automatic alternative was to buy the F-111": Roy Jenkins, *A life in the centre* (Macmillan, London 1991), pp. 171-2.

[28] PRO, marginal note on DCAS to CAS, 6 Jan 1965, CAS to DCAS, 7 Jan 1965, both AIR 8/2429.

[29] Richard Crossman, *The diaries of a cabinet minister, vol. 1: Minister of Housing* (Hamilton and Cape, London 1975), p. 191.

[30] PRO, Quinlan to CAS, 24 March 1965 with Elworthy's manuscript notes, AIR 8/2413; ACAS(OR) to PS/CAS, redrafted note for CAS signature, and Healey's reply to CAS, all 31 March 1964, AIR 8/2414. Bennell seems to have had access to a further 30 March 1964 draft of CAS's note (*Defence Policy*, p. 2.13-14).

[31] PRO, Appendix 3 to Annex A, OPD(66)30, 8 Feb 1966, CAB 148/27.

[32] PRO, Burnett report, 19 March 1965, AIR 20/11779.

[33] Plan Addington had been drawn up in 1964; another plan, Althorpe, envisaged similar air strikes against a wider target set including naval forces, ports and oil installations: see National Archives of Australia, Canberra (NAA), file A1838 TS687/9/1 PART 2: Plans – Cannon, Spillikin, Mason, Addington, 1964.

[34] PRO, Zuckerman to SofS, 22 Nov 1965, AIR 8/2417.

[35] From a brief to Wilson, 8 Feb 1966, quoted in Hampshire, *From east of Suez*, p. 131.

[36] PRO, Burnett report, 19 March 1965, AIR 20/11779, p. 3.

[37] For one other example, see PRO, note of a meeting in Healey's room to discuss Polaris, 8 Jun 1967, DEFE 11/437.

[38] NAA, A1838 TS688/27/8 PART 1: SEATO Plan for defence of south-east Asia including East Pakistan and Philippines against attack by Communist forces and Democratic Republic of Vietnam, 1959-1960. One PRO document suggests 41 SEATO nuclear targets were assigned to the UK: note on range requirement for AFVG, 1 Apr 1966, AIR 2/17962.

[39] PRO, Burnett report Appendix 5 to Annex G, 19 March 1965, AIR 20/11779.

[40] PRO, Air Staff requirement OR.343 Issue 3, drafts of 10 and 30 June and 6 July 1965, AIR 2/17309 and 25 Aug 1965, AIR 2/17310; formal issue, 26 Oct 1965, AIR 2/17312.

[41] PRO, Air Plans 1 note, 10 Jun 1965, AIR 2/17309; RAE note on OR, 4 Aug 1965, AIR 2/17310.

[42] PRO, DCSA(P) to SofS, 28 Jan 1966, AIR 2/17861.

[43] PRO, OR29 to DOR1, 22 Feb 1966 and DDOR6 note, 18 Mar 1966, AIR 2/17861; D Air Projects note, 24 May 1967, AIR 2/18053.

[44] PRO, draft paper for Weapons Development Committee, 18 Nov 1965, AIR 3/17313; notes of visit, circulated 10 May 1967, AIR 2/18053.

[45] PRO, table dated Mar 1963, AIR 2/18112.

[46] PRO, letter of offer, 30 Nov 1965, AIR 2/17313.

[47] PRO, paper on F-111K programme costs, undated (6 Dec 1967), AIR 2/18054; also Quinlan (MOD) to France (Treasury), 15 Dec 1967, T 225/2951.

[48] PRO, C(68)10, 3 Jan 1968, CAB 129/135.

[49] PRO, C(66)35, 11 Feb 1966, CAB 129/124 and CC(66)9th, 14 Feb 1966, CAB 128/41; implementing sales order signed 22 March 1966, AIR 2/17862; OPD(67)12th, 15 March 1967, CAB 148/30, Healey to McNamara, 16 March 1967, DEFE 13/552.

[50] PRO, OPD(66)5th, 21 Jan 1966, CAB 148/25; MoA paper DC/P(65)2, 13 Jan 1965 and COS.3rd/65, 17 Jan 1965 both, AIR 20/11510; Bennell, *Defence Policy*, p. 7.6.

[51] PRO, papers of the RAF Programme Working Group, Oct-Nov 1965, DEFE 13/745.

[52] Cmnd.2901, *Statement on the Defence Estimates Part I: the Defence Review* (HMSO, London Feb

1966). The AFVG had a troubled existence until the French cancelled it in 1967; conceptually it was a fore-runner of the Tornado.

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[64] Tony Benn, *Office without power: diaries 1968-72* (Hutchinson, London 1988), p. 1.

[65] Richard Crossman, *The diaries of a cabinet minister, vol. 2: Lord President of the Council and Leader of the House of Commons, 1966-1968* (Hamilton and Cape, London 1976), p. 635.

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[67] PRO, C(68)10, 3 Jan 1968, CAB 129/135.

[68] Benn, *Office without power*, p. 12. Brown used the same phrase "bloody unpleasant" in a telegram to Wilson from New York: PRO, 11 Jan 1968, PREM 13/1999.

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[78] PRO, undated paper (with others of 15 Jan 1968), AIR 20/11920. The file copy is marked "draft only" in manuscript, and Grandy may not have had the courage to send it.

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The RAF in Operation Telic: Offensive Air Power, March-April 2003

By Dr Sebastian Ritchie

Operation Telic, the UK contribution to coalition operations against Iraq launched in March 2003, was the culmination of some thirteen years of almost continuous UK air operations in the Persian Gulf, in response to a succession of challenges and threats posed by Saddam Hussein's regime. The initial UK air plan was based on a potential RAF contribution comprising 88 fast jets and 38 support platforms – more aircraft than the RAF had deployed on a single operation since the First Gulf War and more, in all probability, than it will ever deploy again. This article provides a brief summary of the Air Historical Branch narratives on Operation Telic, and includes consideration of some of the broader lessons that might be identified from the RAF's experiences. Historically, the operation will always be viewed as a milestone along the road to improved air-land integration (ALI), and ALI was certainly a prominent issue, where the exercise of combat air power was concerned. But it is important to ensure that other aspects of the Telic air power story are not forgotten.

Introduction

T he Royal Air Force's involvement in Operation Telic followed on from some thirteen years of almost continuous UK air operations in the Persian Gulf. In 1990, in response to Iraq's invasion of Kuwait and the initiation of Operation Granby, a force of more than 120 fixed-wing aircraft and 36 helicopters was sent to the Gulf as part of the US-led coalition that ultimately liberated Kuwait in the following February. September 1991 witnessed the commencement of coalition air patrols over the Northern No-Fly Zone (NFZ – Operation Northern Watch), designed to protect Iraq's Kurdish minority, while the RAF based a detachment of six Tornado GR1s at Dhahran in Saudi Arabia in August 1992 to contribute to the maintenance of the Southern NFZ – Operation Southern Watch. This detachment was later moved to Prince Sultan Air Base, Al Kharj (PSAB).

During the so-called UNSCOM (United Nations Special Commission) crisis, beginning in late 1997, this force was augmented by a detachment of carrier-borne Harrier GR7s and more GR1s were deployed to Ali Al Salem air base, Kuwait, from where twelve aircraft eventually participated in Operation Desert Fox in December 1998. Soon afterwards, the Saudi commitment was taken over by Tornado F3s and, at the beginning of 2000, the GR1 detachment in Kuwait was reduced to eight aircraft. This remained the UK posture in the Gulf in 2002, when the build-up to Telic began.

What follows is a brief summary of the Air Historical Branch narratives on Operation Telic, and includes consideration of some of the broader lessons that might be identified from the RAF's experiences during the campaign to overthrow Saddam Hussein's regime. Historically, the operation will always be viewed as a milestone along the road to improved air-land integration (ALI), and ALI was certainly a prominent issue, where the exercise of combat air power was concerned. But it is important to ensure that other aspects of the Telic air power story are not forgotten.

The Build-Up to Operation Telic

The first documented intimations of UK involvement in the operation that became Telic can be traced to March 2002. In May, the Chief of the Defence Staff (CDS) was advised of a potential RAF contribution to a future operation in Iraq comprising 88 fast jets and 38 support platforms – more aircraft than the RAF had deployed on a single operation since the First Gulf War and more, in all probability, than it will ever deploy again. It was envisaged that such a force could be generated in a period of three or four months, while other UK contingents would require slightly longer. A concept for the operation was briefed to the President of the United States in June 2002, and UK planners were present in the US from July onwards.

UK participation in a coalition with the US was based on a strategic end state in which Iraq became 'a stable, united and law-abiding state, within its present borders, co-operating with the international community, no longer posing a threat to its neighbours or to international security, abiding by all its international obligations and providing effective government for its

own people.' By contrast, the end state envisaged by Washington more openly embraced the concept of regime change: the American aim was to put 'an acceptable provisional/permanent government in place.'

A formal operation plan emerged in August numbered OPLAN 1003V. This would ultimately form the basis of the operation that the Americans named Iraqi Freedom – the UK Operation Telic. The plan was designed 'to overwhelm the Iraqi regime through a co-ordinated multiplicity of threats applied across a number of lines of operation.' These were defined as operational fires, operational manoeuvre, Special Forces (SF) operations, unconventional operations/support to other governments, influence operations, humanitarian assistance and political-military engagement. Coalition forces would attack Iraq from three directions simultaneously – the North, the South and the West, where a largely separate mission was planned to prevent Iraq from launching theatre ballistic missiles (TBMs) at neighbouring countries. During the First Gulf War, Israel had repeatedly been targeted by Iraqi Scud launches from this area. Otherwise, by mounting simultaneous attacks from different directions, the plan aimed to destroy Iraqi cohesion and prevent Saddam Hussein's forces from concentrating against the primary – southern – axis of advance.

In support of these broad objectives, the air plan had five basic components. The Counter-Air mission would eradicate any threat from the Iraqi Air Force, while Counter-TBM operations were designed to locate and destroy Scuds and Scud-related equipment in the western Iraqi desert. Counter-Land would provide direct and indirect support to coalition ground forces and SF support would also feature prominently. A strategic element was included in the air plan, involving multiple strikes against regime targets famously designed to achieve 'shock and awe'.

The UK would establish an Air Contingent Headquarters in theatre and RAF personnel would also be 'embedded' within the Combined Air Operations Centre (CAOC), securing visibility of, and influence within, the air command and control process and providing highly valued air planning expertise. The RAF would contribute offensive air assets in the form of Tornado GR4s and Harrier GR7s, and further key capabilities designed to add value to the US air campaign – notably intelligence, surveillance and reconnaissance (ISR), air-to-air refuelling (AAR) and air transport platforms. As UK ground forces were expected to enter Iraq from Turkey, on the northern axis, it was originally planned that a substantial proportion of the RAF's offensive resources would operate in the same area to support their advance. The RAF was also to establish a so-called Air Point of Departure (APOD) in Turkey through which the UK Land Contingent would deploy.

On the basis of this plan, the RAF originally envisaged the use of two Turkish airbases. The Jaguars already based at Incirlik for Operation Northern Watch would be joined by 18 Tornado GR4s, 3 E3Ds, 2 Tristar tankers and a Nimrod R1; 18 Harrier GR7s were to operate from Diyabakir. By contrast, the RAF's presence south of Iraq was to consist of just 12 GR4s, 6 F3s, 2 Tristars and 2 Nimrod MR2s. More westerly basing was planned for a further 4 Nimrod MR2s

and 2 Canberra PR9s, and 8 VC10s were to operate from RAF Akrotiri. Fixed and rotary-wing air transport would also deploy on a substantial scale, and the UK Air Contingent was expected to number approximately 6,700 RAF personnel.

The original American concept was that operations would commence towards the end of 2002, possibly via the graduated escalation of Northern and Southern Watch. But the Bush government was sufficiently realistic to accept that a coalition operation was essential; the US could not act in isolation. With the UK inevitably viewed as the main partner in such a coalition, some compromise had to be accepted to accommodate British political sensitivities. Effectively, it would be necessary to seek United Nations authority for military action against Iraq, on the basis of her alleged failure to implement UN resolutions prohibiting the manufacture or possession of weapons of mass destruction (WMD). But pursuing the 'UN route' (as it was termed) inevitably involved delays and uncertainty, and pushed back the start of Operation Telic into 2003.

For the RAF, there were two dominant issues in this period. The first was the collapse of the northern, Turkey-based plan, and its consequences; the second was the transition from Northern and Southern Watch to Telic. As we have noted, UK forces were originally to operate on the northern axis of advance, using Turkey as a springboard. However, in Ankara there were deep misgivings about the prospect of coalition operations being launched from Turkish soil, and it became clear in December that the plan to attack Iraq from the north was in jeopardy. Contingency planning began, and alternative air basing arrangements were finalised in January. It was envisaged that UK forces would deploy between the end of January and mid-March.

The revised basing plan left only the 8 Jaguars in Turkey; they were grounded by the Turkish authorities on the outbreak of hostilities and played no part in Operation Telic. All other fixed and rotary-wing detachments were otherwise concentrated to the South and West, the main fast jet presence being at Ali Al Salem and Al Jaber in Kuwait (GR4s and GR7s respectively), Al Udeid in Qatar (GR4s), and Prince Sultan Air Base in Saudi Arabia (F3s). The Tristars would all base at Muharraq, in Bahrain, E3Ds and Nimrod MR2s would also operate from PSAB, and there would be a further MR2 presence at Seeb, in Oman. The larger detachments each comprised elements of different squadrons, which were effectively merged into wings. The GR4 detachment at Ali Al Salem became known as the Combat Air Wing, while the Harriers at Al Jaber assumed the name 'Harrier Force South'. The Al Udeid GR4 detachment was simply christened the Al Udeid Wing.

The basing plan was revised at minimal notice; it involved more than 100 aircraft, thousands of personnel and multiple deployed operating bases across the theatre of operations. To many of those committed to the UK Air Contingent, experiencing the process on a day-to-day basis, it certainly must have seemed that the deployment was beset by every imaginable problem. Yet it was successfully completed in a period of 4-6 weeks – an achievement probably without

precedent in the history of RAF overseas operations, and a reflection of the substantial efforts expended on developing expeditionary capabilities during the previous decade. Thereafter, UK air power could play almost exactly the role envisaged for it under the original operation plan. The RAF proved itself to be a far more mobile force in 2003 than in 1990, but benefited from certain advantages beyond the American support that was, in any case, a feature of both Gulf Wars. There was more lead time in 2003, and the RAF was already operating from several bases in the Gulf in support of Operation Southern Watch; relations with potential host nations were, as a result, very well established.

The second issue, the transition from Northern and Southern Watch to Telic, assumed particularly challenging proportions as it became clear that ground operations against Iraq were unlikely to be preceded by an extensive preliminary air campaign, as they had been in 1991. The USAF Combined Forces Air Component Commander (CFACC) concluded that he would, in these circumstances, have little opportunity to degrade the Iraqi Integrated Air Defence System (IADS), unless such shaping operations were conducted under the cover of NFZ enforcement. He therefore secured such authority as was necessary to extend the parameters of Southern Watch. However, the UK targeting directive imposed tight restrictions on RAF participation in any activity extending beyond the basic NFZ tasks.

This placed the UK Air Contingent Commander (UKACC), Air Vice-Marshal (later Air Chief Marshal Sir) Glen Torpy, in an awkward position, and he eventually felt constrained to ask for his targeting directive and ROE to be relaxed. His perspective is easy to understand, but the problem was viewed rather differently in London, predictably enough: the suggested changes in the directives would have been difficult to reconcile with the government's declared position that no decision had as yet been taken to go to war. Although very seriously considered, therefore, the request was rejected. However, there was rather more flexibility where ISTAR activity was concerned, and the targeting directive was altered to permit strikes against Iraqi forces deemed to be threatening the coalition build-up in the Gulf.

On 3 March, authority was received for aircraft deployed on Operation Telic to participate in Southern Watch; on the 19th, the UKACC adopted the Operation Telic ROE, at the same time as the Americans switched to the ROE for Operation Iraqi Freedom. Thereafter, the friction occasioned by this complex issue largely disappeared. Ministers and legal advisers accepted that a high degree of control from London was unrealistic, given the realities of high-tempo, high-manoeuvre warfare, and extensive targeting delegations were issued to the UKACC, marking a significant and welcome change from earlier operations.

Offensive Air Operations and the Fall of Baghdad

The original Telic air campaign plan envisaged the initiation of air operations to shape the Iraqi battlespace 16 days before the ground campaign began. These preparatory air strikes were to include the targeting associated with 'shock and awe'. Once ground operations started, it was broadly anticipated that offensive air power would fulfil a variety of roles, encompassing

attack, interdiction and close air support (CAS). In December 2002, the time allowed for the preliminary air campaign was cut to five days, but this did not result in a significant change in expectations. Consequently, the main RAF GR4 and GR7 detachments deployed to the Gulf foreseeing a period of attack and interdiction tasking, followed by CAS in support of the Land Component, and their preparations for Operation Telic reflected this expectation.

However, much uncertainty still surrounded the precise circumstances in which operations would commence and, when the initial air campaign was compressed still further, it became clear that an earlier shift towards CAS was in prospect. 'A-Day' (the start of the air campaign) and 'G-Day' (the launch of the ground campaign) were then merged before, finally, the Combined Forces Commander (CFC), who exercised overall command of all committed coalition forces, decided that G-Day should actually precede A-Day; no time would be allocated for preparatory shaping operations. Against this background, the air plans were repeatedly revised, and numerous missions scheduled for the opening stages of Telic were cancelled altogether. Much of the targeting associated with 'shock and awe' was abandoned. The ground offensive began on 20 March, while the air campaign was initiated 24 hours later.

The CFC was motivated by a number of concerns. A preliminary air campaign would warn the Iraqis that a ground assault was imminent. Tactical surprise would be lost, the Iraqis might well begin setting fire to their oil wells and Iraqi missile attacks might target the coalition's small and crowded assembly areas in Kuwait. There were also concerns that 'shock and awe' could be accompanied by collateral damage, bringing international condemnation and jeopardizing regional – Arab – support for the coalition. All of these arguments carried some weight. Nevertheless, it is clear that the CFC also wanted the forthcoming operation to provide a potent demonstration of the capabilities of the Land Component, air power having been assigned lead role in the First Gulf War, the No-Fly Zones, Bosnia-Herzegovina, Kosovo and Afghanistan.

The implications for the RAF GR4 and GR7 detachments were profound. Instead of being allocated a mix of attack and interdiction tasking as well as CAS, they received, at most, 2-3 days of pre-planned missions. During this period, in addition to more conventional tasking with Paveway laser-guided bombs (LGBs), the GR4s mounted the first Storm Shadow missile attacks, which chiefly targeted key nodes within the Iraqi Integrated Air Defence System (IADS). It was also during this phase of the air campaign – on 22 March – that the UK Air Contingent tragically sustained its only battle casualties of the operation, when a 9 Squadron GR4 returning to Ali Al Salem was shot down by a US Patriot missile battery, having been misidentified by the battery crew as a hostile incoming anti-radiation missile. The pilot, Flight Lieutenant Kevin Main, and navigator, Flight Lieutenant Dave Williams, were both sadly killed.

By 23 March, the GR4s and GR7s were largely being switched to CAS or, to be more precise, KI/CAS – standing for Kill-box Interdiction/Close Air Support. KI/CAS was a US Marine Corps (USMC) concept, which was adopted by the CFACC for the operation. The whole of Iraq was

divided into kill-boxes. Outside a Fire Support Co-Ordination Line (FSCL), some distance beyond the Forward Line of Own Troops (FLOT), aircraft were cleared to attack any targets they could find in their assigned kill-boxes, assuming they had been declared 'open'. If they were 'closed', aircraft could only attack under positive direct control, normally from a Forward Air Controller (FAC).

Inside the FSCL, kill-boxes were automatically closed unless opened with the agreement of the Combined Forces Land Component Commander (CFLCC). In the absence of such agreement, they were subject to three types of CAS, all of which necessitated positive direct control of the aircraft. Type 1 required the terminal controller to have sight of both the aircraft and the target – a rare occurrence during the campaign; Type 2 required the terminal controller to have sight of either the aircraft or the target, while Type 3 enabled air strikes to take place when the terminal controller could see neither aircraft nor target.* Ultimately, KI/CAS accounted for 75 per cent of GR4 and GR7 tasking.

For the RAF detachments, KI/CAS was accompanied by many difficulties. First, neither of the two deployed platforms was particularly well-adapted for CAS, the Tornado GR having been designed as an attack platform, while the Harrier had only really been envisaged as a *low-level* CAS asset before the general shift towards medium-level flying during the 1990s. On many occasions, the TIALD pod, which provided laser designation for both aircraft, did not give a sufficiently clear picture of the ground to allow small, tactical targets to be positively identified unless aircraft descended to lower altitudes, where there was a greater threat from ground-based air defences.

Second, as there had been no requirement for air support from the British Army since the Falklands War, none of the aircrew had any 'live' experience of CAS, and all were accustomed to extensive mission planning and pre-briefing on their targets, as well as target folders containing up-to-date photographs, intelligence and other mission-specific information. By contrast, in the KI/CAS role, aircraft were simply dispatched to a kill-box to await any tasking that became available; detailed targeting information normally only emerged during transit to the target area. After that, aircrew had still to locate the target, positively identify it, apply their targeting directive and select appropriate weaponry – a considerable challenge. Complicating matters still further, in due course, would be the requirement to conduct KI/CAS in urban environments, where the collateral damage risks were particularly high. Third, some of the Land Component's air support machinery was very far from perfect: the US Army's V Corps lacked 1 Marine Expeditionary Force (1 MEF)'s familiarity with the KI/CAS system, devised, as it was, by the USMC. For all of these reasons, a high proportion of the aircraft tasked with KI/CAS returned to base without releasing weapons.

Among the factors that influenced the outcome of KI/CAS missions, the ability of offensive aircraft to hold in the target area was particularly important, as was the availability of targeting

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* For example, when forward troops were reporting the location of a target to a terminal controller in radio contact but not visual contact with both the troops and the attack aircraft.

intelligence. In the early stages of Operation Telic, the residual air defence threat in Southern Iraq was such that larger, more vulnerable aircraft, notabaly AAR and ISR platforms, were kept well to the south of the Iraqi border for their own protection. This compelled the fast jets to withdraw from Iraqi airspace in order to refuel, and denied the coalition much important target information. However, once the majority of air defence threats in southern Iraq had been eliminated, it was possible to move AAR and ISTAR tracks forward to the Saudi-Iraqi border without undue risk. This improved the on-station time and intelligence supply for KI/CAS assets, increasing their chances of locating and attacking the Iraqi military.

Beyond this, Harrier Force South and the USMC Tactical Air Control Centre, which was also located at Al Jaber, collaborated closely to improve the effectiveness of KI/CAS missions involving the RAF GR7s, and a system of 'alternate targets' was introduced, in recognition of the fact that some Iraqi units and military installations had been bypassed by the rapid ground offensive and remained a potential threat. Aircraft returning to base with unexpended ordnance after KI/CAS missions in support of V Corps and 1 MEF regularly attacked these targets during the second week of the campaign.

In the initial coalition offensive, V Corps drove north-west along the western bank of the Euphrates river, while 1 MEF and 1 UK Armoured Division concentrated on securing southern areas of Iraq, including the port of Umm Qasr, the Rumaylah oilfields, the Al Faw Peninsula and Basra. Responsibility for this area then passed to 1 UK Armoured Division, freeing the bulk of 1 MEF to follow V Corps as far as Nasiriyah, where they crossed the Euphrates and advanced north. The campaign then developed into a headlong rush for Baghdad.

For the air component, this created further challenges, given the limited opportunities previously available to target the Iraqi IADS. The threat from Iraqi air defences over Baghdad was far greater than in the south. To ensure that there was no diminution in the provision of air support to V Corps and 1 MEF, the IADS had to be degraded further, so the CFACC launched a series of operations under the banner of DEAD – the Destruction of Enemy Air Defences, and not merely their suppression. Central to the entire concept was the USAF RQ4-A Global Hawk UAV, with its capacity to provide commanders with near-real-time high-resolution reconnaissance imagery, allowing coalition aircraft to be launched against enemy targets within minutes of their location. DEAD made steady progress and there was clear evidence by the 28th that Iraqi electronic warfare and surface-to-air missile capabilities were in terminal decline; on the 31st, no fewer than 38 air defence weapons or radars were destroyed. RAF platforms were not involved in these operations, but they certainly benefited from their success.

On the ground, progress slowed after 25 March. The CFC subsequently felt that the two US formations had focused too much on seizing ground rather than destroying enemy forces. It became clear that V Corps and 1 MEF's extended lines of communication were vulnerable to attack, and that measures had to be taken to ensure their security. Iraq's best Republican

Guard divisions were also known to be defending the southern approaches to Baghdad; it would have been unwise of the CFLCC to launch a major ground assault against them while his supply lines were threatened, and neither corps was at first strong enough to do so. The weather also turned against the coalition, central and southern Iraq being hit by violent and prolonged sandstorms between 24 and 26 March. By the 28th, a more-or-less formal pause in the ground offensive had been called. Plans to move against the Republican Guard divisions were postponed from the 29th to 2 April to allow V Corps and 1 MEF to marshal their resources for the forthcoming 'Battle of Baghdad'.

This unexpected pause gave the air component the opportunity to mount extensive attacks on the Republican Guard divisions deployed along the main coalition axes of advance. By the time the ground offensive resumed, it was estimated that the Baghdad Division retained a combat effectiveness of just 10 per cent. Comparable figures for the other five divisions were:

Republican Guard Division	Per cent combat effective
Medina	25
Adnan	55
Hammurabi	55
Nebuchadnezzar	70
Al Nida	70

The divisions that suffered least apparently reduced their vulnerability to air attack by employing such far-reaching dispersal and concealment measures that their combat capability was also substantially reduced. Hence, V Corps and 1 MEF encountered only the most limited and ineffective opposition when their offensive resumed. As one British observer put it on 3 April, 'Question is, where has the enemy gone? It is not certain if they have withdrawn, been destroyed or deserted. Probably a combination of all three.' The anticipated pitched land battle for Baghdad never materialised; on 9 April, the Iraqi capital passed decisively into coalition hands.

Counter-TBM Operations

Beyond supporting the coalition offensive in Southern Iraq, the RAF's chief contribution to Operation Telic involved Counter-TBM operations in the western Iraqi desert. The Counter-TBM task was of exceptionally high strategic importance. The Iraqis had launched Scuds against Israel in 1991 in a transparent attempt to precipitate Israeli retaliation. An Israeli attack on Iraq might well have united Arab opinion against the West, resulting in the withdrawal of Arab nations from the coalition. The same countries might also have denied other coalition members permission to operate from their soil in these circumstances. In the event, through sustained diplomatic efforts and a mammoth *ad hoc* diversion of resources, including air power, SF and Patriot missiles, Israel was dissuaded from intervention.

In 2002, as the prospect of further conflict with Iraq became increasingly real, US and UK planners had to address the possibility that Saddam Hussein would pursue exactly the same strategy, possibly using missiles equipped with chemical or biological warheads. Although many Scuds had been destroyed after Operation Granby, no satisfactory inventory of missiles had ever been produced by the Iraqi government; on the basis of UNSCOM investigations in the 1990s, it was believed that a few had been retained at hidden locations and Iraq was also suspected of holding Scud components that might have been used to make more missiles. Naturally, the Israelis were also deeply concerned that they would again come under attack in the event of a Second Gulf War. Unless a concerted effort was mounted by the coalition to address the Scud threat, there was always a danger that Israel might initiate action against Iraq unilaterally.

In July 2002, the US Air Combat Command was tasked to devise a Counter-TBM concept of operations (CONOPS), involving a range of reconnaissance and offensive support aircraft, as well as ground elements. This was the genesis of an operation that would become a major commitment for the RAF in due course. Alongside the USAF contingents, the RAF deployed more GR7s as well as Canberra PR9s, C-130s and Chinook helicopters, and the Nimrod MR2 and E-3D detachments based at PSAB were also assigned to Counter-TBM. In addition, provision was made to exploit the GR4's excellent low-altitude capability when adverse weather inhibited medium-level surveillance or bombing, and both VC10s and Tristars provided vital AAR. In all, some 32 RAF aircraft were permanently assigned to the mission, along with the GR4s and tankers.

The basic Counter-TBM CONOPS that emerged during the later months of 2002 was based on close collaboration between offensive air power, airborne ISR and coalition SF drawn from the Combined Joint Special Operations Task Force-West (CJSOTF-W). Operations in Afghanistan in 2001 had witnessed an unprecedented level of Air-SF collaboration; the CONOPS sought to build on this experience. The primary aim was to deter Iraq from attempting to launch any Scuds by maintaining a significant air presence over Western Iraq and a limited but very potent and highly mobile ground presence. The second objective was to find and destroy any remaining Scuds or Scud-related equipment. This involved the observation of some 6,000 possible hide sites located chiefly along the few main supply routes that ran across the desert towards Syria and Jordan. The sites were to be monitored partly by airborne ISTAR and partly by combat aircraft functioning in the Non-Traditional ISR (NTISR) role. On the ground, hide sites would also be inspected to achieve so-called 'area sanitisation', when it was firmly established that none of the sites in a particular area were being used.

The CFACC was appointed as supported commander for the Counter-TBM mission, while the role of supporting commander was assigned to the Combined Forces Special Operations Component Commander (CFSOCC) and Operational Control (OPCON) was exercised by the commander of CJSOTF-W. Operations were planned by a Counter-TBM Strategy Chief, who headed a dedicated team at the CAOC, and he provided guidance to a Mission Commander

with day-to-day responsibility for all airborne Counter-TBM operations and assets. Beneath him, mission planning cells functioned at base level, while continuous tactical command and control functions for airborne assets were executed by the RAF E-3Ds.

In the first Gulf War, the Iraqi Scud launches had caught the coalition off guard; in 2002, it seemed clear that the Scud would only be defeated if extensive preparations preceded the outbreak of hostilities. Iraqi launch doctrine and the tactics employed during 1991 were carefully scrutinised. There was close liaison between key US and UK personnel, and several exercises were organised in the US and in theatre to test the CONOPS, which was transformed into a clear and detailed 'playbook' for all participants, defining all the agreed Counter-TBM tactics, techniques and procedures. Many (though by no means all) the air and ground force elements committed to Counter-TBM had the opportunity to conduct at least some training together before the onset of hostilities.

The Counter-TBM mission was launched on 19 March 2003 – the day before G-Day – and focused at first on more westerly and southern areas, before moving north towards the Syrian border. The operation went largely according to plan, rewarding all the meticulous preparations of the preceding months, but no Scuds were located and there were no launches. Their whereabouts have since been the subject of much conjecture and may never be definitively established. As the number of Scud launches would probably have been very small, in any case, it might be contended that the Counter-TBM mission needlessly tied up resources that could more profitably have been employed elsewhere.

Yet this would be wrong for three reasons. First and foremost, the mission was essential to dissuade the Israelis from intervening and jeopardising Arab support for the coalition. As there was no overt Israeli action against Iraq, this objective was achieved. Second, however small the residual threat from the Iraqis may have been, one single successful Scud launch against Israel could have exercised a wholly disproportionate strategic effect, with disastrous consequences. Third, even if Scuds were not launched initially, there was always a possibility that they might be deployed later on, perhaps in a final act of defiance as coalition troops reached Baghdad. It was for this reason that the CFC continued to attach top priority to Counter-TBM and insisted on maintaining the hide-site checks throughout Operation Telic. Once it was established that coalition air power could monitor the majority of sites independently, it was, in fact, possible to transfer at least some CJSOTF-W units to other high-priority tasks.

Ultimately, the coalition forces assigned to Counter-TBM opened what was virtually a third front in Western Iraq, additional to the main southern front and the northern front created by American airborne forces at the end of March. In so doing, they contributed to a process whereby coalition operations destroyed the cohesion of the Iraqi regime and its security infrastructure by exposing it to multiple simultaneous threats. Of particular importance were operations in the Haditha Dam area, in support of an American ground unit, Task Force 20. The dam, on the upper Euphrates River, became a focus of coalition attention when intelligence

suggested that the Iraqis might destroy it to flood the lower Euphrates valley and impede the advance towards Baghdad. Such a measure would also deny vital hydro-electric power to any post-Saddam regime.

Task Force 20 was therefore deployed to secure the dam, but they were soon attacked by a substantial Iraqi formation, which included tanks, self-propelled guns and artillery. Without heavy weapons of their own, Task Force 20 would have faced insuperable odds had abundant air power not been available on call. Over a period of several days, USAF F-16s and RAF GR7s mounted frequent strikes against the Iraqis, while airborne command and control was provided by the E-3Ds. The GR7 strikes targeted tanks, artillery, mortars, military vehicles, buildings, and patrol boats on the reservoir. Their intervention ensured that Task Force 20 retained their hold on the dam until relief arrived on 7 April.

Offensive Air Operations: Assessment

Coalition dominance in the air was a decisive factor in the rapid overthrow of Saddam Hussein's regime. The Iraqis proved completely unable to assemble large or remotely capable ground formations to block the coalition advance and did not launch a single counter-attack against the main V Corps or 1 MEF spearheads; the most they could achieve amounted to small-scale, piecemeal raids on the extended American supply lines. Under relentless pressure from the air, the Iraqi divisions guarding the southern approaches to Baghdad largely melted away, leaving the city only lightly defended. Shattered command and control and intense demoralisation were amply demonstrated by the disintegration or surrender of many units.

The Combat Air Wing's contribution to this successful outcome, from 20 March to 15 April 2003, consisted of some 498 planned sorties from Ali Al Salem, 476 of which actually became airborne. Of the 498 planned sorties, 324 were classed as offensive support and there were 121 reconnaissance sorties employing the GR4's RAPTOR pod. Other tasking encompassed Counter-TBM in Western Iraq, Storm Shadow launches and Suppression of Enemy Air Defences (SEAD), using the ALARM anti-radiation munition. In the same period, the Al Udeid Wing planned 278 sorties, 268 of which flew.

Both wings predominantly discharged the offensive support task using TIALD and laser-guided Paveway 2 bombs. The GPS-guided Enhanced Paveway 2 (EPW 2) was also employed. However, during KI/CAS missions, crews had to exercise extreme caution when using GPS-guided munitions: in the heat of battle, it was by no means unusual for ground units to supply inaccurate target co-ordinates. The target list extended right across the military spectrum, but particularly featured tanks, other armoured fighting vehicles and miscellaneous military vehicles, artillery, radars, fielded forces, military buildings, command and communications nodes and supply depots and bunkers. A significantly higher proportion of offensive support sorties flown from Ali Al Salem resulted in the release of weapons, compared with Al Udeid. Flying over far longer distances to reach the target area, the Al Udeid GR4s were unable to

hold for so long awaiting tasking without AAR, which was by no means always available. The Combat Air Wing was also allocated a somewhat higher proportion of fixed targets than the Al Udeid Wing, which was overwhelmingly assigned to KI/CAS.

Of the other GR4 capabilities, the RAPTOR pod's stand-off performance and the high quality of its imagery drew very favourable comment throughout the operation, although the system was found to require intensive maintenance to remain serviceable in an environment characterised by high ambient temperatures. As for Storm Shadow, the missile's performance has to be viewed in context. Operation Telic was essentially used as an opportunity to test Storm Shadow in a live operational environment and many of the deployed munitions were 'development' missiles rather than the finished article. The trial proved extremely valuable: Storm Shadow demonstrated exceptional accuracy, and several important lessons were identified to help improve its performance still further in future operations.

From 21 March to 14 April (inclusive), Harrier Force South flew 190 operational missions for 389 sorties. In all, 367 offensive sorties were flown, the overwhelming majority of which involved KI/CAS. The detachment also mounted 22 reconnaissance sorties with the Joint Reconnaissance Pod (JRP). During Operation Telic, the Al Jaber GR7s released 117 munitions, chiefly against fielded Iraqi forces; other targets included aircraft, surface-to-air missiles, radars and minelaying vessels in Basrah harbour. The GR7s assigned to Counter-TBM flew 142 missions for 290 sorties. Some 32 sorties released weapons and 73 munitions were dropped in all. The contrasting strike rates partly reflect the fundamental difference between the two detachments' respective tasks; 3 Squadron were dispatched each day to perform both the NTISR and attack roles, but a large part of the NTISR task was focused on one specific object – the Scud missile – which was not, in fact, deployed in the western desert. By contrast, the Harrier Force South reconnaissance role was entirely separate from their attack role, and offensive missions were tasked to destroy virtually any legitimate Iraqi target that could be found. They were also allocated some pre-planned and alternate targets, whereas 3 Squadron was not.

As in earlier operations, the GR7 proved itself to be an extremely robust platform, and boasted an excellent serviceability record; it also demonstrated great flexibility across the tactical spectrum. Again, the TIALD pod functioned as a critical enabler, despite its limitations: TIALD and Paveway provided a vital combination of precision and firepower, and Paveway II bombs guided by TIALD accounted for 49 per cent of weapons used by Harrier Force South. However, due to the over-riding priority assigned to Counter-TBM, only a limited number of pods and TIALD-capable GR7s were initially allocated to Harrier Force South, and heroic efforts were required from the wing engineers to ensure that virtually every GR7 mission included at least one TIALD-equipped aircraft. Other weapons employed by the GR7 detachments included the EPW 2, the Maverick infrared-guided missile, and a small number of unguided 1,000lb and 540lb bombs and RBL 755 cluster bombs. Of these, EPW 2 and a modified electro-optical version of Maverick proved the most effective.

Across the detachments, there was a significant improvement in the accuracy of bombing over the standards achieved in earlier large-scale operations. This reflected a marked increase in the ratio of precision-guided to non-precision-guided weapons, as well as greater aircrew experience with TIALD and Paveway and better training. Nevertheless, the operation demonstrated that improved targeting pods were required, together with smaller precision-guided munitions, to allow tactical targets to be engaged from medium altitude with the absolute minimum of collateral damage risk. There was a particularly pressing need for a new anti-armour weapon to replace RBL 755. The installation of tactical data-links across the various aircraft fleets was also strongly recommended.

However, the key air lessons stemmed directly from the many and varied challenges associated with KI/CAS. Both the UK Air and Land Contingents periodically found themselves struggling with the KI/CAS system, and the operation clearly demonstrated that it was essential for the RAF and the Army to conduct far more regular and intensive CAS training than had generally been undertaken during the preceding decade. Given the subsequent preponderance of CAS tasking in Operation Telic and Herrick, this lesson has tended to fade from view, and it is important, now that British ground troops have been withdrawn from Iraq and Afghanistan, that there is no return to the situation that prevailed before 2003.

In the aftermath of Operation Telic, OPLAN 1003V was widely proclaimed to be a model for future intervention operations, the assumption being that a preliminary air campaign to shape the battlespace was no longer necessary. In future, Land would lead and Air would follow, chiefly through the provision of CAS and reconnaissance. Yet this assessment may be challenged on a number of counts. With so many aircraft being left untasked to return to base with their weapons, the experience of KI/CAS during the operation raised far-reaching questions about such elementary principles of war as economy of effort and, in the longer term, sustainability. Furthermore, it would have been impossible to dispense with preparatory shaping activity and provide comparable support to the Land Component if Iraq had boasted a more capable IADS. In March 2003, G-Day could precede A-Day only because of the progressive degradation of Iraq's air defences since the First Gulf War and a certain amount of shaping activity carried out by the Americans during the closing stages of Operation Southern Watch.

More broadly, Telic marked a clear break from the air-centric strategies that had predominated since the end of the Cold War. Initially, the case for 'boots on the ground' in Iraq was apparently underlined by the ease with which the immediate campaign goals were achieved, and yet this only served to deceive coalition governments when they were confronted by the infinitely more difficult task of post-war reconstruction. The price of over-optimism was a protracted and costly insurgency, which was only defeated through the commitment of still more ground troops. But the effect was purely temporary. Security and stability did not survive for long after coalition forces finally withdrew; the rise of ISIS may be traced directly back to the events of March and April 2003. Iraq's troubled history since the fall of Saddam Hussein suggests that

there is a strong case for reconsidering the air-based strategy of containment, as pursued via the Southern and Northern NFZs, in the decade following the first Gulf War. In 2003, it was argued in some quarters that containment had failed, but it could hardly be maintained that boots on the ground have fulfilled the aspirations of western governments more successfully since then.

As for the Counter-TBM mission, by creating, in effect, an entirely separate battle front, the Air-SF combination central to the CONOPS pointed towards an alternative approach to military intervention that was high on capability and effect but low on footprint. It proved itself to be extremely dynamic and responsive, and it demonstrated considerable scope for further development. Yet a number of episodes served to underline the fact that even the most effective air support providing continuous firepower, ISTAR and mobility, could not entirely offset the limitations of the SF – notably, their relatively small numbers and their lack of heavy weaponry. Furthermore, while Counter-TBM may have written a new chapter in the convoluted history of air-land integration, it did, to an extent, lock up the air assets involved, raising questions about how, or even whether, the inherent flexibility of air power can be retained if similar missions are conducted in future.

The Art of Article 5: The Utility of NATO's *Jus ad Bellum* in the Face of Ambiguous Warfare

By Flight Lieutenant Andrew Otchie

Air power practitioners can hold at their disposal such destructive, and indeed decisive power, so as to make pertinent, a broad strategic-level understanding of military operations. In the contemporary operating environment, this objective is usually translated as maintaining the International rules-based order, with the cooperation of other nations and within the framework of International law. Moreover, with the deepening complexity of relations between nations, the rapid pace of hostilities enfolding around the world, and the speed at which aircraft can easily move across jurisdictions; attention is continuously demanded as to what future conflicts may arise, how force might be lawfully employed, and air power remains the tool of choice to those in positions of authority that believe they can influence events for the better. Within this context is NATO, an International Organisation that is the greatest amalgamation of military power that the world has ever seen, and a vital element of defence and security strategy for many nations. Whilst the sheer magnitude of NATO's military power is seemingly indomitable, it may turn out to be that NATO's greatest challenge, is advancing a workable legal basis for its military operations, within our modern era.

This article examines the conditions which permit the use of force according to Article 5 of the NATO Treaty, in the light of the applicable International legal framework, as well as recent developments in political and military events. It identifies the legal basis under the NATO Treaty that authorises the use of force as compared to the contemporary threats faced by NATO. The article asks whether Article 5 remains relevant, and functional, or, is in need of reform. It argues that whilst NATO States continue to possess the legal right to engage in collective self-defence measures, the NATO Treaty's utility as an International instrument lies in legitimising the doctrine of deterrence, which has thus far prevented large-scale International aggression.

Introduction

NATO and the International Legal Framework

The legal construct which recognises the rights of States to use force is set out in legal terms in the UN Charter, a document which emerged from deep intergovernmental cooperation in the immediate aftermath of the Second World War. When efforts were renewed to deprecate the 'scourge of war', the rights of States to exist and resist attacks from International aggression were formally recognised and therefore, measures taken in pursuit of 'self-defence' can be deemed as lawful, falling within a relevant exemption to the general prohibition on the use of force. Moreover, the Charter sanctions measures in pursuit of 'collective security' taken by the International community, by authority vested in the UN Security Council. However, the UN was not the only International institution to materialise in the post-war world; through NATO, certain European States and the USA formed a military alliance that guaranteed they would assist each other in respect of acts of aggression against them. Article 5 of the NATO Treaty mirrors Article 51 of the UN Charter in that it decrees NATO States have the right to collectively use force, to defend each other from an armed attack in collective self-defence. Whilst NATO had been designed to protect against the specific threat of the expansion of the Soviet empire, NATO was never called upon in this regard, and its Treaty obligations had never been invoked until after the end of the Cold War, in the onset of the September 11th attacks. In one sense, the NATO Treaty can be deemed as a tremendously effective document, in that it gave a legal basis to the policy of deterrence (which seemingly succeeded in preventing a full scale Cold War) as well as recognising the inherent right of States to resort to the use of force on a collective basis. On the other hand, NATO forces have now been deployed for prolonged periods in order to combat the threat of International terrorism, when this had never been the intended purpose at the time of NATO's formation, thus prompting scepticism as to the legitimacy of NATO's use of force.

Since the establishment of the post-war International legal framework, the potentially catastrophic danger that the world faced through inter-State war has largely subsided, although in 2014, a threat to the interests and stability of European States became very apparent from a resurgent Russia and its seizure of the Crimea. The threat is however difficult to define and involves the use of next generation, or 'ambiguous' warfare, through the deployment of unconventional tactics, including asymmetric and cyber attacks, which may be hard to properly attribute and counter.[1] Concerns have been raised that Russian actions have been deliberately calculated so as to fall outside of a remit that would potentially trigger the collective self-defence principle as is understood by Article 5 of the NATO Treaty.[2] Meanwhile, amidst Russian military intervention in Ukraine and the regional instability posed by the onset of Islamic State in the Middle East, the most recent NATO summit was held in Wales in September 2014 and made clear that NATO States would abide by their Article 5 Treaty obligations, in order to assist each other in the face of an armed attack; NATO, International law and the use of force have new found relevance.[3]

The International legal framework, under which States can lawfully employ force, has been of considerable interest to scholars. There is a range of opinion as to what circumstances are sufficient to qualify as an armed attack, thereby triggering the lawful use of force in rebuttal. Moreover, in the face of budgetary constraints on much of the world's defence spending, policy initiatives have looked to collective self-defence, as a means of ensuring protection from outside military aggression. Participation in NATO forms a central place in the UK's defence strategy. Against this background, this article aims to offer an original contribution to the debate by examining NATO's use of force and asking whether there is any need for the reform of Article 5. It will be argued that the NATO Treaty already makes clear that NATO will respond to acts of International aggression, so as to deter such, and prevent potential conflicts taking place; besides that, it is clear the prohibition on the use of force in International law already applies to 'indirect aggression', a state of affairs falling short of war, which is most likely to encompass ambiguous warfare. In summary, this article will examine the theoretical and legal doctrines as to the prohibition of the use of force and relevant exemptions; the rationale behind these positions and where the debates have reached thus far; the current defence policies concerning NATO and possible responses to Russia's ambiguous warfare; established critiques of NATO and collective self-defence; and discusses if the NATO Treaty might be amended to better achieve its aim. In conclusion, remarks are offered as to the direction of the continuing debate on the lawful use of force.

NATO and the Use of Force

A. The Academic Views

With its stunning array of military power and an impressive diversity of forces and brigades under its control, NATO is undoubtedly the world's most powerful military organisation[4] and remains important in the shaping of military doctrine.[5] NATO has continued to expand, taking on a new lease of life into the 21st Century, when it might not otherwise have done, and its efficacy in using force cannot be disputed. As well, NATO plays a significant role in shaping the understanding of the legal constraints on the use of force.[6] Meanwhile, the central debates and doctrinal positions taken by scholars on the legality of the use of force have tended to focus on State practice, including the pre-emptive use of force and responses towards terrorism, rather than the fact and status of the world's great military alliance. Whilst there is nothing inherently unlawful in the NATO Treaty and the obligation conferred upon its members, through Article 5, to use force in the face of an armed attack upon any of them, it ought to be remembered that the character of International law which prohibits the use of force is explicit – Article 2.4 of the UN Charter bans the use of force between States, save for the exceptions of self-defence, or Security Council authorisation, as is found in Chapters VII and VIII. At present, there is a fragile consensus that force can only be lawful when used by States within the legal paradigm of the UN Charter, although the peremptory nature of the prohibition on the use of force has come under increasing attack over the past decade, particularly with the military interventions, led by a 'coalition of the willing' into Iraq and Afghanistan respectively. It had been claimed by the US Administration that the legitimacy

of those conflicts arose in circumstances that had not been originally envisioned by the UN Charter and thus, these recent military interventions have been justified by the novelty in method and the potential degree of destruction that would be executed, if possible, by the perpetrators of the terrorist attacks of 9/11, as well as the intentional sense of alarm spread by them - giving rise to reciprocal novel rights of States to use force.[7]

Moreover, it is argued that doctrines of anticipatory self-defence, preventative self-defence, regime change, revival theory, humanitarian intervention, State responsibility, and pre-emptive strike, now have legitimacy because of the security challenges faced in the 21st Century.[8] So it goes, the applicable limitations originally imposed upon States, by International law, on the use of their military power (force) since the founding on the UN Charter, and as so eloquently set out in the seminal work of over 50 years ago by Ian Brownlie QC FBA, in '*International Law and the Use of Force by States*' ought to be viewed in light of contemporary State practice and therefore reinterpreted, in a more permissive light. However, when a UN high level panel came to consider the sufficiency of the International legal framework, and particularly, whether the rules on the use of force (including Article 51 of the Charter) are sufficient, the conclusion was that they were, and its recommendation was that there need be no reform.[9] Nevertheless, debates as to the sufficiency of the legal framework and the legacy of conflicts in Iraq and Afghanistan on the understanding of the lawful use of force have continued for sometime thereafter. In '*Reappraising the Resort to Force*'[10] Moir carefully examined the impact of the Iraq and Afghanistan conflicts. His observation was that while Article 51 of the UN Charter was drafted in a State-centric paradigm, which it seems States have reasonably moved on from, the UN Charter paradigm is not dead and it would be dangerous and premature to conclude that any enduring change to International law has occurred.[11] Moreover, that there ought not to be a loosening of the constraints on the use of force is a view forcefully espoused by Corten in his considerable polemic on '*The Law Against War: The Prohibition on the Use of Force in Contemporary International Law*'.[12] This scholar goes a considerable way to demonstrate just exactly how the prohibition on the use of force, and its peremptory nature, remains one of the cornerstones of International law. For Corten, the question of what suffices as an armed attack, according to Article 51, can be answered definitively by reference to the context and formal discussions at the time of the Charter's configuration.[13] Therefore, the term 'force' mentioned in Article 2.4 was deliberately chosen, as differing from what is an 'armed attack', the later denoting a military act, as opposed to adverse economic or political action.

In addition, Corten sees particular significance as to what qualifies as an armed attack, in the definition of 'aggression' appended to Resolution 3314 (XXIX), adopted by consensus by the UN General Assembly in 1974.[14] Thus, it is only by very stringent criteria, that unlawful force becomes an act of violence, which is necessary to meet the definition of aggression, or armed attack. However, in practice, while the Security Council does not abide by such a definition to guide it in determining situations of aggression, or whether an armed attack has occurred, the text also provides an informative basis as to the question of 'indirect aggression' – which

involves certain adverse measures taken by one enemy State against another, thus falling short of a direct military operation. Even so, according to Corten's (restrictive) view of International law, such forms of belligerent confrontation by States are not sufficiently recognised (by precedent or case law) as giving rise to the right of self-defence. Another major contribution to the literature comes from Yoram Dinstein in War, *Aggression and Self-Defence*. While Dinstein recognises a number of situations 'short of war' which involve the limited use of force, he contends that in legal terms 'there are only two states of affairs in international relations – war and peace – with no undisturbed middle ground'.[15]

Consequently, it would appear clear that Article 5 of the NATO Treaty is drafted in terms that are analogous to Article 51 of the UN Charter and means that nothing short of an actual armed attack, meaning a substantial and intentional, military incursion into the sovereign territory of a State, will entitle NATO to use force. Albeit, if an applicable situation which would activate the Article 5 obligation to resort to the use of force may be capable of evolving into novel circumstances that were not envisioned at the establishment of NATO, such circumstances must be determined carefully on a case by case basis, with utmost care being taken not to proliferate the use of force. However, the problem that has been identified by the UK Select Committee's report on recent Russian actions, is a profound one, and does not seem to have been adequately dealt with in academic opinion as yet. Essentially, in recent times, NATO has come to grapple with the threat of "ambiguous warfare", "asymmetric warfare", or "next generation warfare" and in particular, certain techniques posed by Russian forces in unconventional attacks upon its neighbouring States. The deliberate and sustained types of attacks by Russia against Estonia (2007), Georgia (2008) and Ukraine (2014) include substantial cyber attacks, information and psychological operations, attacks on the target economy and proxy attacks which have involved Russian Special Forces (Spetsnaz).[16] The Select Committee has concluded that Russian asymmetric tactics represent a new challenge to NATO; it would appear that events in Ukraine demonstrate that Russia has the ability to effectively paralyse an opponent and such operations may have been deliberately designed to come short of aggression, or an armed attack, so as to evade any potential invocation of Article 5.

B.   Policy Positions

Despite the seeming end of the Cold War, the UK has recognised that there are a myriad of future threats which are relevant to the use of military force. In January 2010, the UK Ministry of Defence published the 4th edition of "*Strategic Trends Programme – Global Strategic Trends – Out to 2040*" which demonstrated the need for wide understanding of the possible future strategic environment and sought to place this into some form of context.[17] Likewise, the UK's National Security Strategy proclaims that *In a world of startling change, the first duty of the Government remains: the security of our country*[18] – thus, resort to collective self-defence, in the form of participation in NATO, forms a central part of the Strategy, as well as featuring prominently in British defence doctrine.[19] The US has similarly stated that it will work

closely with International allies, including NATO, further to the principle of collective security.[20] The current US National Security Strategy, promoted by President Obama, exhibits a notable departure from previous US Strategy – it is evident that later US foreign policy initiatives have sought to distance the Administration from the past approval of pre-emptive warfare under the Bush doctrine.

In the context of the Cold War, it is easy to see how the UK and US have viewed their policy positions, as to defence and national security, through recourse to NATO. The deterrence theory was made credible by NATO, as a major international actor with a substantial nuclear arsenal at its disposal. However, while Article 5 was drafted with the potential threat of Soviet aggression in mind, specifically in attempting to defend against any furtherance of its political control of Eastern Europe into other parts of the continent, it was not the Cold War which led to the invocation of the clause, rather the terrorist attacks upon the World Trade Center in New York City on 9/11. NATO therefore found relevance and a new lease of life into the 21st Century, when it might not otherwise have done, not through the policy of deterrence, but through its unforeseen participation in the International security architecture, and taking on a role of combating the phenomenon of global terrorism.[21]

Thus, as the importance and use of NATO, as a means to enforce international peace and security grew exponentially, NATO deployed and sustained the world's most potent military forces in the far flung destinations of the former Yugoslavia, Afghanistan and Libya; it remains responsible for the defence of 900 million citizens around the world, and over 70% of the world's military expenditure; it is a strategic alliance that must face rapidly changing challenges, in terms of environments in which to operate, defending against the most difficult and dangerous potential armed attack (upon any of its members), being prepared to face unknown hostile aggressors and having the arrangements in place to meet the threat of other contingencies, such as nuclear warfare.[22] NATO's political purpose is commonly addressed through its biennial summits, which serve as a means for Heads of State and Heads of Government of member nations to consider the strategic direction of NATO activities. NATO summits frequently serve as a means of shaping new policies and initiatives.[23] Furthermore, NATO is an organization that uses International law to further its political purposes. In particular, when the detente between NATO and Russia started in 1991, there was a deliberate attempt to establish the footing between the great powers by International agreements, such as with the NATO-Russia founding Act[24] and NATO has been instrumental in the peace agreements that took place in the aftermath of the Bosnian conflict;[25] NATO has defined its International legal position, necessary for military operations, through the negotiation of certain privileges and immunities from potential legal suits, on a multi-lateral basis and throughout the various jurisdictions of the Alliance and outside it, by its Partnership for Peace (PfP)[26] and Status of Forces Agreements.

However, it is NATO's seeming success, through enlargement and posturing towards the concerns of Eastern European countries, which has been said to have triggered the apparent

Russian riposte. In the post Cold War world, Russia has attempted to re-assert its military prowess and in particular, Russian aspirations for grandeur have been expressed through the Putin Presidency. The Russian position is that NATO ought to have been disbanded at the end of the Cold War and its continuing accession of new allies has deliberately undermined Russian security interests. Moreover, Russia has been critical of the legality of NATO operations in Kosovo and more recently in Libya, suggesting that the deployment under the Responsibility-to-Protect doctrine and the operationalisation of UN Security Council Resolutions 1970 and 1973 was contrary to International law. Accordingly, Russia reckons that there are new threats to its national security, presented by an increased NATO and its global activity, such that in December 2014 Russian military doctrine was updated.[27] Russia sees its armed forces as a defensive tool, only to be employed as a last resort. The primary aim of Russia's nuclear forces is to serve as a deterrent against an attack on the Russian homeland, particularly against one which – whether using conventional or nuclear weapons – might threaten the nation's very existence.

NATO and the Thin Red Line?

A. Why Collective Self – Defence

Whilst there is considerable benefit for NATO members in the policy of collective self-defence, which is given a firm legal basis through Article 5 of the NATO Treaty, as well as Article 51 of the UN Charter, it ought to be remembered that NATO's relationship with International law has not been an entirely positive one. 'A thin red line' –is how Bruno Simma (a former Judge of the International Court of Justice) described the threat, or use of force by NATO without UN authorisation, in regard to the ensuing Kosovo crisis in 1999. If the 1999 air strikes against the then Federal Republic of Yugoslavia had breached the UN Charter, or taken the possibility of doing so unto a knife-edge (as most commentators say)[28] it is prudent to ask, where are we now, and more specifically, whether any further erosion of the UN paradigm can be attributed to NATO; Simma went on to say that the NATO Treaty implies subordination to the principles and practice of the UN Charter and furthermore, that if repeated, there was a great potential for the actions of NATO to undermine International law.[29] On the other hand, the widespread regional destabilisation in Ukraine and unlawful annexation of the Crimea, are well documented and can only be properly attributed to Russian indirect aggression.[30] The Eastern European and Baltic States that once feared for their existence are still protected by Article 5 of the NATO Treaty, as the Wales Summit has recently made explicitly clear, the principle of collective self-defence is the most logical and arguably the only, manner in which to ensure the continued existence of small States that are considerably weaker than Russia in military terms.

Nonetheless, the legality of collective self-defence remains contingent upon a response being made to an actual armed attack and throughout the Cold War, there seemed to be little doubt as to what an armed attack entailed. Then, in the wake of the War on Terror, the question became unsettled, through the targeting of non-State actors and the pre-emptive use of force.

Russia's recent military intervention into Ukraine has highlighted the question of whether force can be lawfully employed, as a result of indirect aggression. Despite massive developments in the manner and motivations for modern military operations,[31] NATO and the principle of collective self-defence endures as an effective means of protecting States against International aggression. However, there are definite criticisms that are in order: whilst NATO carries on with a renewed sense of purpose, it ought to be remembered that NATO is not a nation, nor cannot be properly understood as a collection of nations, or States with legal personality, such as the EU, or US. NATO's legal status has meant that it is difficult to hold accountable and NATO has never been successfully sued before any national court.[32] Neither is NATO an institution that is formally connected to the UN, such as the International Court of Justice, but NATO is an International Organisation that is supposed to be strongly allied to the principles and purposes of the UN (this includes the peaceful resolution of disputes and developing friendly relations among nations).[33] Moreover, NATO has yet to formally take on the promotion of human rights and recognise the jurisdiction of the International Criminal Court, which would be important objectives in the context of a mature International Organisation.

The ambitious system that was originally set out by the UN Charter in 1945, envisioned an amalgamation of world military power, ready to take on any threat to International peace and security, contributed to by all the members of the United Nations, being made available to the Security Council to direct and control. This has not been done, although the applicable legal provision that sought to make it so is Article 43 of the Charter, which still remains in place. In reality, a rather different system of International security architecture is at play, which relies on delegations of power from the UN Security Council to a range of powers, namely the Secretary-General, groups of States, UN subsidiary organs, and regional arrangements, including NATO.[34] Simma's critical observation that NATO is not subordinate to the will of the UN is a weighty one and NATO's autonomy to interpret the circumstances which will give rise to its collective self-defence obligations, does not yet bestow any corresponding obligations in International law.

B.   Amendment of the NATO Treaty?

International law recognises a philosophical belief that the use of force (war) has brought terrible consequences to mankind and must only be permitted in situations of necessity, only then as a last resort, and then to a proportional extent. In the context of the total war, which was World War II, it is easy to see why.[35] However, the recent pursuit of Russian stealth tactics constitutes indirect aggression and ought to be addressed by the International community. If Article 5 can be interpreted in a manner that is set in motion by the type of behaviour from Russia, which has caused concern in the House of Commons Select Committee report, then this would signify a significant shift in International law. The report suggests this may be desirable and goes as far as to say that consideration ought to be given to amending the NATO Treaty, so as to remove the adjective 'armed' from the phrase 'armed attack', signifying that NATO would be entitled to respond to the full breadth of the Russian unconventional

threat, stretching into economic and energy policy.[36] The appeal in this proposed reform is that it would signify the obligations conferred upon States by the NATO Treaty are being taken seriously and reviewed against a relevant state of play in international affairs. However, because of the analogous relationship between Article 5 of the NATO Treaty and Article 51 of the UN Charter, any such re-interpretation of an armed attack, if adopted and exploited by other unscrupulous States, would be likely to have far reaching consequences for the concept of self-defence in International law altogether.

On the other hand, the Vienna Convention on the Law of Treaties requires that the words of a Treaty be interpreted in their context and in the light of the Treaty's object and purpose, and therefore, a good case exists that the NATO Treaty can already be used in a manner that means it can recognise and respond to measures that come short of an armed attack (with proportionate force). In fact, most commentators agree that whilst there is a particular threshold for an armed attack to cross,[37] NATO remains entitled to reply to any lesser use of force, against any of its members, if it so chooses. As of late, NATO's disposition in this respect seems to be very much reflected in its increased enthusiasm for Baltic air policing measures, and upping of military training exercises in Eastern Europe.[38] Moreover, on a practical level, very little has been established in terms of an alternative model to NATO and the collective self-defence doctrine, save for pursuing a policy of pacifism. So, while the NATO Treaty is not a comprehensive instrument comprising all existing and foreseeable aspects of military defence and security policies (and was not meant to be), it could, with sufficient political impetus, be followed by the conclusion of further subject-specific instruments which would set out in more precise terms, exactly what NATO deems to be sufficient to trigger its Article 5. An obvious example would be the conclusion of an international accord to formalise the NATO position on its stance relating to Cyber attacks, although, the apparent disadvantage in stating anything more than NATO's decision-making process is done on a case by case basis, is that it may lead to criticism that it has acted irrationally, when not demonstrating such discretion as could be expected of it.

Either way, if the NATO Treaty is amended or not, the point has been made clear: NATO continues, and it will safeguard its members' right of self-determination. Thus, as NATO's deterrence factor may continue to prevent a full-scale world war occurring again and so far as appropriate measures are taken, falling short of force, to censure Russian indirect aggression, then there is no need to reform Article 5, as there has been no need to reform Article 51. A thorough examination of the law provides that it remains functional and relevant and does not inhibit the use of lawful military force when necessary. Indeed, to counter the behaviour of Russia, such a fundamental structural change to International law is radical and unnecessary; rather, the more pressing concern is the practical matter of military preparedness and ability to show that the NATO deterrence factor is a credible one. If this can be achieved, then the present International rules based system will be preserved – a departure into an unknown, contradictory world at Russia's behest could prove very difficult to reverse and have cataclysmic consequences.

C.   Lawfare

Consequently, another observation is in order: whether by fault, or design, and with surprising success, the framers of the NATO Treaty encapsulated a legal means to provide for the implementation of an established military strategy: the doctrine of deterrence. Whether the law can ensure that other strategic objectives and principles are provided for, in an evermore unstable and dangerous world, is now a fitting question. In the aftermath of the conflicts in Iraq and Afghanistan, there is an increasing concern from not only the public, but also from senior military commanders, down to the junior ranks, that the full range of military operations, from influence, to coercion, through to intervention, and full-scale invasion, are legal.[39] The NATO Treaty proves that a certain aspect of military strategy can be contained coherently within a legal document and accordingly, further research would be welcome on which other aspects of military doctrine would lend themselves to being enshrined in legal statute, such as ensuring that certain percentages of GDP must be spent on defence spending, or that International Humanitarian Law (IHL) is applicable over International Human Rights Law (IHRL) in a non-International armed conflict.[40]

Indeed, whilst deterrence is a long established defence policy, and military alliances are found throughout history, certainly in Biblical times,[41] the growing resort to litigation over the use of force - 'lawfare', is a phenomenon that now deserves serious attention. Lawfare has been defined as 'the *abuse* of Western laws and judicial systems to achieve strategic military or political ends' and 'the exploitation of real, perceived, or even orchestrated incidents of law-of-war violations being employed as an unconventional means of confronting a superior military power'; so that from this perspective, lawfare consists of 'the negative manipulation of international and national human rights laws to accomplish purposes other than, or contrary to, those for which they were originally enacted'.[42] Thus, whilst States remain legally entitled, either individually, or collectively, to deploy armed forces (and use force), in a range of circumstances that classify as self-defence, another aspect of the difficulty in doing so comes not from violent conflict that their Servicemen may face in an operational theatre, but the damage that can be done by the very accusation (real or imaginary) that their mission, or conduct, is unlawful.[43] The logic of deterrence does not apply in these circumstances and much damage would be done if the NATO model could be fragmented by such an indictment.

Conclusion

The range of circumstances that will trigger Article 5 of the NATO Treaty is renewing the debate on the lawful use of force; the UN Charter paradigm does not seem a good fit for current challenges from the Russian political agenda and the utility of the law is again, under scrutiny. International law has long been used to contain the use of force and there ought to be considerable caution attached to the calls to broaden the definition of armed attack, so as to permit a response to a wider ambit of hostile acts; the danger in an extensive interpretation remains that it may result in unintended consequences, such as States using force on a more

regular basis to settle disputes. Moreover, debates concerning NATO are unique because of the sheer scale of the International Organisation and what is at stake if mistakes are made (the spectre of nuclear war has not gone). Whilst there remains a lawful basis upon which States will continue to defend each other militarily, it seems likely that the enlarged NATO will exhibit a propensity for divergent views, as to the immediacy and level of seriousness, of any given threat posed.

As the practical basis of what military force is used for changes, it is inevitable that there will be further paradigm shifts and further questions raised about the functionality and relevance of International law on the use of force. Into the future, NATO's relationship with International law will be defined by how it reacts in such, as yet unforeseen circumstances, and utilises increasing developments in technology.[44] However, there are also important lessons for NATO that can be learned from history and in particular, the causes of the First World War. The Great powers that fought each other had formed ad hoc defensive alliances, when it was unclear that they would do so, giving rise to unpredicted and catastrophic consequences.[45] It is argued that the success of the NATO Treaty has been that it makes clear which States will react to outside aggression and where the balance of military power ultimately lies.[46] The absence of a full-scale conflict with the Soviet Union - the Cold War going 'hot' - would seem to support this view and it is therefore to be welcomed that debate has not stopped on how the Treaty is to be understood, and can continue to play an important role in maintaining International peace and security.

NATO has become less connected to the UN and has developed outside the original intention of its role as a regional organisation, as set out in Chapter VIII of the UN Charter.[47] Continued debate as to NATO's relationship with the UN is therefore also due and attention ought to be paid to understanding why UN forces have seemingly failed, where NATO succeeds, that is, in implementing sustainable peace keeping and peace enforcement missions. Thus, while debate continues as to when force can be legally used in the modern world, it ought to be remembered that relevant legal doctrines on the definition of indirect aggression have existed for longer than a generation; defining how force can be deployed effectively, and legally, in a contemporary environment, seems to be an endeavour of continuous effort, requiring rigorous and systematic analysis.[48] Moreover, what seems to be needed, in a world that enjoys only fragile condition of peace, is further debate as to how the national, and International, legal systems[49] can successfully categorise and permit appropriate countermeasures to combat ambiguous warfare (within the confines of proportionality and novel circumstances). The principle of the International rule of law remains relevant to influencing the behaviour of States and the application of air power; it must be employed within an existing International security architecture that, like the Royal Air Force itself, may have to fight, to ensure the continuance of its very own existence.

Notes

[1] See Justin Bronk "Russia Outflanks the West" RUSI Defence Systems, 7 Nov 2014: www.rusi.org.

[2] See Defence Committee of the UK House of Commons -Third Report 'Towards the next Defence and Security Review: Part Two-NATO':
http://www.publications.parliament.uk/pa/cm201415/cmselect/cmdfence/358/35807.htm.

[3] The 'Wales Declaration' set out the various agreements that were reached at the NATO Summit Wales 2014 and further actions for NATO: https://www.gov.uk/government/publications/nato-summit-2014-wales-summit-declaration/the-wales-declaration-on-the-transatlantic-bond.

[4] See the Institute for Strategic Studies The Military Balance for the figures from which this assertion is derived.

[5] NATO's definition of doctrine, used unaltered by many member nations, is: '*Fundamental principles by which the military forces guide their actions in support of objectives. It is authoritative but requires judgement in application*' see: AJP-01(D) ALLIED JOINT DOCTRINE (December 2010) available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/33694/AJP01D.pdf.

[6] NATO has not systematically codified its doctrines on when to use force, but it has released the NATO Legal Deskbook, which is intended to reflect, as closely as possible, the policies and practice of NATO in legal matters. However, the Deskbook is not a formally approved NATO document and therefore does not purport to reflect the official opinion or position of NATO. Thus, while the Deskbook is not intended to supplant national guidance on a range of issues, and is a refinement of working practices and experiences gained over the past few years (since its earlier 2008 edition), it can be deemed as a useful compilation for understanding the issues coming before NATO legal advisors. See the Second Edition (2010) of NATO Legal Deskbook is available at: http://publicintelligence.net/tag/north-atlantic-treaty-organization/.
The deskbook reflects the policies and practices of NATO members, but is not a formally approved document and is more a compilation to enable understanding of the issues which NATO legal advisors face.

[7] A primary advocate for the legality of the Iraq War also became the Rt. Hon. Tony Blair, his evidence before the Iraq Inquiry can been seen at: http://www.iraqinquiry.org.uk/transcripts/oralevidence-bydate.aspx.

[8] The debate is explored by C Chinkin in 'Rethinking Legality/Legitimacy after the Iraq War' pp. 219-247 in R Falk, M Juergensmeyer and V Popovski (eds) *Legality and Legitimacy in* Global *Affairs* (OUP 2012).

[9] United Nations High-Level Panel on Threats, Challenges and Change '*A More Secure World: Our Shared Responsibility*' (2 December 2004) UN Doc A/59/565. Available at: http://www.un.org/en/peacebuilding/pdf/historical/hlp_more_secure_world.pdf.

[10] Moir, L *Reappraising the Resort to Force* (Hart Publishing 2010).

[11] Ibid. pp. 150-6.

[12] The title of that work being translated from the famous Latin expression 'Le droit contre law guerre' Corten, O *The Law Against War: The Prohibition on the Use of Force in Contemporary International Law* (Hart Publishing 2012).

[13] Ibid. pp. 402 ff.

[14] Article 3(g) of the Definition of Aggression and its interpretation includes a provision which holds a State responsible for the sending of irregular forces according to certain stringent conditions, thus concerning the matter of State attribution.

[15] Y Dinstein, War, Aggression and Self Defence 5th Edition (Cambridge: CUP, 2005). p. 16

[16] See fn. 2, p.12-17.

[17] The document is available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/33717/GST4_v9_Feb10.pdf.

[18] A Strong Britain in an Age of Uncertainty: The National Security Strategy (Oct. 2010) p. 3. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61936/national-security-strategy.pdf.

[19] Joint Doctrine Publication 0-01 UK Defence Doctrine (Nov. 2014): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389755/20141208-JDP_0_01_Ed_5_UK_Defence_Doctrine.pdf.

[20] US National Security Strategy (May 2010): http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf.

[21] See Chicago Summit Declaration, by the North Atlantic Council 20 May 2012: http://www.nato.int/cps/en/natolive/official_texts_87593.htm?mode=pressrelease.

[22] The Strategic Concept adopted at the 1999 Washington Summit described future threats as 'multidirectional and often difficult to predict'.

[23] Medcalf, J NATO (Oneworld Publications 2005).

[24] See discussion in: 'NATO enlargement and the NATO-Russian Founding Act: the interplay of law and politics' International & Comparative Law Quarterly 1998, 47(1), 192-204.

[25] 'The role of NATO in the Peace Agreement for Bosnia and Herzegovina' European Journal of International Law 1996, 7(2), 164-175.

[26] http://www.nato.int/cps/en/natolive/topics_50086.htm.

[27] http://rt.com/news/217823-putin-russian-military-doctrine/.

[28] Chinkin, C 'The Legality of NATO's Action in Yugoslavia' 49 ICLQ 910 (2000).

[29] Simma, B 'NATO, the UN and the Use of Force: Legal Aspects' EJIL (1999) 10 (1).

[30] "Amnesty International considers the war to be "an international armed conflict" and presented independent satellite photos analysis proving involvement of regular Russian army in the conflict. It accuses Ukrainian militia and separatist forces for being responsible for war crimes and has called on all parties, including Russia, to stop violations of the laws of war. Amnesty has expressed its belief that Russia is fuelling the conflict, 'both through direct interference and by supporting the separatists in the East' and called on Russia to 'stop the steady flow of weapons and other support to an insurgent force heavily implicated in gross human rights violations'. See - http://www.amnesty.org/en/region/ukraine.

[31] So says the highly experienced military practitioner, General Sir Rupert Smith, in The Utility of Force: The Art of War in the Modern World Allen Lane; First Edition edition (2005) p. 269.

[32] An excellent take on the unfruitful attempts by the former FRY to sue NATO is provided by Olleson, S in 'Killing Three Birds With One Stone'? The Judgments of the International Court of Justice in the Legality of Use of Force Cases", Leiden Journal of International Law, vol. 18 (2005), p. 237.

[33] http://www.un.org/en/documents/charter/chapter1.shtml.

[34] Sarooshi, D *The United Nations and the Development of Collective Security: The Delegation by the UN Security Council of its Chapter VII Powers Oxford Monographs in International Law* (OUP 2000) p. 251.

[35] In *The War of the World: History's Age of Hatred* Penguin (2009) Niall Ferguson looks at why the 20th Century was the most violent in man's history, arguing that despite the globalisation, and booming economies married to technological breakthroughs that seemed to promise a better world for most people, it proved to be overwhelmingly the most violent, frightening, and brutalized in history; with fanatical, often genocidal warfare engulfing most societies between the outbreak of the First World War and the end of the Cold War. It was an age of hatred that ended with the twilight, not the triumph, of the West and, he warns, it could happen all over again.

[36] Ibid, p. 34.

[37] See above.

[38] See W. Boothby, *Weapons and the Law of Armed Conflict* (Oxford: OUP 2009).

[39] See Campbell McLachlan"*Foreign Relations Law*" (Cambridge: CUP, 2014).

[40] This was the position of the Ministry of Defence, that was argued unsuccessfully to the Court of Appeal, so that it held British Forces had had no right to detain the first appellant in Afghanistan for more than 96 hours, in *Serdar Mohammed v Ministry of Defence and Rahmatullah & the Iraqi Civilian Claimants v Ministry of Defence & Foreign and Commonwealth Office* [2015] EWCA Crim 843.

[41] In Genesis 14, Abram encounters kings and chieftains who not only are named, but also have territories and military associations that are spelled out in detail; Joshua, as Moses's successor, distinguished himself as a wise and courageous military leader, his successful campaigns against the inhabitants of Canaan, led them to forge alliances with other local populations and fight as a common front against Israel; cf. the Prophet Ezekiel's complaint against the unholy alliances that Israel created with the Egyptians and Assyrians (Ch. 16).

[42] The Lawfare Project: *What is Lawfare?* http://www.thelawfareproject.org/what-is-lawfare.html.

[43] The Policy Exchange have published a paper that is very critical of what it suggests has been 'sustained legal assault' on British forces, which could have 'catastrophic consequences' for the safety of the nation: Tugendhat, T., Morgan J. & Ekins, R'*Clearing the Fog of Law Saving our armed forces from defeat by judicial diktat*': http://www.policyexchange.org.uk/images/publications/clearing%20the%20fog%20of%20law.pdf.

[44] A fascinating account of what futuristic warfare will entail is capsulated by Singer, P.W. in *Wired for War: The Robotics Revolution and Conflict in the 21st Century* (Penguin books 2009); furthermore, see Sutherland, B. in '*Modern Warfare, Intelligence and Deterrence: The technologies that are transforming them*' Economist books (2011).

[45] MacMillan, M. *The War that Ended Peace: How Europe abandoned peace for the First World War* (Profile Books 2013).

[46] A recent and useful article has been published by Buckley, E and Pascu I on '*How to Avoid Wars: NATO's Article 5 and Strategic Reassurance*' http://www.atlanticcouncil.org/publications/articles/how-to-avoid-wars-nato-s-article-5-and-strategic-reassurance.

[47] Gazzini, T '*NATO's role in the collective security system*' JCSL 2003 (231).
[48] Boothby has offered a relevant and complete overview of the law of weapons in armed conflict. He makes out a compelling case that the law concerning the means of warfare (that is, weapons, or weapons systems, in an armed conflict) is arguably one of the most important areas of *ius in bello*: Boothby, W *Weapons and the Law of Armed Conflict* (OUP 2009).
[49] In *Foreign Relations Law* (CUP 2014) Campbell McLachlan QC has made a worthy contribution by examining the legal principles that govern the external exercise of the public power of States within common law legal systems (the United Kingdom, Australia, Canada and New Zealand). McLachlan concludes that the prime function of foreign relations law is not to exclude foreign affairs from legal regulation, but to allocate jurisdiction between the national and the international legal systems.

Viewpoints

Lethal Autonomous Weapons Systems – Warfare's Best Humanitarian Hope?

By Wing Commander Jim Beldon

Introduction

The past decade has witnessed a revolution in the use of remotely operated systems by the UK's Armed Forces. Nowhere has this been more evident – or controversial – than in the air domain. Debate over the nomenclature of such systems – known variously as 'Unmanned Air Vehicles (UAVs)', 'Uninhabited Air Systems (UASs)', 'Remotely Piloted Air Systems (RPAS)' and the plethora of hybrids that these and other terms have spawned – reflects the ideological battle that continues to rage over the nature of such systems and the extent to which meaningful human control prevails over them. The term 'drone' has become the popular, yet currently misleading, term for such systems, which has been exploited by opponents to propagate the false notion that the RAF (through its use of the armed MQ-9 Reaper RPAS) is engaged in unethical and inhumane killing by autonomous machines beyond human control. In this characterization, the anti-drone lobby has been wholly wrong, as the Minister for the Armed Forces, Penny Mordaunt MP, recently addressed during a House of Commons adjournment debate on 'Drones in Conflict':

> I will briefly provide a bit of clarity and on the record bust some of the myths that surround the term "drone", which conjures up images of machines free from human oversight and able to operate with complete autonomy. That is the stuff of science fiction movies, not the reality. Although drones do not operate with an individual in the cockpit, the fact is that a trained professional human being is in control of the system at all times. The difference is that they operate remotely from the vehicle. The term "drone" also overlooks the fact that the aircraft itself is part of a much larger system composed of other vital components such as the ground stations, networks and, most importantly,

the personnel….The Government have no intention of developing systems that operate without this all-important human hand in the weapon command and control chain.[1]

But, as this paper explores, there is reason to question whether the UK's position on Lethal Autonomous Weapons Systems (LAWS) – which applies across all environments – is ultimately sustainable or even desirable, should such systems become viable.[2] The notion that a human should always be the ultimate decision maker in the delivery of lethal force is certainly correct now, but it is debatable whether this can or should remain so in the future.

At the MOD's first RPAS-focused media event held at RAF Waddington in December 2013, the then Defence Secretary, Philip Hammond MP, observed that 'Much of the criticism of unmanned aerial systems is based on misunderstanding. This event provides a great opportunity to better inform people about these life-saving assets and their variety of purposes.'[3] In that aim, the event was successful, and so, albeit to a limited degree, has been the MOD's subsequent communications effort in countering the 'Killer Drones' narrative concerning the use of Reaper, a cause somewhat hindered by the system's unedifying name – an issue which the Prime Minister recently sought to address by giving the RAF's next generation of armed RPAS the name 'Protector.'[4] Encouragingly, the idea of remotely piloted drones as 'life savers' or 'protectors' has gained some traction in academic circles, with Dr David Whetham of King's College London[5] and Professor Caroline Kennedy of the University of Hull[6] arguing in favour of their use in UN Peacekeeping and Enforcement operations. In addressing the bad press surrounding drones (largely as a result of US 'targeted killings'), Professor Kennedy argues that:

> Drones, even armed drones, can be used in a virtuous manner to protect civilians in line with a UN mandate, just as they can be used in a manner which is perceived as immoral or unethical….armed drones are not innately evil or immoral weapons and if used in a manner which deters and prevents acts of genocide and human rights violations then they would likely be welcomed by a public under siege and in need of protection.[7]

The 'virtuous' life-saving drone, in the sense intended by Professor Kennedy, is one that is under permanent human control, reliant on the virtues of its human controllers. But is it conceivable that drones could themselves exhibit sufficient humanitarian virtue to make life taking decisions without explicit human involvement? So far, in promoting its case that the rules[8] governing the employment of lethal force by RPAS are identical to those involving traditional aircraft, the MOD has ruled out developing autonomous weapons systems, stating that only expert military personnel make decisions involving the employment of lethal force and that it is neither possible nor desirable for such decisions ever to be delegated to non-human entities. However, the technology enabling ever higher degrees of automation is evolving rapidly, and so are the arguments. Edges are blurring between machine-made and man-made decisions. Accordingly, although the progression towards autonomy in weapons systems presents some useful opportunities, the legal, ethical and presentational challenges that accompany such

advances are already causing the UK's and other states' policymakers headaches, not least because of public unease over the use of 'drones'.

Perhaps unsurprisingly, owing to antipathy towards drone strikes, vastly more has been written arguing against their use and the development of autonomous weapons systems than has been written in favour.[9] A notable exception is the US computer science and roboticist, Professor Ronald C. Arkin, whose research in the field of autonomy in military systems has added an important perspective to the potential military and ethical benefits that may result from the development of appropriately intelligent LAWS. His 2010 paper on 'Ethical Autonomy in Unmanned Systems'[10] drew together research from a wide variety of sources and over many decades to demonstrate the failure of fighting men and women to behave ethically in war; indeed, nearly two-thirds of his paper was devoted to ethical, moral and psychological human failings in combat – a disquieting yet revealing insight for the military professional. To a large extent, therefore, Arkin's argument in favour of the development of ethical LAWS relies principally on the demonstrated incapability of humans to perform ethically in war rather than on the as yet unproven virtues of ethically endowed machines. In the intervening five years since Arkin's paper was first published, the ethical and legal arguments over LAWS have gained momentum, courting the attention of some eminent figures, such as Professor Stephen Hawking, and Noam Chomsky, who have called for a pre-emptive ban on LAWS.[11] Whilst this author disagrees with the position taken by Hawking et al, their intervention nonetheless highlights that not only has debate on LAWS gained momentum since Arkin's 2010 paper, but so has the technology.

Although a precise timetable cannot yet be given, there is reason to consider that evolution – or perhaps revolution – in the artificial intelligence and robotics fields will ultimately fulfil the dream (or nightmare) of drones endowed with the ability to form reasoned judgements and then decide and act on them without human input.[12] When technology spawns such capabilities, the only remaining impediments to their weaponisation would be international law and decision makers' ethics. Whilst no state (or any other body) has declared outright that a non-human entity could (or should) be empowered to decide on the employment of lethal force, it would be naïve to think that research and development is not already underway in certain states, including the USA, and that such technology is truthfully and universally considered to be undesirable. Furthermore, from a practical perspective, it is likely to become increasingly difficult to determine how the boundary between meaningful human control and machine autonomy can be universally defined and agreed, when the ideal would be to achieve a perfect unity between human and machine.

Already, designers of military and commercial equipment of all sorts seek to lever the mutual advantages of human and machine to achieve optimum synergy for the overall system. As machines become ever more intelligent and capable, it is likely that some functions currently performed best by humans will ultimately be better performed by machines, thereby releasing humans to exploit their consequently freed capacity to perform extant or new

functions for which their aptitude remains supreme. Indeed, there is fundamentally nothing new in this context: for example, aircraft autopilot systems perform certain functions better than their human counterparts, and history shows us that the exploitation of human and machine synergy has been in constant evolution since Palaeolithic man first hewed a cobble into a hand-axe. So far, it is arguable that this evolution has been constrained to the physical rather than conceptual domain, but is it really inconceivable that artificial intelligence should not supersede human decision making, including those decisions involving lethality, if the relevant technology proves itself to be more competent than human beings in making such decisions? Those, like Sharkey, who oppose the development of LAWS, argue that machines lack the sophisticated intelligence and psychology to understand higher intent or interpret human actions, intentions and emotions in the way that humans do.[13] But such a standpoint reflects technology as it is now, not as it might be in the future. Furthermore, such a viewpoint fails to acknowledge that all humans are different and are liable to reach different conclusions when faced with identical inputs based on a whole range of subjective factors (including fear, selfishness, fatigue and ideology) – which Arkin explored extensively in his 2010 paper.[14] It is simply misleading, as Sharkey implies, to assume that all humans are of equal virtue, intelligence and character, or that none is susceptible to the debilitating effect on ethical conduct that exposure to combat can promote. 'Designing out' the frailties that lead human combatants to act unethically and illegally should be a primary aim in the development of LAWS, with a commensurate uplift in the ethical conduct of warfare.

The UK Government argues that we might be a very long way off from witnessing the requisite advance in artificial intelligence that could enable such a possibility, but we cannot be sure. It must therefore be questioned whether the UK's policy on the use of remotely operated military systems, at the heart of which has been enshrined the primacy of human decision making, is sustainable indefinitely, or whether, in fact, the development and employment of genuinely autonomous weapons systems are inevitable and, perhaps, even ethically desirable.

Although there is no internationally agreed definition of what constitutes a 'LAWS',[15] it may be understood that in order to be described as truly or fully 'autonomous', rather than simply 'automated', a system must be capable of independently 'interpreting higher level intent[16] and direction',[17] analysing its physical and operational context in order to make decisions and act independently from further human influence; in the case of fully autonomous weapons systems, these include decisions to employ lethal force. The UK remains sceptical of the feasibility of such systems and categorically states that it 'does not possess fully autonomous weapon systems and currently has no intention of developing them. Such systems are not yet in existence and are not likely to be for many years, if at all.'[18] Indeed, despite the very wide spectrum of opinions on the legalities and ethics of LAWS, there is a general consensus that none are in existence yet. According to Human Rights Watch (HRW), a member of the Campaign to Stop Killer Robots (CSKR), a 'civil society' organisation comprising a number of NGOs,[19] 'Fully autonomous weapons…do not yet exist'.[20] Furthermore, it is generally accepted that in-service weapon systems exhibiting a

high degree of automation, such
as loitering munitions, the Phalanx
close-in anti-shipping-missile system
and Israel's 'Iron Dome' anti-rocket
surface-to-air missile system, fail to
meet the definition of 'full autonomy',
because humans programme them
to respond within precisely defined
parameters to pre-defined conditions.
In Phalanx's case, when commanded
to automatic mode, it automatically
detects and engages sea-skimming
supersonic anti-shipping missiles
(which humans lack the necessary

Automated, not autonomous: Phalanx Close-in Weapon System
(Credit: U.S. Navy)

response time to counter adequately) according to very tightly controlled parameters.
Because systems like Phalanx behave in accordance with the explicit programming
instructions of humans in reaction to precisely pre-defined circumstances, they are usually
defined as 'automated' rather than 'autonomous', although some refer to them as 'partially
autonomous'. Noel Sharkey has described the reasoning process of such systems as ultimately
rooted in the simple computer programming language of 'the humble IF/THEN statement.'[21]
Whilst Sharkey would argue that such systems are to be considered as 'autonomous', they do
not fulfil the requirements set out above of being able to interpret higher level intent and
analyse their context beyond the narrow scope of an 'IF/THEN' decision process. They are not
endowed with the requisite initiative to respond to factors that lie outside those defined in
their programmes. In sum, with apologies to Descartes, such systems do not 'think', therefore
they are not [autonomous].

So much for the current state of play. The future viability of LAWS is where opinion begins
to diverge comprehensively. Contrary to the UK's position that autonomous weapons
systems are 'not likely to be [in existence] for many years, if at all',[22] HRW argues that 'weapons
technology is moving rapidly toward greater autonomy' paving the way for weapons with
the 'power to determine when to take human life.'[23] Despite the wide spectrum of views on
the subject, notably the contested term 'greater autonomy', the international community
is addressing the legal issues concerning LAWS through the auspices of the UN Office in
Geneva's Convention on Certain Conventional Weapons (CCW) annual 'Meeting of Experts on
Lethal Autonomous Weapons Systems', the most recent event having taken place between 13
and 17 April 2015. Because it is a diplomatic forum, the UK's lead department for LAWS is the
Foreign and Commonwealth Office (FCO), supported by the MOD. In addition to state and
UN representation, other participants in the forum include the Campaign to Stop Killer Robots
and the International Committee for Robot Arms Control (ICRAC). So far there has been
little tangible progress towards achieving international agreement on LAWS, even over the
definition of the term. All parties agree, however, that contemporary technology is incapable

of producing systems with the required artificial intelligence to meet the broadly agreed understanding of what a truly autonomous system is, i.e. although a degree of autonomy can be achieved through the automation of certain functions of a weapons system, they are as yet incapable of exercising reasoning and judgement to the same sophisticated level as a human being. In these regards, humans continue to outperform machines and, in the view of the ICRC, a supersession by machines is 'unlikely to be possible in the foreseeable future.'[24] Consequently, although highly automated systems have been demonstrated to perform well in highly predictable circumstances, so far not even the most complex 'autonomous' system has yet exhibited the power of judgement necessary to adapt satisfactorily to complex, dynamic and unexpected circumstances; moreover, as a consequence, when faced with the unpredictable, state-of-the-art 'autonomous' machines can behave unpredictably.

For those who fear imminent World domination by Terminator-esque killer robots, it should be reassuring to learn quite how relatively under-developed even the most advanced 'partially autonomous' systems are at present. Sharkey argues, with some justification, that 'The autonomous robots being discussed for military applications are closer in operation to your washing machine than to a science fiction Terminator.'[25] It is notable, for example, that one of the most significant milestones so far reached autonomously by an unmanned system was the recent

The US Navy's X-47B UCAS-D achieved autonomous in-flight refuelling on 22 April 2015 – a milestone for aviation, but no indicator that machines are capable of out-reasoning humans. (Credit: U.S. Navy)

achievement by the US Navy's X-47B Unmanned Combat Air System Demonstrator (UCAS-D) of in-flight refuelling. Important though this milestone undoubtedly was in terms of extending the range and endurance of unmanned systems and in demonstrating the high technical merit of the machine in performing the delicate manoeuvres inherent in in-flight refuelling, it hardly marked a decisive breakthrough in the race to achieve machine supremacy over human judgement. Indeed, this success served as much to highlight the limits of artificial intelligence as it pointed to its potential.

Hence, in light of the pronounced limitations of current autonomous technology, the debate over LAWS has principally circulated around the issue of whether to introduce a pre-emptive ban on such systems, with groups such as ICRAC claiming that 'The delegation of violence to a machine – whether lethal or less lethal – is a violation of human dignity'.[26] The UK rejects the premise of this argument, stating that it would never delegate the decision to employ lethal force to a machine and that IHL already prohibits their development. As the FCO has

stated, 'Whilst technological advances will likely increase the level of automation in some systems, just as in non-military equipment, the MOD has no intention to develop systems that operate without human intervention in the weapon command and control chain.'[27] The UK considers that its stance accords precisely with extant International Humanitarian Law (IHL), which it believes already effectively bans all states from introducing fully autonomous systems. Specifically, Article 36 of Additional Protocol 1 to the 1949 Geneva Conventions obliges states 'to determine whether [a weapon's] employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party.'[28] In its interpretation of Article 36, the UK contends that a fully autonomous system would never be capable of meeting the principles of humanity, proportionality and distinction in the targeting process and, therefore, IHL signatory states are compelled to limit weapons systems to those which operate under 'meaningful human control'. Article 1 of the UN's Universal Declaration of Human Rights states that 'All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.'[29] Consequently, under the current provisions of IHL, it can be argued that the principle of humanity is inseparable from the human species; ipso facto, no other living or artificial creation has the right to judge matters involving humanity. But in arguing that humans alone have the right to make decisions that have humanitarian implications, there is an inherent presupposition that either humans are (and always will) remain inherently superior to artificial creations in making judgements based on humanitarian principles, or that human mistakes or misdeeds will remain more admissible than machines' potential inerrancy. The first presupposition is open to conjecture, but in this author's opinion is unlikely to withstand the test of time; the second, ironically, seems almost certainly inconsistent with humanitarian objectives. So far in history, humans have failed consistently to live up to humanity's loftier ideals. Indeed, as Arkin argued in his 2010 paper, '… it seems unrealistic to expect normal human beings by their very nature to adhere to the Laws of Warfare when confronted with the horror of the battlefield, even when trained.'[30]

To err is, indeed, human, as humanity's sad history of war and its associated crimes have lamentably demonstrated. But to forgive mankind en masse for its propensity for making bad decisions would be an error in itself if artificial intelligence is developed that is better equipped than humans to make better humanitarian decisions. To argue that decisions to employ lethal force should always be made by humans is to argue that ISIL's murderous reign of terror is more acceptable than, in another context, the sparing of a non-combatant by a machine whose 'mind' is unfettered by fatigue, fear, hatred or perverted ideology.

The UK's position is that it cannot envisage a point at which machines will be capable of exercising the principle of humanity enshrined in the Laws of Armed Conflict. Even defence companies exploring the potential of autonomy seem at pains to highlight the involvement of human decision making. BAe Systems, whose Taranis project seeks to employ facets of autonomous behaviour, is scrupulously coherent with this principle, emblazoning its Taranis web page with the emboldened statement 'CONTROLLED BY A HUMAN OPERATOR.'[31]

But proponents of a pre-emptive specific ban on LAWS contend that high levels of automation and autonomy materially influence human operators' decisions in any case: in effect, they argue, the information presented by the system railroads the operator into taking a particular course of action. Furthermore, proponents of a bespoke ban argue that, without one, there is a danger of a new arms race, lowering the threshold on the use of force and the dilution of discrimination in its application. There are, of course, many shades of opinion on the subject, but none is as well-defined as the UK's policy. The USA, which is the only state other than the UK to have publicly announced its policy on autonomous and semi-autonomous weapons, has provided some detail on its approach to LAWS, but it is ultimately more ambivalent than the UK regarding its interpretation of weapons: 'Autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force'.[32] Quite what is meant by the intention to 'allow appropriate levels of human judgment' remains unclear, but senior US officials seem much more at ease with the concept that fully autonomous weapons systems will supersede some manned and remotely operated systems. US Secretary of the Navy Ray Mabus recently declared, 'I'm for a full-up penetrating strike fighter…..[UCLASS][33] ought to be the bridge to a full-up strike fighter – an autonomous strike fighter – that [operates] in contested environments.'[34] By 'contested environment', it is reasonable to assume that Secretary Mabus means one in which not only can the opposition be expected to employ kinetic measures to defeat friendly systems, but one that is contested in electromagnetic terms too, i.e. an environment in which the ability to control a system via satellite link (or any other reliant on the electromagnetic spectrum) is disrupted. It might further be inferred, therefore, that human operator intervention would be severely limited, if not negated entirely, under such operational conditions. Hence, autonomy – i.e. self-reliance and the ability to think – would be vital facets of such a system. US Admiral Darrah went further in a recent interview:

> "What we're doing today is deterministic autonomy…it's not autonomous" because boundaries and parameters are pre-set for the aircraft, he said. The admiral said the navy would continue using deterministic autonomy until artificial intelligence is capable of operating within the same rule set as humans… The navy is also studying autonomy as it relates to the system's weapons, the admiral said, including the extent to which a weapon could someday make a targeting determination downrange.[35]

Admiral Darrah's statement indicates that the US is not only contemplating, but planning for, the use of LAWS, despite their apparent incompatibility with International Humanitarian Law – at least as the UK interprets it. According to Sharkey, 'decision making robots… have appeared in all of the US military's roadmaps since 2004.'[36] At least the US is relatively candid about its approach to such systems – other states (including China, Russia and France) are substantially more guarded on their own definitions of LAWS and their interpretations of International Humanitarian Law as applied to automatic and autonomous weapons systems.

From this temporal vantage point, it is uncertain if or when fully autonomous weapons systems will become viable. But let us, for a moment, at least assume that they will become feasible at some future point, either through evolution or revolution in the artificial intelligence and robotics domains. Technical viability will ultimately challenge legality. Any international accord that either confirms that IHL already effectively bans LAWS or introduces a bespoke pre-emptive ban on such systems may deter or delay the development of such systems, but it is unlikely that legislation could be anything more than a speed bump on the road to some form of military employment. Already, it is unclear how most states interpret IHL with respect to LAWS, and it is probable that some would actively pursue such systems as soon as technology facilitates them – the USA seems already to be marching down this path.

Weapons innovation nearly always usurps extant legislation – how, for example, could nuclear weapons ever meet the conditions of proportionality and humanity that IHL enshrines, yet despite this contradiction they continue to form a vital component of several states' military inventories?   Moreover, paradoxically perhaps, nuclear weapons are generally (though not universally) considered to have exerted a positive effect on the relative peacefulness of the post-Second World War era. So, despite their seeming incompatibility with IHL, it may be considered that nuclear weapons have (so far, at least) made a positive contribution to peace and, therefore, have reduced the scale of human suffering through war. Consequently, for many states, despite their potentially apocalyptic consequences, nuclear weapons are considered to be peace-positive. Should technology permit, those states that judge LAWS to offer military advantage are likely to argue that such systems are more capable than humans in exercising the lofty principles of human reasoning and judgement than humans themselves because they would not be susceptible to the deleterious effects of anger, fatigue, fear, greed, hatred and pain to which humans are subject. Should LAWS develop to a point where they are capable of practising the highest levels of judgement and reason, unfettered by human frailties, it might reasonably be argued that they would be better equipped than humans to decide on matters concerning the use of lethal force – and to do so consistently. It should need no reminder that each and every crime against humanity has been committed by a human. Is it not humanity's humanitarian responsibility to make LAWS that are more virtuous than humans themselves?

Given the current limitations of artificial intelligence, humans remain best equipped to decide when to employ lethal force. But we already exist in a hybrid world where humans and machines co-exist, exploiting the synergy between the calculative accuracy of machines with human flexibility to deal with multifarious and unpredictable planning conundrums. High automation and partial autonomy have a place in our lives and professions now – the RAF Voyager incident of 2014 served to highlight the life-saving benefits of high automation in aircraft safety systems when humans get it wrong. But neither technology nor humanity are yet at a point where life-taking decisions can be delegated to machines. Nevertheless, whatever the status of IHL, it will take just a few LAWS genies to be released from their technological,

legal and ethical lanterns to revolutionise warfare. Although commendable, the UK's present position on LAWS looks vulnerable to an unpredictable and innovative future. Whether through technological evolution or revolution, it would be unwise to conclude that international law in any form will ultimately prevent the creation of systems displaying a degree of autonomy that draws into significant question the viability and appropriateness of 'meaningful human involvement' in decisions involving the employment of lethal force. Paradoxically, the machines may ultimately be more humane than humans; given humanity's track record, this does not appear to be an impossible or, indeed, undesirable aspiration. Hence, if or when technology matures to the point where machines can be endowed with the ideals of human virtue and the intelligence to interpret their context and higher intent accurately, it is surely advantageous, from both the perspectives of military advantage and ethics, to allow such machines to make lethal decisions. Therefore, rather than seeking to ban such technology or unilaterally withdraw from the development of such systems, it would be better for states to agree to a humanitarian code to which LAWS should adhere – IHL, which humans have proven lamentably incapable of observing, already provides a suitable framework.

Notes

[1] House of Commons Daily Hansard, "Drones in Conflict," www.parliament.uk, October 13, 2015: Columns 292-293, http://www.publications.parliament.uk/pa/cm201516/cmhansrd/cm151013/debtext/151013-0004.htm#15101371000002.

[2] This article considers the use of LAWS within the framework of combat and the Laws of Armed Conflict. It does not address the separate, but often conflated, debate surrounding the use of drones in targeted killings in states which are neither at war with the prosecuting state nor have given permission for such strikes to take place on their sovereign territory. For further insight into this issue, the author recommends reading: Noel Sharkey, "Saying 'No!' to Lethal Autonomous Targeting," *Journal of Military Ethics* 9:4 (2010): 370-383.

[3] UK Ministry of Defence, "Unmanned aerial systems on show," *UK Ministry of Defence*, last modified December 18, 2013, https://www.gov.uk/government/news/unmanned-aerial-systems-on-show--7.

[4] BBC News, "UK drone fleet to double in fight against IS, says PM," BBC, last modified October 4, 2015, http://www.bbc.co.uk/news/uk-politics-34436917.

[5] David Whetham, "Drones to protect," "Virtuous drones?," *The International Journal of Human Rights*, 19:2 (2015): 199-210.

[6] Caroline Kennedy and James I. Rogers, "Virtuous drones?," *The International Journal of Human Rights*, 19:2 (2015): 211-227.

[7] ibid., 222.

[8] International Humanitarian Law (or the Laws of Armed Conflict) and Rules of Engagement.

[9] British attitudes towards drones are complex and dependent upon the context in which they are used. Opinion polling has shown support of up to 75% for drone strikes that would kill a known terrorist if no innocent civilians killed at the same time. See: YouGov, "'British Attitudes Towards Drones," YouGov, last modified April 3, 2013, https://yougov.co.uk/news/2013/04/03/british-attitudes-drones-and-targeted-killing/.

[10] Ronald C. Arkin, "The Case for Ethical Autonomy in Unmanned Systems," *Journal of Military Ethics* 9 (4) (2010): 332-341.

[11] Doug Bolton, "Stephen Hawking, Noam Chomsky and thousands of others sign open letter calling for a ban on 'killer robots,'" *The Independent*, last modified July 27, 2015, http://www.independent.co.uk/life-style-7-4/stephen-hawking-noam-chomsky-and-thousands-of-others-sign-open-letter-calling-for-a-ban-on-killer-10420169.html.

[12] Ben Goertzel, "Human-level artificial general intelligence and the possibility of a technological singularity. A reaction to Ray Kurzweil's *The Singularity Is Near*, and McDermott's critique of Kurzweil," *Artificial Intelligence* 171 (2007): 1161–1173.

[13] Sharkey, "Saying 'No!' to Lethal Autonomous Targeting," *Journal of Military Ethics* 9:4 (2010): 370.

[14] Arkin, "The Case for Ethical Autonomy in Unmanned Systems."

[15] For Conference purposes, the UN and International Committee of the Red Cross used the following working definition of Autonomous Weapons System: 'Weapons that can independently select and attack targets, i.e. with autonomy in the 'critical functions' of acquiring, tracking, selecting and attacking targets'. (International Committee of the Red Cross, "Report of the ICRC Expert Meeting on 'Autonomous weapon systems,'" May 9, 2014, https://www.icrc.org/eng/assets/files/2014/expert-meeting-autonomous-weapons-icrc-report-2014-05-09.pdf.).

[16] Correct interpretation of 'higher level intent' relies on that intent being clearly and unambiguously expressed. The perils of poorly expressed commander's intent were, for example, infamously illustrated at the Battle of Balaclava when Lords Lucan and Cardigan misinterpreted their Commander Lord Raglan's ambiguous intent, and led the Light Brigade to disaster. Even if LAWS are developed that can match humans' ability to interpret commanders' intent, that interpretation will, to a very large degree, remain reliant on the unambiguous articulation of that intent.

[17] UK MOD Development, Concepts and Doctrine Centre, *JDN 2/11 The UK Approach to Unmanned Aircraft Systems* (UK: MOD, 30 March 2011), 2-3. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/33711/20110505JDN_211_UAS_v2U.pdf (accessed 2 June 2015). The JDN 2/11 definition of an autonomous system is: 'An autonomous system is capable of understanding higher level intent and direction. From this understanding and its perception of its environment, such a system is able to take appropriate action to bring about a desired state. It is capable of deciding a course of action, from a number of alternatives, without depending on human oversight and control, although these may still be present. Although the overall activity of an autonomous unmanned aircraft will be predictable, individual actions may not be.'

[18] Alistair Burt (UK Under Secretary of State for Foreign Affairs), Letter to Kate Allen, Executive Director, Amnesty International UK (June 27, 2013), http://www.una.org.uk/sites/default/files/Killer%20robots%20-%20reply%20from%20FCO%20-%2027%20June%202013.pdf.

[19] Human Rights Watch, "Shaking the Foundations – The Human Rights Implications of Killer Robots," Human Rights Watch (2014), http://www.hrw.org/sites/default/files/reports/arms0514_ForUpload_0.pdf.

[20] The Campaign to Stop Killer Robots comprises: Human Rights Watch; Article 36; Association for Aid and Relief Japan; International Committee for Robot Arms Control; Mines Action Canada; Nobel Women's Initiative; PAX (formerly known as IKV Pax Christi); Pugwash Conferences on Science & World Affairs; and the Women's International League for Peace and Freedom.

[21] Noel Sharkey, "Saying 'No!' to Lethal Autonomous Targeting," *Journal of Military Ethics* 9:4 (2010): 377.

[22] Alistair Burt, Letter to Kate Allen.

[23] Human Rights Watch, "Shaking the Foundations."

[24] International Committee of the Red Cross, "Report of the ICRC Expert Meeting on 'Autonomous weapon systems.'"

[25] Sharkey, "Saying 'No!' to Lethal Autonomous Targeting," 379-80.

[26] ICRAC, "ICRAC closing statement to the 2015 UN CCW Expert Meeting," ICRAC, 17 Apr 15, http://icrac.net/2015/04/icrac-closing-statement-to-the-2015-un-ccw-expert-meeting/.

[27] Alistair Burt, Letter to Kate Allen.

[28] United Nations, *Protocol additional to the Geneva Conventions of 12 August 1949, and relating to the protection of victims of international armed conflicts (Protocol 1)* (New York: United Nations, June 8, 1977), 21. https://treaties.un.org/doc/Publication/UNTS/Volume%201125/volume-1125-I-17512-English.pdf.

[29] United Nations, "The Universal Declaration of Human Rights," United Nations, December 1948, http://www.un.org/en/documents/udhr/index.shtml#a1.

[30] Arkin, "The Case for Ethical Autonomy in Unmanned Systems."

[31] BAE Systems, "TARANIS," BAE Systems, http://www.baesystems.com/en/product/taranis (accessed October 2, 2015).

[32] US Department of Defence, *Department of Defense Directive: Autonomy in Weapon Systems* (Washington DC: Department of Defense, November 21, 2012), 2. http://www.dtic.mil/whs/directives/corres/pdf/300009p.pdf.

[33] Unmanned Carrier-Launched Airborne Surveillance and Strike.

[34] Marina Malenic, "Surveillance or Strike?," *IHS Jane's Defence Weekly* (June 3, 2015): 31.

[35] ibid.

[36] Noel Sharkey, "Saying 'No!' to Lethal Autonomous Targeting," *Journal of Military Ethics* 9:4 (2010): 370.

Viewpoints

Future Mission Training in the Royal Air Force: The Utility of Live, Virtual and Constructive (LVC) Technologies

By Squadron Leader Joe Doyle

Introduction

'We must remember that one man is much the same as another, and that he is best who is trained in the severest school.'

Thucydides, 'History of the Peloponnesian War' (431-404 BC)[1]

Thucydides' statement neatly captures the truism that *training matters*. Indeed, this ancient observation is echoed in the more recent aphorism 'train hard, fight easy'. Training is the very foundation of military capability for all armed forces, and underpins warfighting success. The Royal Air Force has long prioritised excellence in training, pushing its people to their limits in peacetime so that they can achieve decisive outcomes when deployed in support of operations.

However, the environment in which training is conducted is changing. Tactical mission training, once largely the preserve of live flying, is expected to be revolutionised by advances in simulation-based and hybrid training capabilities. Blended live, virtual and constructive (LVC) technologies promise to fundamentally change, and enhance, the Royal Air Force's ability to prepare its personnel for future operations. The implementation of these technologies falls within a broader trend in which the balance between live and synthetic training will shift in favour of the latter.[2] Indeed, the Royal Air Force is already seeing the leading edge of this change, necessitated by ever more complex operational training tasks and decreasing resources. However, *fundamental* change will only be achieved with appropriate investment

and an understanding of the challenges that must be overcome. Ultimately, LVC capabilities should erode the distinction between live and synthetic training and this should in turn free the Royal Air Force to be more effective in what it does, both in terms of outputs achieved and resources expended.

This paper briefly defines LVC technologies and then describes the nascent capabilities that the Royal Air Force already employs on its training aircraft, specifically with reference to the Hawk T2 but also describing the Rear Crew training solution that is provided within the UK Military Flying Training System (MFTS). It then explores how the Royal Air Force will benefit from the extension of these capabilities onto the front line. Here the paper considers just how far the Royal Air Force might take synthetic and hybrid training, including the possibility of transferring experimentation and development activity into the synthetic environment. The paper then highlights some of the challenges that must be overcome if LVC technologies are to be exploited as part of a general increase in synthetic training. Conceptually, there are safety and operational issues to consider. There is also a pressing need for early financial investment and there are linked issues surrounding military-industrial relationships. Finally, a broad culture change will be required in order to realise maximum benefits. Inevitably it will be the Royal Air Force's people, and the way in which they are organised, who will be the key to unlocking future potential.

LVC technologies are defined as those in which synthetic capabilities (for example simulated sensors, and entities such as aircraft and missiles) are integrated into, or combined with, live aircraft systems in order to provide an enriched training experience. These capabilities allow pilots flying live aircraft to 'fire' simulated missiles, or react to synthetically inserted tracks and threat indications that are presented in the cockpit via datalink and warning displays. This synthetic information can either be generated onboard each aircraft, and transmitted via datalinks, or within a ground-based synthetic environment that interacts with live participants in the air. Developments in this latter area might allow mixed formations of simulation-based and live aircraft to fight as coordinated units in a single coherent scenario, maximising the size and complexity of an exercise and providing simultaneous benefit to a larger number of trainees than the use of live aircraft alone would permit.

The Royal Air Force has made some early, and impressive, steps towards embracing the potential of LVC technologies in its current flying training capabilities. The Hawk T2, which provides fast jet pilot training at RAF Valley, contains embedded synthetic training systems that are enabled by a combination of onboard avionics and a datalink facility. This permits a wide range of tactical training events to be undertaken without advanced real systems. For example, the T2 has no radar, but student pilots can complete air intercept training using in-cockpit displays that emulate a typical air-to-air radar scope. Target information is provided by other aircraft that are transmitting location and attitude information via their

underwing instrumentation pods. Student pilots can then 'engage' this synthetic radar track with simulated weapons. In addition, instructors are able to either preload, or reactively insert, ground-based threat systems into the airborne scenario. These threats subsequently 'engage' the student as he enters their range. The aircraft then dynamically generates survival or mission kill feedback based on the pilot's defensive manoeuvres.

Beyond Hawk T2, the current Rear Crew Training solution that is delivered within the UK Military Flying Training System (MFTS) also offers LVC capabilities, this time for the Royal Navy's student Observers who train on the King Air 350 Avenger aircraft. This system allows the onboard manipulation of real surface radar contacts, attaching emitter and sensor signatures to otherwise benign tracks and so creating a training target for students to interact with. The next stage of MFTS Rear Crew Training, which will also train Royal Air Force Weapons System Operators and Electronic Warfare specialists, is intended to further broaden these airborne capabilities. Simulation across the entire electro-magnetic spectrum will allow students to train with electro-optical sensors in addition to augmented radar returns. In effect, the student will see a graphical representation of a combat ship on his displays, with correctly calculated aspect and speed, when the reality might be a simple fishing boat in the Irish Sea. This visual simulation could be extended to include weapons engagement cues and battle damage assessment. There is also potential to establish a link between ground-based simulators and aircraft, thereby allowing larger scale exercises involving multiple trainees.

This will represent an impressive capability; however, it is again limited in its current scope to *training* aircraft. There are only basic precursors of these capabilities among *operational* types. The Royal Air Force, alongside other air forces, must therefore understand the feasibility of extending these LVC technologies onto front-line fleets. This might be achieved by modifying core aircraft avionics and systems or by incorporating podded datalink technologies, with the latter option likely to be more affordable for in-service platforms such as Typhoon. Where future aircraft are expected to possess their own native embedded training capabilities, such as with Lightning II, the question will be how to achieve integration between different aircraft types.

These are questions that are worth answering. True front-line LVC capabilities will erode the live/synthetic distinction and contribute to a fundamentally changed future training paradigm. They will offer qualitative benefits and also minimise resource expenditure on live support assets. For example, live formations will 'fight' virtual threats which: require no maintenance; can be limitless in number; can accurately represent the characteristics of threat types; and which can be directed to behave according to the requirements of a specific mission and training audience. To extend this revised paradigm further, hypothetical future capabilities might blur training and operational outputs. Perhaps a future hybrid system might allow the real-world stimulation of an adversary's air defence systems, whose reactions would then be observed and presented to pilots who are training within a parallel synthetic environment. This could represent the ultimate in mission rehearsal fidelity, inserting near-real time and

demonstrably 'real world' intelligence into a training environment of unprecedented complexity and flexibility.

Beyond training, there is also potential to transfer experimentation into LVC systems as part of a wider increase in the exploitation of synthetics. The repeatable and controllable nature of synthetic entity behaviours and environments will lend itself to tactics development; indeed, it already does as the Royal Air Force seeks to understand how it will employ Lightning II. Entity and sensor models of sufficient fidelity should also allow exploration of weapons performance, along with assessment of other warfare techniques, notably in the electromagnetic spectrum. It should also be possible to trial system performance in a variety of operational contexts, for example incorporating geo-specific data, and trends that are forecast in publications such as DCDC's Future Character of Conflict.[3] The potential benefits of enhanced synthetic and LVC capabilities are therefore not limited to operational training alone; they offer a way in which trial-based understanding of *how* the Royal Air Force should fight will increase alongside competency in established tactics and procedures.

Of course, there are a number of challenges that must be overcome if the full potential of LVC training is to be realised, many of which are relevant to synthetic training more broadly. Conceptually, the Royal Air Force must identify the appropriate limits that should apply when transferring live flying to synthetic and hybrid systems. There are potential safety issues that are not yet fully understood, for example concerning the volume of live training that should be preserved, whether LVC-augmented or otherwise. The US Navy has found that a reduction in live flying below 10 hours per month is seemingly linked to an increase in mishap rates.[4] While this conclusion dates from 2008, and therefore interprets older data that does not reflect the true capabilities of current and future synthetic training systems, this still represents an obvious issue of which the Royal Air Force must be mindful. A linked concern is that LVC systems might over-saturate pilots with synthetic data and this could create dangerous real-world situations, with excessive scenario immersion resulting in a lack of appreciation of airspace or terrain.

There are also potential second-order operational effects that should be considered. For example, an entirely simulation-based operational conversion unit might be able to task its *personnel* in support of a period of operational surge, but it would have no pool of *aircraft* with which it could augment front-line force elements, or provide attrition replacements. Equally, reliance on computer-generated 'red air' assets would reduce the availability of live training support aircraft that might otherwise fulfil secondary operational roles. There is a further need to understand the distinction between what might be technically feasible, and what will actually provide tangible benefits, and meet identified requirements. A hybrid formation of live and simulation-piloted Typhoon aircraft might be technically possible; however, because the live aircraft will continue to suffer from restrictions associated with airspace, security and weather, an entirely synthetic approach might offer a more appropriate training solution.

LVC technologies also pose financial challenges. None of these novel technologies will come for free, and they will take time to understand and implement. There is therefore a pressing need to invest, and to do this early. Synthetic systems are likely to be *cheaper* than live equivalents, but cheaper does not necessarily equate to *cheap*. Even though the USAF estimates that one simulator-based hour of F-16 training can be achieved for one-eighth of the total cost of a live flying hour, this still amounts to $900 per hour per device.[5] Further, while virtual LVC-derived threats should allow significant reductions in expensive real-world fleets of 'aggressor' aircraft and electronic warfare hardware, the LVC systems themselves will need to be purchased, and proven, before real-world savings can be confidently realised. It is therefore likely that the Royal Air Force will need to 'spend to save' in order to maximise long term benefits. This will require difficult choices at a time of continuing operational pressures, but failure to allocate resources to future training systems in the short term will only increase the magnitude of the capability problems that will be faced further downstream.

Resources, however, are finite, and future systems need to be affordable and agile in order to have enduring relevance and maintain pace with continuing technological change, much of which is led from outside the defence sector. The Royal Air Force must not be stymied by legacy procurement processes and assumptions lest it end up with inflexible systems or, worse still, capabilities that are obsolete as they enter service. As a result, integration of commercial off the shelf (COTS) hardware and software solutions will increasingly replace 'traditional' bespoke equipment programmes. This, combined with an overall reduction in live flight hours, might threaten longstanding aerospace commercial models that assume high levels of spares provision and resupply. However, in reality this COTS-focused approach represents a shared challenge; it is up to the military to understand not only what industry can *offer*, but also what industry *needs* in order to thrive and play its own essential role in future innovation. Encouragingly, a number of international companies already promote front-line LVC capabilities at varying levels of maturity and these are largely based on COTS models. This is a keen growth area and all parties need to play their part in achieving mutual success.

The avoidance of bespoke solutions promises affordability and the ability to leverage the very best developments across various industries. However, there is potential that a broad international COTS-focused approach might in fact 'level the playing field', with the technologies that enable novel systems being commonly available to all, friend and foe alike. Such a levelling, or averaging, of underlying technology would need to be offset in other areas if the Royal Air Force is to ensure that its COTS-based solutions are used to better effect than similar systems possessed by competitors Here, the Royal Air Force must emphasise the importance of its people, rather than just its technology. It will be necessary to invest heavily in the conceptual component in order to maintain operational advantage.

The Royal Air Force must not be afraid to change the way in which it educates and employs its brightest personnel. The future conceptual edge will not be found only among officers and airmen who follow a career path that most closely fits the established model. The Service

must therefore recognise and reward a variety of successes, not just the 'traditional' and typical; it should encourage specialisation where appropriate, and knowingly build a cadre of experts in training and simulation. This community must possess a cohort of leaders who are empowered to influence and lead in a fundamental, rather than niche, capacity. Simulation experts must be as influential as their peers who are charged with developing and delivering live training outputs; better still, the Royal Air Force should think of 'training' in its totality, and avoid attributing primacy to either the synthetic or the live domain. Efforts must also be made to prevent skilled people drifting out of the service as they feel compelled to seek other opportunities in the middle years of their career. In summary, the Royal Air Force must identify the right people and manage their careers so that they, and the Service, get the very best from future training and operational capabilities. Technology will enable the future, but only the right people can unlock its true potential.

There are also real opportunities to create beneficial change in how the Royal Air Force organises these people. A new training paradigm will require revised doctrine and organisational structures. For example, a Live and Virtual Training Centre, combining concepts and doctrine experts from the Air Warfare Centre at RAF Waddington with those personnel currently tasked to deliver live and synthetic training, would offer impressive coherence and synergy. This would become a cross-domain centre of training excellence. It would also represent the body that oversees experimentation and the development of tactics and fighting doctrine. Finally, it would more effectively allow the UK to follow and develop initiatives such as the United States Air Force's plans to combine Exercise RED FLAG with its virtual equivalent.[6]

This is an air-centric model but it could easily be expanded into a Joint structure, which would ultimately enable truly Joint and Whole Force experiences based upon mutually beneficial training events. Air, land and maritime assets, comprising both live and virtual formations, could be coordinated and exercised together in order to maximise the scale and complexity of capstone mission rehearsal exercises. None of this will be possible if legacy training stovepipes endure. Again, the Royal Air Force, and wider Defence, will benefit from changed conventions that no longer discuss 'live training' and 'synthetic training' as separate and distinct, but rather talk simply in terms of 'training'.

LVC technologies offer revolutionary training capabilities that will provide the Royal Air Force with real advantage in future conflict. They will enable operationally relevant training, harnessing the best aspects of live and synthetic training even as the overall balance of activity shifts towards the latter. These are technical possibilities, with precursors already in service today, but this is not just a technical debate. These are conceptual issues that must be understood and some significant challenges to overcome. It will be important to distinguish between what *could* be achieved and what will actually be safe, useful and operationally

desirable. This understanding must be matched by tangible financial commitment; effective exploitation of LVC technologies will rely upon early and appropriate investment, 'spending to save' if necessary, and emphasising COTS solutions rather than 'traditional' bespoke models. This latter imperative will likely challenge the existing procurement system and the relationship between the military and industry. In managing these relationships, and exploiting the resulting capabilities, the Royal Air Force will rely most of all upon its people. The conceptual component must be developed, promoting a revised culture that allows novel training systems to thrive in both the air and Joint domains. This will be critical if the Royal Air Force is to redefine the live/synthetic training paradigm and create the 'severest school' that Thucydidean success requires.

Notes

[1] Thucydides, *History of the Peloponnesian War*.

[2] HM Government, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review* (London: HM Stationery Office, 2010), 31. Also Ministry of Defence, *SDSR Study 9.2: Simulation and Training* (RESTRICTED, 25 June 2010).

[3] Ministry of Defence, *Future Character of Conflict* (Swindon: Development, Concepts and Doctrine Centre, 2010).

[4] US Government Accountability Office, 'Navy Training: Observations on the Navy's Use of Live and Simulated Training.' *GAO-12-725R*, 29 June 2012, page 16. Accessed 11 March 15, http://www.gao.gov/assets/600/592056.pdf.

[5] Maj. Gen. James Jones, USAF Assistant Deputy Chief of Staff Operations, Plans and Requirements, quoted in Aaron Mehta, 'Under Budget Pressure, US Air Force Looks to LVC Training.' *Defense News*, 20 May 2014, accessed 11 March 2015. http://www.defensenews.com/article/20140520/TRAINING/305200048/Under-Budget-Pressure-US-Air-Force-Looks-LVC-Training.

[6] Staff Sgt Siuta B. Ika, USAF Air Combat Command, 'LVC Integration Takes Red Flag to Next Level.' 5 March 2015, accessed 15 March 2015, http://www.acc.af.mil/news/story.asp?id=123440862.

Book Reviews

Ghost Fleet: A Novel of the Next World War

By P.W. Singer and August Cole

Reviewed by Wing Commander Keith Dear

Introduction

Peter Singer and August Cole's book is important, thought-provoking and gripping. It should be read by policymakers, military planners, the defence and technology industry, and it will be enjoyed by a far wider audience. Both fictional thriller and deeply researched assessment, in the vein of Hackett's 1978 *The Third World War*, this is the best vision of future war that we have, and it makes for enjoyable, intense, yet uncomfortable reading.

The scope of the tale and the research is vast. Beginning 243 miles above the Earth's surface in the International Space Station, the action descends to 10,590 metres below sea level in the Mariana Trench. The war between China and the US focuses on China's *Third Island Chain* with Hawaii at its centre but touches on counter-piracy, European decline, Russian imperial pretentions, Japanese vulnerabilities, the energy industry and globalised industry. It covers the import of autonomous drones in the air, sea and land environments; there is the to-be-expected import of cyber warfare and space, stealth and directed energy weapons. The criticality of logistics is examined. There are important roles for the private sector and non-state actors; a multi-billionaire entrepreneur's help proves crucial while online-hackers Anonymous feature too. I challenge any reader exposed to the array of technologies and trends not to learn something they didn't know before.

This is also an intensely human story, of hubris and nemesis for both the US and China, of difficult family relationships strained by Service life, of racism and identity, of love, of revenge,

of sex. The human element is present in all the main characters, the XO of the USS Coronado Jamie Simmons, as well as a host of others from Vice Admiral Wang Xiaoqian of the Chinese military junta that has replaced the Communist party, to American insurgents in territory occupied by the Chinese. The human interest reminds us of both the enduring nature of war and of man at his best and worst.

There are three principal operational areas of interest for the Royal Air Force. The first is the importance of drones in all of air power's roles including air-to-air combat, the second is the dangers of being reliant on microchips and electronic components often made in China, the third is the need to be able to operate without access to space-based navigation and command and control systems. All are brilliantly described in a series of gripping air-to-air engagements that should leave those planning for our future capabilities with pause for thought.

Strategically the book indicates just how irrelevant Britain is coming to be for the US as it looks to the future. Britain, weakened and divided when Scotland separates from the Union, is unable to deploy its Anglo-French aircraft carriers due to French objections. Britain's air force, seemingly reliant solely on F35s, is unable to respond due to the same software and hardware vulnerabilities in the aircraft that have so weakened the USAF. One can argue with the analysis of how Britain might respond to a global war in the 20-30 year time frame, but when one hears the authors discuss the book in podcast with *War on the Rocks'* Ryan Evans there can be little doubt that Britain is seen, at least by them, as just another declining and unreliable ally. Contrast this with the centrality and import of British capabilities in Tom Clancy's 1986 vision of future warfare in *Red Storm Rising*.

Singer and Cole are both staples of the Washington security commentariat with serious credentials; Singer's *Wired for War* is the seminal book on robotics and warfare. August Cole's work at the Wall Street Journal as Defence Industry Correspondent and his innovative work at the Atlantic Council make him a highly credible and well-informed analyst. Perhaps the most remarkable thing about their book is how impeccably sourced its storylines are. The extensive footnotes at the back of the book provide a trove of useful sources for anyone seeking to think about the future operating environment. The authors are too wise to put a precise date on the story, but have indicated that the furthest forward they thought they could project current trends is the 2020-2030 period. One can only hope our own planning is as well researched and considered.

There is a broader context behind this. The book's authors express the hope that the book is read only as a work of fiction, not prediction. Our strategic context in the future may be that envisioned by Steven Pinker from his detailed statistical analysis of violent trends: a gradually more peaceful, less violent world, marred by warfare yes, but always with violence on a downward trend. Or it may be that Colin Gray, Lawrence Freedman and Nassim Nicholas Taleb are right: the downward trend means nothing. History is made in the discontinuities. And this is certainly the under-pinning assumption of Singer and Cole's book.

Ghost Fleet, has at its centre, a Naval conflict. Perhaps we might end with our senior Service's motto *Si vis pacem, para bellum*, "if you wish for peace, prepare for war". Such a preparation is mental as much as physical. Ghost Fleet's authors have made a significant contribution in helping us to understand what it is we might be preparing for.

Book Reviews

Jaguar Boys: True Tales from Operators of the Big Cat in Peace and War

By Ian Hall

Reviewed by Dr David Jordan

Introduction

Jaguar Boys is another in Grub Street's growing '…boys' series in which those who flew or maintained particular RAF aircraft types which entered service during the Cold War recount their experiences with and impressions of the aircraft. On one level, these books are intended to be nothing other than brief, entertaining accounts aimed at the enthusiast community and perhaps those who were involved with the aircraft, but as noted in the review of the accompanying volume *Vulcan Boys* in Volume 17 No 2 of *APR*, there is more to this series of books than a simple appeal to 'spotters' and 'WIWO...s' ('When I was on…', often the opening gambit to a recollection by a pilot). If the limitations of the genre are taken into account, then these books provide a useful form of historical record, not least since they offer insights into aircraft capabilities (and limitations) that tend to be overlooked, or over-simplified in many studies of the work of the RAF during the years after 1945. This is particularly true of the Jaguar, which did not enjoy the same degree of publicity as the types it served alongside such as the Harrier, Phantom, Lightning and Tornado. As the aircraft was employed by the RAF for just over thirty years – despite often being cited as the most likely candidate for imminent retirement in numerous defence reviews and spending rounds – this is unfortunate.

The SEPECAT Jaguar was the result of an Anglo-French programme intended to provide both the RAF and Armée de l'Air with a supersonic training aircraft. As time progressed, the cost of operating supersonic trainers, coupled with both air forces' need for new attack aircraft

led to the programme being re-aligned to fulfil this task. Over the course of its service with both the French and British, the Jaguar served in the nuclear strike, offensive support and reconnaissance roles with distinction, although the aircraft's legendary lack of thrust – the source of much banter – did present a number of problems which were never really overcome.

Jaguar Boys concentrates mainly upon the type's use with the RAF, although the recollections of General Bernard Molard, a French exchange pilot at Coltishall in the early 1980s and brief accounts of the Jaguar in Nigeria and Oman are provided. For various reasons, the Nigerian experience of operating the Jaguar is held by most accounts to have been rather fraught - Mike Crook's chapter gives some interesting insights into the challenges of bringing advanced aircraft types into use in developing air forces. Ian Ord's consideration of the Jaguar's service in Oman – the source of some familiar online photographs of extreme low-flying – is both instructive and entertaining. It is, perhaps, something of a pity that there is no accompanying coverage of Ecuadorian, French and Indian use of the aircraft, not least since all three used the aircraft in combat. French Jaguars, despite the lower sophistication of their avionics suite were prominent in operations in Africa and Operation *Daguet* (the French contribution to the 1991 Gulf War). Likewise, the Ecuadorians employed the type in the 1995 Cenepa War, while India – which still operates the type – made notable use of its Jaguars in the Kargil War in 1999.

One of the reasons for these omissions must lie in the amount of activity which the Jaguar undertook in RAF service. It is in this area that *Jaguar Boys* is particularly strong, since the accounts range from those explaining the way in which the aircraft was introduced into service, insights into operational conversion and the way in which Jaguars were used during the Cold War era, particularly in RAF Germany, and on deployments to NATO's northern flank. Again, while these chapters are relatively short and anecdotal, they offer useful insights for anyone studying the way in which the RAF operated during the Cold War and wishing to understand the reality of operational flying during that period.

By the end of the Cold War, it appeared that the Jaguar would not last long in British service. The Tornado had replaced it in RAF Germany, leaving three squadrons at Coltishall clearly vulnerable to the projected 'peace dividend', under which the RAF would begin a process which has seen its combat air reduced by over 75% in less than 20 years - a decline sadly not matched by a reduction in commitments and contingency operations. The first of these new commitments came in 1991, when Jaguars deployed as part of Operation Granby.

Jaguar Boys considers the aircraft's role during the 1991 war, drawing upon the recollections of the vastly experienced Sqn Ldr Dave Bagshaw and then looks at other operations. Air Vice-Marshal Bob Judson covers operations over Bosnia in an informative and pithy manner, also giving some consideration to the Jaguar's commitment to the Iraqi No-Fly Zones. It is a shame that a separate chapter covering the Jaguar's use over Iraq after Operation Granby is not addressed in more detail, since this was an ongoing commitment in which the Jaguar – despite the previously-mentioned problems with a lack of power – did sterling work. Finally, the

book examines the impressively swift and cost-effective upgrading of the Jaguar, bringing self-designation capability for precision guided weapons and improved avionics; while Wing Commander Pete Birch's account is self-contained, it provokes questions about the manner in which upgrades are conducted. The outstanding efficacy of the Jaguar upgrades tends to confirm the view that the processes of equipment upgrading and procurement have not been as agile, innovative or cost-effective as they might be, various efforts at reform notwithstanding.

The end result is another useful book in the series for those studying the RAF's work during the Cold War and beyond. As it was never intended to serve as a detailed academic source for air power scholars, it would be deeply unfair to criticise the book for lacking detailed analysis. It is far better to see it for what it is – an often entertaining account of life in the RAF's Jaguar force, offering some useful snapshots which add to our general knowledge and point towards areas for further academic research. The book's insights, when combined with primary source documentation, should be of considerable utility for those studying British air power. If the work's limitations are accepted, and *Jaguar Boys* taken for what it is, Ian Hall and the contributors should be commended for providing much useful source material and clues for further research for scholars and for an interesting and entertaining book for a wider audience.

Book Reviews

A Short History of the First World War

By Gary Sheffield

Reviewed by Squadron Leader Paul Withers

Introduction

In addition to being a year of commemoration, the centenary of the outbreak of the Great War has provided an opportunity to revisit the origins of the conflict, the way it was fought and its broader impact on the 20th Century. Undoubtedly, many new books will be released between now and 2018, but *A Short History of the First World War* provides an excellent broad overview that, despite its relative brevity, includes a great deal of insightful analysis.

Gary Sheffield is Professor of War Studies at The University of Wolverhampton and has previously worked at The University of Birmingham and the Joint Services Command and Staff College. He is an acknowledged expert on the First World War; having written widely on the subject and is one of a small number of revisionist historians who have helped debunk the popular myths about the conflict. His short history tackles an enormous subject and his stated aim is to give the reader an 'understanding of not only what happened in 1914-18 but how and why' (p.xiii).

Sheffield's analysis is set out in broadly chronological order with significant consideration given to the wider global conflict, expanding the aperture beyond the war fought in the trenches of Flanders and France. He starts with a balanced argument on the causation of the war, analysing the international system and the role of 'nationalism', 'imperialism' and 'militarism' in bringing the world to the brink of conflict. He unpicks a range of arguments, but ultimately

concludes that the blame lay at the door of 'the leaders of two aggressor states,' Austria-Hungary and Germany (p.27).

The bulk of the volume focuses on the conduct of the War itself. He examines how the initial large scale, rapid mobile battle on the Western Front, aimed at achieving a quick and decisive German victory, soon bogged down into the stalemate of trench warfare that was to last for almost the entire war. On the Eastern Front, France's key ally, Russia suffered a massive defeat at the hands of the Germans during the Battle of Tannenburg, whilst during the same period, in the late summer of 1914, the Russians inflicted 300,000 casualties on Austria (p.40-41). This breadth of outlook gives the reader the true context of the war. The losses on the Western Front were horrifically large during the various set piece battles, but study of the broader conflict highlights its enormity beyond North-West Europe. As Sheffield develops his study into 1915, in addition to the Western and Eastern Fronts, he examines the Turkish Front, particularly the Dardenelles Campaign, and looks at some of the lesser known parts of the War in Italy, Serbia and Salonika. He provides an interesting analysis of the general strategy of attrition; whilst the received wisdom is that it was ineffective and profligate, Sheffield reviews the evidence and suggests that in fact 'controlled attrition' is a viable strategy and that 'such attrition was costly in human life but ultimately effective' (p.54).

1916 saw some of the Battles that typify the general understanding of the conflict, Verdun and the Somme, but also the most significant naval battle of the war, Jutland. With more than 250 ships involved, this battle ensured that the German Grand fleet returned to port for the remainder of the war. However, victory came at the cost of the Royal Navy absorbing significantly greater losses in terms of tonnage than the Germans. Sheffield goes on to examine the 'Year of Strain: 1917', including Vimy Ridge, Passchendaele and Ypres and the first large-scale tank battle at Cambrai. He also considers the cumulative effect of trench warfare and the impact of widespread mutinies within the French Army. The examination of the actual conflict concludes with the decisive year of 1918, including the final 100 days where the trench-deadlock was broken after the Battle of Amiens through the Grand Offensive, leading up to the Armistice.

Throughout the book he intersperses the main argument with more detailed examination of topics such as the international system, biographical information on the key commanders, the Revolution in Military Affairs, morale and discipline, and the U-Boat War. Of specific interest to the air power audience, he includes sections on 'The Beginnings of War in the Air', 'The Air War Intensifies' and 'The Air War Away From the Western Front.'

The third part of the book deals with Total War and the broader impact on the societies of the belligerents. Sheffield considers total war to be one where 'all the resources of a state – human, economic and technological – are devoted to waging war' (p.128). Beyond mass mobilisation, he considers the impact of the industrialisation of warfare and the establishment of 'total war economies.' In considering the wider impacts, he examines the implications for Irish Independence and the triggers for the Russian Revolution.

The book ends with an epilogue that firmly establishes the implications of the First World War for the remainder of the century. He challenges the common assumption that the punitive nature of the Versailles Treaty inevitably led to the Second World War, arguing that the world 'economic crisis fatally undermined the Weimar Republic' (p.175). He also considers some of the legacies of the Great War that still shape modern conflict: the Sykes-Picot agreement and the Balfour Declaration.

At a mere 239 pages, Sheffield tackles a massive subject in an extremely readable and engaging style. The fact that it is so wide-ranging inevitably means that it lacks depth in some areas and some aspects of the war necessarily did not make it into the book. However, the 'big hand-small map' approach is more than compensated for by Sheffield's insightful analysis. This book should whet the reader's appetite to study the Great War in more depth. Sheffield offers a section on further reading which reviews some of the best literature on the subject. Of these, I would particularly recommend Sheffield's *Forgotten Victory: The First World War: Myths and Realities* (Headline, 2001). For an excellent study on the Great War's most iconic of Battles, the Somme, read William Philpott's *Bloody Victory: The Sacrifice on the Somme and the Making of the Twentieth Century* (Little, Brown, 2009).

In this short introduction, Sheffield provides the reader with insight into to the global nature of the conflict and examines its prosecution across the land, sea and air domains. For the air power audience, it establishes the context that led to air power emerging as both an independent and integrated form of warfare. It is highly recommended as a primer for those looking for a broad scholarly overview of the conflict, but also acts as a very useful general reference. *A Short History of the First World War* sets a basis for any study of modern warfare in giving the reader an understanding of the transformative effect that the Great War had on the 20th Century and beyond.

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