EUROPEAN DEFENCE FOR THE 21ST CENTURY

It's not the first time in history that the question of stepping up defence capability has arisen for Europe, nor at a time when there are so many other pressing concerns for Governments and society, no spare cash in Treasuries, and so little general interest in the subject without an enemy visibly at the gate. But this is the question most European states must now address, because the relative calm and security of Europe in a world that followed a Western lead since the end of the Cold War is passing.

This is happening just as most armed forces in the region are at their lowest point on a trend of reductions in size, equipment and readiness executed in the relatively benign strategic circumstances of the last 25 years. At the same time, potential opponents have already built a degree of military edge that can keep European forces at bay and strike at our homelands - and this gap is widening.

The purpose of this paper is to set out why defence in Europe is in a debilitated state, that this now matters in the face of new military risks, and to argue that there is a good way forward: the transformation of defence and security through the potential of combinations of Digital Age technologies. This may be hard and complex to do, but we need to get going.

THE JOURNEY TO HERE

Throughout human history the way people fight has changed with new thinking about the the art and science of warfare, often propelled by a combination of fear, bitter experience and new technology. The Second World War is the most vibrant recent example, as nuclear weapons, jet engines, radar, and armoured vehicles all attest. When a country is at war the imperative to out-think and overwhelm the opponent is driven by a sense of existential peril, so constraints on spending are massively reduced and the full attention of a mobilised society drives innovation at pace. This innovation has often then been carried across into civil society and transformed many aspects of how we live and work. This where the internet and GPS came from.

Without this impetus of compelling need, complacency and reductions in resources are usually a feature of 'peacetime'. The institutional inclination amongst most militaries to prepare perfectly for the campaign last fought, the uncertainty about the nature and timing of future conflict, and the general lack of interest by society in its military and its demands for money when not threatened, tend to combine in a pattern of stasis and evolving obsolescence. Armed Forces can then be caught out: they turn up for battle surprised and woefully under-prepared. This 'sharp start' when war breaks out carries great risks of premature failure and can cause a more protracted campaign than might have been necessary. This was a common experience for many armies and navies at the outset of the First World War, despite the clear lessons of the wars fought in the previous 50 years in America, Europe and Asia about how the machine gun, artillery and the aircraft were changing tactics and organisation, some of which could be traced at least as far back as the

battle of Waterloo in 1815. In 1939, some had paid attention to the lessons of how WW1 had ended, others had not.

These general lessons from history matter today as we have to come to terms with a world that is changing markedly from the comfortable patterns established in the 25 years since the Cold War ended, and in many cases since the end of the Second World War. US ascendancy is declining in the face of the resurrection of China and the more multipolar world of the 'Asian century'. The seeds of potential serious, existential conflict are implicit in inter-state confrontation over borders, resources, migration, and faith. The effects of climate change, population growth, urbanisation and the uneven distribution of the riches of globalisation may lead to profound unrest. Nuclear weapons continue to proliferate. It is most unlikely that the relative absence of major armed confrontation between states seen in recent times is *guaranteed* to be repeated in the next quarter-century.

In facing up to this new world, all European states need to work out how to reset their armed forces for the potential of conflict arising that is unavoidable, necessary and fought with weapons and methods that are very different from the major wars of the 20th century. In general terms, major war in the 20th century was largely focused on mobilising society to create the combat power needed to invade and occupy territory – or defeat that. This model still applies in many parts of the world today, but there is growing reliance on 21st century-style confrontation and conflict. This aims to deliver decisive influence from long range to break the will of the opponent without invasion. Cyber war, new generations of conventional precision ballistic and cruise missiles (including hypersonic), advanced air power, much improved integrated air and missile defence, and all the potential for disruption from full-spectrum information activity (including social and state media), make invasion and occupation not the only or best route to operational and strategic success.

Yet without the impetus of a vicious enemy actually at the gate, the ability to rise to this challenge and modernise European defence seems to be dangerously marginal. The inertia can partly be ascribed to the combined effects of the diminishing priority of defence through iterative rounds of reductions and demobilisation by NATO states since the end of the Cold War. The reluctance to countenance military intervention in the wake of the bad taste left by the campaigns in Iraq and Afghanistan, and the steep fiscal pressures that have endured since 2008 weigh heavily. They all amplify the lack of societal and therefore political interest in restoring conventional defence when the risks today seem so remote and the changes potentially contentious and expensive.

There are other deeper issues in play. First, today's political leaders generally have no personal experience of war in the raw, they have no sense of what it is like to govern a nation faced by threats to its existence beyond the rather specific and (to date) limited risks from terrorism rooted in violent religious extremism. Ministers are naturally preoccupied by substantial concerns around sustaining health, education, infrastructure and social protection, all of which are firmly in the voter's eye, and fixed by managing their daily diet of populism, migration, and Brexit. Today's political leaders in Western Europe have mostly only experienced 'discretionary' conflict, those interventions abroad (the Balkans, Iraq, Afghanistan and Libya are examples) in which the homeland is not at risk, neither society nor even the reserves are subject to general mobilisation, and the intervention is strictly

limited by geography, scale, costs (blood and treasure) and rules of engagement. The opposition has also been relatively weak in military power: the Taliban does not compete to control the air or the sea, has no air force, no precision missiles, no artillery at scale, and no electronic warfare capability. Where that balance is clearly different, such as contesting a Russian and Iranian backed Syrian regime, the rules of the game are different and caution has dominated. The problem is that historically political leaders must be capable of leading in war in its most feral, modern forms. Although Europe may have felt 'post-conflict' since 1990, that is not the experience of much of the world upon which Europe relies, and it does not reflect the risks inherent in the views and ambitions of powerful international actors at work today. There is no guarantee or script in world affairs: war can choose Europe in the future no matter how hard we stare disconsolately into our lattes.

The second issue is to acknowledge the effects of the continual process of change in defence method and technology. In the case of Russia and China this has been thoughtfully prosecuted over the past 20 years to avoid perceived Western military strengths and to exploit weaknesses. It has led to a position of developing comparative disadvantage today in some capabilities (especially conventional missiles) for Europe. Other capabilities, such as the manipulation of social media content, reflect an uneven playing field: some states can create and exploit rumour and 'fake news' unconstrained by the laws and values that bind others to promote objective truth and honesty. It is absolutely clear that if Europe mobilised its resources to fight it would overwhelm most adversaries and very substantially deter anybody else, but the point now is that the present state of European military demobilisation and obsolescence means that clearly comparatively weaker states – like Russia – have already acquired a military advantage by building different capability and holding it at higher readiness. There is a frisson of Pearl Harbour about this.

With no great sense of necessity, urgency, or will to face up to this gap, or even talk about it, the uncomfortable and deepening truth is that we are already in an inflection process that is placing European homelands and vital interests abroad at potential military risks that the Armed Forces in their current size and form cannot satisfactorily deal with. Despite all its inconveniences and unattractiveness, it is the standing responsibility of European governments to provide for deterrence, defence and security. Yet although Europe sees the reduced state of its collective armed forces capability, it is now more nervous about the robustness of the US security guarantee that underpins NATO's Article V, and can see the potential for real harm in a difficult relationship with Russia, it still limits its responses to summit signals and tokens of conventional deployments such as the Enhanced Forward Presence scheme. Defence spending is only rising very marginally, enough to sustain a lot of what already exists, but not enough to change the balance.

This dichotomy is not new, it is a perennially difficult choice for government and society when the horizon darkens: either recognise the risks now and make the hard choices to resource the changes needed to restore appropriate defence and security, or continue to deny or ignore the problem and trust to a combination of luck, prayer, the benign intent and actions of potential opponents, and trust in the ability to recover from the ashes of a crisis.

THE JOURNEY AHEAD

The opportunity does exist to restore European defence and security in the way that meets the risks and challenges of the 21st century at an affordable price. It will also help to build influence and interoperability with allies, and offers major prizes for the economies of those states that set the pace in leading defence transformation for the digital age.

Transformation is a much overused word, but in this case that is exactly what is it stake. For the way that new technology, with the new method and organisation that is unlocked by it, is profoundly disrupting almost all aspects of our industry, agriculture, commerce, financial services, transport, government, and recreation etc, will have just as stupendous an effect on how armed forces are organised, equipped, supported, trained, lead and employed. Not long ago it was possible to assert that this would occur in general terms. Now, the first signs of this happening are evident, though generally piecemeal, small in scale and mostly as accessories to a standard conventional force. We should now demand to see a top-to-bottom conceptual redesign of how of defence and security are delivered through well considered and connected combinations of digital age technologies. Proceeding from this over-arching design, we would then expect to see how particular areas of capability are advanced as a priority to ensure that the sum of a digital age joint force is considerably greater than even its most innovative constituent parts.

We should be ambitious and open-minded about the spectrum of technologies to be employed. We should recognise that some individual technologies, big data for example, will play a core part, but the greatest wins in efficiency and effectiveness are in clever combinations. How we bring together data, processing power, the connectivity of the Internet of Things, the potential of artificial intelligence, robotics, unmanned and autonomous capability, new materials, hypersonics, directed energy, synthetic biology, biosciences, and leaps such as quantum computing will determine who wins the prizes. And in confrontation and conflict there are few prizes for effort or coming in second.

We know how hard most military organisations are to change without the stimulus of a major defeat or politically led demand for reform. The US Army after Vietnam completely overhauled itself to the condition that so spectacularly engaged in the 1991 Gulf War. The British Army after the tribulations of the Boer War needed firm treatment from outside by Lord Esher. For as long as armed forces exist as hierarchical, highly disciplined and generally institutionally isolated organisations they will be extraordinarily difficult to shake up. They retain a deep and abiding ‘sense of self’, grounded in a long and sometimes distinguished mythology and martial history.

Today this tends to mean entrenched assumptions about what a navy, army and air force should look like built around iconic equipment, causing the first response to new technology to be to try to mould it to existing, preconceived methods. The next piece of equipment is usually only envisaged as a more capable and certainly expensive evolutionary successor to the present inventory, with radical change (such as ending manned cockpits) shoved off to the next leader’s watch. Where particular forms of organisation, such as corps and regiments, have existed and accrued enormous personal devotion over centuries, they can become an objective in themselves – where survival in the current form trumps

considerations about what is really needed. Nothing lasts forever in our world, but some military organisations seem to defy that. We will never transform defence for the 21st century without breaking apart treasured organisations, but we will never make the best use of resources and hone a competitive combat edge unless we do.

In transformation of defence and security in this century we will find – unlike in World War II – that the greatest understanding of technology sits in the civil sector, led by experts who have no thought for defence and indeed may sometimes be allergic to it. Armed Forces like technology to give them a vital edge, but are not fully abreast of the technological potential that exists elsewhere. Between technology and the military are governments that would prefer not to have to think about defence much, and electorates far more interested in the many other things that they expect their government to do for them. So we will have to find a way of bringing all these parties into a single conversation and it will take some effort.

Fortunately, a much clearer sense of what armed Forces for the digital age will look like is appearing. Most of the effort to date has been in specific aspects of capability, proceeding in a bottom-up process of augmentation and aggregation around a conventional navy, army and air force. These need to be rapidly engineered into a coherent top-down strategic force concept so that future moves are coherent with a well-designed joint force ab initio. The present situation reflects how in many countries the most powerful thinking about military capability resides within the individual services more than in the Ministry of Defence. So digital age transformation will be the next chapter in the evolution or otherwise of a primarily joint approach to creating military forces and how this does or does not triumph over resilient 'single service' aspirations.

The logic, however, is clear. The more a force is designed top down as a joint entity, the more this is likely to be done on the basis of thinking about the military problem to be solved or the effects to be achieved rather than the platforms to be replaced. The more the potential of digital technology is not constrained by emotionally-driven perpetuation of analogue organisation and process, the greater will be the fighting effectiveness of the force, the lack of duplication in enabling capabilities, and the efficiency wins in the economies of scale and seamless process. Governments should insist on this, but they will need to lead and resource the discussion to be able to do so.

In designing this joint-led defence capability (capability as: manpower, equipment, training and support) for the 21st century there is more to accommodate than just technology and the way the global balance of power is shifting.

> First, this must be capability that is not hung up on the traditional divide of peace and war: states and non-state actors exist in a dynamic set of complex relationships spanning cooperation, competition, confrontation and conflict. It is also entirely possible for a country to be in confrontation with, say, Russia as a result of its annexation of Crimea yet also cooperate on other issues – including playing in the 2018 FIFA World Cup. So capability must be flexible and calibrated well enough to be useful across a widely diverging range of situations and relationships. The bottom line, however, will always be the need to defend the homeland and to be able to fight in the world for vital interests such as physical, food and energy security.

Second, the use of military force comes in many forms. This is sometimes lost in the quest for the certainty of a particular template by any one generation, and sometimes amplified by misplaced faith in the all-conquering power of a new weapon. In the 20th century some held that the aircraft that would render all other capability unnecessary, and in the early 21st century the same claim – equally misguided – has been made about cyber warfare. History also shows that the nature of military operations comes and goes: modern armed forces must identify the real need and not be tempted to shoehorn every situation into looking like the nail that suits the hammer they happen to have perfected. This spectrum of demand runs from - for example - deterrence (nuclear and conventional, intertwined), to peace support, peace keeping, peace enforcement, counter-terrorism, counter-insurgency, limited intervention, all-out conventional war, and nuclear war. Any given situation will often have a changing mix of concurrent demands ('3 Block War') that requires an equally complex response.

Third, confrontation and conflict require a lot more than the application of physical or kinetic force. States reach for all the levers of power available to them: politics, diplomacy, money, commerce, culture, media and of course armed force. In many cases today military force is a supporting act to *confrontation* led by intelligence, cyber, soft-power and sanctions. So transformation must be on a 'full-spectrum effects' approach, by which all the levers are connected. This includes the private as well as public sector, which most democracies struggle to do. There is no great influence value in Europe cutting EU10m in state aid to a problem country if the banks and industries continue with millions in trade.

The UK's 'Fusion Doctrine' speaks to this, even if the means to deliver it are far from in place. At the heart of 'full-spectrum effects' in confrontation and conflict is the integration of all forms of the *military* capability available to a joint force (a difficult enough challenge, especially in a large coalition) with all the power of primarily *civil* means: cyber warfare and the full set of information warfare tools, TV and print media, social media, talking-heads, agents. In some settings the battle to disrupt and batter the will of an opponent may be led by the media and social media 'arm' of government, but in others these will be the supporting cast conforming to military design and leadership. Common to all (successful) outcomes is that someone must be in overall charge of this effort, able to dictate the direction, set priorities and flex resources across government. This comes more easily to monolithic states with a very powerful executive leader, and less so to democracies that tend to rely on cooperation between strong and independently powerful ministries and agencies. But in a tough fight the limits of democratic 'collegiate campaigning' in matching the potential for tempo and ruthlessness of an autocracy will quickly and disappointingly become apparent.

Fourth, we are long past the point where even the military aspects of confrontation and conflict are the exclusive preserve of people in uniform. The idea of civil control of the military is well established in Europe, as is the precedent that big wars are actually won by civilians once society is mobilised to rise to the occasion and gather

all the talent and mass required to win. What is becoming clearer in this century is that the military does not have, and will not attract, the span of talents it needs to win even the fight. It will have what it needs for its core kinetic business at sea, on land, and in the air, but it will not have in uniform all the intelligence capacity, data scientists, cyber expertise, civil engineering skill, media skills, social media expertise, space capability and industrial knowledge that it also needs. And it also true that as volunteer uniformed manpower is relatively expensive, an intelligent choice is required about how to blend regular, reserve, civil servant, contractor and now robot 'manpower'. This 'Whole Force Approach' is a key element in decisions about the best organisational and process solutions that will exploit the transformational power of combinations of Digital Age technology. It is absolutely not a simple question of accessorising long-standing conventional forms of military organisation with new kit.

Fifth, and back to technology, it is essential to emphasise again from the long sweep of history that nothing lasts forever in the way military technology develops. The bow and arrow triumphed at Crecy in 1346, but would have been laughable at the battle of Waterloo in 1815 in the face of musket and cannon. And the infantry squares at Waterloo would be hopeless against the artillery, machine guns and rifles of 1914, just as the aircraft and the tank killed forces confined to movement on foot in 1939. It should be obvious that the digital age will now bring forward capability that beats the big bets of the period from the Second World War to today.

This process occurs over quite a lengthy period, unless impelled by the force of dramatic events, and as noted above it is usually resisted in some way by the experts in the capability being eclipsed. So we see today that where digital technology has already taken us will continue to define the future. The large platforms that dominated war for 50 years - the aircraft carrier, the manned fighter jet, manned surface warships, massed armoured manoeuvre, and massed area (ie not precision) fires - are in the process of being neutered by the advent of a space-dominated transparent battlespace, very long range precision fires (conventional ballistic and cruise missiles, especially hypersonic), electronic warfare including cyber, and the proliferation of unmanned small platforms in all domains. In step with this, the developing imperative is to focus on fighting in complex, densely populated urban terrain and against hard-to-identify proxies in place of neatly uniformed conventional troops. Conventional forces best suited to battling a peer in large open spaces are going to be poor performers unless they adapt. Recent examples of 'liberation by destruction' in Syria illustrate how hard this is, but the imperative to operate differently to be effective cannot just be ignored.

Sixth, it is neither possible nor desirable to try to just abandon all the capability that exists now in the current 'order of battle' on the grounds that what is coming will quickly and immediately supplant it. It is impossible for politicians to argue for this, for armed forces to go 'offline' entirely as they transform, for industry to accommodate such a radical transition, or for taxpayers to meet the likely spike in costs. So a way has to be found of altering the development and employment of what is already in service and committed in the future programme to provide as

rapid a step as possible to the new order. This will also allow for essential experimentation to occur.

So, for example, the new UK aircraft carriers should not any longer have any expectation of going within range (at least 1,500km) of an opponent's carrier-killing ballistic and cruise missiles, but they will be superb platforms for launching and controlling a future manned, unmanned and autonomous air package, perfect platforms for special forces strike operations, and key assets in challenging humanitarian evacuation and relief. Similarly, the UK's T45 destroyer is capable of stepping up to being a key part of an integrated air and missile defence system if updated to deal with emerging ballistic and cruise weapons, and augmented at sea and on shore by unmanned and autonomous platforms carrying more missiles and sensors. The plan for transition by adoption and augmentation in this way is just as important as the plan for the long term shape of modern armed forces.

SOME PRINCIPLES

To guide the design of defence and security capability for the digital age, and to bring together the ministers, officials, armed forces, tech industry, defence industry and academics who will be needed for the debate to flourish to the full extent, it will be helpful to adopt some common principles.

A Military Transformation led by Civil Technology. The first principle is that most of the answers will be found in the adoption or adaptation of technology that either already exists or will exist through innovation in civil society, including large and small companies and in universities. This is where thought leadership in data, AI, robotics, and autonomy exists. Armed forces will reach out to explain the effect required and to understand the potential open to them. There is no affordable or competitive exclusively military route except in a few specialist areas, and a great deal to be achieved by adoption of technology without massive bespoke changes.

Transformation not Evolution. The real winners will be those able to conceive, design and implement transformative change to create true operational advantage in a highly competitive environment. Taking shelter in more comfortable evolution may be necessary in some cases, but it will usually mean being out-paced by opponents if adopted more broadly. Boldness is required.

Joint and Combined by Design. This transformation must be the definitive break point with how armed forces were once built by the fortuitous aggregation of what individual, national navies, armies and air forces choose to offer. Armed forces for the digital age must be designed top-down as coherent joint forces, and in the case of European armed forces, also designed ab initio to be fully interoperable with allies and partners across government. This will ensure maximum synergy, efficiency and effectiveness. Individual services are foremost trade unions.

Effects Before Platforms. The analysis must start with what *effect* is required and not with how conventional platforms or organisations can be augmented or

enhanced. Much of the current inventory will have a transitory role, but technology will drive very different organisational and process outcomes.

A Process not an Event, including for Acquisition. The transformation will not be a single cycle or event, capability will not stand still or change in single, big whole fleet evolutions. It will be essential to mirror the scale and pace of technological change in the way that military capability and method changes. This will change acquisition and support organisation and process as significantly as military capability itself.

Control of the Electromagnetic Spectrum before Land, Sea and Air. Traditional military operations have generally focused on the imperative to create freedom of action on land, at sea, and in the air. This will clearly remain important, but as military capability increasingly relies on combinations of digital age technology, maintaining sufficient access and control of the electromagnetic spectrum will become pre-eminent. Commanders must be able to communicate, connect to surveillance and reconnaissance, distribute data, acquire targets, employ precision weapons, and do many other things that will not be possible if this spectrum is denied to them. This will require new military doctrine and process.

Cyber Protection. Although cyber defence and offence are already a familiar part of the military lexicon, in the future cyber protection will be a core and standing part of how capability is designed and employed. This is more than protection of networks and data, it extends to organisation, processes, and perhaps above all culture. Cyber protection cannot be a capability afterthought or accessory.

Autonomy is an Opportunity not a Demon. There is legitimate concern about the potential for lethal autonomous weapon systems to kill people without any human intervention. This should not mean that all forms of autonomy are rejected, for example defensive close-in air defence guns will operate autonomously if set to do so – and if not used in this way will fail to protect their owners. How autonomy improves operational outcomes and reduces human risk is important ground to cover. Other powers in the world with different values and interests will not feel similarly constrained, so western forces must anyway be prepared to counter unfettered lethal autonomous weapon systems in the future.

THE EMERGING DESIGN

All these factors need to be considered when designing armed forces for the 21st century around combinations of digital age technology. Nonetheless, it is now possible to sketch out the general direction of travel and to identify the most promising areas to develop first. Dangers exist in trying to break apart what must first of all be a coherent and synergistic grand design, but there are perhaps five key pillars that it makes sense to identify.

First, how intelligence, surveillance, reconnaissance (ISR), and target acquisition will be built around data, processing power, connectivity, and artificial intelligence.

Second, how command and control will be transformed by data, processing power, connectivity, and artificial intelligence, changing organisation and process in the most radical way for well over 100 years.

Third, how combat, combat support, and combat service support capability will switch from the current design based on mixing people and equipment to a profoundly different manned, unmanned, and autonomous team at sea, on land, in the air, in space, and in cyberspace. This will draw on data, processing power, connectivity, artificial intelligence, robotics, and advances in how unmanned autonomous capability is employed in all aspects of life.

Fourth, how the combination of transformed ISR, command and control, and manned/ unmanned/autonomous teaming is linked seamlessly to other government departments and to industrial supply chains as part of exploiting the potential of a whole force mix.

Fifth, how the adoption of very large-scale single synthetic environments will transform not just training but also planning, concept and force development, command and control including decision support, mission rehearsal, and support to operations.

INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE, AND TARGET ACQUISITION

Military intelligence has traditionally focused on collecting information from communications, images, and people. This often secret collection process is fused with what can be gleaned from military operations and open sources by analysts sometimes steeped in expertise in a given area. This builds a developing sense of 'situational understanding' over time and answers the specific questions commanders may have. It has relied on a hierarchy of often large organisations, some in fixed locations at home and some deployed to operational theatres.

The new model will have large sets of unstructured open source big data at its core, collected, fused and analysed in the first instance by artificial intelligence. By connecting to a very much larger set of sources, many operating in real-time, and focusing the human effort on the creative and thoughtful aspects of intelligence work, it will be possible to paint a much more detailed and accurate picture of the current situation. It will enable different choices about what can be done in protected, static locations and what can only be done by deploying forward in harm's way. It will require many fewer yet equally talented people. It will diminish the centrality of traditional closed secret sources of collection, but these will still add essential insight and assurance. Using artificial intelligence, the distribution of intelligence product will be done more expeditiously. Overall, this new system will create intelligence organisations that operate less like libraries or think tanks, and more like news rooms pushing the latest information to all its customers.

Collection will see layers of assets from space, manned and unmanned air platforms, surface sensors at sea and on land, and subsurface collection. These will combine with the greater

array of open source collection. Because they are connected, data from a sensor can flow to a number of users simultaneously and the appropriate mix of collection assets can be flexed in an agile way to the points of greatest need. If necessary a sensor, a weapon system, and a commander can be linked directly at almost any point on the globe.

Overall, such a system will allow military commanders to understand the problem better, decide faster and more accurately, and act with greater confidence and precision. This will be vital in the competitive, reciprocal business of confrontation and conflict.

COMMAND AND CONTROL

Today's system of military command and control is based on a 'command and staff' model that can be traced at least as far back as late 18th century Austria. It owes much to 19thcentury Prussia and the formative experience of two world wars. Generally built around nine functional pillars, today there are layers of headquarters stretching from strategic level, through the operational level of command, and down to tactical level headquarters commanding very small numbers. Within a big headquarters there is a rank-based hierarchy connected by networked information systems and wedded almost beyond imagination to PowerPoint.

It is already evident in many industrial and commercial undertakings just how data, processing power and connectivity strip away layers of management. Jobs that require the basic collection, fusion and distribution of information will increasingly be done by machines. Equally, so will much of the current skilled professional work that requires drawing on a repository of professional expertise. The military system of command and control will be transformed in the same way. There will be fewer headquarters, at least half as many, and those that remain should require at least half the number of people that they presently demand. It will be possible to have far fewer people in harm's way, employing the reach-back enabled by connectivity. As the potential of the technology is harnessed these new headquarters will be significantly more effective than the current state.

The effect will be military headquarters that know more, decide better and faster, plan more efficiently, issue and adjust clearer direction, monitor the conduct of operations and logistics faster and more comprehensively, connect to superior and subordinate headquarters better, and cooperate more closely with partners and allies.

MANNED, UNMANNED & AUTONOMOUS TEAMS

In the current paradigm, military power is usually defined in terms of the numbers of people and the amount of key equipment. In the near future armed forces will operate as a mix of manned, unmanned and autonomous capability. This will also exploit the advances in separating complex weapons and sensors from reliance on complex and expensive platforms. Missiles today can come in a box that can be bolted to almost any platform and networked to a control system. It will not be necessary to spend £1 billion on a ship just to get a radar and air defence missiles into the right place in the world.

This manned/unmanned/autonomous mix will be adjusted according to the needs of a particular situation, but there are major advantages to be played for. First, one of the primary drivers of the expense of regular volunteer forces is the cost of manpower. As machines do not require recruiting, training, housing, hospitals, leave, pay or pensions, where they replace people there is the potential for major and enduring savings. Machines may make forces smaller and yet more effective as they do not require as much rotation in and out of operations and can be made less susceptible to the depredations of terrain and climate. Machines will take people, predominantly young people, more out of harm's way – although there is a risk this may make recourse to the use of force more likely. So in the future the present tank troop of four tanks each with four people inside may exist as perhaps one tank that is manned and three others that are either unmanned (controlled by people elsewhere) or more likely autonomous in some way that allows them to support and conform to the manned platform. The same will apply in the less complex maritime, air and space environments.

As noted above, the challenge of managing autonomy will have to be met, especially lethal autonomy, just as the problem of driverless cars will have to be met by civil society. It will be important to think about how the manned/unmanned/autonomous mix is aligned with a whole force approach. There may be many aspects of future capability which can be put in place and maintained by contractors, where the only uniformed requirement arises when it is used. This might apply, for example, in the establishment of future integrated air defence systems.

Overall, the new mix will provide for a bigger and far more effective force for a set sum of money than is the case today, or for a cheaper more effective force of the same size. These forces will be more resilient, less easy to detect, more lethal, and more flexible – and more affordable. As a proposition that makes defence more effective and more efficient, its appeal should be as strong for taxpayers, ministers and treasuries as for military leaders.

SEAMLESS INTEGRATION

A less glamorous, but just vital aspect of military transformation is how a joint force is integrated with other parts of government, allies, and the industrial base that supports it. At the core of this requirement will be the ability to communicate and exchange data so that what is needed in the fight is known and acted upon even in the furthest depths of homeland industrial capacity. Similarly, seamless connectivity will meet the requirements for civil control of the military and for close cooperation across government and with allies. This is partly to optimise the effectiveness of military force itself, but also to underpin the place of the military in full spectrum effects, where primacy may sit elsewhere in government. The transformation of military capability will be substantially enhanced by the way it is supported and integrated into all the levers of power engaged in contemporary confrontation and conflict.

A SINGLE SYNTHETIC ENVIRONMENT

The development of simulation to support training and operational analysis has been a story of the bottom-up aggregation of various devices, some for training on individual platforms

and some for exercising commanders and staff. Today, it is increasingly possible for aircraft simulators located in different countries to fly together in the same simulation, and for headquarters separated geographically to engage in this same staff training. But to date, although things are improving, most aircraft, maritime, and land platforms do not easily link together, certainly not with the array of command and staff simulators.

The future will be dramatically different. Drawing on expertise from the global gaming industry and maximising the power of data, processing power, and connectivity, it is now possible to build a very large-scale single synthetic environment in which 100,000 users can operate together. The degree of detail and complexity in replicating the operating environment is such that it provides a very accurate picture of the operating environment anywhere in the world. Where this is connected in real time to relevant sources of data it means that the force that is participating in the simulation is looking at what is actually happening. A synthetic environment of this type, connected to applications that enable military force in all its dimensions to come together will be used for much more than training. The fidelity of detail and the quality and range of visualisation options will make it a primary means of exercising command and control. It will certainly be used for the conceptual development and training of the manned/unmanned/autonomous force mix, as it will not be practical or necessary to run out this capability for training and experimentation in the real world.

Overall, the use of a single synthetic environment as an underpinning enabler to all the other aspects defence transformation for the digital age will be a pivotal capability in how forces are conceived, designed, commanded and operated.

SUMMARY

This paper has argued that we can easily understand why European armed forces are in their current weak condition. We understand why this is so, and we accept it didn't really matter for a long time. Yet we also see how the world is changing and how this may well present unacceptable new military risks to Europe in a future that looks much more uncertain and challenging than the past generation. So no matter how much we might wish it was otherwise, if we think our future defence and security is heading for unacceptable jeopardy, we can either choose to do something about it, or just trust to luck, prayer and global good will. In a new era of constant confrontation and potential conflict with very high stakes, restoring defence and security also means bringing together all the levers of power available to a state and its allies. The way forward for military power is through the transformation offered by combinations of digital age technologies to build a new joint force by design, top-down. This will be a hard, enduring process, but whoever does this first and best will not only restore their security, but also influence their allies and find economic and commercial benefit. These are the prizes. There are none for those who watch this happen and relegate themselves to the status of potential victims-in-waiting. The race has started.

General Sir Richard Barrons

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