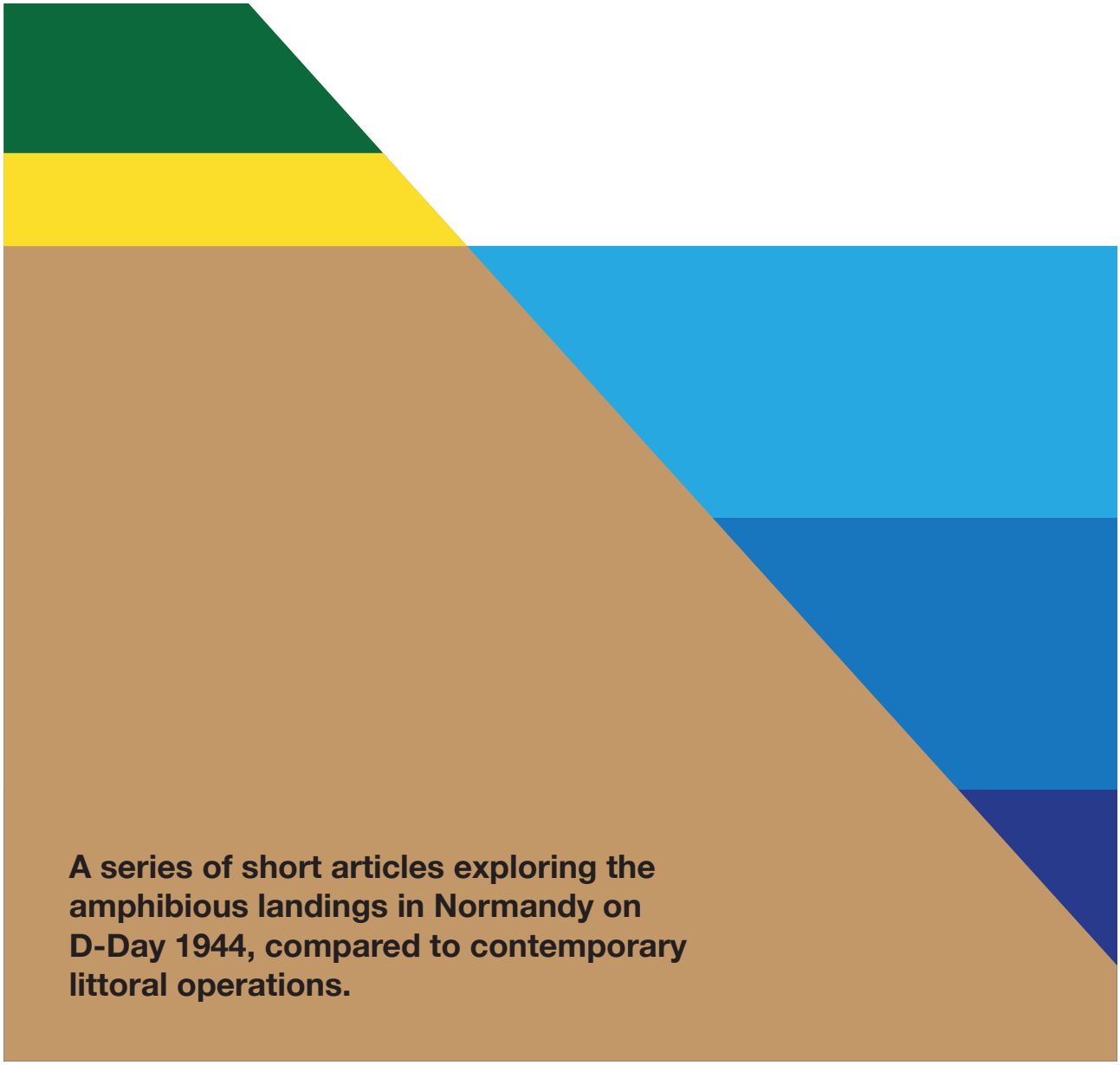
Contested Shores

Littoral Warfare from D-Day to Today



A series of short articles exploring the amphibious landings in Normandy on D-Day 1944, compared to contemporary littoral operations.

Foreword

Over eighty years after Allied forces landed on the beaches of Normandy, the lessons of D-Day continue to resonate. The UK has a long and distinguished maritime heritage, and the experiences of those who served before us continue to shape how modern forces prepare for and operate within the littoral environment. Their example remains a reminder of the professionalism, ingenuity and resolve required in these complex settings.

For a UK company like SubSea Craft, there is both pride and a feeling of responsibility in reflecting on this history. This is why we produced this paper, a piece of work enriched by the perspective of those who authored it: former service personnel who now contribute their operational experience to SubSea Craft in support of our customers.

The challenges may have evolved, but the principles endure, and so must our commitment to supporting the people who operate at the sharpest edge of the maritime environment.

Dame Penny Mordaunt

PART–1

PREVAILING GEO-STRATEGIC ENVIRONMENT

"Those that fail to learn from history are doomed to repeat it"
Winston Churchill

6 June 1944 represented a turning point in a global conflict of epic proportions, establishing the conditions by which, in one of 3 key theatres, one group of protagonists would prevail against another. Of those three theatres, two featured decisive operations which were fundamentally joint (involving elements across the key domains – sea, land, air) and which involved multiple large scale amphibious operations.

Prevailing Geo-Strategic Environment

D-Day 6 June 1944.

Operation Overlord was a military assault conducted by Allied forces in June 1944 that involved landing over 160,000 men and their equipment on the Northwest Coast of France. The purpose of Overlord was the creation of a lodgement or bridgehead on the European landmass from which operations could be conducted to defeat the Germans. The landings represented a turning point in the Second World War, bringing to bear the full weight of the Allied forces, backed by the industrial heft of the United States.

Comparison with today

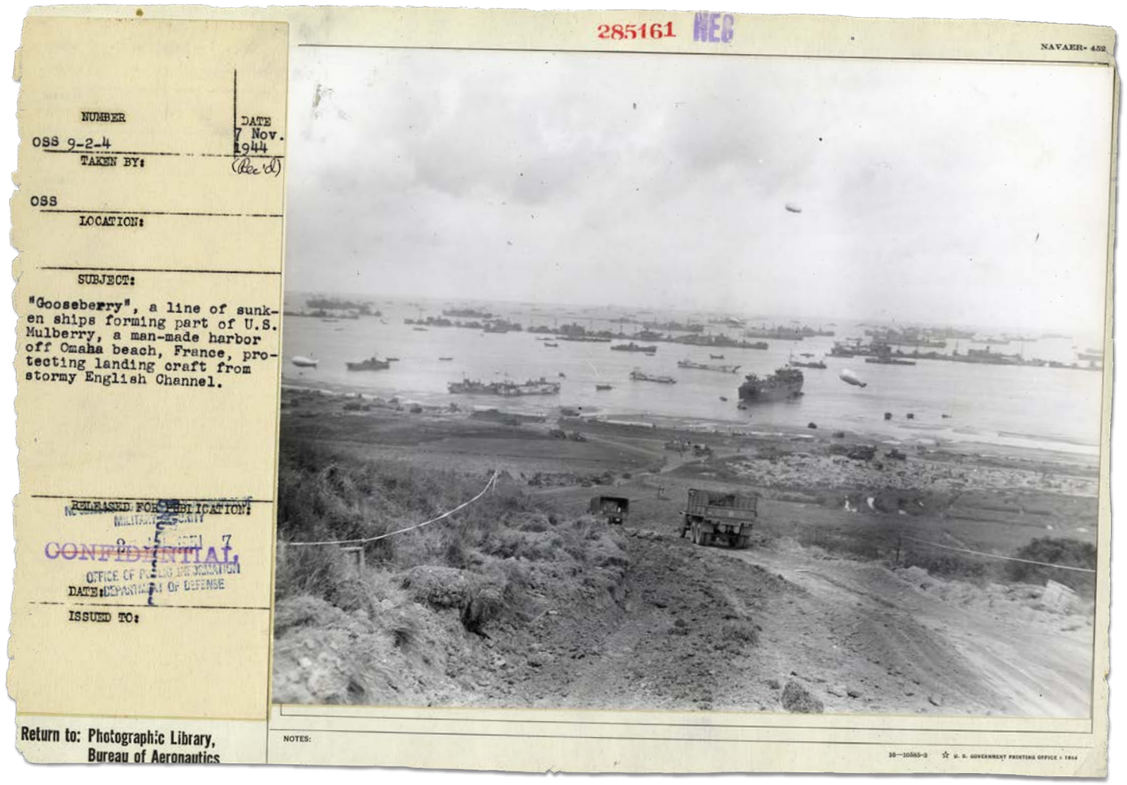
In many respects, this 1944 Allied endeavour looks obsolete when seen through today's lens, due to the slim likelihood of anything on a scale similar to that in Normandy being required by western forces. However, in modern littoral operations, we should not underestimate effectiveness of force projection of the kind shown here, which, employed differently, can still achieve strategic aims. Although, we should also be wary - there is nothing to suggest that this rubric could not be applied by others.

Mass

The task facing the Allies in 1944 was significant, landing on a hostile shore and facing, in the Germans, a well-organised and capable adversary. Yet, for the landings and subsequent operations to succeed, it was vital. A bridgehead on the coast of France not only meant that the Allies could land men, equipment and combat supplies - it created the conditions needed for the Allies to attack and defeat the Germans - initially in France, then through the Low Countries and into Germany itself. The focus was on mass – pouring thousands of men quickly into the lodgement, securing the landing area and then shifting to the introduction of combat supplies (initially ammunition, food, fuel and medical supplies) at vast scale. The absence of proper port facilities led to the employment of temporary harbours (Mulberries) constructed with prefabricated concrete caissons towed from England and positioned off Gold and Omaha beaches. They would be used until French ports could be captured and brought back into use. The Allied approach was largely underpinned by US industrial power which exploited the mass-production of numerous systems, without which the operation would likely have been delayed beyond June 1944 with attendant challenges arising viz the Soviet position.

Comparison with today

Projection of force at any scale can garner advantage across the spectrum of conflict from 'Grey Zone' (sub-threshold) conditions through to high-intensity conflict. However, today's technologies render the D-Day example almost unthinkable as human mass is largely absent in today's operational conditions. Technology makes its employment more risky and simultaneously somewhat redundant in effect whilst political appetites make it a very high-risk option in all but authoritarian regimes. Cheap and powerful sensors linked to long-range strike systems would likely deny a force the opportunity to close up to a coastline and would compel forces to operate at range from the shore. Equally, the quality of such sensors compels forces ashore to avoid mass: they are too easily sensed – and thus potentially identified, acquired and engaged by adversary forces and thus they will seek to operate in a more dispersed and disaggregated fashion. All this isn't to say that force projection at scale is now impossible - but it is unlikely to resemble Normandy 1944.



Manpower

Other considerations would affect the Allied endeavour. Manpower was not unlimited and whilst the USA could call on a bigger pool than the British, both nations employed conscription for the duration of the conflict and beyond. However, although domestic politics in the UK were largely overshadowed by the nature of the struggle, caution had to be exercised. British memories of the First World War were still relatively fresh and the appetite to foot the 'butchers bill' of combat was eroding as the war ground on. Whilst there was no question that the invasion of Europe would bring with it a significant casualty bill, a seemingly endless flow of casualties was extremely unpalatable politically, morally and socially. Any post-war economic recovery would be centred on the availability of working-age men able to take their part in the regeneration of a peace-time economy. As a direct consequence of these considerations, there was a strong sense of the moral imperative to avoid casualties and so an implied policy of 'steel not flesh' prevailed in Allied circles. This would entail the employment of overwhelming force wherever possible and the use of heavy weapons and machinery in place of humans where circumstances allowed.

Comparison with today

In comparable modern operations, manpower deployed at the scale of that seen in 1944 would be unlikely, not least as technology has reduced the need for humans in many

instances. What would have been manual tasks in many arenas in 1944 are more than likely to be automated today. Additionally, whilst some western nations are contemplating a return to some form of national service, the armed forces of NATO nations are almost wholly volunteer. And while some may have powerful reserves (e.g. Finland), the numbers of uniformed service men and women is today but a fraction of their 1944 forebears. Military service is not a particularly popular choice, as evidenced by under-bearings in many of the UK and European military services.

Technology and Doctrine

Over the span of the Second World War, the ability to conduct littoral operations advanced, with technology enabling the fielding of match-winning systems. The USA were the undoubted leaders in the development of amphibious warfare with significant investment in the creation of new doctrine, specialist equipment and training. This would inform the conduct of all of the major amphibious operations of the conflict. Across all domains, platforms and systems, capabilities were advanced at remarkable speed. It is of note that the British aircraft inventory at the outbreak of war still featured a number of bi-planes and yet, within 6 years, a jet fighter had been successfully deployed. Likewise, the Germans had perfected the land/air battle with their use of armour to achieve shock, surprise and overwhelm, supported by agile 'flying artillery'. Sadly for them, they lacked the scale of battle-winning capabilities to prevail across the two theatres – East and West. A significant proportion of German artillery was horse-drawn through to the end of hostilities and whilst their U-Boat operations were highly successful, they lacked the numbers of craft to successfully strangle supplies into Britain.

Comparison with today

The (relatively) recent publication of conceptual pieces by the USN and USMC including 'Littoral Operations in a Contested Environment' (2017)[1] and 'Expeditionary Advanced Base Operations' (2018)[2] set out just how that doctrine has evolved to reflect the different challenges faced. These concepts describe the integrated application of US Navy and Marine Corps capabilities to overcome emerging threats within the littoral, addressing challenges created by potential adversary advantages in geographic location, weapons system range, precision and capacity. This is matched by an appetite for different capabilities including the fielding of a vast array of sensors, the employment of unmanned systems in all domains and increased lethality.

Range and Scale of Operations

Whilst Operation Overlord in June 1944 was, to a great degree, the turning point in an existential conflict, it is worthy of note that D-Day in Normandy had been preceded by numerous operations at differing scales. These ranged from the assault at Dieppe in 1942 (widely regarded as a military failure) to Operation Husky (the landings in Sicily in 1943 which were set on a grand scale and highly successful). In the Pacific theatre, the US conducted a series of amphibious operations as they 'island-hopped' across the ocean, dislodging the Japanese en-route to the ultimate show-down on the home islands that ended with the dropping of nuclear weapons. Many of the brutal lessons learned during the fighting on Guadalcanal and Tarawa would inform the allied approach to their operations in Europe.

Comparison with today

Operations in the littoral today would probably be unrecognisable to the 1944 practitioners as today's adversaries fight very differently, largely enabled by technological advances. This is characterised by comprehensive, immersive, active surveillance networks alongside passive surveillance detection and classification systems. These are enabled by large numbers of low-cost sensors across all domains, the whole feeding into a modular, hard-wired, networked and integrated hard and soft kill protection system including highly-capable short, medium and long-range strike systems. In addition, today's allied forces can expect to encounter peer-level military capabilities designed to bypass traditional Western strengths (particularly in terms of platforms, technology and connectivity) with equal or superior force ratio numbers, shorter lines of communication and hard-wired infrastructure. And whilst scale is simply a reflection of the nature of the task in hand, it is unlikely that today's operators would be present in the littoral at the same scale and in the same concentrations as seen in 1944. Disaggregation allows forces to negate adversary advantages in the sensor coverage described above to operate discreetly and, with the potential to leverage remote and unmanned systems, can achieve effect without the need for grand scale.

Disaggregation of forces into small teams creates myriad challenges in any operational context from Grey Zone through to open hostilities, particularly those that require operators to remain undetected while operating within an adversary's Weapons Engagement Zone (WEZ). But it is often worth it - a small cohort of high-calibre individuals with improved training, appropriately networked and with access to an assembly of organic, remote and autonomous systems, can have effects out of proportion to their size, contributing to wider maritime missions including sea control and maritime strike. As the nature of warfare changes from 1944 to now, so too must the way we prosecute it.

The expansion of the 'Grey Zone' also marks a shift in the change in the Range and Scale of Operations. The 'Grey Zone' (or sub-threshold) is a term given to operations which offer the potential of low-profile and even deniable effect but can contribute to a wider strategic intent or shape a broader narrative. Such operations can be wide-ranging, from cyber-attacks, through coercion, to broader information operations including propaganda. In opposition to the all-out warfare seen during WW2, modern operators use this Grey Zone to achieve objectives without triggering hostilities, frequently referred to as 'hybrid' warfare.

[1] *USN N5C/MCWL Navy and Marine Corps Concepts; Littoral Operations in a Contested Environment, 2017*

[2] *Expeditionary Advanced Base Operations (EABO) Handbook, Considerations for Force Development and Employment, 1 June 2018*

Chapter 1 Picture Credits

Page 4–5: *Normandy 1944; Courtesy of The National WWII Museum*
Page 6: *Normandy 1944; Courtesy National Archives, NAID 6682629*
Page 7: *Mulberry Harbour in Operation, Normandy 1944; Courtesy National Archives, NAID 219775795*
Page 9: *A RIM-7 Sea Sparrow is launched from the aircraft carrier USS Kitty Hawk; Courtesy National Archives, NAID 6609950*

War Theatre #12 (Grandcamp-Les-Bains, France)
D-DAY INVASION (over)

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RISK/THREAT ANALYSIS

U.S. Army Signal Corps

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PART–2

Risk/Threat Analysis

Overview

Examination of historical and contemporary risk/threat will reveal a common influence – complexity. Multiple factors doubtless shaped Allied thinking in the 1940s: the relentless cost in men and materiel; political unity in the home base; strategic relationships between key protagonists; and the possible post-war shaping of Europe, the Middle East and Asia. In the contemporary landscape there exist similar challenges albeit played out in a different context and shaped by the exigencies of global financial interdependencies and trade; exacerbated by the effects of digitization, mass migration and climate change.

Historical Context

For the Allies in 1944, the opening of a second front in Western Europe was never in question. It was self-evident that the Germans would have to be defeated across all theatres and that Berlin was the ultimate Allied target. Furthermore, it was clear from the outset that the Allied decision to pursue the 'unconditional surrender' of the Nazi regime effectively closed the doors to other potential negotiated outcomes and could lead to greater determination among the German leadership to fight on – the 'least worst' option for some Nazis. Although large-scale open conflict is uncommon today, (the war in Ukraine illustrates that it should never be ruled out) it is more likely that conflict will be experienced in a broader, less defined form ranging from grey-zone or sub-threshold activities at one end of the scale, to small-scale actions to influence, intimidate and disrupt adversaries and larger-scale AA/AD.

Strategic Relationships

In the run-up to D Day, the principal strategic concern among the Allies (beyond defeating the Germans) was the relationship with the Soviet Union, not least as the ideological separation between liberal, democratic Western allies and their communist counterparts sat awkwardly with the authoritarian Soviets. By mid 1942 the Soviet Union were desperate for some relief in the East and encouraged their Western allies to increase pressure on the Germans in the West. Soviet determination to dominate the European landscape in any following peace was very real and compelled the Allies to generate and maintain strategic momentum in the West, notwithstanding Soviet reliance on US/British supply. To the Allies, the struggle was an existential one and the risks attending even partial failure were profound, especially when considered in the scope of unconstrained Soviet expansionism – failure by the Allies would be very costly and thus the imperative for Overlord to succeed was reinforced. Furthermore, any risk calculus was complicated by the requirement to deal with the vanquished. Addressing the needs of a destroyed Germany and a shattered Japan (once the latter were defeated) were serious challenges which could not be ignored. Moreover, the three-front approach in a truly global conflict was complicated by the territorial and ideological ambition of the Soviets and Imperial ambitions of the British.

Comparison with today

The modern World is similar but rests on a much more complex foundation. Growing inequality between the developed North and the Global South promotes large-scale migration that flows northwards while economic stasis in much of the developed world impedes both the ability and appetite to absorb it. Potential adversaries can see possibilities in the margins of such activity to undermine the democracies of the West.
Furthermore, established blocs such as NATO, the EU and the international 'rules-based order' are increasingly challenged both by growing domestic political opposition within western states and deliberate interference from hostile external actors

Political Unity

Roosevelt had been re-elected in 1940 and whilst deteriorating in health, was nonetheless politically strong. The USA could clearly identify national interest in the successful outcome of Overlord, which set the seal on the USA's position as the pre-eminent global power. In Britain, Churchill sat atop a coalition which, whilst generally stable, was divided on the national post-war future. The 1942 Beveridge Report influenced a slew of future social reforms which were embraced by the Labour Party and led to their landslide victory in the 1945 election – a victory informed by popular national concern over the future. This would be the defining British political influence of the time.

Comparison with today

Politics today is less straightforward and more difficult to define. Digitization in all its forms has enhanced information flows to the point where democratic politicians are extremely cautious and unlikely to take risks. Likewise, investment in the sort of capabilities required to counter contemporary threats are expensive and thus unpopular when hospitals, schools and other public services are strapped for cash. One of the commodities that will be in great demand is people and, under current conditions, recruitment or, worse, conscription into Defence is likely to be seriously unpopular across Western nations.

Cost

The economic and industrial power of the United States was highly influential in the conduct of the war from 1942 onwards and was particularly important for the conduct of Operation Overlord. Britain had been severely weakened by the fight – operating as a war economy with all industrial output focused upon supporting the effort. By mid 1944, the British state was approaching exhaustion whereas for the USA, with a rapidly expanding economy and with the increasing global markets, the Second World War provided a welcome commercial opportunity to some US businesses. But the cost in men was of particular concern, particularly for the British where memories of the generational slaughter that the Great War represented were still fresh. With eyes on the post-war world, Britain would be heavily reliant upon a returning workforce of able-bodied men and thus limiting the human cost of operations was key.

Comparison with today

The modern Western corollary is volunteer forces, small in scale and with limited depth of reserves in either personnel, equipment or ammunition and thus ill-prepared for conflict in short order. The same cannot be said for potential adversaries. China has a vast military backed by significant industrial potential. Russia, whilst lacking Chinese capacity, nonetheless has an ambition to restore former power and a large population which the Russian leadership views as expendable.

The cost of mobilising for modern conflict will be prohibitively expensive and thus unlikely to be politically attractive among Western liberal democracies, and any contemporary approach is likely to mirror the British WW2 'steel, not flesh' policy, ie, 'why should we send our children into battle when drones can do it?' Equally, grey-zone interference by cyber-attack or by the disruption of critical national infrastructure (subsea data cables or power supplies) could have a devastating effect upon Western economies and the whole is further affected by the development of AI, the unconstrained spread of information through social media and global digital inter-connectivity. The sum of these threats is significant and the resultant cost of addressing them is politically unpalatable – when there are so many calls upon the public purse. However, the risk to our security is vast.

Chapter 2 Picture Credits
Page 10–11: *German Teller mines fixed to posts, exposed at low tide.; Courtesy National Archives, NAID 204892392*

DOCTRINE AND TACTICS

PART–3

"Doctrine: a handrail, a guardrail; a lifejacket or a straitjacket"
Anonomous

"Tactics are the steps from which operational leaps are made; strategy illuminates the path"
Alexandr Svechin
Russian/Soviet General and Strategist

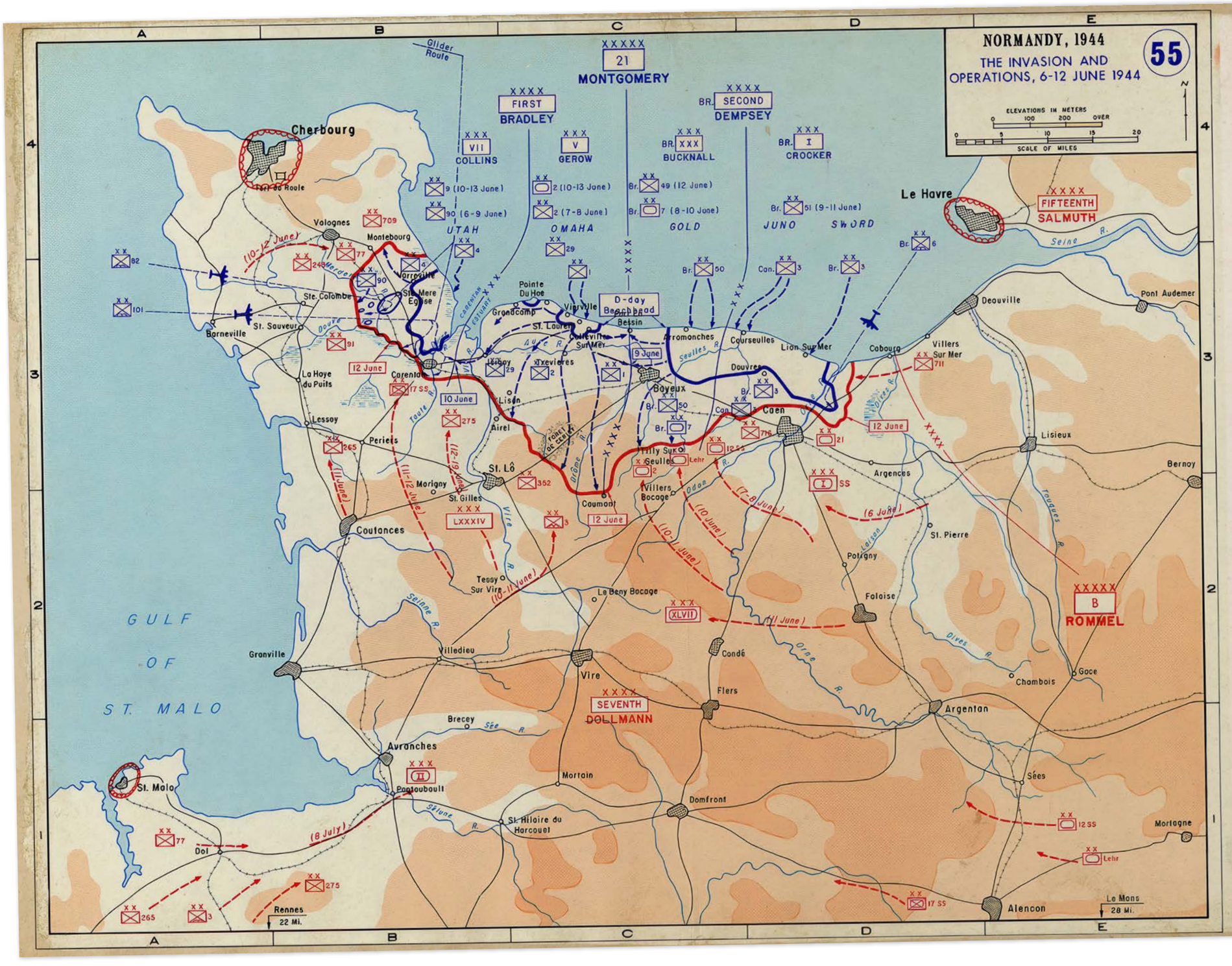
Doctrine and Tactics

Description

Military doctrine can be described as a fundamental set of principles which provide guidance to military leaders as to how their forces can be employed, set out in plain language in order that it can be easily absorbed at the very lowest level. It can be many things to many people but is at heart a 'guide book'. Tactics are the specific methods applied to engage and defeat an enemy in combat and focus how military force is employed. It is the lowest in a hierarchy of levels at which warfare is conducted: Strategic, Operational and Tactical.

Normandy 1944

The 1944 doctrine was developed by the United States between the wars. The USN/USMC modelled possible future operations in the Pacific, shaped by the technologies available and under development at the time. Based on Landing Operations Doctrine (1938), it emphasized 6 key capabilities: Command, Control and Communication, Ship-to-Shore Movement, Naval fire support, Air support (in its myriad guises), Establishment of a Beachhead and Sustainment. It required isolation of the target, preliminary bombardment, swift combined-arms assault and immediate follow-on support. Prior to Normandy, the doctrine had been tested in Sicily and elsewhere but was far from foolproof as the landings at Salerno and Anzio showed. The challenge for the Allies in 1944 was to create the conditions in France from which further operations could be prosecuted. While some limited local surprise was anticipated, the Germans knew that such an assault was imminent but were uncertain of its exact location. For the Allies, the shorter the distance to Berlin, the better. Normandy was selected – less well protected than the Pas de Calais but closer to the German centre of gravity (Berlin) than a landing further south. Four beaches allowed for the landing of significant numbers quickly and across a relatively broad front, complicating the German response.



Modern Doctrine

Modern doctrine has advanced significantly and any cursory glance at the current library, particularly the USN/USMC 'Littoral Operations in a Contested Environment' (LOCE) and 'Expeditionary Advanced Base Operations (EABO)[3]' among others, illustrates the point well. Recognising technological advances, particularly in the Indo-Pacific area, acknowledged by the USA as the most dangerous potential flash point, modern doctrine reflects the emerging need to address Anti-Access (A2) (those actions/capabilities, normally long-range, that prevent an opposing force from entering an operational area) and Area-Denial (AD) (actions/capabilities, normally of a shorter range, that are designed to limit freedom of action within the operational area) in order to protect and maintain freedom of navigation and action.

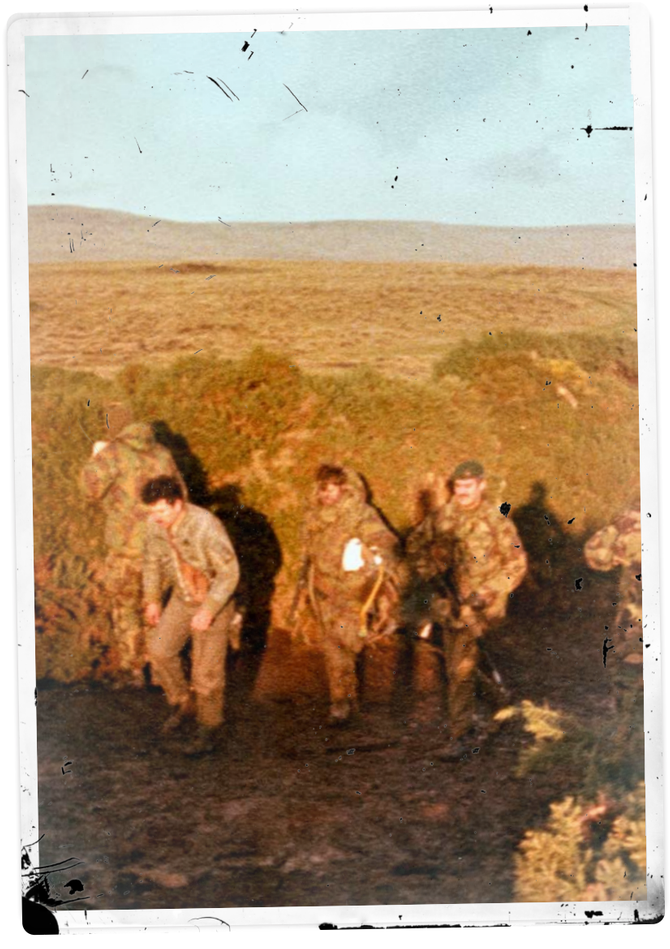
And future littoral operations are unlikely to be constrained to the purpose of gaining a lodgement or a beachhead. They are more likely to be a part of a wider effort, potentially contributing to key maritime missions such as strike or sea control. This is likely to continue to develop as AI and the full potential of unmanned systems at sea (surface and sub-surface), on the land and in the air increasingly influence the shape of conflict.

Tactics – Then…

On 6 Jun 1944, an enormous allied fleet closed-up to the beaches of Normandy to launch thousands of small craft to land forces on the coast – aiming to generate massed combat power on the beaches rapidly. As a consequence of this principal aim, the tactical options were limited. The landings were preceded by heavy bombing of transport and other infrastructure to impede German movement and by airborne landings to seize key ground and protect the flanks of the lodgement. The landings were possible because weapons ranges and effectiveness allowed for them, but heavy casualties were anticipated and there were few tactical alternatives.

…over time

Since 1944, Allied thinking adapted. While the USA maintained the capability to project force at scale, other NATO allies' ability to do so declined and so, the 1980s, the UK, for one, tended to '..go where the enemy isn't..', illustrated by the landings in the Falkland Islands in 1982 - in other words: avoid enemy strengths, a defining flavour of the contemporary model. The advent in the late 1980s/early 1990s of 'Over the Horizon' operations and 'Ship to Objective' manoeuvre saw forces launched from longer range with large platforms held well out of reach of the coast. This had the benefit of reducing risk to large, specialist ships and, from greater stand-off distance, influencing a much greater area of the littoral and thus complicating the response of the defender.



…and Now

1944 tactics would be unthinkable in contemporary conditions in anything but the most benign threat situation and tactics have developed over time to match the emerging threats from widely deployed and capable sensors, to the current model which sees the employment of small, agile groups deploying at great range from their objectives in a distributed fashion. Deployment could be via a variety of means: surface vessel, aircraft (especially helicopters), small craft, submarine or a combination of all four and will undoubtedly involve a combination of manned and unmanned systems.

This avoids investing in a lodgement (an 'iron mountain'), a la Normandy, instead focusing on leveraging numerous long-range autonomous/remote systems to achieve effect in the battlespace. This is a significant deviation from the 1940s example but reflects better the need to apply force more cautiously and, in doing so, to avoid mass. It also seeks to minimise the potential for large-scale casualties, exploit to the maximum the benefits which accrue from the 'Manned/Unmanned Team' (MUM-T) and integrate secure, digital systems that can achieve effects across all the domains. But it remains, ultimately, a case of putting individuals in harm's way in an adversary's back yard. The same bravery, resilience and willpower is needed as was the case in 1944!

[3] *Expeditionary Advanced Base Operations (EABO) Handbook, Considerations for Force Development and Employment, 1 June 2018*

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Page 18: *Falklands 1982*
Page 19: *Members of 40 Commando Royal Marines and Army Commandos taking part in PROJECT HERMOD LIVEX. Contains public sector information licensed under the Open Government Licence v3.0.*

JOINT FORCE EMPLOYMENT ACROSS THE DOMAINS

PART–4

Joint Force Employment Across the Domains

The Western contemporary command model is inherently joint, with operational-level command typically exercised through joint structures (as seen in US, UK, and NATO models)4. At the tactical level, however, command generally reverts to single-service, component-based arrangements.

In contrast, in 1944 the Supreme Allied Commander exercised command over all deployed Allied forces. Below this strategic level, command largely reverted to a single-service model. Nevertheless, there were several examples of joint activity in practice, albeit limited in scope and focused primarily on the land/air domain.

Maritime (surface).

Amphibious/littoral operations are essentially a maritime endeavour and are rightly acknowledged as among the most complicated. They involve the fusion of combat activity across all domains and *can* involve a complex command-shift when the balance of investment in the operation transitions from the maritime to the land domain (in the modern environment command may remain afloat).

1944. The maritime element of the 1944 Normandy landings was vast and involved vessels, aircraft and personnel in a wide variety of roles. The complexity was Byzantine, choreographing a huge fleet to arrive in the Amphibious Operations Area (AOA) off the Normandy coast simultaneously, preceded by advanced force teams, many of them landed from submarines to fulfil a multitude of tasks: confirming sea-bed profiles, obstacles and to mark beaches as well as providing swept, mine-free channels for assault craft. For Overlord, the landing force (multiple tens of thousands of troops) was delivered in specialist assault landing craft supported by fire support platforms, air-defence vessels, anti-submarine defence, service support (including casualty receiving ships) and command vessels. The absence of accurate long-range strike systems in the German inventory meant that shipping could come relatively close inshore at minimal risk (other than from occasional Luftwaffe attack).

Most of the first wave of the landing force embarked directly onto small assault craft and sailed to the landing beaches from Southern England; there to land troops, vehicles and materiel straight onto designated landing points. These assault craft were slow, open to the elements, and poor sea-keepers. Subsequent waves were embarked upon larger vessels before transferring into the assault craft when close to the beaches. Some specialist vehicles (amphibious tanks etc.) launched from parent craft and 'swam' ashore, providing immediate combat support to the landing infantry. Once ashore, assaulting troops advanced to pre-ordained objectives, achieving these to provide security to the landing area against counterattack. As soon as the beaches were declared secure, offloading activity continued at higher tempo with ships, vessels and craft moving closer to the shore. All activity on the beaches was organized and directed by naval beachmasters whose principal responsibility was to maintain tempo of activity in order to develop the bridgehead.

Today's Model.

The contemporary model is very different, reflecting an altered context. The proliferation of cheap, abundant sensors linked to capable strike systems create a complex set of challenges. Anti-Access (A2) (those actions/capabilities, normally long-range, that prevent an opposing force from entering an operational area) and Area-Denial (AD) (actions/capabilities, normally of a shorter range, that are designed to limit freedom of action within the operational area) systems compel maritime platforms to sit well beyond an adversary's Weapons Engagement Zone (WEZ - in this instance the defined

area and airspace inside which an individual, platform, unit or formation has a high probability of being successfully engaged by an adversary). The stand-off distances (the range from a target or objective that allow for friendly shipping to operate safe from engagement by an adversary) are thus significant and so call into question the investment in large, highly expensive specialist platforms.

Notwithstanding this, the projection of force into a hostile or potentially hostile shore **may** be required in order to meet strategic aims. Small, agile groups could be introduced from the sea over long distances either by submarine (usually only Special Operations Forces), fast, stealthy surface, surface submersible craft, by helicopter or a combination of all. They can be tasked with multiple possible missions from ISR through direct strike actions or deception to influence operations. These deployments would likely be augmented by unmanned systems providing ISR, fires and protection. But the central challenge for today's commanders is in many ways the same as 1944 – to propel a force from the sea onto an occupied landmass, ensure its survival, sustainment and provide it with the necessary command and intelligence support along with the means of manoeuvre, fires and protection.

Maritime (Subsurface)

1944. Sub-surface infiltration has played a role in littoral operations in multiple campaigns and has developed significantly in recent years. Throughout both World Wars, submarines offered the potential for ultra low-profile infiltration and exfiltration of personnel and high-value stores. This can be illustrated by Operation Frankton in 1942, when 6 pairs of men from the Royal Marines Boom Patrol Detachment were infiltrated into the Gironde Estuary in France, launching kayaks from submarines to paddle upstream and successfully attack shipping in Bordeaux harbour. Special operations forces have maintained the capability to launch from and recover to submarines however, these tend to be for tasks of strategic value. This practice was significantly enhanced by the development of the Swimmer Delivery Vehicle (SDV) in the early 1980s.

Today's Model

Capabilities such as the SDV are expensive, slow, limited in range and few in number. They are also reliant upon nuclear submarines (SSN) or other strategic assets for their deployment. The advent of lower-cost, more capable platforms capable

of operating at speed on the surface as well as submerged increases the options for commanders of maritime, joint and special operations and so adds significantly to the inventory of systems for prosecuting littoral operations. Such dual-domain craft which can operate at range to create effect in the littoral could dovetail with emerging maritime operating constructs such as the US 'Distributed Maritime Operations' (DMO)[5] or the UK Royal Navy's 'Protean Force' concept, where forces disperse to increase survivability and combat effectiveness. One example of a dual-domain craft that functions like this is SubSea Craft's VICTA[6].

Land.

Landing forces can be generated from any suitably trained and equipped body and although historically, many states have invested in specialist naval infantry or marines, land campaigns are usually conducted by land formations – Army. In an amphibious operation, the key differentiator from other operations is the transition from the maritime to the land domain.

1944. Based upon the requirement to generate mass, the landings involved pushing thousands of men quickly over the beach, so the transition from sea to land was physically reduced to the bare minimum, moving troops via simple assault landing craft quickly from ship to shore. Troop training in advance of Operation Overlord was minimal – sufficient only to allow fully trained infantry to be able to embark into craft and disembark from the craft onto an assault beach **safely**. This extended to the drivers and crews of vehicles (including armour) where training was a little more comprehensive. Preparation of men and equipment was rudimentary and focused largely upon vehicles with some waterproofing of personal equipment and weapons possible although investment in this was quite low. Specialist equipment did, however, feature. Large tank-landing craft (60m; c300 tons) were developed and built in order to minimise the friction of navigating heavy equipment to the shore.

Specialist waterproofed vehicles such as the DD tank, Buffalo and DUKW which could independently 'swim' were also developed albeit the DD tank was a 'one-shot' vehicle whereas the Buffalo and DUKW could transit into and from the water continually. Once troops had landed, immediate objectives would be seized and command of the landing forces transferred to the land formation. The nature of Operation Overlord meant that the initial desired effect was to generate sufficient combat power ashore to prevent a counterattack by the Germans and thence to create the conditions for a land campaign culminating in the defeat of Germany.

Today's Model

The contemporary picture is, again, very different where mass is, in the main, not a feature and there is a high likelihood that the force will comprise an assortment of manned and unmanned remote and autonomous capabilities. A small force with a mix of capabilities, able to operate on land and at sea can achieve effect out of proportion to its scale and as such, is likely to complicate the adversary response. As previously noted, facing the likely threats from massed, low-cost sensors linked to long-range strike systems, today's littoral forces are compelled to disperse and disaggregate, relying on digital, secure integrated networks to access different capabilities remotely. This will likely include specialists in ISR, including the operation of remote and autonomous systems; fires – accessing the full panoply of capabilities available from organic individual light weapons through to land attack systems including fast air; manned and unmanned mobility systems; secure, digitized communications systems; and medical support.

This confers a different set of challenges upon the landing forces as the skills required to be able to fulfil these functions are considerable and are supplemented by the requirement to operate in small groups and at long ranges. This implies that the contemporary task is possibly beyond the scope of the average infantry soldier and is more closely suited to specialists, warranting very high levels of fitness, self-reliance, adaptability and initiative. The USMC have recognised this and, like the RN's emerging Commando Force, are investing in the capability, focusing on broadening the skills of the individual marine, fire team, squad and platoon. Whilst there is possibly a higher cognitive burden for today's troops, this reflects the reduced mass and scale of contemporary and future operations and their focus upon leveraging technology. There is, equally, some similarity between the approach adopted 80+ years ago and today – the requirement to reduce the burden upon participating forces to the very minimum. This is illustrated by the broad commonality of equipment and components in 1944 and the adoption of simple commercial games controllers for use today. Today's landing force could be deployed independently into hostile terrain over long range and possibly separated from other friendly forces. These small teams would likely be commanded locally by junior leaders reporting via secure digitised communications to a remote C2 hub. They would be equipped with a broad assortment of sensors, many deployed via unmanned vehicles at sea, on land and in the air. The team would carry defensive weapons but may include a limited strike capability - fires would likely be delivered remotely, targeted and controlled by the team. Some limited mobility is likely with lightweight land vehicles available while sustainment would be delivered by manned, remote and autonomous vehicles.

Air

Advances made in aircraft development over the period of the Second World War were among the most profound of any across the 6 years of conflict. At the outset of hostilities, the RAF fielded a mixed-bag of fighter aircraft including bi-planes. However, by mid 1945, 52 different versions of the Supermarine Spitfire had flown in action. German aircraft were similarly subject to continuous development with the Messerschmidt Me 109 fielding dozens of variants while the Me 262 was the world's first operational jet fighter. Photo-Reconnaissance (PR) was viewed as of secondary relevance at the outset of hostilities, but as aircraft, technologies and tactics advanced, PR became increasingly important with significant impact upon the conduct of operations. The German V Weapon programme produced the first unmanned/remote/autonomous platforms in the form of the V1 and V2. The former was a pre-programmed unmanned aircraft similar in some respects to a cruise missile whereas the latter was, to all effects, an ICBM. Developments in the air extended across aircraft types, radar, bomb-aiming, communications and weapons systems. Inaccuracy by bombers early in the war was eye-watering, with aircraft delivering weapons to within 5 miles of the target viewed as successful. Enhancements in targeting, target marking, bomb aiming and battle damage assessment improved on this markedly across the conflict.

Normandy. In addition to the strategic bombing campaign targeting German cities, Allied aircraft fulfilled 3 main missions during Operation Overlord: air defence; ground attack; and battlefield air interdiction – tasks which would have chimed with Cold War aircrew. Air defence aircraft operated in patrols to engage Luftwaffe fighters and bombers to prevent German air interference in and around the beachhead. In direct support of the landings, Allied fighter bombers operated in the 'cab-rank' system whereby combat air patrols would loiter over or close to the battlespace either to engage ground targets of opportunity or to respond to ground forces calls for air support.

Operating with rockets, cannon and bombs, this proved devastating for the defenders. Finally, Allied fighters and bombers would strike targets in depth to deny the Germans freedom of manoeuvre, to destroy infrastructure and to prevent German counterattacks.

Today's Model

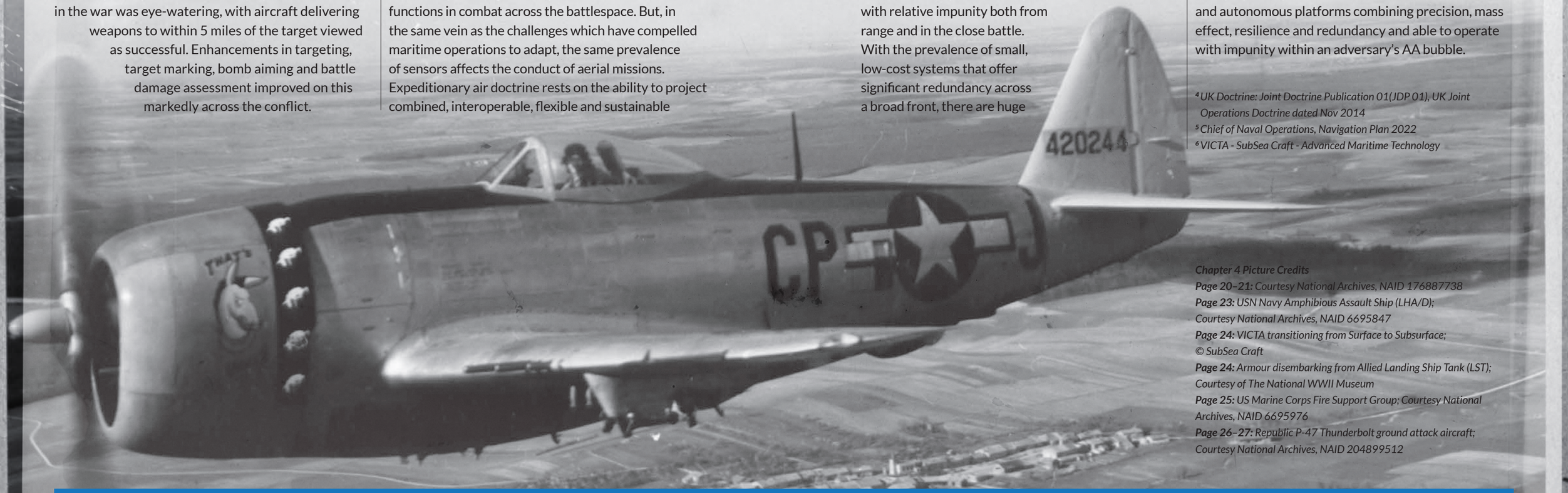
Modern air capability is impressive; comprising an increasingly mixed suite of manned and unmanned airframes providing a variety of effects to match the functions in combat across the battlespace. But, in the same vein as the challenges which have compelled maritime operations to adapt, the same prevalence of sensors affects the conduct of aerial missions. Expeditionary air doctrine rests on the ability to project combined, interoperable, flexible and sustainable air power rapidly into any theatre. Reyling upon centralized control/decentralized execution based on robust C2 structures and a full spectrum of air power roles - from air superiority to ISR, mobility, and precision strike, it aims to provide tailored air capability to meet joint needs with the flexibility to surge when required. Air support in littoral operations is likely to come in a variety of forms, with larger, land-based systems supplementing ship-launched aircraft with the whole enhanced by a plethora of unmanned and remote systems. It is worth viewing this through the lens of 3 key areas: Command, ISR and Strike, prosecuted by a networked, integrated force. Dedicated command and control platforms enable aerial operations from range, able to maintain persistent coverage well outside adversary WEZ, able to adjust to circumstances with agility and tempo. They can be supplemented by unmanned platforms to deliver high-grade support. ISR in the modern environment consumes multiple hours of effort across assorted types. Again, larger, long-range aircraft can 'see' into target areas from distance and can maintain persistent coverage over long periods.

Unmanned systems can operate with relative impunity both from range and in the close battle. With the prevalence of small, low-cost systems that offer significant redundancy across a broad front, there are huge opportunities to harvest vital data. Strike options abound, whether in tactical support to a landing force or precision attacks against strategic targets. Again, the profusion of unmanned systems provides depth and breadth in the battlespace. Some of these are likely to be operated by the landing force and will deliver a variety of weapons from anti-personnel systems (grenades) through small, shaped-charge munitions to counter protected vehicles or strong points, to specialist guided weapons to enable precision attack.

The Future?

The future in all domains is likely to include a combination of capabilities that can provide effect in a variety of ways and means. This will doubtless see a focus upon the combination of both manned and un-manned capabilities in the so-called 'Manned/Un-Manned Teaming (MUM-T)' operating from sub-surface through surface to land and air systems. The importance of this combination operating throughout a complex battlespace cannot be understated. The emphasis is likely to be upon discreet, low-profile systems – networked and integrated and with a variety of deployment profiles; manned, unmanned, remote and autonomous platforms combining precision, mass effect, resilience and redundancy and able to operate with impunity within an adversary's AA bubble.

[4] *UK Doctrine: Joint Doctrine Publication 01(JDP 01), UK Joint Operations Doctrine dated Nov 2014*
[5] *Chief of Naval Operations, Navigation Plan 2022*
[6] *VICTA - SubSea Craft - Advanced Maritime Technology*



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SUSTAINMENT

"Tactics are the art of the logistically feasible"
Anonomous

"Amateurs talk Tactics. Professionals talk Logistics"
Anonomous

PART–5

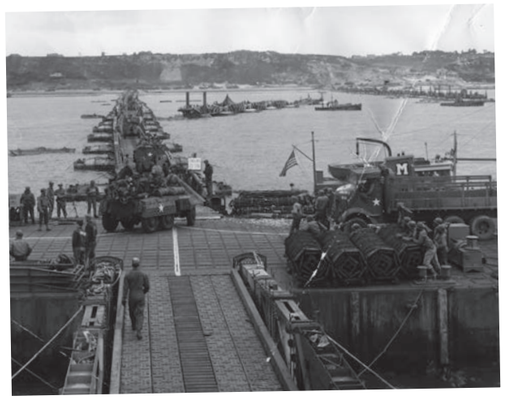
Sustainment

Overview.

Any consideration of the demands of Sustainment in Littoral Operations must include a definition of its breadth and limitations. In short, military sustainment includes *supply* of key commodities (ammunition, food, fuel, water, equipment); *maintenance and repair* of key equipment and capabilities; *transportation and movement* of both men and materiel; and *medical and health* support. Other tasks may fall under this banner (i.e., *facilities and services*) but will not be considered here. A reminder - the Normandy Landings were *largely* characterised by mass and demanded the development of the 'iron mountain': daily landing multiple thousands of tons of stores and moving them through large logistics bases to enable sustainment functions to be pushed forward to support combat divisions. It is also worth highlighting the assumption that an undertaking of the scale and ambition of Operation Overlord is unlikely to occur again and so a reproduction of the logistic requirement in the modern setting is therefore remote. In the region of 160,000 men landed on D-Day from the sea and the air. *All* required sustainment, so the logistic burden was immense. That said, the 'lines of communication' were relatively short – from Southern England to the Northwest Coast of France. But it is also worthy of note that the USMC, in their quest to deploy multiple small teams dispersed across the battle space, identify their 'pacing challenge' today as one of sustainment. And, that sustainment may have to be conducted over many hundreds if not thousands of miles.

Supply.

Military planners in 1944 wanted to secure a port as quickly as possible. Given that this would have been obvious to the German defenders, the ports along the Atlantic/Channel coastlines were both heavily defended and badly damaged (as a consequence of both Allied and German activity). Because of this, and given the enormous scale of the undertaking, a number of radical decisions were taken. The first was that two artificial harbours (Mulberries) were prefabricated in Britain and towed to the French coast where they were assembled to create the means for rapid bulk supply.



The second decision was the construction of a 'Pipeline Under the Ocean' (or PLUTO) which operated from Oct 1944-Aug 1945, pumping fuel from Southern England into Le Havre in France. Although dwarfed by the delivery of fuel by tankers, the ambition to deliver fuel in this fashion was impressive and reflects the nature and scale of the challenge. Combat supplies (food, ammunition) were moved by Ordnance Companies into pre-planned dumps from which supplies could be pushed forward. This would include key combat capabilities such as bridging equipment which could not be held too far forward but had to be ready to be pushed quickly into action when required.

Comparison with today

The contemporary challenge is similar insofar as it involves the movement of key commodities and functions over distance into a (potentially) high-risk theatre. However, 1944's practices would be mostly redundant for the likely operations of today, where the sustainment of small, dispersed teams in an adversary AA/AD zone is likely to be both hazardous and highly complex.

Maintenance and Repair.

Along with supply of key equipment, spares and components, equipment requires maintenance and repair – particularly in forward areas. This was certainly the case in 1944 where a huge number of weapons (and their associated ammunition) radios, craft, vehicles and aircraft along with a wide array of specialist kit was operated by the landing forces. Not all the equipment was standardised and whilst there was some commonality, national lines were inevitably drawn, causing inefficiencies. Usually, repair parties would be located well forward with mechanics and maintainers commonly operating immediately behind the front line (and sometimes beyond it when recovering key equipment damaged in combat). This is particularly relevant given the requirement to maintain momentum and to keep high-value equipment in the fight.

Comparison with today

Given modern doctrine, the repair and maintenance function forward is likely to be minimal and quite possibly limited to covering highly specialised vital equipment such as secure comms. Repair and maintenance are more than likely to be switched to 'replacement', as attritable or lightweight systems are probably easier to replace than to repair.

Transportation and Movement.

Transport and Movement in the logistic sense is not to be confused with Tactical Mobility, although in 1944 the two were often blurred. The former is not generally undertaken in contact whilst the latter is a function of manoeuvre and is generally undertaken when in close proximity and in contact with the enemy. In the main, transport and movement assets provide the lift for combat supplies, replacement equipment and specialist equipment (i.e., bridging) moving forward whilst recovering damaged equipment to the rear for repair. The 'Red Ball Express' is a good example – a huge US Army road convoy system that pushed supplies forward to support divisions in combat and thus maintain operational tempo. During the Ardennes offensive in 1944 an entire division (101st Airborne) was moved by these vehicles to reinforce the besieged town of Bastogne. But movement of any sort presents a significant challenge within an adversary AA/AD zone and thus logistic replenishment is likely to be conducted by manned and unmanned air, surface and sub-surface vessels and possibly in very limited form by road when tactical circumstances permit.

Comparison with today

In today's climate, unmanned systems are likely to form a large proportion of transport and movement assets in support of a littoral force and, whilst there is frequent discussion concerning the limited capacity of unmanned aerial systems, uncrewed surface and sub-surface vessels offer significant possibilities.

Medical and Health Support.

The development of military medicine and health care has grown over time and, post the carnage of the First World War, significant effort was expended to avoid the doctrine and tactics that would lead to any repeat of the industrial slaughter experienced in 1914-18 – see previous comments about 'steel not flesh'. Significant casualties were anticipated in the planning for Operation Overlord in 1944 and whilst they were not fully realised, there were (and remain) an inevitable consequence of conflict. Front line Aid Posts triaged casualties and carried out emergency treatment before moving the wounded rearwards, initially to Dressing Stations and thence possibly to Field Hospitals. But Second World War casualties were still high in comparison to the conflicts that followed. In the major post-war conflicts (Korea and Vietnam) and in the many, limited, 'brush fire' wars that characterised the 1960s, the same medical support system endured as had been employed in Normandy, standfast the introduction of dedicated casualty-evacuation (CASEVAC) helicopters.

But by the latter part of the 20th Century and into the 21st Century, nation states began to recognise more closely the negative political effect of casualties and so steps were taken both to reduce the risk of death or serious injury and to improve treatment. It is fair to say that the conflicts in both Iraq and Afghanistan saw men survive wounding that simply would never have done so in previous campaigns. In particular, the 'golden hour' of achieving evacuation of casualties, often by specialist aircraft with embarked surgery specialists within an hour of wounding, became the norm.

Comparison with today

The challenge for the commanders and planners of today's littoral operations is to attempt to live up to the demands of the 'golden hour' and to manage political expectations accordingly. Small teams of disaggregated specialist troops, distributed across an area of operations may be prone to incurring fewer casualties and may have advanced first aid capabilities deployed forward. However, dealing effectively and quickly with casualties under such conditions will undoubtedly pose a testing challenge. Exploiting the full array of remote and autonomous systems, particularly unmanned surface craft and submersibles is likely to feature as a part of any solution to the sustainment challenge.

The Future

The prosecution of future operations is likely to be very different to that of 1944, as technology continues to advance and geo-political conditions wax and wane. But, against that backdrop, combat development will certainly continue to influence change. This is already evident across the globe as nations attempt to reform their militaries in order to adapt to new norms and to take account of and exploit change. Technological advances in weaponry, coupled with the digital revolution and the increasing power and utility of Artificial Intelligence paint a dazzling picture of future conflict and any future operation in the littoral is likely to be characterised by many (if not all) of the factors described in this paper: capable adversaries with access to cheap and abundant sensors linked to capable strike systems. These peer-level capabilities also seek to by-pass traditional Western strengths and so compel a shift in approach. The requirement for urgent change has been firmly seized and investment in an array of new systems, not least in the unmanned area is broadly evident, influenced by the lessons emerging from Ukraine. The forthcoming introduction of medium displacement uncrewed surface vessels (MDUSVs), in the USA and the initial flight of the Proteus full scale unmanned rotary wing aircraft in UK are good illustrations but are but two elements of a vast programme which will see the nature of conflict in the littoral evolve. The ongoing adaptation of people, formations, systems and processes to reflect the new challenge is compelling although there remains significant scope for acceleration of change across the board. New doctrines and concepts will see force being applied in different ways and using a vast array of complex new means however, it is quite likely that objectives may remain familiar.

It was obvious to the Western Allies in 1944 that Germany and Japan would have to be defeated in detail, not least because of the imposition of unconditional surrender as a condition for the Axis. To achieve such ends would require the employment of the full weight of national power, not least the commitment of vast numbers of (mainly) men to the task. The requirement for mass was possibly never better illustrated than by the Allied invasion of France in 1944, spearheaded by Operation Overlord. The likelihood of conflict on a similar scale to that witnessed in 1944 is probably limited (but not impossible) and force projection at varying scales is still a valuable military option but will likely be employed in a different form to that in 1944. Mass will be replaced by a more refined application of small packets of highly capable combat power projected at range into the adversary's zone of influence without being sensed.

The influence of technology means that adversaries will operate differently, so Allied responses must reflect that by avoiding opposition strength and leveraging the full panoply of systems available by deploying small, agile and highly trained teams in a dispersed fashion across the area of operations, able to bring combat power to bear using organic and remote manned and unmanned systems.

These will range from submersible craft capable of operating with relative impunity within an adversary's Weapons Engagement Zone (WEZ) and likely in an Anti-Access and Area-Denial (AA/AD) environment, through to multiples of small, lightweight air systems that can confuse or overmatch an adversary air defence system and thus change the risk/threat balance. Adding the potential benefits of Artificial Intelligence in the development and operation of equipment and in the prosecution of operations could also yield significant advantages. Operating as a part of a secure, integrated, networked framework, this gives today's commanders with an array of options and will allow force to be applied in support of Allied objectives. This will require small, agile, highly trained teams, deployed at range and able to conduct an array of tasks. This could be undertaken across the spectrum of conflict from limited 'Grey Zone' or 'Hybrid' operations through to high intensity combat in high risk/high threat conditions and involving the full spread of offensive capabilities. Technology has and will continue to shape the way that littoral operations are conducted.

Doctrine and tactics continue to evolve to reflect the operational environment and technological development in much the same way as they had in the run-up to the Second World War and they continue to change. Whereas the 1944 norm was to assemble a vast force and to land it into a beachhead or lodgement, followed by reinforcements, reserves and supplies, the modern way is somewhat different – avoiding the 'Iron Mountain' and operating at range from the shore. The availability of cheaper, capable sensors and their integration into complex hard/soft kill systems means that the doctrine for the modern operator in the littoral is very different from its 1944 counterpart and today's forces cannot adopt the same tactics as their forebears. The evolution from Ship-to-Shore movement through Over the Horizon Operations to the contemporary dispersed force approach illustrates this. However, doctrine then and now reflects the need for commanders at all levels to be able to function with robust, flexible and resilient command supported by intelligence, fires, manoeuvre and protection.

And while it is unlikely that we will see a repeat of the engineering marvel that was the Mulberry harbours off the Normandy coast, littoral operations will remain a complex and challenging logistical undertaking, not least in the areas of supply and medical support. However, without the appropriate sustainment, operations are untenable and so the full array of remote and autonomous systems is likely to be employed in pursuit of sustainment of deployed forces in the same way as in other combat functions. Thus, modern littoral warfare will be sustained in as effective a fashion as Overlord.

Conclusion

Any brief analysis of the conduct of operations in the littoral of 80+ years ago and the contemporary approach might, on the face of it, seem to yield a yawning gulf in everything from doctrine through tactics to the application of technology. However, that would be to ignore some of the fundamental principles that apply to the conduct of war. Clausewitz famously described war as the 'continuation of politics by other means' and that it is 'an act of force to compel our enemy to do our will'[7]. Arguably, these statements remain true for today's environment, despite the very different prevailing geo-political political situation and the development of technologies, capabilities and tactics.

An examination of littoral or amphibious operations through both the lens of the 1944 and contemporary models indicates that the central purpose of such activity remains unchanged – the aim of littoral operations is, in rough terms, the projection of military power onto a hostile or potentially hostile shore in order to achieve specific aims.

Certainly, there are technological and other developments which result in significant separation of approaches but, the paper above reveals that whilst there are indeed some profound differences, there remain key areas where the principles and practices employed are constant over the 81-year gap and putting humans in harm's way will likely remain a central tenet of littoral operations for generations to come.

[7] *Clausewitz, Carl von. Vom Kriege (On War). Berlin: Dümmlers Verlag, 1832.*

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