
# The Australian Army in the Urban, Networked Littoral

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## The Author

Dr. David Kilcullen served 24 years as an army officer, diplomat and policy advisor for the Australian and United States governments. He served in regimental, instruction and staff postings in the Royal Australian Regiment, Directorate of Infantry, and Army Headquarters, served as an exchange instructor on the aBritish Army Platoon Commander's Battle Course, and deployed on operations in Cyprus, Bougainville, Indonesia and East Timor, before retiring as a Lieutenant Colonel. He then served as a senior analyst in the Office of National Assessments and was a member of the writing team for Australia's national counterterrorism white paper in 2004. In the United States he served on the writing team for the 2006 Quadrennial Defence Review, then as Chief Strategist in the U.S. State Department's Counterterrorism Bureau, serving in counterterrorism roles Afghanistan, Pakistan, Iraq, Southeast Asia and the Horn of Africa. He served in Iraq as Senior Counterinsurgency Advisor, Multinational Force—Iraq through 2007, before becoming Special Advisor for Counterinsurgency to the Secretary of State in 2008-2009. He was the State Department's representative on the 2008 Lute Review of Afghanistan-Pakistan Strategy, was lead author for the U.S. Government Counterinsurgency Handbook, and founded the ISAF Counterinsurgency Advisory Assistance Team in 2009.

## Executive Summary

As the Australian Army leaves Afghanistan, the urban littoral will rise in importance simply because Australia's primary operational environment (POE) is overwhelmingly littoral and increasingly urbanised. But we no longer face the littoral of which Ralph Peters or Charles Krulak wrote in the 1990s — in the pre-mobile phone era, before significant penetration of the internet into the developing world. Today we face an urban, *networked* littoral. The explosion of electronic connectivity changes both the environment and the threats we may encounter within it.

This paper explores the *urban, networked littoral* and proposes concepts for control operations in this setting. The ensuing discussion considers in turn the environment, missions and threats, the operational response, and capability implications.

# Introduction

In the last days of the twentieth century, predictions pointed to a future that would be crowded, urban and coastal. Between 1960 and 2000, world population doubled from 3 to 6 billion. From 1970 to 2000, 40 million people moved to cities on the Mediterranean coastline, three-quarters of them in the Middle East and North Africa. In Australia's region, coastal cities such as Jakarta, Kuala Lumpur, Manila and Port Moresby struggled with breakneck growth: Jakarta grew from 4 to 11 million and Manila from 3.5 to 10.8 million in a generation. Further afield, Mumbai, Karachi, Dhaka, Tokyo and Shanghai swelled into littoral megacities.[1] By century's end, 80% of humans lived within 100 kilometres of the sea, more and more of them in larger cities than ever before.

And since wars most often occur where people live, these long-standing trends of population, urbanisation and 'littoralisation' affected the incidence of conflict, like every other aspect of life. Thus in the 1990s, Australian soldiers found themselves operating in urbanised coastal terrain. They fought Somali urban militias, kept the peace in Cambodian refugee camps, patrolled Bougainville's littoral ghost city of Arawa, ran observation posts above Lebanon's coastal strip and secured the coastal towns of East Timor. Australia's allies dealt with urban irregulars in Sierra Leone, Haiti, Bosnia, Somalia, Northern Ireland and Kosovo.

Urban littorals, naturally enough, featured in that era's professional debates: Michael Evans, Russell Glenn, Ralph Peters, Robert Scales, Roger Spiller and others analysed their challenges. Australia developed a concept for 'manoeuvre operations in the littoral environment'; US Marines wrote of 'chaos in the littorals' and 'three block war', publishing doctrine on urban warfare and operational manoeuvre from the sea; the Royal Marines experimented with Commando 21,

a structure optimised for urban littoral warfare. Army-Navy collaboration deepened, and new capabilities — the Kanimbla-class LPAs, the Abrams tank, the C-17, the ARH Tiger — pointed to power projection, entry from air and sea, precision strike and control operations as the way forward.

## The long detour

But the terrorist attacks of 9/11 took us on a long detour. For a decade, counterinsurgency in rural, landlocked environments became the norm. In this, Australia's experience resembled that of its allies. Of the 50 countries in Afghanistan and the 49 in Iraq, only US forces saw sustained urban combat (in landlocked cities such as Fallujah, Ramadi and Baghdad), and only the British in Basra experienced combat in urbanised littorals. Australians saw combat frequently in Afghanistan, and occasionally in Iraq, but mostly in rural, landlocked environments.

For Australia, like most allies, the war on terrorism has centred on frontier outposts, mountain villages, remote tribes and rural communities. But if we step back from Australia's experience to look at global conflict during this century, we see a different picture. Since 1999, Russians in the Caucasus, Georgia, Abkhazia and Crimea have operated in urbanised, littoral environments. Israelis in Gaza, Lebanon and the West Bank conducted urban counterinsurgency and high-intensity combat in Jenin, Ramallah, Nablus and Bint Jbeil — towns which, while mostly inland, are 'littoral' in that they are places where the effects of land, sea and aerospace intersect.[2] Sri Lanka fought the Tamil Tigers in urbanised littorals in 2006–2009, while African Union troops captured the coastal city of Mogadishu from al Shabaab in 2009–2011.

The 2008 Mumbai attack demonstrated the vulnerability of coastal megacities to seaborne terrorism, while attacks in London, Madrid and Boston (all, likewise, large coastal cities) prompted coordinated police, intelligence and emergency responses to terrorism. In Jamaica, Nigeria, Mexico and Brazil, police and soldiers fought gangs in urban coastal slums, in operations that often approached full-scale counterinsurgency (for example, in Kingston in 2010 and Rio since 2011). The Arab Spring convulsed a string of littoral societies that had grown and urbanised rapidly over the preceding generation.

In short, urban littoral combat has been more common this century than Australia's (primarily Afghan) experience suggests. True enough, there are — and surely will continue to be — wars in remote, landlocked places. Mali, Congo and the

Central African Republic have experienced such conflict in the last decade. But Afghanistan — a conflict in landlocked, mountainous terrain with poor connectivity, where cities are the safest areas — is far from typical.

## Back to the future

As we leave Afghanistan, the urban littoral will rise in importance simply because Australia's primary operational environment (POE) is overwhelmingly littoral and increasingly urbanised.[3] But we no longer face the littoral of which Ralph Peters or Charles Krulak wrote in the 1990s — in the pre-mobile phone era, before significant penetration of the internet into the developing world. Today we face an urban, *networked* littoral. The explosion of electronic connectivity changes both the environment and the threats we may encounter within it.

This paper explores the *urban, networked littoral* and proposes concepts for control operations in this setting.[4] The ensuing discussion considers in turn the environment, missions and threats, the operational response, and capability implications.

# The Environment

The dynamic interaction of four factors — population, urbanisation, 'littoralisation' and connectivity — shapes the environment. The first three are longstanding; the fourth is new and transformative.

## Population

In the mid-eighteenth century, as the industrial revolution was in its early stages, there were around 750 million people on the planet. By 1900 the population had doubled to 1.5 billion. By 1960, it had doubled again, reaching 3 billion in just six decades despite two world wars and an influenza pandemic which, between them, killed more than 120 million predominantly young and healthy people. By 1999 the population was 6 billion, having doubled yet again in less than 40 years. Since then, another 1.1 billion people have brought the population to around 7.1 billion. United Nations (UN) data suggest that the global population will reach 9.6 billion by 2050 and 10.9 billion by 2100. But growth will not be evenly spread:

> *Almost all of the additional 3.7 billion people from now to 2100 will enlarge the population of developing countries … Growth is expected to be particularly dramatic in the least developed countries of the world, which are projected to double in size from 898 million inhabitants in 2013 to 1.8 billion in 2050 and to 2.9 billion in 2100. In contrast, the population of the more developed regions is expected to change minimally ... At the country level, much of the overall increase between 2013 and 2050 is projected to take place in high-fertility countries, mainly in Africa, as well as countries with large populations such as India, Indonesia, Pakistan, the Philippines and the United States of America.*[5]

This is the *median* projection, assuming a fertility drop as GDP rises (a twentieth-century pattern, which may or may not be repeated in the twenty-first). Higher fertility projections indicate 10.9 billion by 2050 and 16.6 by 2100.[6] Whatever the numbers, it is clear that population growth has been accelerating for two centuries and will disproportionately affect developing countries (the 'global south') in the next generation, even as the overall growth rate slows.

## Urbanisation

This crowded world is increasingly urban. In 1800, for example, 2% of humans lived in a city. By 1900, that figure was 10%; by 1950 it was 25% and, in April 2008, the planet reached 50% urbanisation. More than half the global population now lives in a city, so that even as the total population rises and urban populations grow, the rural population is shrinking (Figure 1).

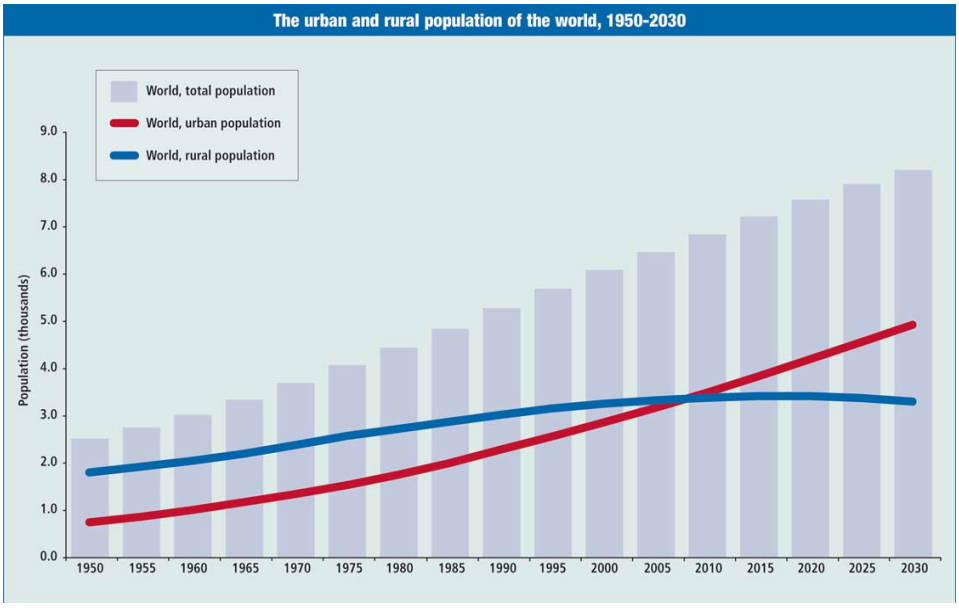


*Figure 1: Urban and Rural Population of the World, 1950-2030. Source - United Nations, Economic & Social Affairs, Population Division, 2005.*

Urbanisation will account for virtually all population growth by mid-century:

> *… Urban areas of the world are expected to absorb all the population growth expected over the next four decades while at the same time drawing in some of the rural population … Furthermore, most of the population growth expected in urban areas will be concentrated in the cities and towns of the less developed regions. Asia, in particular, is projected to see its urban population increase by 1.4 billion, Africa by 0.9 billion, and Latin America and the Caribbean by 0.2 billion. Population growth is therefore becoming largely an urban phenomenon concentrated in the developing world.*[7]

Like population, urbanisation is unevenly spread. Europe, North America and Oceania, the first to industrialise, were also the first to urbanise. Their urban populations are now growing slowly, albeit from a high base. Australia is a special case, given its recent European settlement, low population density and desert interior. More than 80% of Australia's population is already urban, with more than 90% expected by 2050.[8] In contrast, developing countries began industrialising later, and are currently more rural, but are rapidly urbanising as twentieth-century population growth translates to urban growth via rural-to-urban migration.

A few countries — including several in Australia's area of strategic interest — will absorb most of the world's urban growth in the next 15 years. 'Between 2011 and 2030, the urban areas of the world are expected to gain 1.4 billion people, including 276 million in China and 218 million in India, which account together for 37% of the total increase.'[9] Asia will see the fastest growth, with megacities including Dhaka, Karachi, Delhi, Calcutta, Mumbai, Shenzhen, Beijing, Guangzhou, Shanghai and Manila continuing to expand. Indonesia, Bangladesh and the Philippines are the countries in Australia's region most heavily affected by urban growth; Chinese cities (particularly in China's coastal strip and coal-producing north) are also growing rapidly, while India will shift from two-thirds rural to two-thirds urban in less than 30 years:

> *According to one vision, India's entire western seaboard could turn into a single conurbation, stretching from Ahmedabad in Gujarat in the north, past Mumbai and south to Thiruvananthapuram in Kerala. Inland, Delhi and its environs could be a hub for 60m-70m people, provided there is enough water. Within two decades India will probably have six cities considerably bigger than New York, each with at least 10m people: Ahmedabad, Bangalore, Delhi, Mumbai, Hyderabad and Chennai.*[10]

While some governments and economies have responded effectively to rapid urbanisation, many cities are experiencing overstretch. Indeed, the pace and scale of rapid, unplanned, under-resourced urbanisation in the developing world contributes to what urban theorist Mike Davis has called a 'planet of slums'.

*Figure 2: Mumbai Slums. Source - Joel Newell.*

Edgar Pieterse, Head of the Africa Centre for Cities, speaks of 'dramatic, disruptive change in one generation'. As city populations grow through natural increase (the surplus of births over deaths) and rural-to-urban migration that draws, on average, 1.4 million people per week into cities, there is a disproportionate increase in slum populations.

New urban arrivals tend to settle in informal (often illegal) peri-urban settlements that lack government presence, infrastructure, jobs, health, sanitation, transportation, education and rule of law.[11] This political and economic marginalisation of peri-urban newcomers is ironic given that economic opportunity has always been a key driver of urban growth. People flock to cities drawn by the promise of a better life, only to become stranded in congested slums — in view, but out of reach of their goal. In addition to the anger and disillusionment of urban exclusion, newcomers bring conflicts from their home villages and also the religious extremism that has historically been more prevalent on frontiers than in

metropolitan areas. These ‘conflicts of rural origin’ play out in peri-urban slums where people are dislocated from traditional authority systems that once contained conflict.

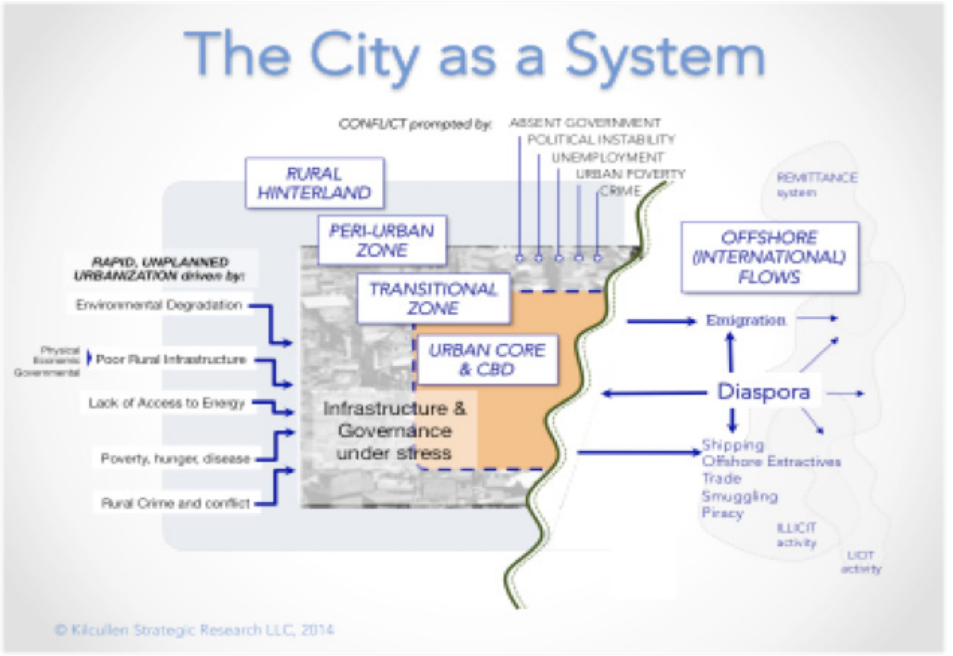


*Figure 3: The City as a System.*

This process can be portrayed graphically by representing a rapidly growing, connected, littoral city as a complex system of flows and overlapping network footprints (Figure 3). Huge numbers of disillusioned, excluded, under-served slum-dwellers create openings for non-state groups — militias, religious or political movements, or criminals — who step into the economic and governance vacuum to offer what populations need and governments cannot provide. Thus growing cities find their cores surrounded by peri-urban no-go areas, afflicted by violent crime and controlled by non-state armed groups.

Another effect of urbanisation is the merging of individual cities into ‘city clusters’: conurbations in which towns, once separated by farms or wilderness, become embedded in contiguous zones of peri-urbanised terrain. This creates what architects such as Ricky Burdett refer to as the ‘Endless City’ and others describe as ‘mega-regions’ — as will be discussed later, this has significant military implications because it prevents a force from isolating urban objectives in the traditional way.

## Littoralisation

'Littoralisation' parallels population and urbanisation. Cities grow around logistic or transport hubs, or at chokepoints (seaports or water-crossing points) along trade and migration routes. Many industrial processes — including textile and coal production — are water-intensive, encouraging urbanisation in areas of water abundance. Since it has always been easier and cheaper to move heavy goods by water than on land, cities tend to cluster on rivers, in deltas, or against lakes and oceans. The same factors driving urbanisation make populations more coastal over time: people do not migrate randomly, but rather to existing cities which are already littoral.

Thus, by 2012, four out of five megacities were sited on coastlines and 75% of large and mid-sized cities were littoral. In Australia, 82% of the population lives within 80 kilometres of the sea. In Indonesia, with the longest coastline in the world, 65% of people lived within 50 kilometres of the coast by 2007, while 75% of cities were in low-lying coastal areas.[12] More than 70% of Malaysia's population is urban, with cities clustering on the west coast of peninsular Malaysia.[13] In the Philippines, metro Manila — the eleventh largest city on the planet — holds 12 million, but is surrounded by a peri-urban zone that houses 26 million, many in coastal slums.[14]

Coastal urbanisation, even assuming no rise in sea levels over the next century, puts more people into low-lying coastal settlements, increasing vulnerability to storm surges, tsunamis and floods. The concentration of industrial infrastructure (oil refineries, petro-chemical plants, bulk storage terminals or power stations) in coastal cities creates environmental threats. And coastal peri-urbanisation produces slums (such as Makoko in Nigeria) that straddle the high-water mark, complicate littoral manoeuvre and choke waterways with congested settlements and toxic waste.

## Connectivity

All this was well understood 20 years ago; the new factor is the connectivity explosion. One statistic illustrates this: in 2000, there were 30,000 mobile phones in Nigeria; by 2012 there were 113 *million* — a 279,000% increase in just over a decade. Figure 5 compares mobile phone subscriptions in selected countries between 2000 and 2012.

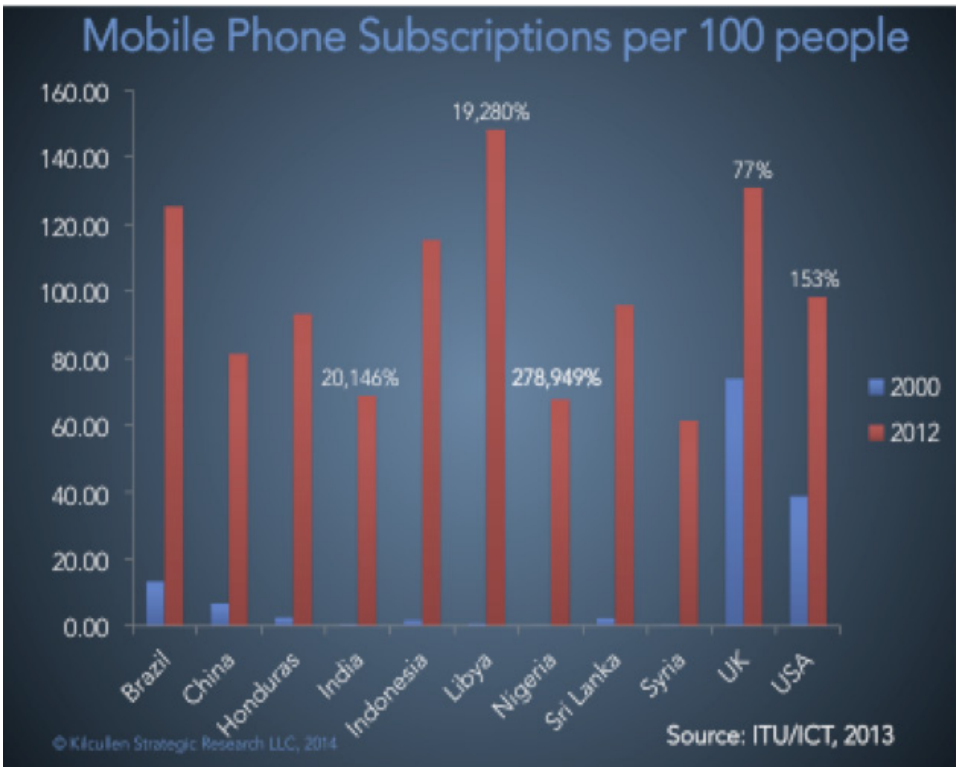


*Figure 4: Mobile phone subscriptions per 100 people. Source - International Telecommunication Union, 2013.*

Connectivity grew so quickly over the last decade that, by 2013, there were 'almost as many mobile-cellular subscriptions as people in the world, with more than half in the Asia-Pacific region (3.5 billion out of 6.8 billion) … Mobile-cellular penetration rates stand at 96% globally; 128% in developed countries; and 89% in developing countries.'[15] There are similar figures for internet users: by 2013, 2.7 billion people worldwide were online (39% of the population), internet penetration in the Asia-Pacific was twice that of Africa, and 1.86 billion people (26% of the world population) were active social media users.[16] This connectivity surge is transforming the environment in three ways: through access to the international economy, population mixing and its effects on conflict

Traditional economies emerging from colonialism depended on primary industry (agriculture, mining, forestry and fisheries). But the connectivity explosion joins emerging economies with global networks to an unprecedented degree. Thus,

Nigerians, Kenyans, Somalis, Sri Lankans, Bangladeshis, Pakistanis and Yemenis are embedded in global trading networks in their own regions and in Europe, the Americas, South-East Asia and Australia via their global diaspora.

Access to the global economy depends on connectivity which is higher in cities where mobile phone and wi-fi coverage is better (See Figure 5 which illustrates the urban, coastal pattern of mobile phone coverage in Kenya). Thus, connectivity in cities is becoming a driver of rural-to-urban migration as people move to cities not only in search of better jobs and living conditions, but also to access greater connectivity.

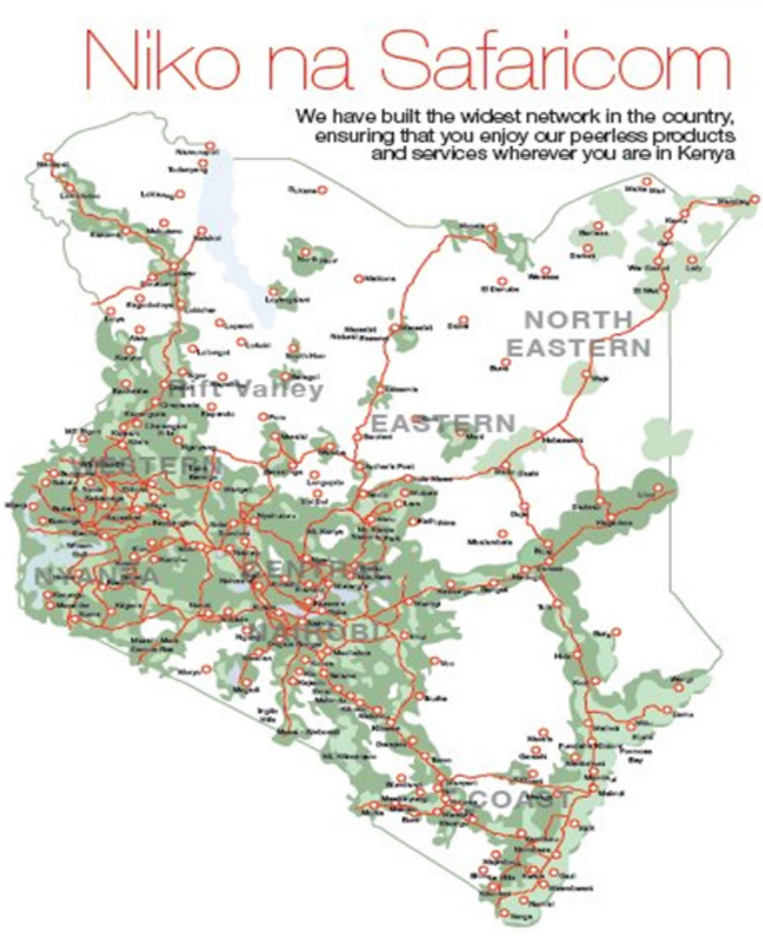


*Figure 5: Mobile phone coverage in Kenya. Source - Safaricom, Kenya, 2013.*

Figure 6 shows the currency exchange in Mogadishu's Bakara market. The Somali Shilling, a currency that survived 20 years of civil war without a state or a central bank, now floats on international markets. Currency traders check exchange rates online and send updated rates via SMS message five times a day to traders in the city who trade with Somalis in the diaspora (almost a million people) and across the region. Obviously, this would not have been feasible even ten years ago.

*Figure 6: Currency Exchange in Bakara market, Somalia, 2013. Source - Jasiira Network.*

Population mixing is another connectivity effect. As populations move to cities, they maintain close ties to their villages of origin. This human network — a dense web of relationships that expands a city's network footprint into its rural hinterland — now meshes with a wider electronic network. Thus the network footprint of a connected city includes not only its own hinterland but also its global diaspora and its trading networks. This has always been true to some degree, but exploding connectivity allows near real-time transfers of information, money, population and goods that were previously impossible. It also links tribal and ethnic groups that are widely separated in space, through the population-exchange mechanism of urban and peri-urban settlements, where people from numerous villages of origin are thrown together.

The Tunisian Revolution of 2010–2011 demonstrated the military impact of this dynamic. The revolution broke out in Sidi Bouzid, a country town. Over the 20 years since 1990, Tunisia had experienced rapid coastal urbanisation: its capital,

Tunis, now held almost 25% of the population, with urban-dwellers drawn from all over the country. Via mobile phone and the internet, news of the uprising rapidly reached the capital and then spread almost immediately — because of the urban population-mixing effect — to dozens of towns. When troops attacked protesters in Tunis (Figure 7), phone calls, SMS, video and photos radiated to outlying towns and into the diaspora, prompting demonstrations across the world, and flows of political and material support. Urbanisation, connectivity and network overlap combined to accelerate the uprising, as it did in the other Arab Spring uprisings.

*Figure 7: Tunisian soldiers serving as gendarmes. Source - Habib M'henni / Wikimedia Commons, 2011*

The Libyan and Syrian wars highlight the effect of connectivity on conflict:

- In Misrata on 6 May 2011, Libyan helicopters dropped a previously unseen weapon in the harbour area. A citizen journalist from the rebels' media centre took a mobile phone photo and posted it on Flickr. Andy Carvin, a journalist in the United States, used Twitter to crowd-source an identification of the weapon. It took less than 40 minutes for his followers to confirm that this was an Iranian copy of a Chinese parachute mine. While this was its first known use in war, the mine was identified while the attack was still in progress.

- Later, during the same battle, civilians used smart phones to create a crowd-sourced, self-synchronised system to 'pin' regime positions on Google Earth, updating markings as NATO planes destroyed the positions. Intelligence staff in the Amphibious Task Group used the system for planning and bomb damage assessment.
- In 2013, Syrian rebels used smart phone compass apps and Google Maps to calculate bearing and elevation for home-made mortars and rocket launchers. Forward observers with smart phones spotted the fall of shot and used Google Earth to mark the point of impact, allowing the baseplate to adjust fire with the same smart phones used to calculate the firing solution. The rebels had converted smart phones to hand-held mortar/artillery fire computers.
- During the Russian invasion of Georgia in 2008, hackers accessed the bank account used by the Georgian government to buy satellite imagery for its air defence system. They drained the account, caused a default on imagery purchases and brought down Georgia's air defence system on D+3.
- During the 2008 Mumbai terrorist attacks, controllers in Karachi monitored Twitter feeds from civilians trapped in the Taj Mahal hotel. They identified civilians' locations in real time then passed these by SMS and voice to assault teams in the hotel, leading them to hiding places. The controllers, in continuous contact with the assault teams, acted as a remote command node that monitored satellite television, updated the terrorists' responses and conducted Google searches to verify the hostages' identity.
- In Libya, Syria, Russia and Iran, government-sponsored groups (known as electronic armies) have been formed to harass, hack and disrupt rebels or dissidents.
- International activists (including Anonymous and Wikileaks), businesses (including Google) and civil society groups (including schoolchildren in the American state of Georgia) shared tools with rebels in Egypt, Libya and Syria, passing resources electronically and expanding the rebels' reach into Europe, Australia and the United States.
- In April 2011, Libyan rebels used Skype from an open field at night as they manoeuvred against a regime position, to contact advisers in London and Finland for information on how to disable a Grad rocket launcher. They then successfully attacked the position.

- In 2012, Syrian rebels built a home-made tank, mounting it with an electronically controlled machine-gun. The ‘tank’ used external video cameras to aim the weapon, linking video to a flat-screen TV inside the hull. The system was controlled with a game controller.

There are dozens of other cases that could be used to illustrate the transforming effect of connectivity on conflict. At this point it is sufficient to note that none of these examples would have been technologically feasible as recently as ten years ago.

# Missions and Threats

Before considering how to operate in this environment, the obvious question is: why we would want to? Would we be better served by simply avoiding urbanised, networked littorals?

Unfortunately, the urbanised littoral will be unavoidable. The Asia-Pacific is one of the world's fastest growing regions, with coastal cities containing increasingly larger populations and giant conurbations linking existing cities. It has one of the highest levels of connectivity (measured by mobile phone and internet access) in the developing world. Avoiding the urbanised littoral would mean opting out of military cooperation, security assistance, power projection, and exercises or operations alongside allies, with negative consequences for Australia's influence and interests. Likewise, conflict in Australia's region will increasingly occur in littoral, urbanised, connected environments, simply because there will be few strategically significant areas left that are not littoral, urbanised and connected. Strategic relevance, by definition, implies grappling with the challenges of this environment.

## Missions

Numerous scenarios could draw the Army into combat in the urban littoral, intentionally or otherwise. These are apparent in the principle of operational uncertainty, explained in *Complex Warfighting* (2005) and *Adaptive Campaigning* (2009), which holds that, in complex physical, human and informational terrain, where adversaries operate (at least initially) below the detection and discrimination thresholds of intelligence, surveillance and reconnaissance systems, land forces

must operate adaptively across a blend of joint land combat, population support, indigenous capacity building, population protection, and public information operations. Even if initial plans do not anticipate combat, the ability to prevail — particularly in *close* combat — is critical to force protection and mission success as it enables the force to safely maintain the persistent presence and close engagement on which all other actions depend. Following this logic, scenarios that could trigger combat in the urban, networked littoral include:

- **Non-combatant evacuation operations (NEO)**. Evacuation of Australian and other nationals from conflict or disaster areas would bring forces into cities in crisis. Protecting evacuees and the force itself may draw a NEO contingent into combat.
- **Peacekeeping and peace enforcement.** Peace operations place troops in complex, congested environments involving multi-sided conflicts. Australian peacekeepers could be vulnerable to abduction or attack, and to environmental hazards that could draw a force into combat in order to safeguard or recover them.
- **Humanitarian assistance and disaster relief (HADR).** Natural or man-made disasters are often accompanied by breakdowns in law and order, mass population movement and civil unrest, so that a HADR force may find itself confronting violent adversaries.
- **Alliance commitments.** Treaty commitments may draw forces into combat in Australia's POE or further afield (on the highly urbanised and littoral Korean peninsula or in the Middle East). As of 2014, US and NATO planners are analysing littoral megacities, revising urban and amphibious doctrine. For Australia to remain relevant, it must be able to contribute meaningfully to coalition combat in the urban littoral.
- **Counterinsurgency, counter-terrorism and security force assistance.** Countering insurgents and terrorists — usually alongside regional partners — will place Australians in urbanised littorals, which are becoming the operational area of choice for irregular combatants.

## Threats

Threats to an Australian land force may arise from the environment itself or result from enemy action. Environmental threats include industrial hazards, disease, and climate/weather events. The following examples are illustrative:

- On 14–15 July 2006, Israeli air strikes on a power station in the coastal city of Jiyyeh released 20–30,000 tonnes of fuel oil into the Mediterranean. The oil created a 10 kilometre-wide slick along 170 kilometres (one-third) of the Lebanese coast, killed marine life and caused air pollution, creating health risks and impeding air and coastal navigation. While the strike was deliberate, the spill (and the resulting propaganda defeat for the Israelis, impact on non-combatants and operational hazard) was probably an unintended consequence of manoeuvre in an industrialised urban littoral.
- On 11 March 2011, a tsunami severely damaged the Fukushima No. 1 nuclear plant, causing a meltdown. Nuclear installations represent an extreme (but not uncommon) example of destructive forces in urban littorals. Clean-up efforts involved Australian, American and Japanese forces from air bases, on the ground, and sea-based aboard USS *Ronald Reagan*, plus civilian urban search rescue teams, and coalition and UN agencies. In total 24,000 personnel, 189 aircraft and 40 ships were involved. Some (like USS *Ronald Reagan*) required extensive decontamination and there are ongoing claims concerning the impact on the health of those involved.
- Following the 2010 earthquake, a UN force deployed for HADR in Haiti's devastated cities. In October 2010 a cholera outbreak occurred which, by mid-2013 had killed 8200 and spread to the Dominican Republic and Cuba, making it the worst in modern history. The consensus is that the cholera strain responsible was brought into Haiti by Nepalese peacekeepers and spread through poor latrine discipline in a UN camp. The breakdown of urban infrastructure — particularly water purification, sanitation and food hygiene — spread the disease, as did crowded internally displaced persons' camps and military bases.[17]
- In November 2013, super-typhoon Haiyan struck the coastal city of Tacloban in the Philippines. A five-metre storm surge destroyed the airport and strong winds devastated 90% of the city. American, Philippine and Australian forces (among others) undertook HADR using sea-based joint task forces including engineers, amphibious ships, medical personnel, helicopters and cargo aircraft. New People's Army insurgents, after initially attacking aid convoys, declared a temporary ceasefire.

Armed actors pose an even greater threat than the environment. Irregular (i.e. non-state) groups in an urbanised littoral include a stunningly wide variety of insurgents and terrorists (home-grown or externally sponsored), militias, neighbourhood self-defence groups, gangs, crime networks, traffickers, pirates, smugglers, and armed protest movements. An intervening force always changes the alignment and activities of such groups. It may cause rival groups to unite against the outsider, force a shift in temporary alliances, or favour a previously minor group. Local actors seek to manipulate the force to improve their position vis-à-vis other groups, settle scores, or build a base of support. They may do so by attacking the force, or seeking to exploit it.

A force engaged in control operations must guard against two equal and opposite errors. The first is to view all non-state armed groups as the enemy. For Australians, coming from a democracy where elected governments maintain a monopoly on the legitimate use of force, it may be difficult to regard a local militia gang as a legitimate partner; however, many such groups provide crime prevention, dispute resolution and mediation services, and social goods that populations need and governments cannot deliver. Clearly, in contested peri-urban environments, groups that fail to defend their turf disappear, so by definition any group that controls territory is likely to be armed — although it may be a potential ally as well as an enemy (or both), or may be more effective and legitimate in a given area than government forces.

The second error is to imagine that any local group is completely aligned with the intervening force. Even a highly cooperative group has its own interests. Thus a force conducting control operations must guard against attempts to manipulate it — including, in extreme cases, to provoke it into using lethal force against a local ally's rivals, or misdirect assistance to one group over another. This creates tensions that can trigger major combat.

Not all threats fall neatly into a state/non-state dichotomy. In cities experiencing overstretch, no-go areas may arise, controlled by non-state groups (for example, peri-urban gangs may threaten supply routes, or dominate critical infrastructure or essential workers). Urban elites strike deals with such groups (for example, when political bosses partner with organised crime) and security forces may sponsor (or be sponsored by) non-state actors. Likewise, a hostile state may insert covert operatives into a city, unilaterally or in partnership with local groups. And a non-state group at the outset of a campaign may become a state group via incorporation into state structures or by becoming the government (for example,

a successful rebel group). Even for 'pure' state-on-state conflict, in urbanised littorals, the disaggregated battlespace (discussed in the next section) may prompt states to use asymmetric, irregular or unconventional means.

One outcome of trends described in Part 1 is that Australians are rapidly losing the technological edge on which they have traditionally relied to compensate for lack of numbers. Urbanised, connected populations are increasingly technologically literate. They can leverage a wider network than ever, access facilities such as workshops, industrial sites and communications hubs, apply online and mobile technology, and convert consumer electronics for use in combat. In Iraq, garage-door openers, mobile phones, TV remote controls and industrial chemicals became weapons and, in recent conflicts — as we have seen — this has reached new levels. Even marginalised populations now have impressive *latent military capability*. Libyan and Syrian rebels — students, shopkeepers and civil servants — rapidly became effective guerrillas with small inputs of training, equipment and leadership from experienced cadres. This tech-enabled transformation should be anticipated in future conflicts in Australia's region.

# The Operational Response

## The nine-domain challenge

All this creates challenges for control operations. Unlike the traditional concept of littorals (areas in which the three domains of land, sea and aerospace overlap), deconstructing this environment shows that it poses a nine-domain challenge. A force must contend with dynamic complexity across *seabed*, *sub-surface* and *sea surface* domains at sea, *land surface*, *super-surface* (i.e. rooftop) and *subterranean* domains ashore, *cyberspace*, *aerospace*, and — most importantly, since these spaces are increasingly populated — the *human* domain. Further, each domain is not a static space but a dynamic system. A corollary of the city-as-a-system model discussed earlier is that urban complexity is not additive but multiplicative: each domain is dynamic, all are interdependent, and therefore actions in any single domain influence (and change the problem set) in all others. Complexities dynamically reinforce one another: an urban, networked littoral environment is the product (not the sum) of its constituent domain complexities (Figure 8).

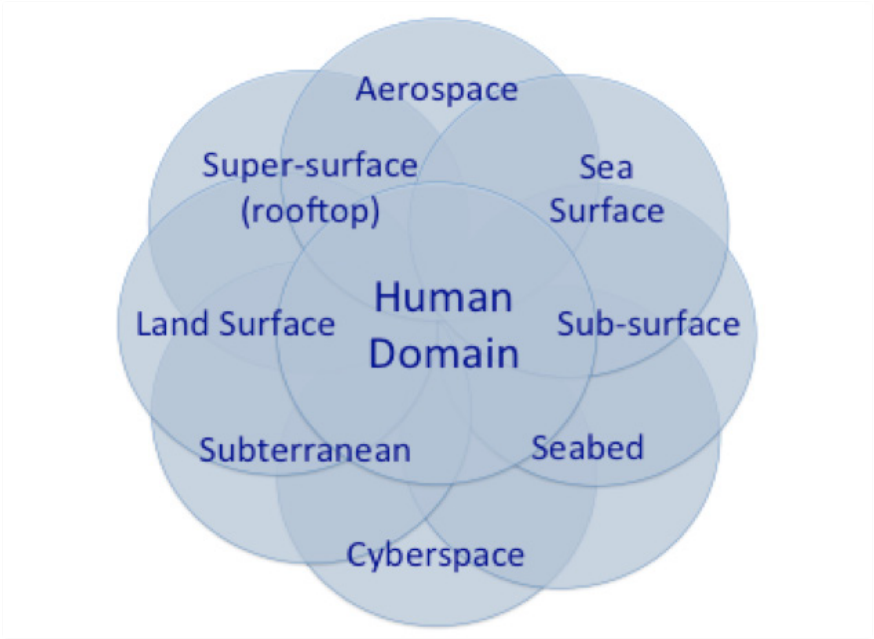


*Figure 8: Dynamic Complexity.*

This dynamic complexity requires an adaptive approach to combat and battlespace management. In particular, control operations demand a departure from the doctrine (such as US Field Manual 3-24 *Counterinsurgency* or Australia's LWD 3-8-4 *Counterinsurgency Operations*) that drove operations in Iraq and Afghanistan. Current counterinsurgency doctrine emphasises protecting civilians to prevent them being intimidated by insurgents. Such protection demands persistent presence where the population lives, ideally round the clock. This, in turn, requires a high ratio of counterinsurgents to civilians — doctrinally, 20 per 1000, or roughly one rifle company per 5000 people.[18]

## Projecting and sustaining forces

How might an Australian force project and sustain land forces using its projected sea and airlift capabilities in the post-2017 timeframe?

The first fundamental problem would be *scale*. Littoral megacities (even mid-sized cities) are too vast for expeditionary forces to achieve the troop densities recommended in current doctrine. A single slum may house 300–400,000 people

and thus, doctrinally, require 6–8000 troops to secure — more than a division when troop rotations are included. In the gigantic slum conurbations in Australia's region, such personnel-intensive tactics are unworkable. Indeed, a city of only 1.5 million could absorb the entire Australian Army without most people even realising it was there. This does not mean that control operations are impossible — far from it. It simply means that security by occupation is unrealistic. Rather, a *light footprint* is needed, avoiding permanent presence at unsustainable troop densities. Current doctrine also often assumes adversaries are concerned with controlling populations — that is, their strength derives from the ability to manipulate and mobilise a population. But many urban adversaries actually rely on control of terrain (industrial sites, ports or airports, supply routes, or essential services) to hold cities to ransom. We will return to this issue in a moment.

The second problem is *combat weight*. Historical studies (and experience in Iraq, Libya and Syria) demonstrate that the urban battlespace is highly disaggregated. Rather than a single, continuous battle, urban combat comprises hundreds of small, fleeting, close-range engagements that are distributed in time and space. Troops and vehicles (land, air or sea) must rely on direct protection. That is, rather than detecting threats early enough to neutralise or avoid them (indirect protection), forces must close to killing range against threats that 'pop up' without warning. Further, because the battlespace is crowded with non-combatants, forces often cannot return fire. Combat under these conditions demands the ability to survive repeated hits (direct protection) rather than solely to avoid being hit. Given current technology, direct protection requires armour, implying weight — an ASLAV weighs 13.2 tonnes, a Bushmaster 15.1, and an Abrams tank 61.3 — but vehicle mass is not the main element of combat weight. For individual vehicles, combat weight includes ammunition (often considerable for firepower-intensive urban engagements), fuel, water, and sustainment loads. At the force level, combat weight is the total mass of troops, vehicles, information and firepower that can be brought to bear at a point of decision (including land, sea and air-based forces and fires). As General Waldemar von Erfurth wrote in 1938:

> *Absolute superiority everywhere is unattainable: hence it must frequently be replaced by relative superiority somewhere. To achieve relative superiority somewhere is the main objective of almost all military movements and the essential purpose of generalship.*[19]

The scale and complexity of coastal megacities (or mega-slums) make it impossible to achieve superior combat weight simultaneously across an entire operating area — even temporarily — and thus 'relative superiority somewhere' demands

the ability to mass fires, forces and information to achieve critical overmatch at the place and time of decision. This invokes considerations of mobility and counter-mobility (the ability to move in a congested, canalised urban environment while denying mobility to adversaries), modularity (force structures that allow troops to concentrate and disperse with agility), fire control (systems that allow a nimble and discriminating application of firepower) and battlespace management (control of air, land, riverine and maritime forces and fires across a dynamic battlespace).

These factors imply the need — already recognised by Australian planners — for increased combat weight. A countervailing pressure, however, arises because Australia's sealift and airlift assets — the Tobruk and Bay class (LSH/LSD) landing ships, Canberra class amphibious assault ships (LHD) and C-17 and C-130 transport aircraft — impose an upper limit on the combat weight a force can deploy, insert and sustain. Further, in littoral slums — with narrow alleys, weak bridges, soft roads and poor drainage — there are places armour simply cannot go. The average width of Australian armoured vehicles (Abrams, ASLAV and Bushmaster) is 2.92 metres, while many slum alleys are less than half this width. This suggests that the optimum force is a medium-weight capability which, in the Australian context, still represents a substantial increase in combat weight over current capabilities.

That said, light infantry dismounted operations remain absolutely essential in the urban environment as part of distributed operations. Indeed, in Baghdad during the 2007–9 surge, one configuration used a medium-weight armoured vehicle as a base of fire, with three or four 'satellite' patrols of four to six dismounts moving in a radius of 50 to 200 yards around it. This distributed configuration allowed the vehicle to provide fire, observation, communications, an ammunition reserve and access to supporting fires, while the dismounted teams — who were more agile in complex terrain — deterred snipers (because they could quickly run a shooter down at the prevailing short engagement ranges), offered some protection against IEDs through dispersal and visual detection, and allowed engagement with the population, which over time generated better threat intelligence and civil information. This demanded a large number of small, mobile, often joint or interagency teams rather than a few large units. It produced a 'company commander's war' in which the main functions of higher headquarters became battlespace management, fire support and logistics. Decisive manoeuvre — except for rare set-piece engagements — occurred at the platoon and squad (or even fire team) level.

*Figure 9: US-Iraqi joint patrol near Iskandariya during the surge. Source - David Kilcullen.*

The third fundamental problem for force projection and sustainment is *logistics*. In the wars of the past decade, Australians (like other coalition forces) used a system of forward operating bases (FOBs) where supplies — water, fuel, some types of food, and labour — were acquired through commercial contracts. In Iraq, the supply chain ran from Kuwait via land routes fanning out from larger to smaller FOBs. While some isolated bases relied on air resupply, the overall system was land-based. Similarly, in Afghanistan, two trucking routes from Karachi through Pakistan provided the main supply route until 2011 when they were replaced by the Northern Distribution Network, using railways or ferries through Europe and Central Asia and trucks from the Afghan border. Both systems were contract-driven (supplies were commercially purchased and convoys operated by contractors), land-based, and optimised for static deployment rather than mobile warfare.

This is unlikely to succeed in an urbanised littoral. If (as discussed in Part 2) a force deploys precisely because cities are *not* coping, then adding demand to an overloaded system by contracting for supplies (which civilians also need) may exacerbate shortages, destabilise the economy, empower some local groups over

others, and create conflict. It may make the force dependent on armed groups that dominate routes through peri-urban areas, while fixed logistic hubs — indeed, FOB-based systems in general — create predictabilities that can be targeted.

One apparent solution is to secure a sea/air point of entry (a port or airfield) as a base to which manoeuvre units can return for replenishment. Ports are more viable than airfields alone, since purely air-based logistic systems would be prohibitively expensive for all but very short-duration missions. But seizing (even peacefully securing) a port poses very significant challenges. Taking over a port may disrupt civilian relief efforts and commercial activity; many ports also draw workers from peri-urban zones where the force may be operating, creating operational security problems or conflict with organised crime groups. Most importantly, securing a sea point of entry requires ships to enter the complex hydrography and dangerous congestion of urbanised littorals. This hampers the task group's manoeuvre and exposes it to land-based weapon systems, underwater IEDs and mining of littoral chokepoints. It exposes naval units to attack by surface action groups (like the fast boat swarms of the Tamil 'Sea Tigers'), makes it harder for submarine escorts to screen the task group, and pins it to a known location that can be targeted. All this, of course, is in addition to the non-trivial issue of securing the port in the first place!

For these reasons, most analysts have reached a similar conclusion: the force needs to be sea-based. In the Australian post-2017 context, a sea-based force would maintain its headquarters afloat (probably aboard the Canberra class LHD given its command and control capabilities) along with logistics, fires, transportation and medical assets, supporting landing forces with surface craft and helicopters. Land forces would operate under an ISR, air defence and naval gunfire umbrella from the Adelaide or Anzac class (FFG/FFH) frigates and the Hobart class air warfare destroyer (AWD), with supply and amphibious ships providing the sea base, and minehunters, submarines, patrol boats and aircraft screening the force.

Air defence is critical since a force would be extremely vulnerable to air attack (including, in future, to UAVs). The AWD only partially supplements the need for air superiority, and the Air Force would have a crucial role establishing and maintaining air superiority, interdicting adversary moves and safeguarding ships and aircraft in transit. With the decision to purchase additional F-35 Joint Strike Fighters, the government has committed to longer range strike-capable aircraft to complement the F/A-18F and F/A-18D aircraft currently in service; until JSF is introduced, there may be a requirement to seize a forward base to give shorter range aircraft sufficient time on station to provide meaningful air cover.[20] These considerations

might prompt a joint commander to seek an advanced base — but this would depend on the availability of secure anchorages and airstrips a reasonable distance from the operational area.

While this paper is primarily concerned with land forces, clearly demands on naval and air forces would also be extremely heavy and it would require great strategic commitment for Australia to place such a large portion of the ADF so close to a potentially hostile coastline. Even more critically, Australia lacks sufficient selective-offload supply ships and replenishment oilers for a long-term, unilateral, sea-based operation. This suggests that an operation (sea-based or otherwise) would be significantly more viable if undertaken with international agreement and in conjunction with regional partners and key allies.

## Control operations across the urban system

How does a medium-weight force achieve control in an urban or peri-urban environment? The approach suggested here is to treat the urban environment as a system (rather than a piece of terrain) and exert influence — simultaneously or near-simultaneously — across the entire breadth and depth of the system.

Current doctrine (*Military Operations in Urban Terrain* or *Operations in Built-Up Areas*) treats urban environments as terrain. This implies that cities are static, like landscape, but in fact cities are living systems that change continuously. Every morning, masses of people flow into a city's core for work, moving out to peri-urban zones in the evening, while others flow in; goods and commodities flow continuously through the city; overlapping networks (human, physical and informational) control these flows. Rather than static terrain, cities are complex flow systems — of people, money, information, goods, construction materials, food, water, fuel and energy — overlaid on a physical framework that shapes flows and, over time, is shaped by them.[21]

Conflict disrupts flows, causing parts of a city to wither while others flourish, and creating new physical structures. This is obvious in cities (such as Grozny, Hiroshima, Dresden or Beirut) damaged in war then rebuilt in new places or configurations. More subtly, generations of gang conflict shaped Kingston, Jamaica, determining the location of its 'garrison districts', routes and infrastructure. Likewise, two decades of war shaped Mogadishu, altering the city's human and physical terrain. Thus, conflict shapes the city, the city in turn channels subsequent conflict, and this reshapes the city in an iterative cycle.

As noted earlier, terrain-centric approaches will fail because we lack the force density to secure cities on this scale. Attempting to overcome this by substituting firepower for troops would risk destroying the city, and would be legally and ethically unacceptable. Likewise, 'endless cities' — in which conurbations fill spaces between cities — invalidate the traditional method of isolating cities to control them or before a break-in battle. To quote US doctrine:

> *One key to success in the history of urban operations has been the* ***effective isolation*** *of the threat force … In a modern metropolis or megalopolis, this can appear a daunting task. Operational isolation requires dominating all physical and electronic contact between the threat in the urban area and supporting threat forces outside the urban area. This does not necessarily require physically encircling the urban area, but* ***it does require that Army forces be able to exert control over the area's entire perimeter, as well as decisive points within****. For a sprawling urban area, successful isolation may require the commitment of a large amount of resources.*[22]

For a light-footprint force, isolating a littoral city is impossible — not only because of scale, but because of the open coastal flank which a land force (or joint force of the size likely to be available) will struggle to close. Instead, the force must understand the city as a flow system, determine key nodes (at each level of the city system), access these nodes and the populations who control them, control the city by shaping and if necessary stopping its flows, then transition to a legitimate local or international follow-on force (or redeploy out of the operational area). We can sequence this approach as: understand, access, shape, control, and transition.

This may seem esoteric, but it aligns well with current Australian doctrine for agile campaigning, and mirrors the method already used by non-state groups in many cities. As described earlier, such groups hold cities to ransom by controlling terrain rather than population. Gangs such as Mungiki, for example, dominate peri-urban zones on the edge of Nairobi, so that essential flows into the city core must run the gauntlet of territory the group controls. By 'taxing' these flows, groups build resources to service local communities (and so cement their control), and buy off officials (neutralising state-based threats to their control). By blocking flows, they can shut the city down, forcing elites to strike deals. The 'choke-hold' effect created by dominance of essential flows gives them critical leverage. A light-footprint force could conduct control operations in the same way, either directly establishing leverage over flows, or via an indirect approach (partnering with local groups that already possess such leverage).

Rather than occupy and secure a dense city core (let alone 'control the area's entire perimeter', which could be hundreds of miles) the force would *understand* the urban system, studying its flows, determining where and how to shape them, and identifying local actors controlling them. It would then *access* key nodes — where feasible, by building partnerships (physically or electronically) with actors controlling them — where necessary by entry from air and sea and direct seizure. Once astride key nodes it would shape flows by securing key terrain and infrastructure, then *control* by interdicting flows, or physically neutralising armed groups who choose to fight rather than cooperate. Using this approach, the force could gain sufficient control to effectively blockade the urban core and could then engage actors in that core from a position of strength, allowing it to begin *transition* to a steady state, handover or extraction. The force would simultaneously influence the entire breadth of the urban system from the core through transitional and peri-urban zones, rural hinterland and the wider network footprint. Examples of actions a force might take are illustrated graphically in Figure 13 and are subsequently explained.

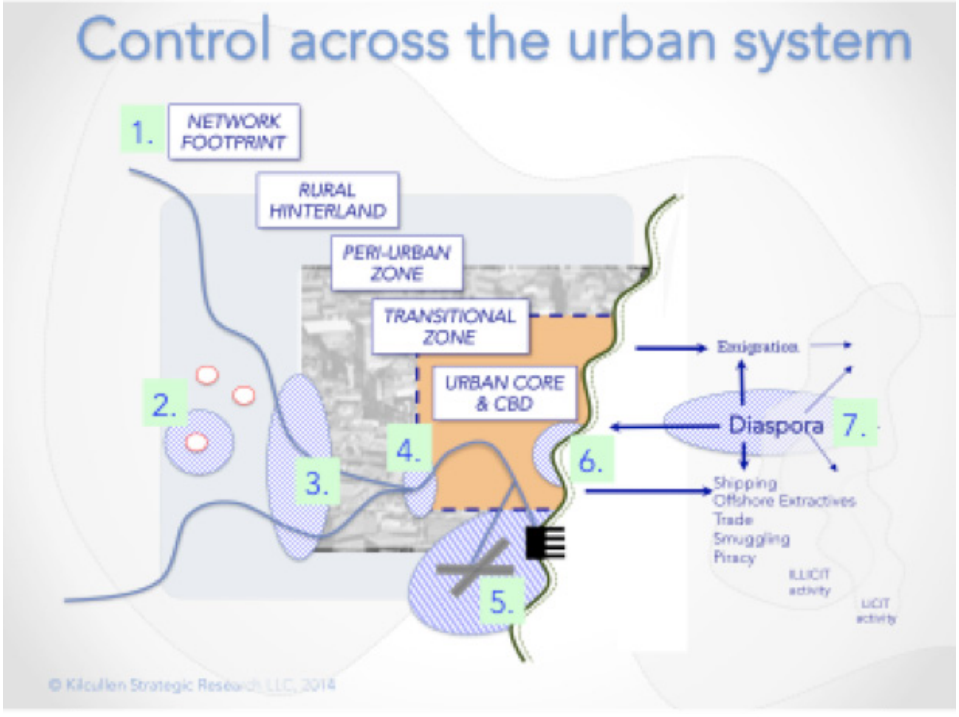


*Figure 10: Control across the urban system.*

- **Network footprint** — physical/electronic engagement of points and individuals of influence in a city's network footprint (examples 1 and 7). Trading partners, business interests, expatriate members of a city's elite, or elements of its broader diaspora would be engaged to build understanding of, and exert leverage over a city.
- **Villages of origin** — inserting teams into villages in a city's rural hinterland (example 2) to access and influence urban populations connected with those villages. Initial electronic engagements would be followed by long-term, collaborative deployments resembling village stability operations in Afghanistan. Teams would identify individuals or groups in a village able to influence recent migrants to the city.
- **Partnership with peri-urban groups** — using network and village-of-origin access, the force would insert specialised teams to partner with armed and unarmed groups in peri-urban and transitional districts (example 3). The goal would be to build partnerships with actors who sit astride, and hold leverage over flows of resources critical to the city's functioning (including transport routes, pipelines, water catchments, food sources, workforce residential areas, fuel storage and distribution facilities). These groups have the ability to interdict or disrupt critical flows; deployed teams (which could be special operations, military information or civil affairs teams, or a mix) would partner with them to place the force astride these flows, gaining the same leverage.
- **Access controls on major routes** — closer to the urban core, the force would occupy chokepoints astride major routes into and out of the city (example 4). This would enable the force to control flows through these corridors, allowing them to flow freely, disrupting them, or interdicting them completely. Ideally such operations would be undertaken in conjunction with local partners, but (given sufficient combat weight) a landing force might also undertake such operations.
- **Control of ports, airports, terminals and harbours** — as noted, the force would initially be sea-based, but would need to dominate air and sea ports to control critical urban flows (example 5). This would ideally be achieved via maritime/air exclusion or interdiction zones, but may also require land forces to rapidly secure ports/airports, or safeguard them from threat actors. In subsequent phases of the campaign, control of these facilities would allow the force to transition to land-based logistics if necessary.

- **Control of critical urban infrastructure** — land forces may secure, safeguard or disable critical urban infrastructure to cement control (example 6). This would include (most significantly) telecommunications infrastructure such as mobile phone and microwave towers, telephone exchanges, satellite ground stations, TV and radio stations, internet service providers and fibre-optic cable landing points. It may also entail occupation of warehouses, distribution centres, power stations and workshops, and control of water, electricity and fuel supplies. Importantly, the force would seek to occupy the *absolute minimum number* of such sites, based on a systems analysis of the city, rather than spreading itself in numerous fixed locations.

Applying this approach, a force would gain extremely significant leverage over an urban system while occupying a tiny portion of its land area and without seeking to protect or occupy large population centres. At this point — depending on the specific mission — the force may negotiate a handover of control with adversary or neutral actors, prepare to redeploy or transition to a follow-on force, or — if adversaries proved unwilling to cooperate — it could begin to conduct kinetic strikes and insert medium-weight manoeuvre forces along the movement corridors it already controlled. Again, the goal would not be to occupy urban terrain or destroy threat actors by direct assault, but rather to flush adversaries into open areas, or force them to concentrate in defended localities, allowing joint strike assets to target them.

# Capability Implications

Clearly, significant capability implications arise from the foregoing discussion, from now until 2025 (the period of current capability plans) and beyond.

In fact, however, both the environment and the operating approach described here align closely with, and build incrementally on *Adaptive Campaigning*, *Complex Warfighting*, and *Military Operations in the Littoral Environment* (MOLE). Many capability implications are thus already included in Plan Beersheba, Land 400 and other projects. This section therefore focuses on issues of capacity (amount rather than type of capability) or on issues not already — or not sufficiently — addressed in current planning.

Obviously, capacity matters. A single amphibious battalion, for example, is likely to lack the capacity for control operations of the type just outlined in a littoral megacity for reasons of scale and of sustainability over the course of a deployment. A brigade group lift (using both sea and air assets, possibly with an intermediate staging base, and potentially in a coalition setting) is likely to be much more viable, but even a force this size would probably struggle.

In terms of amphibious (as distinct from generic sealift) capacity, because there will be very few useable beaches (or, more importantly, beach exits) in an urbanised littoral environment, classic 'across-the-beach' amphibious operations are less likely than joint forced entry (or, in previous Australian parlance, entry from air and sea). This approach uses simultaneous or tightly sequenced sealift, amphibious, submarine, parachute, helicopter and fixed-wing air to insert forces via multiple modes and routes, spreading the lift burden across services and posing a targeting

challenge for an adversary. This approach — rather than 'pure' amphibious operations — is the norm among key allies and is likely to be more achievable for Australia. Expanding amphibious capacity may turn out to be less important than adding sealift (and logistic) capability to enable sea-basing. Selective offload logistics platforms — in sufficient numbers to enable rotation and resupply — may well prove to be the single point of failure in future littoral operations.

Another major implication is the need for pre-conflict (also called 'pre-phase 0') sensing to build detailed, current information on locations, networks, populations and threats ahead of crises. Again, this is the direction in which major allies and international organisations (the United States, NATO and the UN) are moving, and it requires a focus on cities (particularly megacities) as a unit of analysis in their own right (using a combination of remotely observable big data and field-validated open source or denied-area collection) allowing planners to build and update systems models.

Australia would probably never contemplate this kind of operation without host-nation cooperation. But this does not obviate the information problem because many cities are growing so quickly that even their own governments lack detailed visibility of them. Fortunately, one effect of the connectivity explosion is the 'self-revealing environment' in which urban populations and actors of all kinds are online, communicating, analysing their own environments, and producing verifiable information. The problem then becomes one of validation and filtering signal from noise, rather than collection *per se*.

Once on the ground, forces will 'fight unplugged' at times for three reasons.[23] First, joint forced entry operations (including East Timor in 1999 and early-phase Iraq and Afghanistan) suggest that landing forces must expect to fight without resupply for at least 72 hours. Second, if a light-footprint force seeks to control a city by manipulating urban flows, there will be times when mobile phone systems, electrical grids, water and fuel systems are suspended, and thus units must operate without them. Finally, threat actors may engage in 'technological hugging', using the same systems — mobile phones, GPS or internet — as friendly forces, making it more difficult for the force to disrupt them without also disrupting itself. Units may need to fight unplugged to counter this tactic.

Threats will be omni-directional, involving a 360-degree threat to dismounted troops, sea and air platforms, and ground vehicles. In addition to the rooftop and superstructure battle, fighting can be expected in sewers, basements and tunnels, in canals, harbours and inland waterways in coastal cities. Six principal threats

emerge: snipers, IEDs, indirect fire, drones or air attack, cyber attack and chemical/biological/radiological attack. These are all well understood, but it bears repeating that to survive the city, a force must maintain a balanced posture, generating protective responses against all these threats without becoming so defensive that it ceases to manoeuvre.

One technique for overcoming this 'defensive crouch' is to operate in small, mutually supporting combined arms teams that move dispersed but fight concentrated. These teams require protected mobility, secure redundant communications, the ability to rapidly mass and disperse fires, forces and information, and capabilities to discriminate between threatening and non-threatening personnel in crowded dynamic environments, and to engage threats with precision while minimising collateral damage. This may imply a distributed configuration such as that outlined earlier from Iraq, which in turn requires organisational modularity down to platoon or troop level (or even lower) so that organisations quickly reconfigure mid-task. This, in turn, may require a detailed rethink of how junior officers and NCOs are educated, supported and empowered.

Additional engineering capacity will be needed given the extremely intensive requirement for combat engineering, construction, high-risk search, counter-IED, and mobility/counter-mobility operations. Urban environments soak up engineers: they channel ground movement into predictable patterns, placing troops into unobtrusive killing areas that can be engaged from in-depth positions (including at long range from flanks and rear). Extensive engineering work is often required to harden locations or move troops off the street into cover (for example, by mouse-holing structures or linking tunnel systems). The Israeli Defense Forces — the most experienced organisation on the planet today in urban, networked operations — have repeatedly emphasised the role of armoured engineers and, in battles such as Jenin, relied on armoured D9 bulldozers as the central manoeuvre element.

Combat bridging and water transport will be in demand in a littoral city in which forces must negotiate inland waterways on a regular basis, and normal infrastructure may be destroyed. To some extent this is a capacity issue, but it should also be noted that Australian forces (with the exception of commandos) have not traditionally emphasised opposed riverine operations. These may turn out to be critical, and *urban* riverine operations — in which an enemy sits behind hard cover in elevated positions overlooking waterways, and can create riverine ambushes using rooftop firing positions and underwater IEDs — are extremely challenging. This area almost certainly requires more attention.

Another area requiring attention is civil affairs, both in terms of capability and capacity. Australia has a civil-military operations (CMO) capability, but lacks a true civil affairs capability. One benefit of Afghanistan is the creation of a cadre of personnel with experience of reconstruction and post-conflict stabilisation; but there are other civil affairs specialisations — military government, civil-military support element operations, long-term foreign internal defence, law enforcement support, security force assistance — that may become critically important in building partnerships with communities in the urban littoral. Although addressed to some extent in current plans, this aspect — considered within a joint and combined framework — may also need additional attention.

Finally, beyond 2025, certain capabilities may be worth considering (albeit not all Army capabilities). These include long-range precision maritime land attack such as a ship-mounted GMLRS, allowing a joint force to engage targets deep into littoral territory, protect a lodgement area or interdict enemy movement, as well as an expanded capability for organic unmanned ISR to complement existing Army and Air Force capabilities, and build on the capabilities of the JSF, EA-6B Growler, and MQ4-C Triton. Rotary Wing UAVs — similar to the US Marine Corps CRUAS — may be useful in urban environments where rooftops provide the only viable landing sites and combat engagements may prevent piloted helicopter operations. Armoured combat boats (such as the CB-90, currently in service with Scandinavian, German, US and Latin American police and military) may also prove a long-term acquisition worth considering, since they allow a fluid type of integrated sea-air-land manoeuvre that is very well suited to complex littoral waters of the type discussed here.

# Conclusion

This paper builds on previous work, both within and outside the ADF, over more than 20 years, on the future urban littoral and the nature of conflict within it. As noted in Part 4, it offers nothing revolutionary, and rather builds on the analysis and capability decisions taken since MOLE was completed in 2001–2002.

But MOLE was written in the year of the 9/11 attacks — which changed the Army's direction for more than a decade — and the long detour into land-locked, tribal frontier territory that the terrorist attacks prompted is only now coming to an end. A whole generation of junior and middle-ranking officers and senior NCOs have spent their careers in the mountains of Afghanistan confronting a fast-moving, low-contrast, non-state adversary in some of the remotest, toughest, least connected terrain on the planet. It is no denigration of the challenges we have all faced in the past decade, however, to suggest that operations in a future urbanised, networked littoral could be even tougher.

Massive, overcrowded slums surrounding megacities that lack the infrastructure to cope with their own growth, extensive no-go areas dominated by criminals and militias, urban elites hunkered down in civilian versions of the Green Zone, rarely and timidly venturing out: this is the world, somewhere between *Mad Max* and *Blade Runner*, that some projections indicate may be just around the corner. And the technology of connectivity, which is already transforming conflict and is the new ingredient that has been added to the mix since 9/11, will add further challenges to an already daunting mix.

As we have seen, traditional approaches to control operations are likely to fail in this environment — but that does not mean such operations (or littoral manoeuvre in urbanised, connected environments) cannot work — it simply means we need some different concepts, new capabilities, and additional capacity in certain key areas. This paper does not provide the answers, but it does pose some of the questions Army will need to address as it considers a crowded, connected, urbanised future.

# Endnotes

1 Megacities, in this context, are cities (more often, city clusters made up of many contiguous urban areas) with populations greater than 10 million people.

2 Throughout this paper, I use the term 'littoral' in this military sense, not to mean coastal or waterfront areas, but rather areas in which the operational effects of land, sea, air and (as discussed below) cyberspace overlap. Since operational effects are defined by weapons capabilities and the radius of action of mobility platforms, it follows that littorals are not fixed geographical spaces, but rather 'littoral influence zones' that vary in size depending on capability. Areas that are littoral for a force with long-range strike, mobility and maritime power projection platforms may not be littoral for one that lacks such capabilities. More concretely, a littoral influence zone can be defined as that area of land which a given force can engage with sea-based platforms and weapon systems, that area of sea space which it can engage with land-based systems, and the surrounding aerospace, electromagnetic spectrum and cyberspace.

3 The Primary Operating Environment (POE) is an area delineated by the Australian government in the 2009 *Defence White Paper* and on which Australian military planning focuses. In strategic terms it represents Australia's region of direct military influence. The POE extends from the eastern Indian Ocean to the island states of Polynesia and from the equator to the Southern Ocean. That area contains all Australian sovereign, offshore and economic territories such as the continent of Australia itself, Cocos (Keeling) Islands, Christmas Island, Heard and McDonald Islands, Macquarie Island, Norfolk Island and waters adjacent to the Australian Antarctic Territory.

4 See Appendix A for a brief discussion of the specific research question assigned and the analytical constraints, limitations and assumptions implied by this formulation.

5 United Nations Bureau of Economic and Social Affairs, *World Population Prospects: the 2012 Revision*, Vol. 1, New York: United Nations, 2013, p. xiv.

6 Ibid.

7 United Nations Bureau of Economic and Social Affairs, *World Urbanization Prospects: the 2011 Revision*, New York: United Nations, 2012, p. 1.

8 Ibid. p. 9.

9 Ibid. p. 13.

10 *The Economist*, 23 September 2012.

11 'The term "peri-urbanization" refers to a process, often a highly dynamic one, in which rural areas located on the outskirts of established cities become more urban in character. This transformation occurs in physical, economic, and social terms, and often in piecemeal fashion. Peri-urban development usually involves rapid social change, as small agricultural communities are forced to adjust to an urban or industrial way of life in a very short time. High levels of in-migration are an important driver of social change. Rapid environmental deterioration and infrastructure backlogs are usually another characteristic of the peri-urban landscape.' See Webster and Muller, 'Chinese Peri-Urbanization' in *Encyclopedia of Life Support Systems*, UNESCO and EOLSS e-publication, 2004, p. 6.

12 Rokhmin Dahuri, 'Pre-And Post-Tsunami Coastal Planning And Land-Use Policies And Issues In Indonesia' in *Proceedings of the workshop on coastal area planning and management in Asian tsunami-affected countries*, Food and Agriculture Organization, 2007, online at http://www.fao.org/docrep/010/ag124e/AG124E07.htm

13 See Tarmiji Masron, Usman Yaakob, Norizawati Mohd Ayob and Aimi Shamimi Mokhtar, 'Population and spatial distribution of urbanisation in Peninsular Malaysia 1957–2000' in *Malaysian Journal of Society and Space*, Vol. 8, issue 2, 2012, pp. 20–29.

14 Republic of the Philippines, National Statistics Office, *2010 Census of Population and Housing: National Capital Region*, Manila, 2012.

15 International Telecommunication Union, *The World In 2013: ICT Facts and Figures*, ITU Telecommunication Development Bureau, Geneva, February 2013, online at http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2013-e.pdf

16 Ibid.

17 Cholera has a short incubation period (0.5 to 4.5 days); diseases with longer periods such as Dengue (3 to 14 days) or Ebola (2 to 21 days) may be brought on board by a landing force, spreading widely before the first patients become sick, with devastating operational effects.

18 This figure is intended to include police and military, including local host-nation forces — so might be thought to imply a lower military force density — but on the other hand it does not take into account the need for rest and battle preparation rotations in the deployed force, which tends to zero out the benefits of local partner presence, taking the ratio back to the 1:50.

19 General Waldemar Erfurth quoted in Harry G. Summers, *On Strategy: A Critical Analysis of the Vietnam War* (Kindle Locations 2826-2828), Random House, Kindle edition, 2009.

20 For figures of the combat radius of action for the JSF and the F/A-18s, see: http://www.defence.gov.au/news/raafnews/editions/4617/features/feature01.htm; http://www.fas.org/programs/ssp/man/uswpns/air/fighter/f18.html#f18a; http://www.navair.navy.mil/index.cfm?fuseaction=home.displayPlatform&key=32F08227-0DE1-437F-93AB-C7241517AA8D

21 The concept of urban metabolism represents a city as a living biological system, with inputs that are transformed by metabolic processes into energy, mass and waste products, which in turn must be metabolised if the city is to avoid a toxic build-up. This is the theoretical basis for the city-as-a-system model described in Part 1.

22 US Army Field Manual FM 3-06, *Urban Operations*, 7-54, 2006, emphasis added.

23 I am indebted to Dr Janine Davidson for this term.