The whole power of the United States, to manifest itself, depends on the power to move ships and aircraft across the sea. Their mighty power is restricted; it is restricted by the very oceans which have protected them; the oceans which were their shield, have now become both threatening and a bar, a prison house through which they must struggle to bring armies, fleets, and air forces to bear upon the common problems we have to face.[1]

—Winston Churchill, 1942

Logistics Islands

The Global Supply Archipelago and the Topologics of Defense

BY PIERRE BÉLANGER AND ALEXANDER SCOTT ARROYO

For the Department of Defense (DOD), the most important difference between Operation *Iraqi Freedom* (OIF) in Iraq and Operation *Enduring Freedom* (OEF) in Afghanistan is neither cultural nor political, but logistical. Admiral Mike Mullen, former Chairman of the Joint Chiefs of Staff, summed up the difference with terse precision: "We don't have a Kuwait."[2] Lacking a secure staging ground adjacent to the theater of operations exponentially complicates getting materiel[3] to and from forward operating bases (FOBs) and combat outposts (COPs), in turn requiring a longer and more complex logistical supply chain. Landlocked among non–International Security Assistance Force (ISAF) states, unstable allies (Pakistan and China to the east, Kyrgystan and Uzbekistan to the north), and regional "rogue states" (Iran), Afghanistan is, for logistical operations, a desert island.

Afghanistan's Atoll

The key logistical hubs of Kandahar and Bagram are laboriously accessible via three costly, infrastructurally underdeveloped, dangerous, and inefficient routes: from the Arabian Sea via the port of Karachi, Pakistan; from the Baltic and Caspian regions via the transnational, heterostructural Northern Distribution Network; and by airlift via support facilities in the Indian and Pacific oceans or bases as far afield as Fort Blair, Washington. The infrastructural network undergirding OEF logistical operations via sea, land, and air demarcates an adaptive manifold

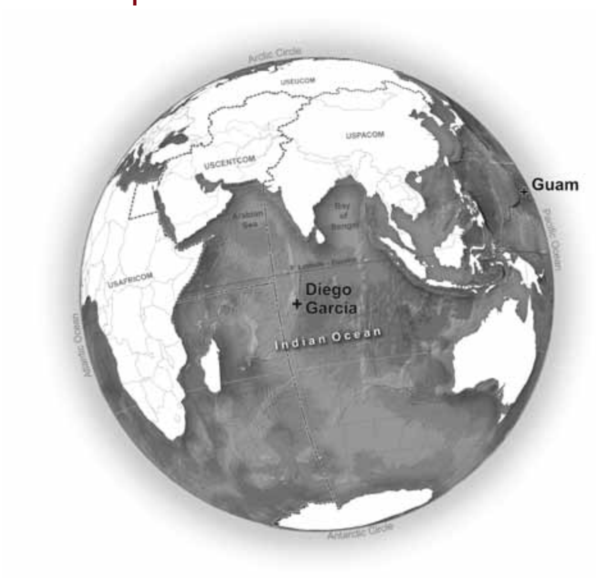
Pierre Bélanger is Associate Professor of Urbanism, Landscape, and Ecology, and Coordinator of the Postgraduate Studies Program at Harvard University's Graduate School of Design. Alexander Scott Arroyo is a Graduate Student in the Masters of Landscape Architecture Program at Harvard University's Graduate School of Design. This article is part of a book that explores the global footprint of the U.S. Department of Defense as a result of fin-de-siècle force protection and power projection examining the spatial infrastructure of sites, networks, and geographies required to carry out foreign policies during an era where ecology and energy have become matters of national security.

that migrates its geometries in real time with geopolitical forces. To track those logistical networks, then, is to diagram the skeletal forms onto which urban generative processes may be grafted; the lasting legacy of ISAF in Afghanistan must therefore be equally read as a project of construction—in the form of infrastructural development and urbanization—in addition to any human, infrastructural, and environmental destruction caused directly or indirectly by combat operations. Indeed, the ubiquitous invocation of a "New Silk Road" as overcode for regional infrastructural strategy—ranging from General David Petraeus and his chief liaison between U.S. Transportation Command (USTRANSCOM) and U.S. Central Command (USCENTCOM) to spokespersons for the Royal Bank of Scotland and the Asian Development Bank—shows the logistical operations and networks deployed through OEF to be endemic to those processes of infrastructural development that would reconnect the old Silk Road from China to the European Union—this time, however, with iron links.

While logistical acquisitions are managed by the Defense Logistics Agency (DLA), logistical operations in the field are predominantly coordinated by USTRANSCOM. On average, the command oversees almost 2,000 air missions and 10,000 ground shipments per week, with 25 container ships providing active logistical support. From October 2009 through September 2010 alone, USTRANSCOM flew 37,304 airlift missions carrying over 2 million passengers and 852,141 tons of cargo; aerially refueled 13,504 aircraft with 338,856,200 pounds of fuel on 11,859 distinct sorties; and moved nearly 25 million tons of cargo in coordinated sea-land operations. DLA and USTRANSCOM and their civilian partners are responsible for the largest, most widespread, and most diverse sustained logistics operation in history.[4]

USTRANSCOM is divided into three operating groups or "component commands" corresponding to the three infrastructural strata exploited for logistics operations: Military Sealift Command (MSC), managed by the Navy; Surface Deployment and Distribution Command (SDDC), managed by the Army; and Air Mobility Command (AMC), managed by the Air Force. While much attention is paid to the familiar iconography of the parachuting crate or the airdrop or the long tail of the fuel-truck convoy, the vast majority of materiel is transported beyond public purview via both chartered and military container ships under the aegis of MSC. According to the USTRANSCOM 2011 Strategic Plan:

Figure 1. Staging Grounds and Theaters of Operations



Geographic locations and key strategic positions of Diego Garcia and Guam amid growing, complex regions of the Indian Ocean and Pacific Rim

Map Diagram: OPSYS/Landscape Infrastructure Lab 2012

More than 90 percent of all equipment and supplies needed to sustain US military forces is carried by sea. Since the start of operations in Iraq and Afghanistan, MSC ships have delivered nearly 110 million square feet of combat cargo, enough to fill a supply train stretching from New York City to Los Angeles. MSC ships have also delivered more than 15 billion gallons of fuel—enough to fill a lake 1 mile in diameter and 95 feet deep.

Neither metric nor imperial but geographic, the amount of materiel moved by MSC accounts for itself in terms of continents and water bodies such that to transport its cargo, the MSC must quite literally move volumes on the scale of mountains and square footage on the scale of islands.

The first MSC-led logistical foray of OEF was, in fact, launched from Diego Garcia, an island 1,800 nautical miles from the African coast, 1,200 nautical miles from the southern tip of India, and the largest island of the Chagos Archipelago, British Indian Ocean Territory. Along with Guam, Diego Garcia is the most strategically important island base providing logistical support for USCENTCOM

(cont. on page 60)

Figure 2. Prepositioning

The banal yet essential work of the Seabees (Construction Batallion Squadrons) at work on marine platforms, port engineering, road construction, and airport infrastructure

From top left to bottom right: (1) U.S. Navy (Elizabeth Merriam), (2) U.S. Navy (Bryan Niegel), (3) U.S. Navy (Joseph Krypel), (4) U.S. Air Force (Shawn Weismiller), (5) U.S. Air Force (Jarvie Z. Wallace), (6) U.S. Navy (Ace Rheaume), (7) U.S. Air Force (Robert S. Grainger), (8) U.S. Navy (Ernesto Hernandez Fonte), (9) U.S. Navy (John P. Curtis)

Figure 3. Military Mobilization

Diego Garcia as a link in the iron chain of command and responsibility for the U.S. Central Command remote theater of operations involving the Department of Defense, U.S. Transportation Command, Defense Logistics Agency, U.S. Air Force Air Mobility Command, U.S. Navy Military Sealift Command, U.S. Army Surface Deployment and Distribution Command, and U.S. Navy Military Sealift Command Office Diego Garcia.

DOD

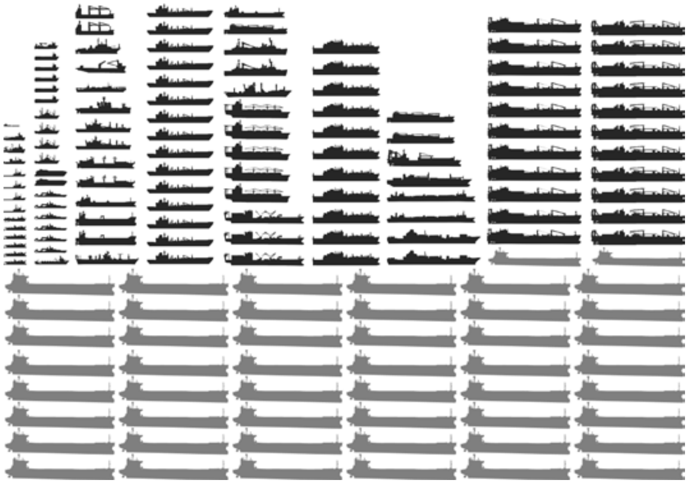
Figure 4. The Fuel Chain

The extents, exchanges, endpoints, and hemispheres of fuel distribution across the U.S. Central Command inventory of fuel farms, tankers, convoys, bunkers, and bases

From top left to bottom right: (1) U.S. Air Force (Samuel Rogers), (2) U.S. Air Force, (3) U.S. Navy (Eddie Harrison), (4) U.S. Army (Steven P. Haggerty), (5) U.S. Navy, (6) ISAF Public Affairs (Russell Gilchrest), (7) U.S. Army (Ryan Matson), (8) U.S. Air Force (S.C. Felde), (9) U.S. Army (Tierney P. Wilson), (10) Combined Joint Special Operations Task Force (Jon Rasmussen), (11) U.S. Marine Corps (M. Trent Lowry), (12) U.S. Air Force (Bradley A. Lail)

Figure 5A. Logistical Fleet

The relative size and distribution of the worldwide fleet of 116 noncombatant, civilian-crewed ships and 50 other standby ships operated by the U.S. Navy Military Sealift Command.



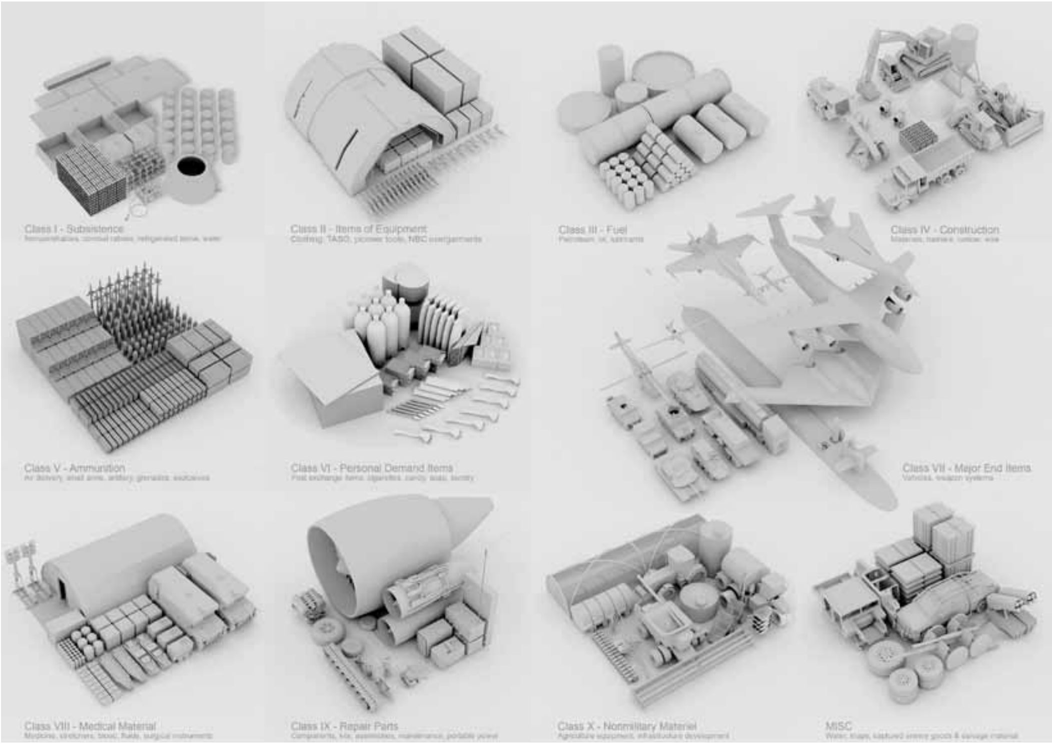
OPSYS/Landscape Infrastructure Lab 2012, adapted from U.S. Navy Military Sealift Command data

Figure 5B. Fleet of Logistics

Chain links of military and civilian ships carrying over 90 percent of military cargo and supply via oceanic infrastructure toward land-based military facilities

From top left to bottom right: (1) U.S. Navy, (2) U.S. Navy (Brian Caracci), (3) U.S. Navy (Eric L. Beauregard), (4) U.S. Navy, (5) U.S. Navy (PH2 Frazier), (6) U.S. Navy, (7) U.S. Navy

Figure 6. From Coral to Cargo



The typologies and topologies of the 10 classes of supply channeled via Diego Garcia by the U.S. Navy Military Sealift Command

OPSYS/Landscape Infrastructure Lab 2012, adapted using source information from Joint Publication 4-09, *Distribution Operations* (Washington, DC: The Joint Staff, February 5, 2010), C-11.

(cont. from page 57)

operations in Iraq, Afghanistan, Yemen, and Pakistan, and U.S. Africa Command operations in Kenya, Rwanda, Somalia, and Libya. In addition to its strategically desirable geographic location, Diego Garcia was selected, after extensive review of Indian Ocean sites (specifically the British Indian Ocean Territory) during the 1960s by U.S. Navy surveyors, for its geomorphological type: the atoll. Formed by the fringing growth of hermatypic (reef-building) corals around the rim of a subsided volcano, the atoll consists of a thin, supramarine strip of eroded geologic and animal material encircling its collapsed submarine interior, creating a ring of dry land around a shallow lagoon. The atoll, simply put, is an island emptied of its geologic content. It is appropriate, then, that its interior has been filled with a history of logistical operations. From British slave galleons collecting coconut oil and harvesting sea cucumbers in the 1790s, steamers restocking coal supplies in the 1880s, German commercial raiding ships seeking shelter during World War I, or the operation of Great Britain's Advanced Flying Boat base during World War II, Diego Garcia has served as a logistical lily pad for centuries prior to its adoption by the U.S. Navy as a keystone of its "Strategic Island Concept"—maximally isolated yet maximally connected—developed

Figure 7. Logistical Lily Pad

Aerial view of Diego Garcia and the classic, ring-shaped reef morphology of mid-ocean atolls that naturally harbors shallow and protected lagoon interiors for easy navigation and berthing

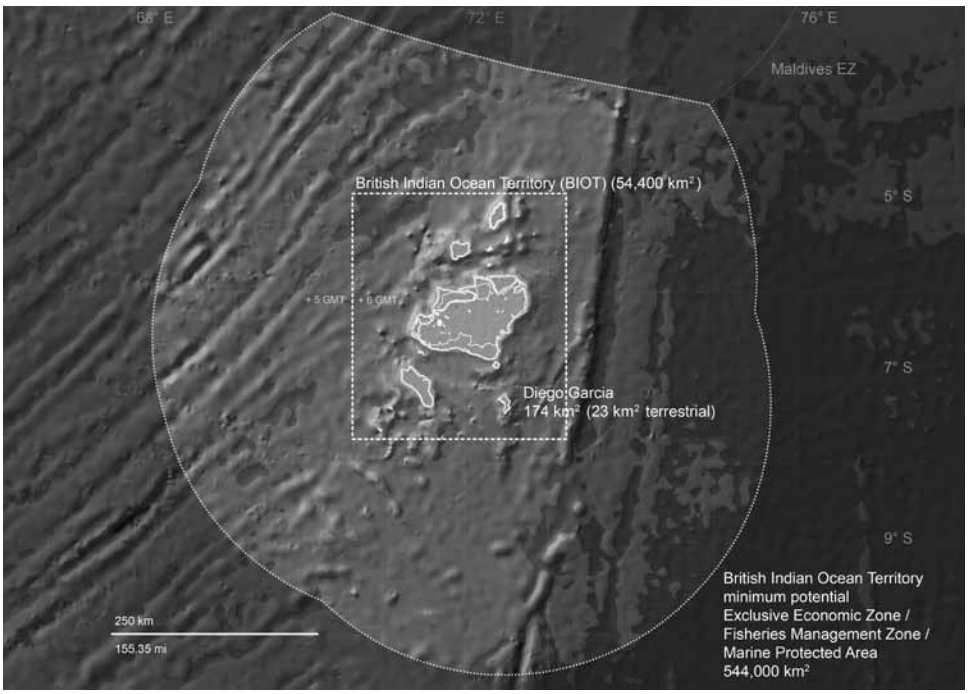
Image Science and Analysis Laboratory–NASA Johnson Space Center, Image STS038-86-104, 07-28-2012 03:53:33

during the first years of the Cold War to formalize and expand on Dwight Eisenhower's "leapfrog" bases scattered throughout the volcanic islands of the Pacific.

Indefinitely leased to the U.S. military under a bilateral agreement between the British and U.S. governments—an agreement notable for its controversial exclusion of the 1,500 Chagos islanders that had occupied the island for centuries prior to its lease—Diego Garcia began its most recent round of infrastructural and logistical metamorphosis as early as 1971.[5] Following the evacuation of armed forces from Vietnam, sites in Okinawa, Japan, and Diego Garcia were slated for significant introduction or expansion of capacity, requiring major investment in new facilities and infrastructure; accordingly, the combat engineers responsible for such work, predominantly drawn from the Naval Construction Force, were reallocated to sites emerging out of the post-Vietnam wave of military-infrastructural projects. Spearheaded by U.S. Naval Mobile Construction Battalions, better known as "Seabees," Diego Garcia began its $1 billion transformation in a manner well suited to the history of its militarized future: dynamiting deep-draft access channels into the lagoon and blasting out tracts of coral reef for use as paving aggregate for the airfield and fill for harbor breakwaters.[6] By 1983, the Seabees, along with private contracting firms specializing in underwater explosives and harbor dredging, had blasted 4.5 million cubic meters of coral fill for infrastructural projects, including expansions of the runway, wharf, and piers and for the accommodation and anchorage of a full carrier-force fleet in the lagoon.[7] When locally sourced coral fill proved insufficient to meet construction material demands, the Navy sourced over 150,000 tons of cement and complementary quantities of sand and crushed limestone from contractors in Singapore and Malaysia, resulting in a land-filling operation comprising "115,000 cubic meters of concrete poured for airport runways and parking aprons, 29 kilometers of asphalt road, antenna fields and support facilities" over 40 acres of internationally imported landmass. Incrementally turned over to U.S.- and UK-based contractors, including then Brown & Root, a Halliburton subsidiary, the process by which Diego Garcia has been developed results in a base "more reminiscent of the Florida Keys than of the Indian Ocean, with all the facilities of a small American town."[8]

Despite Diego Garcia's recent anthrogeomorphic history, its terrestrial episodes are only significant insofar as they are contextualized by the fluid systems in which it is grounded: water and fuel. Indeed, though the

Figure 8A. Territories of Deployment



Extents and overlaps of U.S. tenancy on Diego Garcia's atoll, nested within the Marine Protected Area of the Chagos Archipelago and Exclusive Economic Zone of the British Indian Ocean Territory, whose boundaries were respectively drawn in 1971, 1965, and 2010.

Map: OPSYS/Landscape Infrastructure Lab 2012, with source information from Central Intelligence Agency *World Factbook*, U.S. Navy Naval Support Facility Diego Garcia Integrated Natural Resources Management Plan (2005), U.S. Navy Marine Biological Survey, July/August 2004.

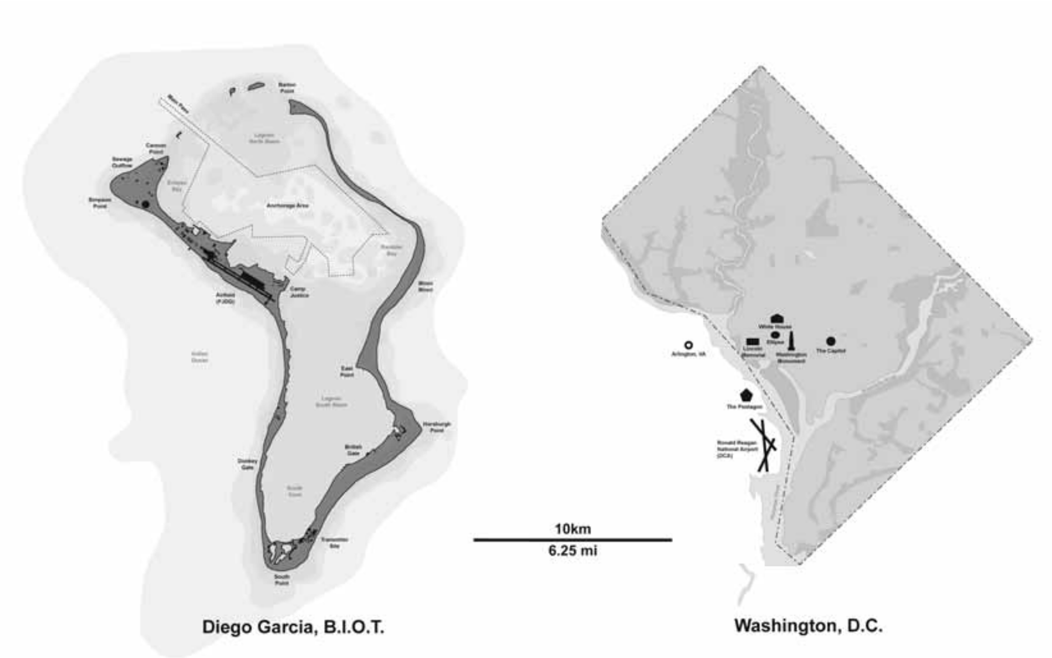
coral reefs that compose the atoll trace a 174 square kilometer footprint, only 27 square kilometers of that area protrude above water. The remainder is submarine reef and lagoon. Totaling approximately 125 square kilometers, the lagoon accommodates an area twice the size of Manhattan. And while the island only hosts a total resident population of about 360 military personnel, the atoll's interior and surrounding waters—since 2010, protected from encroachment through inclusion in the largest marine reserve on the planet at 250,000 square miles—harbor U.S. Marine Pre-positioning Squadron Two (MPSRON TWO), a dynamically composed fleet of dedicated military ("organic") and chartered civilian vessels capable of distributing half a million tons of cargo to combat theaters in the Indian Ocean and Arabian Sea. The atoll's lost geological matter has thus been replaced by the lethal and nonlethal cargoes of MSPRON TWO, including Sikorsky Blackhawk helicopters, M-1 Abrams tanks, High Mobility Multipurpose Wheeled Vehicles, Mine Resistant Ambush Protected vehicles, Stryker Medium Tactical Vehicles, M4 Carbines, Depleted Uranium 30mm munitions, JP-8 jet fuel for engines in jets and tanks, medical supplies, and high-security prisoners captured during war on terror operations. In addition, the terrestrial minority of the atoll

Figure 8B. Strata of Deployment

Layers of lagunal infrastructures and logistical land uses of the U.S. Department of Defense on Diego Garcia

Map: OPSYS/Landscape Infrastructure Lab 2012, with source information from Central Intelligence Agency *World Factbook*, U.S. Navy Naval Support Facility Diego Garcia Integrated Natural Resources Management Plan (2005), U.S. Navy Marine Biological Survey, July/August 2004.

Figure 9. Islands of Influence: DG and DC



Comparative size of the Diego Garcia atoll with the Capital Region of Washington, DC

OPSYS/Landscape Infrastructure Lab 2012, with source information from Federal Aviation Administration

hosts a 12,000-foot runway sufficient for landing a NASA Space Shuttle but most regularly used by B-1B, B-2, and B-52H Stratofortress long-range bombers, C-5 Galaxy troop transporters, KC-10 Extender air-to-air tankers, and KC-135 Stratotankers.

In fact, while supplies for ground operations were being readied for sealift to Karachi, Pakistan, B-1B and B-52H bombers flew the first combat sorties into Afghanistan. The B-52H, with its eight jet engines, consumes about 3,334 gallons per hour without afterburners. Though it carries 312,197 pounds (47,975 gallons) of fuel, the B-52H requires aerial refueling for any long-range mission that could exceed its maximum ceiling of 14 hours of flight; for sorties into Afghanistan—over 2,750 miles from Diego Garcia—bombers flew between 12 and 15 hours over 5,500 miles, requiring accompaniment by KC-10s (356,000 pounds total fuel capacity, 4,400 mile range fully loaded), or KC-135s (200,000 pounds total fuel capacity, 1,500 mile range fully loaded). In addition to the dry lethal and nonlethal cargo filling the atoll's aqueous interior, then, the demand for fuel proves paramount, filling Diego Garcia's lagoon with a lake of fuel.

The demand for fuel is only increasing. Given the characteristics of contemporary conflict—typified by decentralized, asymmetric warfare, rapid deployment to climatically diverse, geographically remote combat theaters across the globe, and multiple, small, forward-deployed expeditionary forces in infrastructurally deficient conditions—both combat and logistical operations have become increasingly reliant on airlift of fuel and sensitive military cargo from sealift and surface distribution terminals into locations inaccessible or insecure by road. In 2010 alone, airlift increased by a third.[9] Longer distances and flight hours, heavier payloads, energy-intensive computer technologies, and the ubiquity of intelligence, surveillance, and reconnaissance (ISR) support operations integral to the security of airlift sorties—only combat helicopters find themselves targeted more than airlift aircraft—make airlift 10 times as expensive as surface distribution and spiral into an ever-lengthening logistical tail that coils over the globe.

It is no surprise then, that in addition to holding court as the largest landowner worldwide, DOD is also the largest single consumer of petroleum, burning through at least 5 billion barrels in 2010 (excluding between 100,000 and 250,000 private-sector security and logistical contractors).[10] By the end of 2010, convoys were delivering 40 million barrels a month to roughly 94,000 troops in Afghanistan, consuming more oil per month—by several million barrels—than Indonesia, a country of 230 million people.[11] While munitions once dominated supplies delivered to a combat theater, fuel now makes up 80 percent of those supplies.[12] Moreover, though a fraction of that fuel is delivered to bombers, fighters, helicopters, and tanks for which fuel economy is best measured in gallons-per-minute, of the top 10 least fuel-efficient vehicles used by the Army, only 2, the M-1 Abrams Tank and the Apache helicopter, are combat vehicles with the rest providing logistical support.[13] The Air Force, consumer of the majority of DOD fuel, expends over 85 percent of its annual fuel budget to deliver fuel; of that annual budget, fuel delivered totals a mere 6 percent.[14] By simple subtraction, more than 75 percent of the fuel is used for transporting and conveying it prior to arrival at its final destination. Once the fuel arrives at a FOB, as much as 80 percent may be allocated for facility rather than vehicular use, affirming that the vast quantities of fuel consumed are burned in between "tooth"—in-theater facility—and the tip of the "tail"—CONUS (continental United States)–based point of distribution.[15] In short, logistical operations prove the greatest consumer of the very resource they supply; fuel demands only more and more fuel.

Iron Chain on the Silk Road

If such statistics convey the financial and material magnitude of military fuel consumption in Afghanistan, they fail to track the complexity of the supply chain that would properly anatomize the logistical body between tooth and tail. In June 2011, for instance, it was reported that the U.S. military spends $20.2 billion annually on air conditioning for troops in Iraq and Afghanistan.[16] More than the entire annual budget for NASA, one and a half times that of the Department of Transportation, and more than double the budget for the Environmental Protection Agency, the figure exceeds the entire energy acquisitions budget of the DLA ($15 billion, of which $13.2 billion is spent on petroleum-based fuel).[17] DOD spokespersons have cited this incongruity as proof of the falsehood of the assessment; however, the methodology by which one arrives at such an extraordinary figure better captures the movement of fuel through its DOD life cycle, from initial deployment to consumption, than does a mere budget total. As Brigadier General Steven Anderson, USA

(Ret.), chief logistician to General Petraeus during his command of OIF, explains, such a figure represents the "Fully Burdened Cost of Fuel" (FBCF), a DOD-adopted concept denoting "the commodity price plus the total life-cycle cost of all people and assets required to move and protect fuel from the point of sale to the end user."[18] FBCF incorporates into calculations costs associated with armed convoy protection, aerial ISR operations, command and control to coordinate the dynamic network of terrestrial and airborne security, ISR, and transportation forces, medical evacuation support, and most importantly the construction of transportation infrastructure. (This figure does not, however, include costs of hiring local trucking contractors, which compose over 90 percent of convoy operators, or the significant costs incurred due to local microeconomic and micropolitical conditions such as corruption and pilferage.) No wonder, then, that during a recent conference discussing the metrics and applications of FBCF, another geographically scaled referent provided a graphic placeholder for the concept as such: the iceberg.[19]

If the FBCF is an iceberg, the comprehensive tooth-to-tail military logistical spectrum constitutes the glacier from which it has been calved. The moraine of the military logistical glacier is infrastructure. Since 2001, DOD has spent in excess of $2.5 billion on the "Ring Road," a 1,925-mile stretch of asphalt linking Kabul, Kandahar, Herat, and Andkhoy. In 2011, DOD created the Afghanistan Infrastructure Fund, allocating an initial $400 million for turning "goat paths" into a national network of highways, adding another $475 million in 2012. In addition, nonmilitary funds directly support military logistical operations: from 2002 to 2009, nearly $2 billion in U.S. Agency for International Development funds to Afghanistan were spent on roads—a quarter of all funds and more than twice the funds spent on the second most costly category, power.[20] The economic opportunity to be gained from an extensive, defensible, reliable transportation infrastructure, shocked into development by ISAF logistical operations, is not lost on potential investors. According to the Center for Strategic and International Studies, linking transportation routes through Afghanistan to extant Eastern and Western routes would pave a New Silk Road:

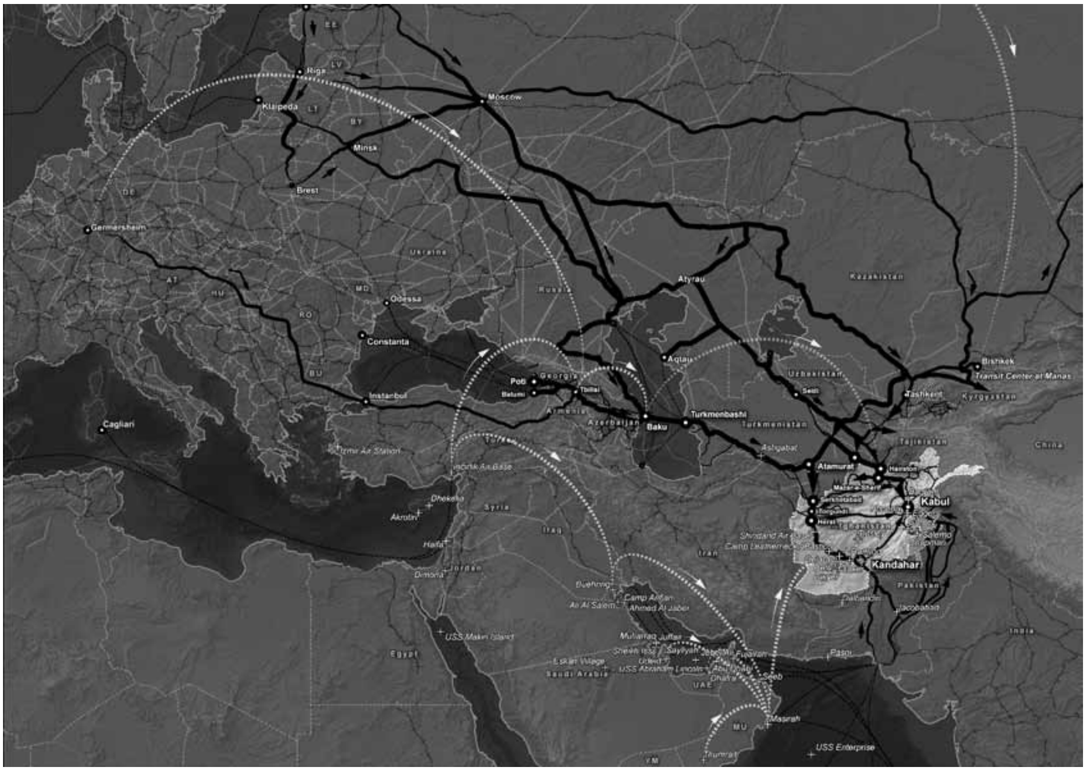
- An overland route running from Lianyungang, China, to Rotterdam via Xinjiang and Central Asia would reduce the time to transport goods from China to Europe from 20–40 days to 11 days and lower costs from $167 to $111 per ton.
- If basic improvements were made to the transport infrastructure connecting Central Asia to Afghanistan, the Asian Development Bank (ADB) predicts overall trade would increase by up to $12 billion, a growth of 80 percent.
- A separate estimate by the ADB found that the completion of new roads would boost total trade among Afghanistan's neighbors by 160 percent and increase the transit trade through Afghanistan by 113 percent. The study also found that these roads would raise Afghanistan's exports by 14 percent or $5.8 billion and increase imports by 16 percent or $6.7 billion.[21]

These advantages are not lost on insurgents, who recognize that larger fuel convoys and infrastructure construction make easy targets—from 2003 to 2007, the Army recorded over 3,000 personnel and contractor casualties in Iraq and Afghanistan resulting from attacks on fuel and water convoys, and in 2010 alone, more than 1,100 convoys were attacked.[22] On average, 1 of every 24 convoys experiences casualties.[23] Many of these attacks exploited USTRANSCOM reliance on transportation of cargo along the Pakistan Ground Line of Communication (PGLOC), a set of treacherous highway routes from Karachi to Kabul and Bagram Air Base via Torman Gate, Khyber Pass, or to Kandahar via Chaman Gate, Chaman border crossing. As a result, since 2005, USTRANSCOM has sought rail and road alternatives to PGLOC, aiming to reroute 75 percent of nonlethal, nonsensitive cargo through the Northern Distribution Network (NDN), an alternative, heterostructural system scattered through the Caucasus.

Topologics of Defense

That infrastructure facilitates and follows military presence as both generator and residuum of logistical operations is as old as war; what is unprecedented, however, is the flexibility, speed, and magnitude with which that infrastructural transformation may be effected. Sharon Burke, newly appointed Assistant Secretary of Defense for Operational Energy

Figure 10. The New Silk Road



The circulation infrastructure of ports, bases, and highways that weaves lines of communication and modes of transportation across the Northern Distribution Network, AFPAK theater of operations, and Afghanistan's new Ring Road, forming the bones of a skeletal link between Asia and Europe

OPSYS/Landscape Infrastructure Lab 2012, with source information from U.S. Army Surface Deployment and Distribution Command

Plans and Programs—DOD's first dedicated energy policy office—notes that though the importance of logistical operations is not new, "the amount of energy [DOD] consumes is new, down to the individual soldier, sailor, airman and Marine."[24] These novel energy demands materialize in both the flexible and rigid infrastructures—typified by MSPRON TWO and Diego Garcia on the one hand, and the NDN on the other—and define the expeditionary built environment for the generation of warfare where *defense*, according to USTRANSCOM Strategy 2011

> *is characterized by numerous smaller, forward deployed forces operating around the globe. In many of the geographic areas likely to experience future US involvement, the critical infrastructure will be austere—lacking air and sea ports, and having few roads. At the same time, these areas will have limited or compromised water, electrical, and sewer services—directly affecting the American and coalition means to respond with humanitarian aid or sustain deployed military forces. . . . These implications for infrastructure will include a heightened requirement to integrate the needs of functional combatant commands (such as USTRANSCOM) with those of geographic combatant commands. The challenge will be to leverage existing infrastructure and partner internationally to achieve the greatest possible power projection capability.*

The trope of the island returns here in terms of infrastructure: combat theaters become increasingly "islandized" into an archipelago of fragmented geographies brought into synchronicity and proximity by a catalogue of techniques drawn from the "fourth-generation warfare" or network-centric warfare playbook: continuously cycling ISR and unmanned aircraft system operations, clandestine special forces strikes, use of private security contractors, cyberwarfare, and so on. Indeed, the most advanced techniques and tools fetishized in popular culture, those unthinkably sophisticated weapons and intelligence systems that give their wielders an insuperable advantage, are in thrall to the unremarkable ubiquity of fuel. Strategically located bases such as Diego Garcia create a global constellation of supply depots, conveyance chains, and fuel farms, fulfilling the Cold War–era Strategic Islands Concept; in addition to its three Maritime Pre-positioning Squadrons based in the Mediterranean Sea and the Pacific, Indian, and Atlantic oceans, the Navy maintains 66 floating storage "defense fuel support points" that, when daisy-chained together with intratheater, intertheater, and extratheater surficial (SDDC) and stratospheric (AMC) logistical networks, begin to constellate a globally distributed, locally deployable, dynamically constituted system of logistical islands. Hard-infrastructural artifacts such as Afghanistan's Ring Road register, codify, and crystallize these fluid systems. Each tactic of connectivity short-circuits the geographic and temporal constraints imposed by a petroleum-based supply chain—a fuel shed—predominantly oriented toward delivering the very product by which it is powered.

As the unit concept in the global supply archipelago, for contemporary discourse on "power projection" via logistics, the island has thus shifted from a concept inhering in geographic and topographic advantage to a concept inhering in topological advantage; thus, as argued by Paul Virilio, "If, as Lenin claimed, 'strategy means choosing which

Figure 11. Stoppages/Blockages

When ground lines of communication are shut down, idle fuel tankers and supply convoys such as this one—marooned in Karachi, Pakistan, en route to the Chaman or Tormand border gates—cost $100 million in monthly losses, as they provide 30 percent of NATO's supplies to Afghanistan

ASIF HASSAN/AFP/Getty Images 2012

points we apply force to,' we must admit that these 'points', today, are no longer geostrategic strongpoints, since from any given spot we can now reach any other, no matter where it might be . . . geographic localization seems to have definitively lost its strategic value, and, inversely, that this same value is attributed to the delocalization of the vector, of a vector in permanent movement."[25] That is, where the island once supplied geographic advantage through a literal topographic superiority—indeed, in its most simple capacity, the island proved useful precisely insofar as it remained above sea level, a condition not to be taken for granted, particularly in recent decades—it now functions in a network of linked sites that, through their interconnectivity, manufacturing bases and theaters of deployment, project and sustain a topologics of force.

Logistics simultaneously designates the form and content, process and product, medium and mathematics of maintaining the integrity of topological relations between heterogeneously programmed, mobile, and mutable nodes. Fragmentation and striation become the very media of radical fluidity. This shift from valuation of the island as static proximity embedded in an absolute geography to a topological unit enmeshed in a relational, networked geometry of forces and flows reflects the historical adaptation of military theory—arguably the avant-garde of spatial thought—to novel modes of spatial production and a paradigm of poststructuralist geography. Corresponding with the military hijacking of the discipline of geography during the interwar period, it is no coincidence that the emergence of the topological concept of the island emerges during the long post–World War II moment during which the work of Norbert Weiner and others on cybernetic theory, broadly adopted by military thinkers across the Armed Forces (in particular, by the influential Air Force colonel–turned Pentagon consultant and organizational theory exponent John Boyd), came to prominence.

And while the work of cybernetics is ubiquitously discernible in what is likely the single most recognizable network of all, the Internet, the transformation of the concept of logistics islands is more difficult to track or identify.[26] Yet the simultaneous development of cybernetic theory and the island as topological concept for military logistics must be read as the most intimate of relations; indeed, it is precisely the addition of an informational stratum woven into the topologics of force projection that allows for the unprecedented flexibility, precision, and coordination of logistical operations, from Maersk and FedEx to USTRANSCOM, and yields the exponential growth of production and distribution of such operations after the opening of global markets following, first, World War II, and second, the Cold War. Indeed, reading the topologics of force as an open, logistical system renders its operations in both fragmentary spatial—islandization—and temporal—from second-based scheduling coordination to longitudinal and latitudinal minutes—logics that engender its capacity for totalization. The topologics of force are omnipresent as a logistical notion of displacement rather than distance, of exchanges instead of settlements, that constitute "the realization of the absolute, uninterrupted, circular voyage, since it involves neither departure nor arrival"[27] but interminable delivery.

By rediagramming logistical operations as a topological technology of force projection, the island as strategic concept finds clearest iteration in the contemporary discourse of "sea-basing." Building on the massive maritime logistical apparatus developed for World War II "transoceanic" operations following the collapse of global communism, naval strategists immediately recognized the need to reconfigure a fleet designed for large-scale naval warfare to a force capable of policing the world's oceans—and through its oceans, its economies. That over 90 percent of military logistical operations are maritime-based mirrors the function of the ocean as the set of predominant operational surfaces through its varied strata on which economic and geopolitical relations of power are inscribed and its transformations are performed, from submarine fiber optic systems to high-orbit satellite networks. These operations, relations, and transformations are evidenced in the ledgers of container ship captains and crews, employed by MSC to command and crew the prepositioning fleet as Civilian Mariners or "CIVMARS": at least 77 percent of international trade moves via container ship, with the global fleet projected to grow by 9.5 percent by the end of 2012, delivering roughly 650 million cubic meters of cargo.[28] Perhaps more importantly, more than three-quarters of this daily maritime traffic, including half of petroleum and crude oil imports and exports, is squeezed through a handful of manufactured and highly maintained waterways surveilled and managed by military engineers such as the U.S. Army Corps of Engineers (USACE) and security forces such as the Coast Guard.[29] Triangulated through these critical waterways, soft techniques of "antiaccess" and "area denial" (together known as the strategy of A2/AD[30]) project a maritime presence into terrestrial territories via an amphibious interface:

> *Our ability to command the seas in areas where we anticipate future operations allows us to resize our naval forces and to concentrate more on capabilities required in the complex operating environment of the "littoral" or coastlines of the earth. . . . As a result . . . we must structure a fundamentally different naval force to respond to strategic demands, and that new force must be sufficiently flexible and powerful to satisfy enduring national security requirements.*[31]

Emphasizing sea superiority as a means to economic dominance, while not new (indeed, the Coast Guard, as the first naval force established by the Continental Army in 1776, was conceived as protection and power for mercantile operations up and down the colonies' Atlantic coast), returned strategic maritime priorities to the historical condition recorded by the very figure responsible for transforming the U.S. Navy into a global power during the late 19th century, Alfred Thayer Mahan:

> *It is not the taking of individual ships or convoys, be they few or many, that strikes down the money power of a nation; it is the possession of that overbearing power on the sea which drives the enemy's flag from it, or allows it to appear only as a fugitive, and which, by controlling the great common, closes the highways by which commerce moves to and from the enemy's shores.*[32]

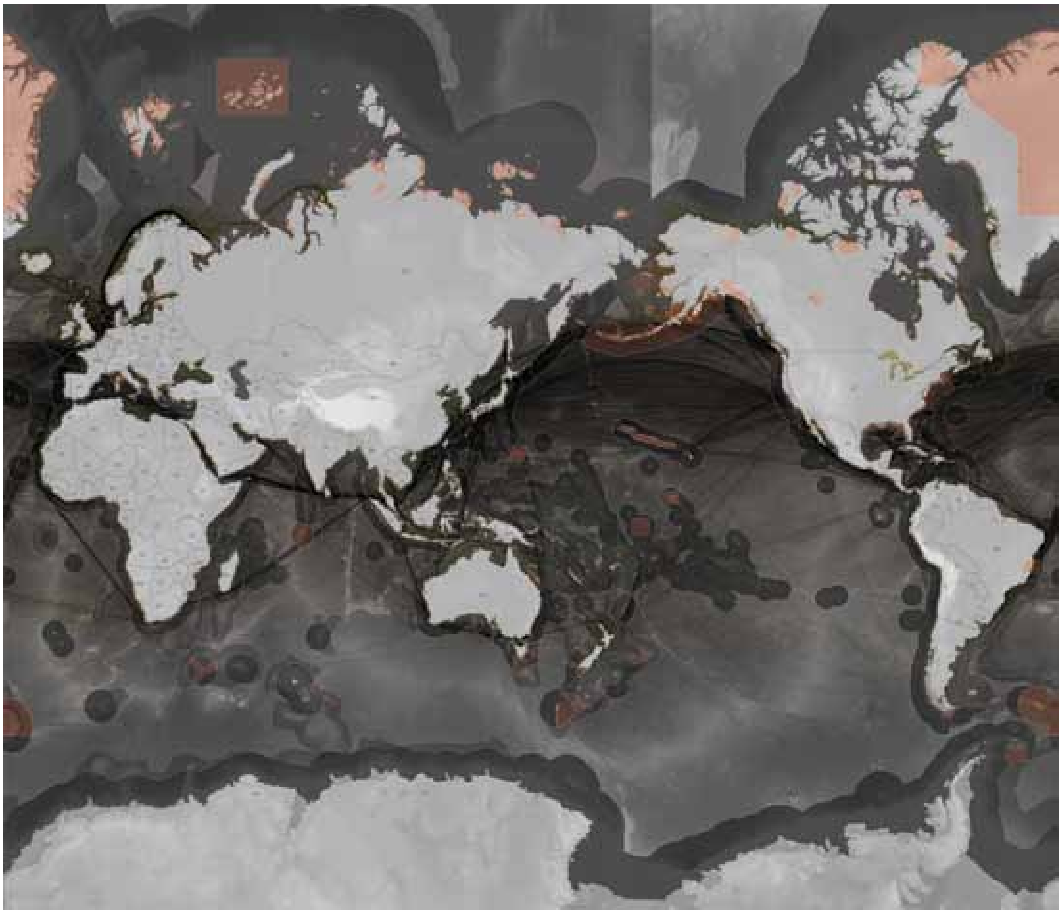
On the one hand, the contested geopolitical conditions to which Mahan was responding, consisting of a handful of maritime superpowers, no longer obtain: the United States Sea Services battle fleet displaces roughly the same amount of water, carries more firepower, and operates more than 2.5 times more aviation sea bases than the rest of the world's navies combined.[33] On the other hand, the notion of the oceans as the "great common" is perhaps more important than ever: as globalized economies depend increasingly on import of basic foodstuffs and goods, marine resources, ecologies, economies, and infrastructure rapidly displace terrestrial systems as the most critical territories of strategic importance, and so demand an attendant militarization of the ocean at unprecedented scope and scale. Nor does the ocean's surface serve as the primary medium for paired projections of privatization and militarization: submarine and air space are striated with zones of exclusion and defense to "protect the passage of nuclear submarines, sea-launched missiles, and maritime surveillance systems undergirded by thirty thousand miles of submarine cables."[34] The infrastructural legacies of terrestrial logistics, in the form of highways, roads, and rails, while easily identifiable as physical artifacts, are of lesser strategic impact than the fluid, submerged, and littoral infrastructural legacies of maritime logistics: dredged channels, multi-lock canals, ports, dams, levees, ever-larger container ships, increasing marine traffic, exclusive economic zones, engineered estuaries, marine ecosystem protection buffer zones, and new trade routes and territories of resource extraction opened up by global climate change inscribe the ocean and its depths with the vectors of power. Furthermore, the interweaving of maritime and terrestrial infrastructures through the ocean is evidenced by the jurisdictional regimes of the U.S. military's construction forces: USACE is affiliated with the most terrestrial force and manages the planning, design, construction, and maintenance of waterways and floodplains; the Seabees are affiliated with the most clearly marine force and perform the vast majority of base-building, road-laying, and other terrestrial infrastructural projects both in-theater and in non-U.S. territory. Thus:

> *In a very real sense the sea is now the base from which the Navy operates in carrying out its offensive activities against the land. Carrier* [navigation] *is sea-based aviation; the Fleet Marine Force is a sea based ground force; the guns and guided missiles of the fleet are sea based artillery. . . . The base of the United States Navy should be conceived of as including . . . the seas of the world right up to within a few miles of the enemy's shores.*[35]

The concept of sea-basing is constituted by a double entendre for which the base is at once a sea and the sea as such. To expand the capacity and extent of sea basing through advanced, diversely scaled and equipped prepositioning fleets, Mobile Offshore Bases,[36] Mobile Landing Platforms,[37] Sea-Based Radar stations,[38] and other mobile logistics islands, then, is to deploy bases-at-sea, bringing the role of terrestrial bases in foreign territory into an era of destabilized strategic status; on the other hand, the concept of logistics islands takes the sea-as-base, the very substratum of force projection and full-spectrum dominance. The sea, as both thickened medium and fluidity, becomes a "vast logistical camp."[39]

In another sense, with the recent shutdown of NASA's Space Shuttle program in 2011, the concept of sea-basing allows for a return of the logistics island concept to its constitutive and material content—a *rappel à l'ordre* to bring the island back to Earth, as it were. As a purely topological concept, the island runs the risk of chorusing "a naturalizing discourse of fluid, trans-oceanic routes" originating in 19th-century American literature and culture—"precisely when the United States became a global naval power,"[40] recapitulated many times over by naval theorists and finance capitalists alike. Indeed, the discourse of fluidity is the native tongue of that Utopian vision of emancipated capital unfettered by regulation and governance. The false freedoms of fluidity, particularly in the context of the sea, are well-tracked through spatial thought: as we are reminded, the apparently "smooth space" of the oceanic surface is "not only the archetype of all smooth spaces but the first to undergo a gradual striation gridding in one place, then another, on this side and that . . . a dimensionality that subordinated directionality . . . [where] the striation of the desert, the air, the stratosphere" entrenches itself in a "vertical coastline."[41] Moving between the smoothness that exceeds the grids of governance and the striations operations of governance inscribe through its fluidities, the "sea, then the air and the stratosphere, become smooth spaces again, but . . . for the purpose of controlling striated space more completely."[42] What then can the constitutive content of the logistics island tell us about these operations of governance and

Figure 12. Oceanic Urbanization



Reorganizing the world Trans-Atlantic projection forwarded by the Central Intelligence Agency since World War II, this map privileges the regions of the Indian and Pacific oceans—where nearly two-thirds of the world's population live in the crossflow and crossfire of pipelines and politics, boundaries and buffers—as the new field of urban focus

OPSYS/Landscape Infrastructure Lab 2012, with source information from United Nations Convention on the Law of the Sea, INOGATE, GAZPROM, TeleGeography, United Nations Environmental Programme, NATO

modulations of mechanisms of marine control? As the logic of the logistics island and its broader landscape of defense, a topologics of force is still, after all, a material and geographic system; and as with any system prone to entropy, a topologics of force and power projection has its externalities—conceptual, material, and ecological.

The concept of the logistics islands thus reconfigures the Strategic Islands Concept for the topological age and becomes the most critical, diffuse, and powerful mode of military spatial production and management: maximum protection to localized nodes of power for the bases-at-sea, and maximum connectivity for soft techniques of modulation and control through ubiquity of the sea-as-base. At different scales, from the personal to the planetary, nation-states, regions, cities, and even identities may operate as islands. Recalling Churchill's words, then, the continental United States is the epitome of the base-at-sea, the inversion of *aqua nullius*; the only means to avoid the fulfillment of his prison-house prophecy is the exploitation of the connective medium of the geographic itself capable of conducting force to local expressions of power across the depth of the ocean and extents of the atmosphere—the militarized mediums of the globe that are the heavy waters and thick air of the world. PRISM

Research for this article was made possible with funding from the Harvard Graduate School of Design, Harvard Milton Fund, and Boston Society of Architects. The authors would like to thank Alexandra Gauzza, Sara Jacobs, John Davis, and Christina Milos for reconnaissance work that contributed to this research.

Notes

[1] Benjamin W. Labaree et al., *America and the Sea: A Maritime History* (Mystic, CT: The Museum of America and the Sea, 1998), 9.

[2] Mike Mullen, *Briefing to Congress*, December 2009.

[3] According to Joint Publication (JP) 4-0, *Doctrine for Logistics Support of Joint and Multinational Operations* (Washington, DC: The Joint Staff, 2008), *materiel* denotes "all items (including ships, tanks, self-propelled weapons, aircraft, etc., and related spares, repair parts, and support equipment, but excluding real property, installations, and utilities) necessary to equip, operate, maintain, and support military activities without distinction as to its application for administrative or combat purposes" (GL-8, 120).

[4] U.S. Transportation Command, *2010 Annual Report*.

[5] David Vine, *Island of Shame: The Secret History of the U.S. Military Base on Diego Garcia* (Princeton: Princeton University Press, 2011), 61.

[6] See Peter H. Sand, "Diego Garcia: British-American Legal Black Hole in the Indian Ocean?" *Journal of Environmental Law* 21, no.1 (2009).

[7] General Accounting Office (GAO), "Further Improvements Needed in Navy's Oversight and Management of Contracting For Facilities Construction On Diego Garcia," in *Report to the Secretary of Defense*, GAO/NSIAD-84-62 (Washington, DC: GAO, May 23, 1984), 46 (appendix I) and 50 (appendix II).

[8] Sand, 121.

[9] Carlos Rojas, "Supplies from the Sky," *Army Sustainment* (July–August 2011).

[10] Department of Defense (DOD) Report, "Contractor Support of U.S. Operations in the USCENTCOM Area of Responsibility, Iraq, and Afghanistan," July 2011; and Jeremy Scahill, "Obama has 250,000 Contractors in Iraq and Afghanistan," *Rebel Reports*, June 1, 2009.

[11] Federal News Service, "Defense Department Briefing with William Lynn, Deputy Secretary of Defense; Sharon Burke, Assistant Secretary of Defense for Operational Energy Plans and Programs," *DOD Briefing*, June 14, 2011; Louis Peck, "New Mission for U.S. Military: Breaking Its Dependence on Oil—Interview with Sharon Burke, Assistant Secretary of Defense for Operational Energy Plans and Programs," *Yale 360 Environment Interview*, December 8, 2010, available at <http://e360.yale.edu/feature/new_mission_for_us_military_breaking_its_dependence_on_oil_/2348/>; GAO, "Defense Management: DOD Needs to Increase Attention on Fuel Demand Management at Forward-Deployed Locations," GAO-09-300 (Washington, DC: GAO, February 20, 2009).

[12] William Lynn, DOD Operational Energy Strategy Briefing, June 14, 2011.

[13] Barry Sanders, *The Green Zone: The Environmental Costs of Militarism* (Oakland, CA: AK Press, 2009), 49.

[14] Defense Science Board, "Report of the Defense Science Board on More Capable Warfighting Through Reduced Fuel Burden," Office of the Under Secretary of Defense for Acquisition and Technology (Washington, DC: Defense Science Board, May 2001).

[15] Federal News Service.

[16] National Public Radio Staff, "Among the Costs of War: Billions in AC?" *All Things Considered*, June 25, 2011, available at <www.npr.org/2011/06/25/137414737/among-the-costs-of-war-20b-in-air-conditioning>.

[17] Assistant Secretary of Defense for Operational Energy, Plans, and Programs, *Energy for the Warfighter:*

Operational Energy Strategy (Washington, DC: DOD, 2011), 4.

[18] Chris DiPetto, "DoD Energy Demand: Addressing the Unintended Consequence," in *DOD Energy Demand* (September 2008), 7.

[19] Ibid., 6.

[20] U.S. Agency for International Development, Afghanistan Budget FY2002–2009.

[21] Center for Strategic and International Studies (CSIS), *The Northern Distribution Network and the Modern Silk Road* (Washington, DC: CSIS, December 2009).

[22] Lynn.

[23] Steven Anderson, "Save Energy, Save Our Troops," *The New York Times*, January 13, 2011, available at <www.nytimes.com/2011/01/13/opinion/13anderson.html>.

[24] Burke.

[25] Paul Virilio, *Speed and Politics*, trans. Paul Palizzotti (Los Angeles: Semiotext(e), 2006).

[26] Cf. Antoine Bousquet, *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity* (New York: Columbia University Press, 2009), chapter 4, "Cybernetics and the Genesis of the Computer," 93–120.

[27] Virilio, 65.

[28] Braemar Seascope Container Fleet Statistics, 2012.

[29] Kaplan, 52.

[30] DOD, *Seabasing Joint Integrating Concept* (Washington, DC: DOD, 2005).

[31] . . . *From the Sea* (Washington, DC: Department of the Navy, September 1992), available at <www.globalsecurity.orgmilitary/library/ policy/navy/fts.htm#INTRO>.

[32] Alfred Thayer Mahan, *The Influence of Seapower on History, 1660–1783* (Boston: Little, Brown and Co., 1890), 116.

[33] Robert O. Work, *To Take and Keep the Lead: A Naval Fleet Platform Architecture for Enduring Maritime Supremacy* (Washington, DC: Center for Strategic and Budgetary Assessments, 2006).

[34] Elizabeth DeLoughrey, "Heavy Waters: Waste and Atlantic Modernity," *PMLA* 125 no. 3, 705.

[35] Samuel P. Huntington, "National Policy and the Transoceanic Navy," *Proceedings* (May 1954), 491. Referenced in Seabasing JIC.

[36] Paul Nagy, "Setting the Record Straight on Mobile Offshore Bases," *National Defense Magazine*, August 2001, available at <www.nationaldefensemagazine.org/archive/2001/August/Pages/Setting_the6984.aspx>.

[37] "The U.S. Navy's Mobile Landing Platform Ships (MLP)," *Defense Industry Daily*, January 26, 2012, available at <www.defenseindustrydaily.com/The-US-Navys-Mobile-Landing-Platform-Ships-06525/>.

[38] Boeing, "Sea Based X-Band Radar," available at <www.boeing.com/defense-space/space/gmd/gallery/photos1.html>.

[39] Virilio, 64.

[40] Deloughrey, 705.

[41] Gilles Deleuze and Félix Guattari, *A Thousand Plateaus*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1989), 480. With augural prescience, Deleuze and Guattari go on: "How can one fail to mention the military technicians who stare into screens night and day and live for long stretches in strategic submarines (in the future it will be satellites)."

[42] Ibid.