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Shipping container mobilities, seamless compatibility, and the global surface of logistical integration

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Abstract. Recent notions of surface emanating from poststructuralist theories posit surface as an 'event': expressionistic, restless, turbulent. In this paper I focus on a different idea of surface: one where the multiplicity of such restlessness is apparently immobilised. This perspective is tellingly advocated by the logistically driven movement of commodities on a global scale. Steinberg has argued that postmodern capitalism utilises a spatial logic that is redolent of earlier forms of capitalism, viewing ocean space in particular as a controllable void. Building on this debate, I set out to interrogate the construction of a 'global surface of logistical integration': those spatiotemporal mechanisms of control employed by the commercial logistics sector, which attempt to create an integrated and continuous global surface devoid of differences between ocean and land. In particular, the intermodal shipping container and its attendant apparatus of standardisation is taken as a paradigm of producing surface compatibility.

Keywords: surface integration, logistics, shipping container mobilities, compatibility

Introduction: tensions

> "The container links land and sea transport in an almost seamless and profoundly international continuum."
>
> Broeze (2002, page 5)

To speak of 'surface' is to engage with a variety of tensile relationships: one might think of the metaphorical and literal textures of solidity, smoothness, viscosity, fluidity, roughness, or stickiness. It is also a question of volumetric tension: between the supposed transcendent qualities of height, and the seeming superficiality of surface value (Bachelard, 1988; Elden, 2011, page 30; Lefebvre, 1991, page 242). There is an attendant tension between surface and depth, with the latter implying a sense of gravitas, of a reaching *below* the surface (Nietzsche, 1968, page 261). Such forms of tension demonstrate the critical issue of how we approach and *conceptualise* surface.

The conceptualisation of surface is at the root of this paper. It is concerned with how surface is both envisioned and produced, with specific regard to commodity mobilities. Whilst the mobility of objects and commodities has been addressed more broadly (see Bratton, 2006; Easterling, 2005; Steinberg, 2001; Thrift, 2004a; Urry, 2000), in the context of surfaces my argument focuses on what I term *logistical surface*. By this I refer to the type of surface envisioned by logistics and supply-chain management (SCM) practices, but more precisely by containerisation, as one of global *compatibility*, where the previously disaggregated sectors of land and sea freight transport were combined in order to provide the type of integrated transport network described by Broeze in the opening quotation. Effectively, through the development of spatial technologies such as the intermodal standardised shipping container, as well as the attendant material–legislative apparatus of containerisation, specific forms of surface compatibility have been designed to promote flows of trade through the integration of land and sea freight transport.

The development of standardised containerisation was "one of the great innovations without which we would not have had globalisation, [or] the deindustrialisation of America" (Harvey, cited in Buchloh et al, 2011; also see Harvey, 2010, page 16). The spatiotemporal logic of containerisation has profoundly altered the economic geography of US labour markets; and this has also been the case in numerous other contexts, including the maritime industry as a whole (Sekula, 1995), labour relations at ports, and the cultural and regional geographies of traditional port cities. One brief example illustrates this last point. In the late 1970s, the Port of London Authority argued that to make the port commercially viable they had to move the main operations out of the Pool of London to Tilbury, on the Essex coast (Port of London Authority, 1979). One of the main drivers for such a move was the lack of deep-water berthing facilities at the Pool of London, a key requirement of the increased size of container ships (Joint Port Trade Unions' Committee, 1979, page 10; also see Port of London Authority, 1966, page 14), as well as the availability of better road and rail infrastructure at Tilbury. A fundamental result of containerisation was the reduction in staffing levels required to handle cargo, and headlines such as "90 per cent Cut in Labour Possible" in the official Port of London newspaper *The Port* (1967) highlighted the impact that containerisation would ultimately have on staffing levels at the port. Of course, the move out of the Pool of London had more widespread social, cultural, and economic effects, most obviously the significant changes to the urban geography of the Docklands area in London and the subsequent 'regeneration' under the Thatcher government in the 1980s (Smith, 1989).

This brief illustration cannot do justice to the complexity of debates surrounding this one port, let alone the specificities of other national contexts, but it does begin to highlight how the changes instigated by the move toward containerisation have had effects across a variety of registers: how the need for deep-water berths necessitated a reconfiguration of docking facilities; how the infrastructural linkages required to produce an integrated transport system have ultimately led to the delinking of port spaces from traditional maritime communities (Graham, 2001, page 9); and, significantly for this paper, how the importance of this link between land and sea had significant social, economic, political, and spatial impacts. Whereas traditionally this littoral space or seam has been the site of poetic tension and wonder (Corbin, 1994, page 13; Martin, 2011b; Ponge, 1972; Taussig, 2002; Thomas, 2007), in my reading of logistical surface I suggest that this moment of transfer of commodities between land and ocean transport becomes one of spatiotemporal control designed to make this movement between the two as seamless as possible (Wallace and Hardy, 1999). The decisive factor is of course the speed and efficiency of transfer: in contemporary settings, such as the port of Singapore, Airriess (2001) argues that information and communication technologies (ICT) have been instrumental in transforming the port into a global logistics hub. In effect, this port—like all key global container ports—has become a hub for the "spatial articulation of goods along the global production conveyer belt" (page 236). Alongside the significant power of ICT in shifting traditional port spaces into spaces of global transfer is their spatial reconfiguration in terms of design and architecture. Where the traditional architectural forms of dock warehousing stood as icons of port cities, in 1967 Banham noted the aesthetic transformation of ports into spaces of horizontality, or what he termed "the goods-handling aesthetic of horizontal spread and aluminium cladding" (page 232). Aesthetically, little has changed significantly since 1967: container ports are bounded spaces of vast acres of container stacks, with flat surfaces populated by container-handling vehicles, and gantry cranes, all in the interests of spatiotemporal efficiency. Although container terminals themselves may be delinked from the surrounding community, they are manifestly linked into the global production and distribution conveyor belt described by Airriess—most notably in the seam between land and sea.

However, this moment of transfer is also a site of tension, for the geopolitical significance of this conjoining of land and sea transport is more broadly seen with the issue of 'seam space' (Cowen, 2010a; 2010b), where the complex security implications of logistics and SCM in relation to the policing of international flows of trade is evident (see Sarathy, 2006; Sheffi, 2001; Tang, 2006). For Cowen and others (Dillon, 2005; Harris Ali and Keil, 2010; Martin, 2012) the simultaneous function of the seam represents both the decisive moment of transfer for continuous flows of sanctioned goods, peoples, and capital, whilst also being viewed as a threat to the security of nation-states through the interconnected flows of nonsanctioned peoples and goods across seam space (Bhattacharyya, 2005; Nordstrom, 2007; SOCA, 2009/10). This tensile relationship at the seam between land and sea [what Cowen (2010a, page 602) calls the "critical zone of flows"] raises some important concerns about the wider project of the intermodal mobilities of containerisation. Intermodalism itself is defined as "the use of at least two different modes of transport in an integrated manner in a door-to-door transport chain" (OECD, 2001, page 7; also see Jennings and Holcomb, 1996). It is a highly sophisticated, complex, and tightly coupled apparatus designed to bridge the divide between land and sea, promoting instead the continuum of commodity movement from door to door. But as this paper will address, there is a profound tension between the need to produce, maintain, and secure the linkages in the chain, and the concomitant need to delink the transport networks from a localised context in order to project the linkages onto a global level.

The arguments are developed as follows. The next section considers the idea of surface control. It is suggested that the spatiotemporal ideology of containerisation emanates out of a wider body of reasoning based on the notion of *integration*. In particular, it is argued that the development of flexible production under the auspice of globalisation (Dicken, 2011) and the functional integration of distanciated global production mechanisms is part of a genealogy of spatial-surface control. This is situated amidst discussions of how land and sea have been conceptualised, both as separate entities, but also as an encapsulated *whole*. The section ultimately addresses the relationship between such conceptualisations and their *organisation* through the striation of surface in Deleuze and Guattari's work (1988). Whereas the overarching envisioning of surface is addressed in this section, in the next section I begin by pursuing the logic of integration through an outline of logistics and supply-chain management, before going on to tackle containerisation specifically. Although it is argued that it did not represent a paradigm shift in the logic of integration, the crux of containerisation was the attempt to construct a system of integrated linkages which bridge the divide between physically distinct surfaces (Graham and Thrift, 2007, page 3), thus reflecting Thrift's assertion that logistics is concerned with the efficiency of linkages (Thrift, 2004a, page 589). Although protoforms of unitised freight point to this logic of integration, it is ultimately suggested that only with the *standardisation* of the entire apparatus of containerisation did the logic of a global surface of logistical integration become developed. Although the standardised shipping container did not produce contemporary capitalism, it is an intrinsic mechanism of it. With standardisation we see both the materiality of compatibility in the form of attempts to stabilise linkages between various aspects of containerisation but, as I also argue here, there is a concomitant form of 'guarantee' through legal bodies such as the International Organization for Standardization. The final section deals with one specific logistical moment: that of container movements at the container terminal, London Thamesport. Although this inevitably focuses on one single instant, and thus may be said to simplify the process of integration, my intention with such an approach is to address particular spatial and technological mechanisms which have been developed to produce this moment of transfer. That said, one should not privilege these spatiomaterial forms over other mechanisms, such as legal and political frameworks, to facilitate such processes, including planning regimes in place to enable container ports to be situated in specific locations. Finally, in this last section I return to the discussions in the first section by considering the envisioning of cargo movement as a seamless whole.

Envisioning surface control

Harvey, discussing Allan Sekula and Nöel Burch's film *The Forgotten Space* (2010), describes how the movements of shipping containers imply that it is possible to "ride across the surface [of the ocean] in an unruffled way and bring the world into a unity of production and consumption" (Harvey, cited in Buchloh et al, 2011). This illustrates the way in which the surface of the ocean has become seemingly pacified by the technology of containerisation. Harvey also describes how the idea of unruffled movement stands in contrast to traditional images of the sailor fighting the onslaught of the ocean. In his work Sekula (1995; 2000) deconstructs the changing conception of the ocean under the force of containerisation, where ships are now just "giant floating warehouses shuttling back and forth between fixed points on an unrelenting schedule" (2000, page 411). These schedules illustrate the shifting economic geography of globalisation, where, since the 1970s, production processes have been decentralised (Hardt and Negri, 2000, page 294). According to Robinson (2010, page 290), this decentralisation runs parallel to "their functional integration into vast chains of production and distribution that span the globe". Whilst Robinson situates this in the developing contexts of financial flows in the 1980s, and the increasing power of technology in the 1990s to facilitate 24-hour trading and a variety of transnational alliances and networks (also see Graham, 2001), the point I want to pursue in this paper is precisely the argument that *chains of production, distribution, and consumption bridge the globe through a process of physical integration*. This reflects both Harvey's observation of a "unity of production and consumption" provided by containerisation, and the brute fact that as of 2011 nearly 5000 cellular container ships carried just over 14 million containers (Institute of Shipping Economics and Logistics, 2011, page 5). The technology of containerisation offers a vital demonstration of the power of globalisation to reconfigure the integration of transport mechanisms: as advocated by Broeze when he states: "the container integrates land and sea as no previous technology has ever been able to do" (2002, page 11).(1) This ideology of integration trades on the ability of the container to smooth out the limitations of geographic choke points in terms of eradicating the traditional separation between land and sea transport. This is in line with Steinberg's critique that, "with containerization, movement by sea, rail, and truck is constructed as *one continuous flow*. The aim is to annihilate any unique characteristics of the environments across which the containers move" (Steinberg, 2001, page 165, my emphasis). Decisively, Steinberg identifies the surface ideology of how the ocean is conceptualised as an empty "friction-free surface across which capital can move without hindrance" (2001, page 165). However, the huge amount of effort required to produce surface integration, which lies at the core of containerisation, testifies to the fact that friction-free movement is an illusion (Tsing, 2004).

Steinberg's argument echoes Virilio's (2006) assertion that logistics produces a "single glacis" (page 74) spanning both land and sea in an "infrastructure of seamlessness" (Koolhaas, 2002, page 175). This 'single glacis' is situated within a genealogy emanating from mechanisms that control the spatial alignment, rationalisation, and gridding of territory, both terrestrial (Scott, 1998) and oceanic (Mancke, 1999). In the specific context of maritime space, the issue of control rests upon a range of technical, political, and legal adjustments, including new

(1) Whilst the relationship between transportation and globalisation has been articulated in economic geography (Dicken, 2011), according to Wrigley, the wider notion of distributive space has been lacking in the literature on the economics of globalisation. He has argued that, "*distribution* systems and industries are, at best, a very minor, and more frequently, a totally neglected topic" (Wrigley, 2000, page 292, emphasis in original).

shipping technologies, weather patterns (Law, 2003), financial mechanisms, but also with the physical geography of particular seas. So, whilst Braudel (1975, pages 276–277) has suggested that the movement of people, animals, vehicles, and goods constituted the very notion of the Mediterranean region, importantly, this sea was seen as a connective-space where the relatively calm surface, climate, and physical features afforded mercantile opportunity (Horden and Purcell, 2000, page 124). This envisioning of connective space also speaks to Elden's (2011, page 29) argument that the idea of the globe as a homogenous whole promotes a global image under spatial ordering, or what Braudel, in the context of Mediterranean trade, termed the imposition of "a unified human construction *on* geographical space" (1975, page 277; my emphasis). Such ideologies of surface control reach back to the imperialist mindset, where the global surface of land and sea were part of a "preformed surface waiting to be occupied" (Ingold, 2000, page 214).[(2)] The imperialist intent of such actions of occupation attests to the importance of how surface is conceptualised and, crucially, how it is *organised*.

To this end, we can briefly address the idea of striated space in Deleuze and Guattari's work. Whereas smooth space is a projective, open surface, "without conduits or channels" (Deleuze and Guattari, 1988, page 371), striated space is constrained by such infrastructural mechanisms to organise movement "from one point to another" (Deleuze and Guattari, 1988, page 363). In other words, as Sekula suggested (see above), the strategic coding of surface is a means to determine movement based on allocated points and intervals. For Deleuze and Guattari the sea is the archetype of both smooth and striated space: where it is *open* in its trajectory, this openness is also that which is necessarily striated through navigational techniques of gridding this surface. And critically this striation of surface is locked into the development of maritime enclaves, or what Virilio (2006, page 64) terms a "vast logistical camp", and their projection of commercial power across the surface of the ocean, but also onto the globe as a volumetric whole, including the desert and the air [Deleuze and Guattari (1988, page 480); on air, see Williams (2007)].[(3)]

These various arguments are intended to suggest that specific conceptualisations and mechanisms of surface control have been developed for military, political, and commercial projections of power. The apparent passivity of the sea that Harvey describes emanates from a lengthy history of *envisioning* the surface of land and sea as controlled through striation; and this extends onto the encapsulation of the globe as an integrated whole. Critically, as I will argue in the following sections, land and sea were seen as compatible both ideologically, as well as through the technology of containerisation. For although Steinberg's observations that the annihilation of surface difference speaks to the ideology of containerisation, it is clear that the envisioning of friction-free movement obscures the enormous amount of effort—be it technological, logistical, administrative, or legal—that is required to produce such an apparent global continuum (Graham and Thrift, 2007). This I consider in the following arguments regarding the formulation of attempts to integrate land and sea transport, as well as the wider logic of integration.

(2) Ingold raises an interesting argument concerning the relationship between textual and geographic surface: he suggests that the writer encounters the tabula rasa of the blank page in a manner similar to how the "colonial conqueror confronts the surface of the earth" (Ingold, 2007, page 13).

(3) Deleuze and Guattari go on to describe an important facet of the interplay between smoothness and striation, echoing the earlier point in my introduction regarding the simultaneous function of the linkage between land and sea as a moment of logistical transfer and as security threat. For them, the sea (like other space surfaces) has the potential to reimpart smoothness, for example, through turbulent weather occurrences, or forms of illegality, such as piracy (also see Bogard, 2000).

The logic of integration

As we have briefly seen, one of the key arguments surrounding the economic and political contexts of containerisation stems from changing production and distribution processes associated with globalisation and, in particular, the structural integration of these across the globe (Robinson, 2010). One area where this logic of integration is potently demonstrated is with contemporary commercial logistics and SCM. This focuses on interactions between various aspects of a supply chain and is defined as "a systems approach to viewing the supply chain as a whole, and to managing the total flow of goods inventory from the supplier to the ultimate customer" (Mentzer et al, 2001, page 6). The fundamental differences between early trading mobilities, and SCM are with the control of the flow of goods across the entire chain. In the context of post-Fordist production processes the dominance of logistics providers has resituated this traditional separation between production and distribution, so that global mobilities of raw materials and components are intrinsic to production itself (Thrift, 2004b, page 182). The attendant, but often underplayed, role of transportation is also evident in the histories of this shift (Airriess, 2001, page 236; Janelle and Beuthe, 1997).

Up until the 1950s the role of physical distribution and transportation was seen as an inevitable facet of business activity. In the US this was, in part, due to the tight regulation of the freight-transport sector in the mid-20th century (Allen, 1997, page 107). One of the changes that instigated the 'logistics revolution' was the market-driven deregulation of freight transit, especially the US Shipping Act of 1984 (Shashikumar and Schatz, 2000, pages 8–9). The economic imperatives of this meant that significant cost reductions and time saving were possible with greater emphasis on the *control* of transportation. Prior to this, a lack of integration was present within the transport sector, where "manufacturers, road hauliers, freight forwarders, shippers, shipping companies, railways, stevedoring companies, consolidators" operated in isolation from one another (Gunston, 1968, page 59). From the late 1950s, management theory also began to posit the importance of "how industrial company success depends on the *interaction between the flows* of information, materials, money, manpower, and capital equipment" (Forrester, 1958, page 37, my emphasis), facilitated in part by the growth in cybernetics and the wider ideology of systems-based thinking (Allen, 1997, page 110; Brecht, 1970, pages 63–81; Gomes and Mentzer, 1988). The emphasis in the 1980s on the logistics sector's control of company functions, including materials management, transport, storage, and information management, highlights this process of integration. We see this notion of integration extended even further with the move towards SCM in the mid-1990s (Mentzer et al, 2001), where aspects of supply, materials management, distribution, and retail functions were placed under the control of a single company. The overarching ideology of logistics and SCM are *systemic completeness* and the *management of flow*. Central to this is the means to overcome a variety of divisions: those within the supply chain more broadly; the historic separation between different aspects of the transport sectors; broader systemic separation between company functions; and, critically for this paper, the physical and surface divisions of transport infrastructure.

Whilst logistics and SCM represents the wider remit of integrating various upstream and downstream flows, the focus here is on a subcategory of this: containerisation. The containerised movement of cargo stands as a critical component of SCM, as it accentuates surface control through *the integration of land and sea transport*. As noted above (Gunston, 1968), through the provision of infrastructure it was argued that lack of integration could be overcome by the development of "an effective multi-modal sea-and-land system with door-to-door transport from producer to consumer" (Broeze, 2002, page 9).(4)

(4) Albeit a tangential argument, it is perhaps not insignificant that the textual linkage—the hyphenation—between sea-and-land parallels the ideological impulse of the material linkage of sea-and-land. Indeed, one of the earliest transshipment container operators was a company called Sea-Land.

The genealogy of containerisation points to a broader process of uniformatisation, regularisation, and the equalisation of difference. It also speaks of the desire to reduce petty theft by dockyard workers (Huntington, 1964, page 76; Mars, 1983, page 183).[5] Prior to containerisation, various types of cargo were characterised by a lack of uniformity, with dockyards populated by disparate arrays of packaged items: crates, individual cans, sacks, bales, as well as animal carcasses. Stevedores would unpack these and load them individually into netting, and attach them to winches or ship's booms for them to be offloaded onto the dockside, or vice versa. The procedures needed to store such disparate shapes in the hold of a ship involved convoluted—but highly skilled—forms of handling, loading, and packing. Although these stowage techniques may at first seem somewhat rudimentary in comparison with the calculative logic of contemporary computer-controlled modelling of loading,[6] these represented early forms of organisation, including the use of dunnage to hold in place loose cargo.[7]

Cargo homogenisation had been present prior to the standardisation of container freight, the most notable example being pallets. Whilst still in evidence today in some commercial ports (House, 2005, page 28; interview with Logistics Manager, London Thamesport, 29 March 2007), the use of pallets prefigured the uniformity of cargo shape and formal regularity of the intermodal shipping container. The regularisation of break-bulk cargoes provided quicker turnaround times for loading and unloading vessels (which typically stood at five days for break-bulk cargoes),[8] teamed with greater labour productivity, and reduced dockside congestion (McKinsey & Co Inc., 1967, page 75). This process of regularisation was extended further by the design of fully sealed, but *non*standardised metal containers. Unlike pallets, these enabled cargo to be stacked on top of one another, as well as providing even quicker handling and turnaround times, and reduced opportunities for theft. Designs for such containers were seen as early as 1920 (No Author, 1969, page 84), and freight-distribution services using aluminium containers with rounded top edges were used in the Link-Line service between Liverpool and Belfast, which started in January 1959 (No Author, 1959). Even as late as March 1967, nonstandardised designs were still in evidence, including the use of metal containers to transport spare parts for the Ford Motor Company from London to Melbourne (No Author, 1967). In this case, although the container offered protection of the contents and easier loading through unitisation, it still had to be loaded into the ship's hold through relatively archaic means of ropes and hooks. Overall, the potential of unitised container cargo was highlighted by Owen, when he stated:

> "Most types of liquids and solids may someday be moved in sealed containers interchangeable among road, rail, air, and marine transport. Advantages would include reduction in damage and loss in the time and cost of loading and unloading. Containers may prove to be the catalyst that integrates the various components of the transport sector which are now being independently planned, financed, and operated" (1962, page 410).

(5) Somewhat ironically, Mars also notes that containerisation created its own system of workplace crime: "the introduction of containers has reduced these opportunities [for theft], but it has increased others—not least because of what can be concealed in containers" (1983, page 6).

(6) A variety of loading software exists, one example is CubeMaster (see http:// www.logensolutions.com/VMS/CubeMaster/Cargo_Load_Plan_Optimization_Software_Overview.html).

(7) At this point in time, 'dunnage' referred to pieces of wood (often cordwood) that secured cargo in place, as well as filling-in the inconsistencies of cargo shapes. Even with the move towards fully standardised containers, the method of packing the containers themselves means that dunnage is still utilised, albeit in the form of air-filled packaging materials.

(8) 'Break-bulk cargoes' are individual items of cargo, as opposed to containerised cargo or bulk cargoes such as oil. Bohlman (2001, page 13) suggests that containerisation has reduced the time of moving commodities by 84% and the cost by 35%.

These comments helpfully demonstrate the possibilities that unitised freight was seen to offer—especially their interchangeability across various transport systems, and the cost reductions associated with quicker loading and unloading times. Owen also highlights a decisive factor in the perceived need for standardised containerisation: the lack of integrated planning and organisation at this time. For although the homogenisation and regularisation of cargo facilitated quicker turnaround times, the diversity of container designs and sizes, as well as the nonstandardised nature of handling equipment, meant that the scope of the system was relatively limited. Indeed, as McKinsey & Co, argued, there was a "need to look upon transport as an *integrated* process from origin to destination" (McKinsey & Co Inc., 1967, page iv, my emphasis).

Standardisation: towards intermodal integration

For Gunston (1968) the development of a *standardised system* of container freight movement was seen as the mechanism [or a new mode of address, as Thrift (2006) might see it] that would provide such an integrated system of freight transport and, in a different context, Graham and Thrift echo this when they argue that integration focuses on "linking and standardising a whole range of activities" (2007, page 5). Although the historicisation of standardised containerisation is beyond the remit of this paper, it is necessary to outline the way in which it affected the notion of surface integration by briefly considering its genealogy (see Broeze, 2002; Cudahy, 2006; Hunter, 1993; Levinson, 2006; also see Jackson, 1983, pages 154–155).

The widely acknowledged key figure in the historical development of the container was the truck operator Malcolm McLean. In 1953 McLean developed the idea of transporting truck trailers on ships rather than on the congested highways of the US East Coast. His rationale was to overcome congestion by consolidating the transport system: at this time the truck and ship industries were entirely separate (Levinson, 2006, page 43). There were limitations to such a proposal—notably, the inefficiency of transporting truck trailers with their wheels attached. The irregular shape of the truck trailers meant that space was wasted under the chassis. If the wheels were removed spatial wastage would be reduced, and perhaps more fundamentally it also meant that the "trailer bodies could be stacked" (Levinson, 2006, page 47). This did not profoundly differ from the earlier processes of unitisation outlined above. However, McLean recognised that the system as a whole needed to be reconfigured to enable the demounted trailer bodies to be *moved across multiple transport networks*. The rationale for full systemic overhaul was a result of high labour costs, poor industrial relations, and the competition from other transport solutions. McLean's decision to separate the truck trailer and box may not seem significant, but as both Broeze (2002, pages 31–32) and Levinson (2006, page 53) suggest, this meant that the previous divergence of road, rail, and sea networks was finally overcome by the intermodal container. Employing the container engineer Keith Tantlinger, McLean commissioned him to design a new aluminium container. In addition to this a decommissioned tanker, the *Ideal-X*, was refitted to accommodate the new containers, with its first sailing on 26 April 1956 from Newark to Houston.

The decisive difference between the protoforms of containerisation and the intermodal shipping container we know today lies with standardisation. Without agreement on the design and dimensions of the container, a global system of compatibility in the form of intermodalism would not have been possible. Equally, without standardised container handling and, more fundamentally, without the standardisation of the entire freight-transport infrastructure, the logic of integration that we have seen emphasised numerous times by those advocating the economic imperative of containerised freight movement would not have been feasible. A key issue in the literature on standardisation is that of 'guarantee'. Bowker and Star (2000, page 13) note that standards are "any set of agreed-upon rules for the production of (textual or material) objects". These are guaranteed standards that remain stable across space and time through a legislative framework, such as the ISO, to protect these agreements. Standardised objects are able to operate across geographical distances at different sites, but also to sustain compatibility with one another over time (Graham and Thrift, 2007, page 8). Both aspects of this relationship embody the crux of the intermodal container: its ability to interchange across the entire infrastructure of containerisation. In this sense, the means to sustain compatibility through design and legislation is clearly aligned with Deleuze and Guattari's (1988, page 481) arguments that striation is concerned with 'allocating' functions through closing off a surface "according to determinate intervals", and predetermined points of linkage.

The now widely recognised standard sizes of the '20-foot equivalent' (or TEU) shipping container (8 feet wide, 8 feet high, and 10, 20, 30, or 40 feet long) were only fully agreed as late as 1970 by the ISO (Levinson, 2006, page 148). Although the initial sizes were agreed in 1961 (Levinson, 2006, page 137), it was only after 1966 that various interested parties in the shipping industry began to compromise. Vital to structural integration was the standardised nature of infrastructure, enabling the coupling of the container with a variety of nodes. These included significant technical developments, such as container-cell ships designed to accommodate containers in specially designed cell bays on the vessels (Pinder and Slack, 2004, page 3); the redesign of road haulage vehicles and railway rolling stock; the design of container-handling vehicles in ports; the construction of large-scale dockside gantry cranes (No Author, 1970); the design of spreader bars (Levinson, 2006, page 51); and, crucially for my own argument, the design of the container corner fittings. Approved in September 1965 (Levinson, 2006, page 142), and covered by ISO 1161, the corner fittings (four on top, four on the bottom of the container) consist of an elongated oblong hole on the upper and lower faces, with two shorter oblong holes on each outward-facing corner. Made of steel, stainless steel, or aluminium, their placement on the corner of the container is specified by a standard spacing of 2260 mm in width, so that various means of lifting containers can also be standardised across road, rail, and sea. This apparently mundane design demonstrates how important linkage is to the intermodal nature of containerisation (Graham, 2001).

A moment of logistical compatibility: London Thamesport

We have seen how the various aspects of intermodal, containerised freight movement are determined by the complex integration of numerous factors: the container itself; the corner fittings; the reconfiguration of road and rail infrastructure; as well as the shifts in the regional geographies of container ports. These factors point to the importance of the interconnectivity between them. Graham and Marvin term these, moments of "adjustment" (2001, page 358), or "tunnel effects" (Graham, 2001, page 4), where each of these are linked. But there is also the decisive issue of *controlling* these forms of adjustment through the organisation or striation of movement. Whilst Steinberg's assertions regarding the annihilation of unique surface characteristics by the shipping container are conceptually highly alluring, my own line of reasoning primarily concerns the technological apparatus developed to produce surface compatibility and integration, rather than the annihilation of surface difference. Although all the moments of interconnection and integration are significant to the networked configuration of containerisation, I want to focus on one particular moment of integration or adjustment: that of the portside operations at London Thamesport (see figure 1). In part, the rationale for focussing on this specific point of linkage is to render visible certain processes that have traditionally remained invisible or taken as a given: "the port remains unrecognized and invisible" (Sekula, 2000, pages 411–412).

London Thamesport is a fully automated container port located on the north coast of Kent on the Isle of Grain. Its deep-water berths of 15 m depth (interview with Logistics Manager, London Thamesport, 29 March 2007) mean that it is one of only three UK ports

Figure 1. Portside operations, London Thamesport (source: author's own photograph, 2007).

able to accommodate post-Panamax container vessels (London Thamesport, 2012).[9] This highlights an important point regarding the significance of the seam between land and sea: as we saw in the introduction with the Port of London Authority's rationale for moving operations out of central London in the 1970s, the location of this port has a significant bearing on the surrounding infrastructure,[10] including its interconnectivity or coupling with the road and rail networks in the southeast of England. Although, as Graham (2001) notes, such port spaces are typified by a form of delinking from the local community.

Although the image in question is an apparent 'snapshot' of the highly complex working practices at the port (see Martin, 2011a), the focus on the moment of transfer from the portside onto the vessel via the container gantry crane offers a valuable insight into how such movements are central to the intermodal linkage between the container vessel and dockside. The image is firstly striking in its depiction of limited human presence, with only the slightest hint of human labour in the form of the container-tractor operator. The dockside operations at such container ports involve the delivery of a container either via road or rail networks to the port; the discharging of the container by gantry crane; its deposit in a container stack on the dockside; the subsequent transport of the container on a container-tractor vehicle to the dockside gantry crane; the transfer from this vehicle to the gantry crane through the container being affixed to the spreader bar (as depicted); and finally, the movement of the container via the dockside gantry crane to the container cells onboard the container vessel. In this case, the organisation of the container movement between ship and shore—the decisive moment of logistical transfer—depends on the 'guaranteed' interactions between each point of connection. The gantry-crane spreader bar (shown above the container) is lowered into place by the

[9] 'Post-Panamax' vessels are those ships which can carry up to 10 000 TEUs but are too big to route through the Panama Canal due to their scale.

[10] The Logistics Manager at London Thamesport (interview, 29 March 2007) makes an important point regarding the berthing jetty at the port. The jetty is constructed on stilts and situated a short distance out from the natural shoreline; added to this, a 'berth box' has been dredged which provides a natural form of dredging due to the flow of water.

gantry-crane operator and automatically locks onto the top of the container, enabling the box to be hauled onto the vessel. It is able to do so through the design of the corner fittings on the container, as well as the twist-lock mechanisms that engage the corner fittings.(11) So, whilst Gunston argued that the precontainerised system was built on incompatibility, it is clear from contemporary operations that the production of compatibility is paramount: the standardised compatibility of the system is intended to enable the container to flow through the port as quickly and efficiently as possible. Although the wider issue of vessel speed is a key question in the ongoing debates on logistics,(12) typically an individual container transfer between the dockside and the container cells on the ship takes approximately one and a half minutes (field notes, 29 March 2007). When compared with the laborious and time-consuming processes of loading and discharging cargo prior to containerisation, the differences are striking. The image speaks to the assumed systemic efficiencies of containerisation more broadly, but specifically, this stilled moment highlights the infrastructural power of the critical moments of linkage or, more metaphorically, of conjoining land and sea through the container as a 'mobile bridging device'. The critical divide appears almost negligible in the image. Although I am cognisant of the implied representational flattening, it is rather telling that the movement from shore to ship is now a seemingly smooth, arced trajectory. So, one of the key issues to emerge from this is the apparent compatibility of land and sea transport.

To restate my position: whilst Steinberg's assertion regarding the annihilation of surface specificity is perceivable in relation to the flattening out of surface difference, this could equally be read in terms of making these differences compatible through the technology of standardisation. Through the mobilisation of the shipping container and its attendant infrastructure, the two surfaces are deemed compatible. Their differences are not annihilated as such: rather, they become standardised by the apparent compatibility of these two surfaces.

Here, it is important to return to some of the initial discussions on how surfaces or, more literally, movements between surfaces, are conceptualised and *envisioned*. Rather than dealing with individually packaged break-bulk items, it was argued by advocates of containerisation that the increased scale of intermodal shipping containers meant that they were more akin to other forms of homogenised bulk cargo—significantly, that of oil (McKinsey & Co Inc., 1966, page 3). As a commodity, oil was viewed as a "homogenous standardized product" (McKinsey & Co Inc., 1967, page 5). The specific materialities of bulk cargoes were eliminated, and treated as unified forms that flowed smoothly. The mobility of oil and other bulk cargoes had an important impact on how containers were seen to flow in an integrated manner across land and sea as a seamless continuum. Paramount to the technical infrastructure of such a continuum is the striation of these moments of adjustment, as described above. In the context of contemporary oil mobilities, the geopolitical significance of controlling and securing the flows of oil, via both bulk-carrier vessels and pipelines, highlights the strategic implications of maintaining this networked continuum (Rodrigue, 2004; cf Barry, 2011), as do the security implications of 'seam space'.

The control over global flows of oil echoes the wider ideology of *systemic wholeness* as articulated in relation to SCM more broadly, but also conceptually in terms of Deleuze and Guattari's argument that striation functions by closing off a space-surface. Within SCM the envisioning of systemic completeness and the management of flow suggests how significant

(11) The twist locks themselves are nonstandard designs. The Health and Safety Executive (HSE, 2008) note that as of 2008 some forty-six designs of manual and semiautomatic twist locks were in use. This, they suggest, has resulted in a lack of systemic transparency, so that the diversity of designs (including left-handed and right-handed mechanisms) results in a lack of safety.

(12) For example, Paché (2007) argues in favour of slowness in the logistics chain, thus mirroring the move by the shipping company Maersk to reduce its vessel speeds in order to reduce costs and emissions (see Rosenthal, 2010). I thank one of the referees for this observation.

the control of the join between each element is. Whilst the example of the portside movements at London Thamesport highlights a specific moment of this join, it is telling that on a larger scale the port itself is part of the wider network of seam spaces. The critical factor here is that, although the various elements are distributed across a range of regional, national, and global levels, the standardised nature of infrastructure implies an *internalised* wholeness as a form of control (see McCarthy, 2005, page 113; Martin, 2012).

The historical precedents for this notion of systemic wholeness fold back to the manufacturing technologies of the 19th century. We can look to grain flows, and in particular the grain elevators constructed in Chicago in the mid-19th century. Instead of grain sacks being carried by workers, the grain elevator [developed by Joseph Dart in 1842 (Cronon, 1991, page 111)] facilitated the automation of grain movement within the building. Buckets would transport the grain to the top of the building, where it was weighed before being directed into the specific storage bins. Then, "once it was inside the bins, workers could deliver grain to a waiting ship or railroad car simply by opening a chute at the bottom of the building and letting gravity do the rest of the work" (Cronon, 1991, page 111). The role of the grain chute is an interesting one as it offers a continuous, homogeneous, surface for movement, as opposed to the fragmented movements of individualised sacks (also see Schoenberger, 1994). As such, the chute seems to represent a bounded conduit or channel, perhaps echoing the 'chain' metaphor in SCM, as well as the homogeneous qualities of striated space. The determining factor in the grain elevator was the construction of an automated system (minus extensive human labour), resulting in the almost continuous flow of grain through the space; the organisation, temporal scheduling, and integration of operations; and finally, the designation of the system as a single functioning totality. This example serves to highlight the wider spatiotemporal logic of controlling movement within a systemic whole, but also the movement between the grain elevator and transport infrastructure. Fundamentally, the logic of the seam is that of two surfaces meeting, and the desire to move from an atomized notion of individual items of cargo towards the flow of cargo en masse (albeit in larger scaled units) produces a similar question with regard to the movement and transfer of containers across the various transport platforms and, in particular, how this moment of transfer within a wider logic of continuous movement was and is envisioned.

Conclusions

To reflect upon Harvey's comments in the introduction, it is clear that the development of containerisation has had a profound impact on global economic processes, including flexible production. Without containerisation, flexible production would not have been possible. Although in this paper I did not set out to address the specific sociopolitical implications of such processes of change, including the dramatic reductions in labour in the maritime industry, the wider effects were highlighted through discussions in the first section on the envisioning of global surface control. Part of the intention of this paper was to consider the spatial–material constructions which are an intrinsic facet of intermodal freight transport, including the bridging devices such as the container corner fitting, and the wider infrastructural apparatus, and how these have provided logisticians with a set of powerful 'tools' to *control* and *stabilise* the compatibility between each of the various stages of intermodal commodity mobility. Given this, it is clear that the control of linkages and the wider project of integration are significant ideologies of contemporary logistics.

However, a further remit of this paper was to argue that although the processes of standardisation may have made compatibility more stable, there is a continuing need to address the background work that produces and maintains the *integrative* power of such sociotechnical systems (Graham and Thrift, 2007). My intention by focusing on the container movements at London Thamesport was to draw attention to the material processes in place to promote the power of surface integration—specifically, the moment of transfer. It should be further noted that this paper has addressed only one aspect of this 'moment of transfer' in relation to the physical distribution of commodities, and there are significant developments beyond the freight-transport sector that signal "new kinetic surfaces" (Thrift, 2004a, page 585). For example, the need for physical distribution of products is beginning to change in the face of new distributed forms of production, and personal fabrication, notably that of 3D printing (Ricca-Smith, 2011; also see Thrift, 2006). To conclude: by dealing with the notion of logistical surface it has been suggested that a certain form of surface ideology is present within the functioning of containerisation. As I argued above, the significance of trade flows (on both land and sea) in their historical guise clearly pointed to the legacy of surface control as inherent to commodity mobilities. However, one of the central focus points of this paper has been the attempt to *integrate* land and sea trade routes through containerisation. This decisive divide—the littoral seam—is a point of ongoing logistical tension, where the means to amalgamate the previously divided sectors of land and sea freight transport depend on the continued development of this tightly coupled system of integration.

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