World's biggest container ship, *MSC Pamela*, courtesy MSC.

TRADE AND CONSEQUENCES

The globalization of trade is having some unexpected—and unwelcome—effects.

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Walk into any Wal-Mart, Target, or Sears store in the United States, pick out a selection of goods from the shelves, and look at the manufacturer's label. The portable DVD player for your teenage daughter costs less than $100 and is made in Singapore. The silk-screen T-shirt with the cartoon characters for your 7-year old son is less than $15 and labeled "Made in the Philippines." The new wrenches for your garage toolkit cost half of their American counterparts; they're made in China, as is the new microwave for your home office. The sleek LCD monitor for your family's computer comes from Korea. In fact, chances are that more than 75 percent of the small manufactured goods in your shopping cart were made in Asia and hauled by container ship across the Pacific.

It is not news that U.S. stores sell many imported products. The United States has always been a trading nation and its role in international trade has grown steadily during the last several decades. But it has been 30 years since the United States exported more than it imported. In 2004, when U.S. international trade totaled $2.9 trillion, imports exceeded exports by more than $620 billion.

The largest contributors to the U.S. trade deficit are imported oil and manufactured goods. Although oil represents the largest dollar fraction of U.S. foreign trade, the growing flood of imported manufactured goods is having equally profound effects. As the United States shifted from a manufacturing-led to a service-oriented economy, mainland Asian economies filled the gap. Lower Asian labor costs and less stringent environmental regulations translated into lower production costs, more than counter-balancing the expense of international marine freight shipping. (China is now the largest source of manufactured imports in the United States, except for automobiles, and is the second biggest U.S. trading partner.)

These new Asian imports, along with goods arriving from other countries, have resulted in a flood of marine freight that is swamping U.S. ports and overwhelming nearby communities.

Most manufactured imports arrive on container ships, and the resulting growth in marine container freight is creating grave new technological, environmental, economic, and national security challenges. These challenges are especially acute in the United States but have implications for many nations caught up in the economic web of trade.

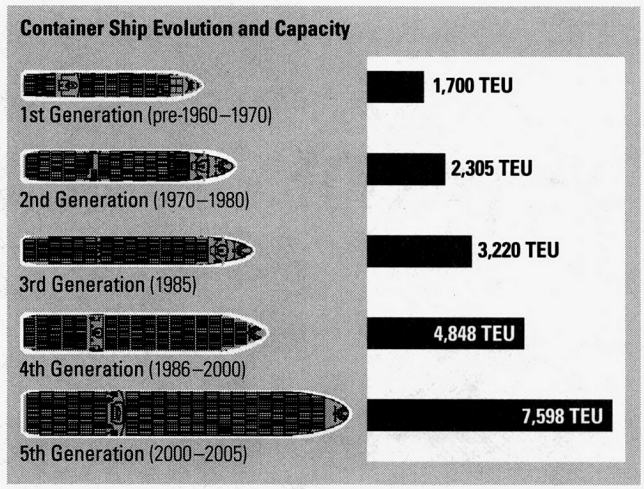
SEA CHANGES

Containers are rectangular aluminum or steel boxes, typically 6–12 meters in length. Invented in 1956, containers and the ships built to carry them have revolutionized marine freight. It's no exaggeration to say that container ships are taking over the world's general cargo fleet. In 2003 they carried 75 percent of general cargo along a virtual marine highway.

The pressure to reduce marine freight costs is driving technological evolution in the international shipping industry. One response has been to minimize both fuel use and manpower per ton-mile by steadily increasing the carrying capacity of ocean-going container ships. A second approach has been to modernize port management and dockside cargo handling in order to increase cargo throughput and decrease ships' idle "dwell time" in ports.

Container ship capacity has ballooned dramatically in the last 40 years. Ship size is measured by the number of standard containers, called 20-foot equivalent units (TEU), a ship can carry on its decks and in its holds. Third-generation container ships, built in the mid-1980s, carry about 4,000 TEU. These so-called PanaMax ships are the largest freighters that can pass through the Panama Canal. By comparison, fourth-

and fifth-generation ships with capacities between 4,200 and 7,600 TEU are too big to use the Panama Canal and must travel other routes. Although the Port of Long Beach can dock ships up to 8,000 TEU, most ships in this class are too large to dock at U.S. ports. Beyond these "MegaShips," several containerized cargo vessels being designed today have capacities approaching 15,000 TEU. When built, they will be the largest cargo ships able to transit the Suez Canal. The Dynamar Consultancy in Rotterdam, the Netherlands, has predicted that ships of 18,000 TEU will be built by 2010. These ships are designed to haul containerized cargo at costs of only $0.07 per ton-mile, compared to $0.10 per ton-mile achieved by today's PanaMax ships. These ships will be barely able to float through the Straits of Malacca and will be unable to dock using existing facilities at most of the world's historically important ports.



Alberto Lowe/REUTERS © 2005

The PanaMax container ship *Nedlloyd Clement* squeaks through the Miraflores locks in Panama City.

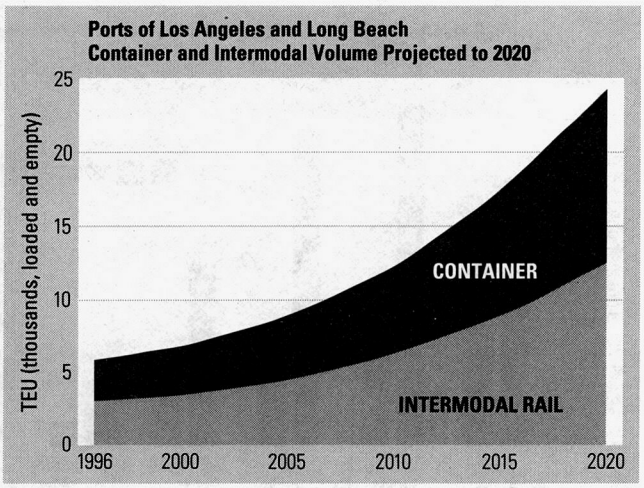
MegaShips are beginning to dominate both shipbuilders' order books and the current fleet of container ships at sea. The aggregate global capacity of containerized MegaShips grew by 44 percent annually from 2001 through 2005. Twenty container ships with capacities exceeding 7,000 TEU were added to the global fleet in 2004 (compared to seven such ships added in 2003). More than 100 of the 167 new vessels on shipbuilders' order books in 2005 are MegaShips.

The arrival of PanaMax and larger container ships at U.S. and other international ports creates a need for dramatic changes in dockside cargo-handling and transfer facilities. Before container ships, virtually all freight except bulk cargo was packed on pallets and skids, then off-loaded by teams of longshoremen using shipboard cranes and hand-held cargo hooks. This is no longer the case.

Today's ports are not just points of entry but function as a "mini-land bridge," integrated with specialized facilities to transfer containers to railroad cars or trucks for overland shipment. Thus, a container of DVD players and other electronic goods from China may move across the Pacific on a container ship, land at Los Angeles, and transfer to a truck for a trip to Fresno or to a rail car that will haul it across the continent to New York City. At the Port of New York, the container might be put on a truck for delivery to a Connecticut Wal-Mart or loaded back onto another container ship bound for Europe. Efficiently handling the enormous cargo loads that arrive on MegaShips requires sophisticated cargo-tracking information systems as well as automated loading and transfer facilities.

U.S. ports, however, are strapped with aging infrastructure, and even the current demand for imported freight pushes most of them well beyond their design capacity. Yet the goods just keep on coming. Demand for cargo throughput is projected to double at all major U.S. international ports between 2010 and 2020. Demand at the San Pedro Harbor ports of Los Angeles and Long Beach, California, for instance, is projected to reach twice the current volume by 2015.

As a result of the continuing mismatch between existing infrastructure and growing demand for off-loading facilities, many U.S. ports frequently experience dockside gridlock. More than 5,000 ships transited the Port of Los Angeles in 2004, a facility designed for about 1,800. On October 12, 2004, a record 94 ships passed through, almost twice the target maximum of 50 ships per day. One day in September 2004, more than 60 ships sat off-shore waiting to dock. All docks were occupied and there was a shortage of longshoremen. Local railroads were groaning under their loads and trucking firms struggled to find tractors and drivers. Some ships sat at anchor as long as 10 days. Throughout the year,



local authorities diverted nearly 120 ships carrying cargo worth over $4 billion to other ports.

Aging dockside infrastructure, shortages of skilled labor, and chokepoints along rail and truck routes sap the productivity of U.S. ports. But not only do these problems slow the movement of goods to store shelves, they radiate out from the docks, punishing portside communities with noise, air pollution, and congestion. The I-710 freeway, for example, is the primary artery for freight leaving the ports of Los Angeles and Long Beach. Average daily traffic volume on I-710 exceeds 240,000 vehicles, including more than 34,000 heavy trucks leaving the ports. The current daily volume exceeds the design capacity of the freeway, frequently leading to extreme traffic congestion and serious traffic accidents. Nonetheless, heavy truck traffic exiting the ports is projected to grow steadily, exceeding 90,000 vehicles per day by 2025. Many experts forecast that increasing truck traffic will cause I-710 traffic to grind to a halt every morning, with traffic stalled all the way from the San Pedro ports to the I-5 interchange, 30 kilometers (18 miles) away. A spokesman for the Los Angeles Economic Development Corporation told the *Los Angeles Times* in October 2004, "The U.S. cargo system has reached its maximum capacity and there has been a steady growth in imports, while there is no coherent expansion plan for transportation."

Hidden Costs

The flow of containerized freight through U.S. ports brings cheap goods into the U.S. economy. However, there are already significant negative social and environmental impacts from marine freight traffic, and these fall disproportionately on the mainly low-income residents of portside communities, who must endure the congestion, noise, and pollution of freight-related activities.

Each day, congestion on U.S. docks creates long queues of waiting trucks. Their engines idle for extended periods before they inch out of harbor areas, noisily traversing the neighborhood streets of portside communities where they compete for space with children at play.

But noise and crowding are not the only problems visited on portside communities. Freight-related emissions (from both trucks and ships) are a major source of local exposure to carbon monoxide, nitrogen dioxide, ozone, and other "criteria pollutants" and carcinogenic particulates. The California Air Resources Board says that port-related activities will be the dominant source of smog-causing nitrogen oxide (NO_X) emissions in the South Coast Air Basin by 2020, out-distancing traditional Los Angeles-area culprits like gasoline-fueled cars and industrial facilities.

Similar trends are projected for the small particulate matter emitted from both ships and trucks in diesel engine exhaust. PM_{10} particulates, with average diameters of less than 10 microns, are easily inhaled. The current average PM_{10} daily emissions of the Port of Los Angeles are substantially greater than the average emissions from a typical U.S. refinery or the daily particulate emissions from 500,000 U.S. cars. The U.S. Environmental Protection Agency (USEPA) estimates that by 2030 marine diesels will account for 60 percent of nationwide emissions of the smallest and most dangerous particulates, called $PM_{2.5}$.

California officials say that diesel emissions account for 80 percent of overall cancer risks from exposure to toxic air pollutants. A recent epidemiological study of 54,000 railroad workers exposed to diesel exhaust in their work environment found that long-term exposure to diesel particulates led to a significant increase in the incidence of death from lung cancers. Internal USEPA memos confirm that extended exposure to diesel exhaust is also likely to increase incidence of chronic, non-cancer health effects in vulnerable populations, especially children and seniors.

Murkier and more dangerous air is not the only environmental damage inflicted by marine trade. As container ships and other marine cargo vessels grow in size, they require ever-larger quantities of ballast water to stay upright. The huge ballast tanks, which are filled with seawater, create inviting habitats for all sorts of aquatic hitchhikers. Invasive species carried in ballast water can be as simple as single-celled plankton, which form the base of the aquatic food web. Once established, foreign plankton species may out-compete local counterparts due to lack of native predators, and may cause organisms further up the food chain to starve for lack of their own favorite "delicacies."

Larger species travel in the tanks as well. The European green crab, for instance, has been found in various locations along the U.S. Atlantic and Pacific coasts. Green crabs devour native mollusks, crustaceans, and algae. They appear to be undermining U.S. scallop fisheries as well as the Dungeness crab fishery on the Pacific Coast. The Eurasian Ruffie, a freshwater perch first inadvertently imported in some freighter's ballast water in the 1970s, has successfully colonized the far western edge of Lake Superior. This aggressive freshwater fish spawns up to six times per year, out-competes native fish species, and has become more abundant than any other fish in Lake Superior. The loss to local fisheries from the Eurasian Ruffie was esti-

mated at $120 million in 1994 and continues to grow.

Perhaps the most destructive species to escape from ships' ballast water has been the Zebra mussel. These hardy and prolific bivalves can form colonies incorporating almost 700,000 mollusks per square meter. They clog the cooling water inlets of electric power plants and have caused damages in excess of $5 billion per year in the United States.

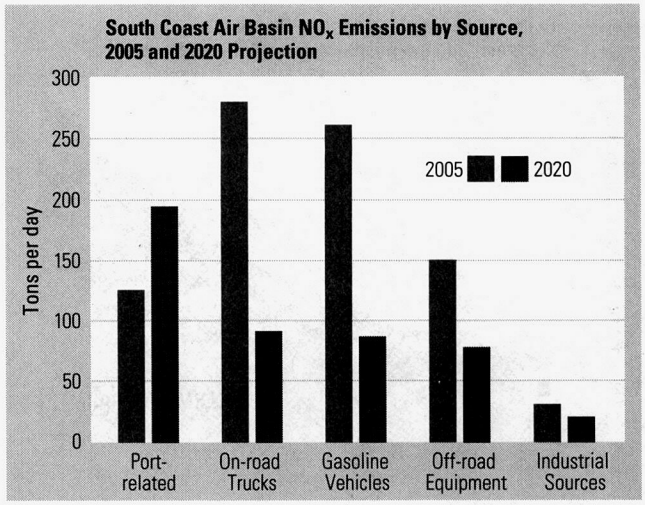
Technological defenses against such "free riders" on the gravy train of international trade are very hard to find. There are no "silver bullets" that can safely and cost-effectively treat ballast water, eliminating hitchhikers on all ships hauling cargo today. Although expensive, some treatment options—ultraviolet light or heat, filtration, biocides, and deoxygenation—may soon be ready for full-scale commercial testing against specific types of invasive species. But U.S. policy decisions about how to identify, control, and regulate these threats have not yet been completed, and no political consensus exists on who should pay for such measures. Perhaps any serious efforts to resolve such issues must wait until a foreign invader, like the voracious Chinese snakehead fish, crawls out of the Potomac Tidal Basin and bites a congressman on the ankle.

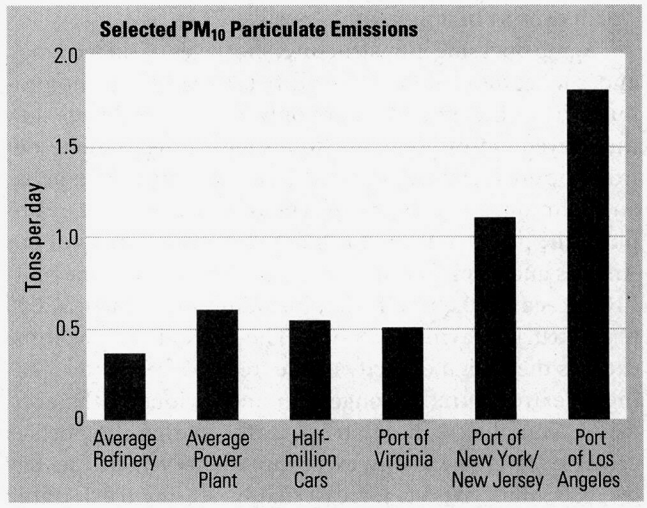
In-sea-curity

Vessels that haul 7,000 to 15,000 steel containers into a port at a time carry major risks besides invasive animal or plant species. The containers can provide nearly unlimited opportunities for terrorists and smugglers to hide in plain sight. Any standard cargo container is big enough to smuggle more than a dozen people or conceal a dangerous quantity of weapons, drugs, or explosives.

But it is the sheer volume of containers that creates the most serious risks. Because of the number of containers now passing through U.S. ports of entry, it is virtually impossible for all of them to be opened and inspected without seriously disrupting trade. U.S. ports today are only able to inspect a small sample of the containers. Indeed, a report released by ABC News on the first anniversary of the 9/11 attacks demonstrated how easy it would be to ship radioactive material into the United States undetected. Having borrowed a cylinder of depleted uranium from the Natural Resources Defense Council, the ABC News crew proceeded to package the mildly radioactive material in a lead-lined, steel canister and hide it inside a container full of furniture. The container was offloaded at the Port of New York/New Jersey, placed on a truck, and delivered without interference to the ABC News offices in midtown Manhattan.

If the cylinder of depleted uranium used in this test had contained an equal volume of more highly enriched uranium, its contents would have been sufficient to make a simple radiological dispersal device (a "dirty bomb"). If it had contained weapons-grade uranium, only slightly more shielding would have been required to keep the much more dangerous material from being detected. The situation at the Port of New York/New Jersey has not improved substantially since September 2002, and the ease with which the operation was executed provides a terrifying reminder of the continuing vulnerability of all U.S. ports, particularly as the volume of container throughput continues to grow. Dealing with these security risks will require the development of nondestructive testing and imaging methods for rapidly examining the contents of each container before it leaves its port of entry.

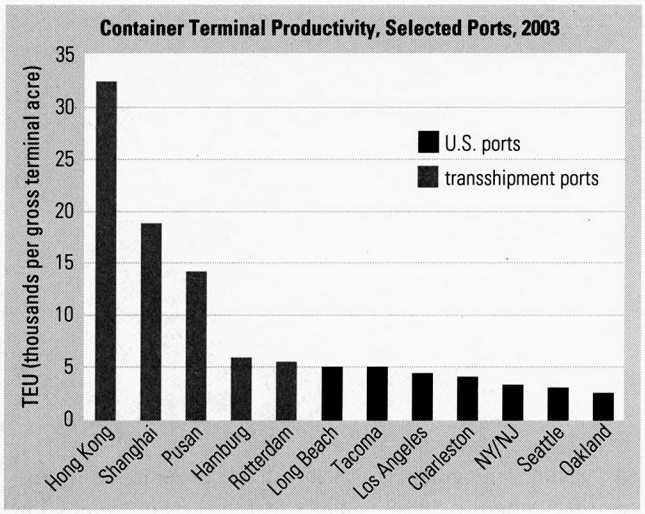




Containing the Problem

The problems associated with marine freight landing at U.S. ports are profound and multi-dimensional. U.S. ports are outmoded, inefficient, under-capitalized, and already straining under loads that only promise to grow heavier.

Contrast this situation with major Asian and European ports, which are bigger and more agile than their U.S. counterparts. Investments in information technology and advanced logistics management capability have made them more efficient per unit time and per acre of wharf space. As long as 10 years ago, several Asian ports achieved container throughputs of 8,800 TEU/acre/year. European ports moved approximately 3,000 TEU/acre/year. In the last 10 years, the



Kin Cheung/REUTERS © 2004

A portion of Hong Kong's state-of-the-art container terminal.

throughput capacity of the most efficient Asian and European ports has increased to over 30,000 and 5,000 TEU/acre/year, respectively. By contrast, the most efficient U.S. ports manage to move only around 5,000 TEU/acre/year today, and U.S. ports continue to under-invest in new technology, giving both Asian and European ports a comparative advantage for years to come.

The Main Container Terminal in Hong Kong is a good example of state-of-the-art port technology. It was designed explicitly to handle frequent off-loadings of large container ships in the most time-efficient and cost-effective manner, deploying a cutting-edge suite of information-intensive container transfer technologies.

Only a handful of U.S. ports are adequately configured even to dock the generation of PanaMax vessels. No U.S. port is currently able to dock and efficiently off-load 15,000-TEU machines or future generations of even larger vessels. Substantial dredging of harbors, the creation of new slips and docks, or the construction of off-shore unloading facilities will be needed to handle the coming generations of container ships now headed toward U.S. ports.

The challenge of operating world-class ports in the United States is not just a problem of small docks or shallow channels. It is fundamentally a systems problem, with demanding elements at every point on the goods movement chain from the dockside arrival of freight to the final point of land-side delivery. These problems will only grow as the volume of marine freight expands over the next decade. If they are ignored, the ever-widening stream of marine freight may have catastrophic consequences for the U.S. economy, for portside communities, and for natural ecosystems.

There is no simple solution for dealing with the economic, social, technological, environmental, and national security challenges arising from the flow of marine freight at U.S. ports. Nothing significant will likely be done until the general public becomes aware of the challenges resulting from our growing demand for imports and understands the trade-offs inherent in increasing reliance on "cheap" goods. Ultimately, a comprehensive, integrated national strategy may be needed to support the smooth and economically efficient operation of the U.S. goods movement system and to avoid the negative impacts of our expanding marine freight trade. Such a strategy can only be implemented through a broadly based, national conversation that invites input from all key stakeholder groups, including importers, shipping companies, port operators, investors, state and local governments, environmentalists, workers, and community groups representing the interests of civil society.

The expanding tide of marine freight is bearing down on the United States like a PanaMax container ship. It is time to look squarely at the problem and recognize that maintaining a sound goods movement system demands a critical investment in national infrastructure.

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For more information about issues raised in this story, visit **www.worldwatch.org/ww/container/**.