

For an Age of High-Speed Mega Container Carriers across the Pacific

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BACKGROUND INTRODUCTION

The Greater facility for faster, more economical transportation methods of goods, whether for the supply of personnel and material in a region of conflict, for the transportation of commercial products for international trade or simply the basic necessities of food items from one continent to another has always been, and continues to be of primary concern for every nation. Entry into the 21st Century has brought about a marked increase in *intra*-national exchanges of information, money and goods, accompanied by an even faster disintegration of distinct *inter*-national boundaries. Society is well underway to becoming accustomed to the idea that information and money can ‘fly’ around the world at the speed of light simply by clicking a small, hand-held computer in the palm of one’s hand. As people aspire to dramatically enhance the quality of their lives by spending less time on

travel itself, innovations such as the development of a scram-jet for the ‘Orient Express’ global passenger plane¹, capable of traveling at ten times the speed of sound, promises a future spent less on the actual time it takes to traverse the physical distances between destinations.

Looking towards the earth from space one can observe that the world’s economies are generally divided into tri-axes regions separated by three primary activity axes; each region represents approximately eight hours of a daily planetary rotation and thus completes a total twenty-four hours of continuous activity around the clock. Figure 1 illustrates three of the more ‘active’ regions of trade and commerce through such organizations/ areas as the EU, NAFTA, and the ‘EAST PACIFIC.’ South Korea, though one of the smaller nations, occupies a critical geographical location in the middle of the ‘east Pacific’ and has the potential for a centralized

¹ The development plan for the HSST (Hypersonic Transport) plane had been originally proclaimed by US President Ronald Reagan in February 1986, and has been in progress ever since. A Mach 10 scram-jet engine was tested across the Pacific in 2004 by NASA. Germany, England and Japan have similar efforts underway. The new Incheon International Airport(ICI) near Seoul in Korea is designed to accommodate such space traveling planes when developed [1].

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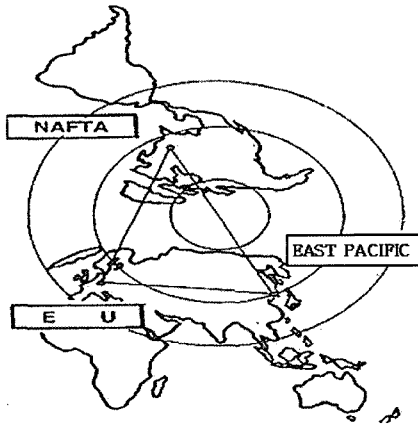


Figure 1 Tri-activity-axes around the globe [3]

role in the growth, prosperity and future industrialization of the region.

Economists estimate by mid-21st Century about 50% of world economies will be centered in the Orient. It is already coming to effect. Japanese economy is the second in the world after U. S. South Korea, Taiwan, Hong Kong and Singapore have been the leading boom centers in the region. Table 1 shows the population and GDPs in the region in 2000. Altogether about 2.0 billion populations currently have about 20% of the world's GDP.

The GDP per capita in China is about \$US 2,000 and has been growing at an annual rate of 10% for the last decade. China joined WTO only last year, and after the Olympic of 2008 it is expected that China will indeed undertake a major economic jump. If we are to understand that merely two hundred million Chinese populations along the eastern shore is actually

Table 1 Population and GDP's in the Orient for 2002

Population, million		GDP, \$US billion	
Indonesia	212	Japan	4765
Japan	127	South Korea	457
Yangtze Delta*	138	Taiwan	309
North-East 3 provinces*	107	Yangtze Delta*	234
Beijing-Tienjin corridor*	91	Hong Kong*	163
Santung peninsula*	91	Indonesia	153
Ju river delta*	86	Thai	122
Phillipine	76	North-East 3 provinces*	119
Thai	63	Ju river delta*	116
South Korea	47	Beijing-Tienjin corridor*	112

By ranks from 1st to 10th;

* Indicates regional parts of China.

engaged in the current economic surges and there is still one billion or so of the population yet to join this furious economic upsurge, we can imagine what will happen in the not-too-distant future². These and others indicate that there is a big road ahead for China for development, consumption and export, and of course for the material traffic one way or another. To support the current Chinese economic boom, oil, coal, steel, cement and everything else, and even transport carriers, have become scarce, and the growth pace had to be curtailed down for now presently in 2004. In terms of container transportation this has resulted in surpassing 100 million TEU in 2004 for the ports around the Far East. Table 2 shows the container market activities in the Orient including a future prospect.

The Chinese export surpassed US\$800 billion in 2004. In fact China has now evolved into

² One indication of such for example is that the electric generating capacity per capita in China is about 0.1kW, while the same for Korea is 11 times and for US, 20~30 times. To bring the electric capacity to the Korean level, China needs one billion kW.

Table 2 Containers from the Orient³

(Unit: 1,000 TEU/year)

PORT	Berth × Water depth	2002	2003	...	After 2006
Hong Kong, China		19,144	20,440		35,480 (2000) 100,000 (2006)
Shenzhen, China	23 Berth('07)	7,610	10,650		
Shanghai, China	28 Berth × 6.5~12m	8,810	11,280		
Yangshen, China	50('05) → 100 Berth (under construction)				
Lianyungang, China					
Chingtao, China	23 Berth('07)				
Tenchin, China	31 Berth('10)				
Dalien, China	17('07) → 100 Berth (under construction)				
Singapore		15,350	18,411		
Kaohsiung, Taiwan		8,490	8,843		
Busan, Korea	30 Berth(2011)	9,330	10,367		30,000 (2008)
Kwangyang, Korea	33 Berth(2011)				
Kobe/Osaka, Japan					
Hibiki, Japan		5,460*			
Yokohama, Japan		6,520*			

For 2003, Los Angeles: 7,179; Rotterdam: 7,107; Hamburg: 6,138; Antwerp: 5,445, respectively.

* For 2001 and for Japanese ports.

the main manufacturing center of the globe with much of these goods being consumed in the United States, and thus today these two heavy-weight economy centers are leading the growth of the world economy.

Other island nations in south-east Asia and another giant, India, will soon follow the suit and there can not be any other outlook other than the very rapidly and greatly increased economic activities around the Pacific.

Scholars in the world and *'The Economist'* with the support of Danish government have

started discussions on outstanding worldly issues. 'Trade barriers and subsidy removal' is one of the four tentatively selected *'Copenhagen consensus'* as of May 2004⁴, which means that the world's best minds have agreed to and that even more active trade barrier removal will be on the way, resulting in further increase in trade exchange worldwide in the future.

These new economic growth and trade volume increase will be different this time from other historical growth patterns however, for the new trade will be spread about not only among the

³ Ref. [18], [20], [21], & [25]

⁴ Copenhagen Consensus, May 24-28, 2004 or Hypothetical Political Debate of 2007 by Danish Government and The Economist [26]. Other issues selected at the May meeting are hunger and malnutrition, water and sanitation and communicable disease.

Asian countries but among the United States and the European nations requiring much longer routes of transport for the goods and materials, and characteristically via sea transport mostly. The crux of the matter here is of course the crossing of the Pacific Ocean, the greatest expanse of the sea on earth.

We are to overcome this to cut time and costs for all by technical as well as by international cooperation. This paper thenceforth brings up issues for the age of high-speed mega container carriers across the Pacific to review the geopolitical conditions around the East Pacific, efficient container flows and transportation equipment, and international cooperation pertaining to the issues, in particular for container transport between the hub-ports of the western United States and Busan, South Korea.

GEO-POLITICAL ECONOMIC ACTIVITIES IN THE EAST PACIFIC

As an effort to consolidate economic activities patterned after EU and NAFTA, ASEAN, APEC, etc., are in formative stages in the East Pacific and soon some definitive form is expected to come out⁵. Bilateral FTA activities have been initiated between Singapore with Japan, and Korea in 2004. There is a discussion going between Korea and Japan also. This year will mark a

starting point of free trade in agricultural products, the last stumbling block for WTO and being a sensitive issue in this region.

In the East Pacific also, interestingly enough major political and economic powers are colliding, colliding in a good sense. The United States, Japan, Russia and now China all have great interests in this region. Particularly the U. S. have been dealing with and organized six-party conference for resolving to confine the North Korean nuclear programs, restructured its overseas armed forces in this region, and has shown interests in keeping such vital sea lanes as Malacca, Formosa, Tsushima and Tsugaru straits open and secure⁶. Then there are problems of Spratly islands, where China, Japan and Vietnam all three have territorial claims, and Paracels islands where also Japan and China have similar claims, and these are awaiting some sort of international mediation. Being international in nature and requiring a third party involvement in one form or another, the direct involvement by U. S. is in the rise. For some it is even viewed as a confinement effort of China by U. S.⁷

Russia has shown a keen interest for developing natural resources and gases in Siberia, and TSR: Trans-Siberian Railway has become an item of negotiation with North Korea which is to pass there to connect to Busan, South Korea.

⁵ ASEAN for the South-Eastern Asian countries earlier, ASEAN+3(China, Japan and South Korea), APEC in 1989 and finally East Asian Summits in 2004 have been organized. Both the South Korea and the United States together with Australia are the members of APEC. APEC stands for Asia Pacific Economics Co-operation summit. China, Japan and South Korea have all signed ASEAN's Treaty of Amity and Co-operation. There is a movement toward East Asian Community. But with differences in industrial development stage, scale and the historical sentiment in the region it will require some more time for adjustment.

⁶ Defense secretary Donald Rumsfeld, busy as he is, had attended a conference for protection of Malacca straits in Singapore in May, 2004

⁷ Ref. [2], [10], and [23].

Also, the transportation of containers across the North passage has been an interest, and there is a nuclear powered container vessel in operation at this time⁸. Japanese interests in thrust into the main landmass is as old as 500 years old, and until the end of the World War II, Korea and Manchuria, now the North-East three provinces of China, have been under their subjugation. Now of course, Japanese economic influence has replaced those.

The U. S.-Korean relationship has also been reviewed and is changing. The relationship, though fifty long years have passed since the Korean War of 1950-53 and sometimes grumbling may be heard in conference tables and it is changing from recipient relations to that of partners, still remains at the level of the staunchest allies of the world. Korea needs on all fronts the U. S. support in dealing with China or Russia, and U. S. needs Korea for a springboard to approach into the land masses. Many U. S. companies feel much more secure to have local manufacturing centers in Korea for an eventual thrust into China. For these reasons, having hub-seaport, hub-airport and international banking centers in Korea has become important, and *the City Bank of New York* and others have come in to Korea for the first time recently. *The General Motors* has bought into *the Daewoo automobile company*, one of the larger ones in Korea. Thus it is seen that the relationship is being firmed up as ever and bilateral commercial cooperations

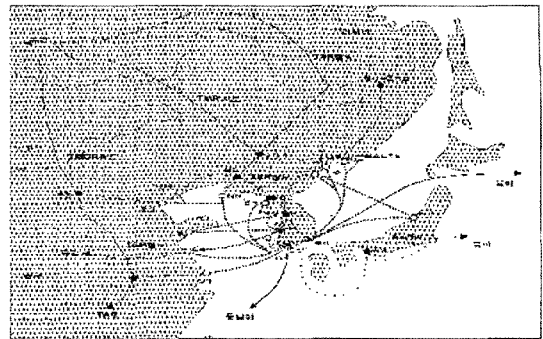


Figure 2 Material flow routes surrounding Korean Peninsular

by major companies have been increasing⁹.

The Korean government's governing policy has been and is that of taking a middle or central role among the surrounding major powers, but keeping the above U. S. relations intact. This is to mean that of taking a stance of the central role in the North-East Pacific, say, like Belgium or Holland in Europe, and of contributing internationally in peace efforts and in such economic matters as information, money and materials flows secure across the Pacific¹⁰.

Figure 2 shows materials routes surrounding the Korean peninsular. There is a fierce competition going in this region for securing the materials flow. China has started on huge container ports, 100 container wharves, in islands of Yangshen connected by sea-bridges of 30 km across from Shanghai in addition to Shanghai itself of 30 wharves. At Dalian, another container yard of 100 wharves are under construction. *The China Shipping Container Line*, a governmental

⁸ Ref. [7].

⁹ Out of 25 bigger companies in Korea more than half are owned over 50% or so by foreigners in 2004. This has happened since 1998 as a result of IMF recovery.

¹⁰ Korea President Roh, Muhyun, has just delivered a lecture to this effect in his state visit to U. K. in December 1-3, 2004.

organization, has launched a massive program of ordering more than 30 containers, 8 of which are the biggest in the world ranging from 8,000 TEU to 9,500 TEU. Also the company has acquired a dedicated port of call in L. A. By this schedule it is foreseen that about 40% of total carriers on the Pacific will be of Chinese by 2010.

Singapore and Hong Kong ranks by far the biggest hub-centers in the world, and are still fast picking up with expansion and will likely to remain so into the 21st century. Japan has in addition to the island port of Kansai near Kobe a program of development at the Hibiki port in Kyusu aiming for a hub-port¹¹. Korea is also developing new hub-ports in Busan and Kwangyang.

Korea has a geographical advantage that it can play an entry threshold to the Asian land mass and at the same time an exist gate to the Pacific. In terms of materials flow, this will mean that it will need to establish strong hub-pots connections between the western ports of U. S. and ports of Korea, operate very efficient system of mega container carriers between the two, and have strong supporting fleets of feeders and rail connections to feed into the hub-ports.

On the land masses behind, rail connections via TSR: Trans-Siberian Railroad (after the North Korean problem is solved) will accelerate eastern Russia's development and TCR: Trans-Chinese Railroad, northern China, Mongolia, and finally renew a 'New Silk Road' into Uzbekistan and Kazakhstan region. And even there are suggestions

for connecting hub-ports via an under-sea tunnel linking between Rienyangang, China and Koonsan, South Korea to expedite the flow of material¹².

These furious international activities seen around here are also expected to come out with more definitive outcomes soon. Those will however depend on techno-economical as well as on the international geopolitical relations as might be expected. Finally also the outcome results will depend very much on U. S. policies, governmental and private, in that U. S. influences far outweigh others on these in this region.

EFFICIENT CONTAINER FLOWS AND TRANSPORTATION EQUIPMENT

Material flow is dictated in the final analysis by technical feasibilities and economic efficiencies although the geopolitical conditions mentioned above plays into the picture. Figure 3 shows the growth pattern of container carrier

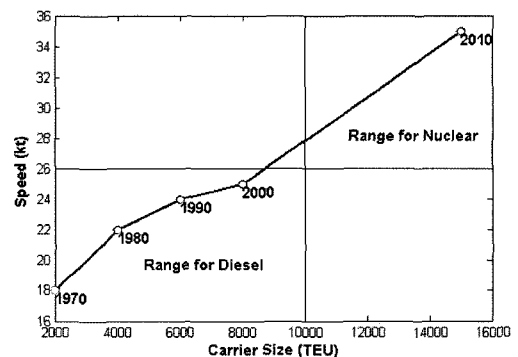


Figure 3 Growth pattern of container sizes and speed (Shows the maximum and the ranges for diesel and nuclear)

¹¹ See Ref. [12], [13], [15], [17], [20] and [22] for various competitions in this region.

¹² For feeders, see Ref. [4], [9], and [24], and for under-sea tunnel see Ref. [19].

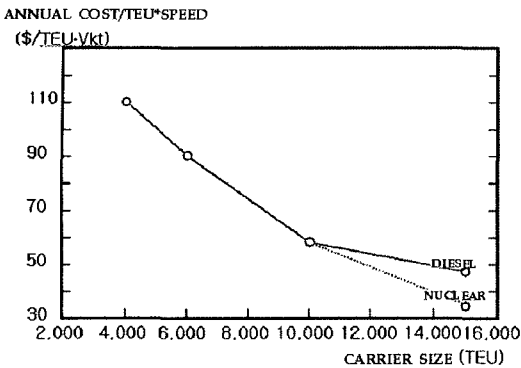


Figure 4 Annual container cost per carrying efficiency across Pacific (includes power plant costs and fuel)

sizes and speed increase over the last 30 years or so, with an understanding that the graph gives the maximum and the majority carriers are much lower than the line drawn.

We notice in the graph that speed increase is coming to saturation level. This is because within the use of one engine per vessel the limit of power of existing slow speed diesel engines is about 80,000~90,000Hp. Use of twin shaft diesel or an introduction of turbine power reduces efficiencies, as well as the need for refueling in the mid-sea if we are to cross the Pacific at high speeds. Also most of the existing ports have de facto draft limits of 15 meters or even less and loading and unloading gears have outreach of about 60 meters, and these conditions dictate the vessel designs and the use of diesels

within the range as shown in the lower-left hand side of the figure, namely the maximum size of carriers by diesel being approximately 10,000TEU and 25 knots.

But the speed and size are the two governing factors in securing of goods and the economy of container transportation. We need a new logistic system for crossing the Pacific. Figure 4 shows the economics of containers across the Pacific as the carrier size increases, and drastic economic benefit is seen by going larger and faster. By going from 10,000TEU and 25KT to 15,000TEU and 35KT an economic benefit is seen to increase by about 40% or better¹³. So returning to Figure 3 the range for nuclear power use is indicated for the coming era on the Pacific for containers. Estimated nuclear power requirement at this time for the 15,000 TEU carriers is about 200,000 kW or 267,000 Hp and the fuel can be used for about four years. This power level is about the same as that of U. S. navy's aircraft carrier *Forrestal*.

Some have considered the maximum size of containers to be 18,000TEU, while others think with port infrastructures already spread about and availability of cargo at hub-ports the maximum size will saturate to about 10,000TEU¹⁴. There is a definite need for U. S.¹⁵ and for Korea and the container markets

¹³ TEU*speed is usual transportation efficiency. The calculated reduction is seen to be about from \$60/TEU*speed to \$35/TEU*speed even with two nuclear power plants of two 100,000 kW each. For diesel, twin shaft, the reduction is seen to be much less, to \$46/TEU*speed, where the speed is 30kT (35kT is considered not plausible).

¹⁴ 18,000TEU size, Delft Univ. design, is considered the maximum size for Malacca strait, and may alleviate this if and when KRA canal across Malay Peninsular, which is under discussion, comes to reality. See Ref. 14. Other suggestions include widening of Suez and Panama canals. There is a need to guard such vital sea lanes as Dover, Gibraltar and Red Sea in addition to those straits already mentioned here.

¹⁵ U. S.'s and U. S. navy's logistics problem across the Pacific has been an outstanding issue as so with logistics across the Atlantic. Ref. 5 and 6.

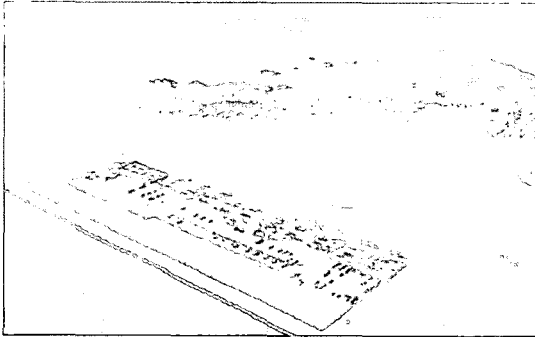


Figure 5 Very Large Floating Structure. This illustration shows a floating VLFS near Haewoondae bay, Busan, Korea. It is approximately 5 km(L)×2 km(B)×20 m(D) weighing more than 5 million tons, extendable, and shall accommodate container port, airport, oil and gas storage, chemical plants, railroad stations, truck terminals, hotels convention centers, services, power and water, etc. It is to be connected by an underwater tunnel and anchored to flexible mooring posts with transparent wave absorbers, all designed for 100-year life. Ref. [11] and [16].

warrantees enough cargo for transport across the Pacific, and therefore a bilateral arrangement between the two nations is suggested and it is hoped that the market will have to find the way later in other routes.

The propulsion is only possible by nuclear power for these vessels and that is another reason why a bilateral arrangement is being sought. There have been a number of efforts in nuclear powered ships, Savannah in U. S., Otto Hahn in Germany, Mutsu in Japan and ice breakers in Russia, but most of these have failed not because of technical difficulties but because they were in the wrong area of competition economically with other means of powering such as the cheapest diesel. Only Russian ice-beakers, 8 of them, are in operation at this time, which

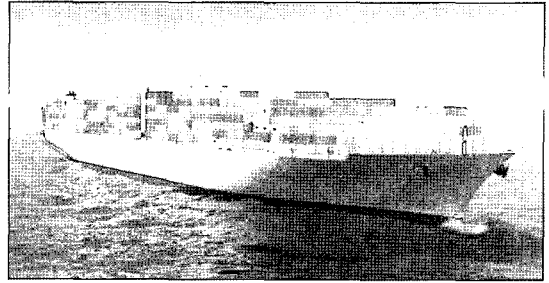


Figure 6 This illustration shows 15,000 TEU container vessel. It is approximately 400 m(L)×57.5 m(B) × 27.2 m(D) (14.7 m(H)) with the displacement of 213,700 tons. Containers are stacked 10 tiers and the bridge will have to be highly placed. Ref. [14].

indicate the robustness of power system technically. Where there is no other competing means of powering such as in underwater or where a large power is required and no other means is plausible, and if the case is economically sound, then there is no reason why nuclear power will not be accepted. The present case belongs in the latter category.

For an efficient operation of the system in addition to network of rails and feeders, cargo handling and port management must be efficient¹⁶. The technical port operation improvement, privatization, labor relations, and the like must all be made to assure the delivery of goods in the fastest time and on schedule. For example the turn around time for these high-speed container carriers must be cut off from about 7 days now to within one or two days. All security check must be automatic, and door-to-door handling of a container must be traceable and handled with the minimum numbers of lifting as possible. We shall have to bench-mark the best systems in Singapore or Amsterdam,

¹⁶ Ref. 4

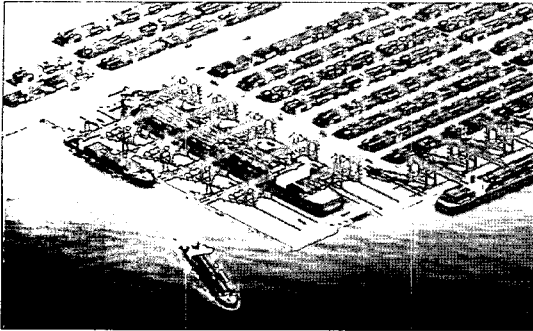


Figure 7 This illustration shows a patented container handling crane adjustable to fit the width of the vessel but workable from both sides. This will reduce the loading and unloading time.

Hamburg, Antwerp, etc. in Europe. In the event of emergencies or labor strikes some measure of alternatives must be provided into a priori.

Physical descriptions for the system, facilities, vessels and equipment, are given in the following in Figures 5~7 with notes where needed. The complete system will be composed of hub-ports on both shores with sufficient water depth of, say, 22~23 meters or better and an ample space for anchoring and unloading of vessels, a multi-modal logistics supply function center that will be able to accommodate 'the Orient Express' in the future and an international airport for transfer cargoes and passengers. It is to be a completely independent island of operation for 24 hours and with self-defense capability.

INTERNATIONAL COOPERATION AND PROTECTION MEASURES

For a system of this international magnitude to exist, it will be critical to initiate, maintain and protect the multi-national, cooperative

venture with visible safety assurances in the ongoing operations of each land based facility, vessels and transportation routes on 24/7 basis. This will be the key to initiating a healthy inducement for the project at the outset.

With so many containers on one ocean going vessel amounting to astronomical values, as assessed by maritime insurance agencies, and considering the nominal depths and size of land based port facilities, a Very Large Floating Structure, or VLFS, would be called for construction off the South Korean port of Busan. The VLFS has the advantage of a secure and better-controlled remote facility, not only in terms of its physical arrangement but also as a more compact logistics port devoid of a residential population and its concomitant support services. There have been very good examples in terms of representative 'container port' models (i.e. Hong Kong or Singapore) in the region as the VLFS would benefit from the advantages of said locales and its operations.

The VLFS construction and maintenance would require a great deal of financing and international promissory efforts; the FDI (Foreign Direct Investment) protocol may be the only way to realize this kind of mega-project requiring a new type of international cooperative measure in terms of an international 'Open Trade Port / Zone',¹⁷ with an exclusively dedicated bilateral investment from, and operation by, an international consortium. Perhaps one incentive may be to incorporate a 'privileged use clause' during times of extreme emergency in the region (the recent tsunami in the south-east region of the Pacific

¹⁷ Ref. [27] and [28]

is one such example), coupled with the need for 'protection of routes and services' and may also permit the entry of nuclear vessels in the VLFS where no country would permit such an activity to occur on their national territories.

Three major concerns would be represented in the scheme; 1) the manufacturing base for the growing export/import amounts in the region, typically heralded by China and other nations in the area; 2) the consumption zones, typically represented by the U.S. and other North American countries; and 3) the transport-base location, maintenance and service provider of South Korea, Busan off-shore location for the VLFS. A balanced tri-partite consortium for these three requirements could be worked out eventually, but in the beginning an exclusive, bi-lateral trade agreement between the U.S. and South Korea could develop beforehand in an effort to ameliorate future relations with other national interests while further cementing mutual defense issues between Korea and the U.S. at the same time.

Although this paper is at best an opening dialogue for the proposal of a long-term investment and procurement of faster transportation means into the region, Korea is poised to be a leader in the advancement of the VLFS idea - supported by the very best in ship construction, desalination protocols, electricity generation and nuclear power generation efforts. As such, Korea would be the country of choice in terms of technology, geographical significance and its capability to construct and maintain a project of this nature for the future prosperity of the region.

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