Planning of an offshore airport for Kaohsiung Port future development

Yuan-Ho Lin1*, Ho-Shong Hou1, Yang-Yih Chen2 and Yang-Chi Chang2

1Ministry of Transportation and Communication and the Center of General Education, I-Shou University, China.
2Department of Marine Environment and Engineering, National Sun Yat-Sen University, Taiwan, ROC.

*Corresponding author. E-mail: yuanho3@msn.com

Accepted 15 April, 2016

Offshore facilities such as airports, artificial islands and floating cities are examples of large-scale constructions built on oceans for accommodation, living, entertainment and commercial activities. Offshore airports are airports built on reclaimed lands near coastal areas. Renowned examples include the Honolulu International Airport in Hawaii (USA) and Japan’s Kansai Airport. The chosen site for the South Star Project (SSP) is in close proximity to Kaohsiung City’s International Airport and the Second Harbor. It occupies an area of 3 x 1 km. Estimates suggest that the land reclamation project for future development of an Offshore airports Area needs roughly 1000 ha (3 x 3.33 km). The SSP is for the relocation of Kaohsiung International Airport. Offshore airports offer three primary advantages: (1) the facility allows planes to take off and land at night; (2) reduced noise and pollution, and (3) well-defined courses to prevent accidents during landing. Since the construction of an international airport at SSP’s designated site is of vital importance to Taiwan, we present a careful analysis on the feasibility for the construction of an offshore airport at said site from the perspective of location theory planning and engineering.

Key words: Offshore, airports, construction, planning, Kaohsiung.

INTRODUCTION

Coast, harbor construction and environmental impact is an introduction to Coastal land and sea areas adjacent to the coast lines on both sides of the strip-shaped area. The interaction of land and sea areas generates dynamic topography and ecological conditions. Located on the coast is shallow water shed on the mainland in which due to sunlight and nutrients is adequate. Plankton may flourish and it is estimated that all the plants and animals on Earth, about four-fifths of the growth in the above areas and the global annual production of fish and shellfish, shallow coastal waters is accounted for 90%.

According to the fragility and sensitivity of coastal resources, once destroyed, is extremely difficult to recover. In addition to reducing the value of water and product quality, opening of outside, environmental hazard, harm homeland security, the threat of people's lives and property, causes social problems. Therefore, the use and management of coastal zones require special care, under the principle of conservation of resources and development of both resources, according to the ecological characteristics and economic development needs resources, coastal resources for the overall planning and evaluation, sequentially partition, and the coastal zone sustainable development.

TAIWAN COASTAL RESOURCES OVERVIEW

Taiwan is located on the Asian continental shelf edge, surrounded by the sea, the west side of the Taiwan Strait, generally within two hundred meters depth, mostly monotonous straight. The gentle slope of sandy, coastal, plain, and the majority of tidal land, coastal topography developed, multi sandbar dunes lagoon of distribution: the east Pacific, mostly steep slope of the great coastal, sea topography developed, narrow coastal plain and continental shelf. The Taiwan Strait by geological terrain can be summarized into four types under: North Coast is
the edge of a volcano gentle slope intersecting with the coastal settlement Coast, the East Coast was the fault of coastal erosion, coral reef belongs to the South Coast, the West Coast for the accumulation of bumps sandy (Chiu, 2014; Harbor, Planning and Design of Coastal and Harbor Engineering, 2005; Ministry of Transportation and Communications, 2010).

Taiwan coastal plants by growth characteristics can be summarized into sandy ground with plants. Plants with reef shore, rocky plant tape, wetland plants rock band, mangrove swamp forest, coastal natural forest artificial coastal belt, where mangroves currently owns a larger distribution area nearby and near the mouth of the Tamsui Houchuwei East stone village house type called Liu coast. West Coast distribution of the majority of the tidal beaches on the groundis near the mudskipper. Crabs snails and shellfish and other invertebrates in large number of fertility, located in Southeast Asia and Taiwan Birds circuitous shift the relay station to the port near the mouth of the Tamsui River. Tatu mouth and Yang Lan and other Xikou areas often have a lot of migratory birds and waterfowl habitat food, located near Waters east of Taiwan by the Kuroshio, rich fishery resources.

OVERVIEW OF THE COAST OF TAIWAN LAND USE

Marine environment is an invaluable property of mankind. Offshore facilities such as airports, artificial islands and floating cities are examples of large-scale constructions built on oceans for accommodation, living, entertainment and commercial activities. The creation of an artificial island is achieved by the construction/repair of bank revetments around the perimeters before amalgamating existing islets with sand or landfill. An artificial island is primarily used as a site for shallow water petroleum exploration or the reception of large tank ships or transportation of minerals. Floating cities (Seasteadings) are basically large steel constructions that are partially submerged in the ocean (Hou, 1991). They are usually modified from cruise vessels that were formally used for marine development activities (i.e. floating cities above large deep-sea mines that serve as multifunctional complexes to provide accommodation, shopping and event entertainment for miners).

Offshore airports are airports built on reclaimed lands near coastal areas. The development of offshore airports has been an ongoing trend around the world and renowned examples include the Honolulu International Airport of Hawaii (USA) and Japan’s Kansai Airport (Hou, 1993). In fact, the government actually planned the construction of an offshore airport before Taoyuan International Airport was built. However, due to rigorous protests by local elected representatives, concrete development of the project has yet to take place (Chiu, 2014; Harbor, Planning and Design of Coastal and Harbor Engineering, 2005).

Figure 1 shows the structure of Kaohsiung Offshore design. The South Star Project (SSP) is located in the south of Kaohsiung which was proposed by ex-mayor, Nan-chen Su, 20 years ago. The local Kaohsiung government has established the South Star Project (SSP) for 20 years. At the beginning, it was proposed to protect the coast line and solve building waste (Hou, 1992). Until now, it has been preceded for 170 ha and proposed to be filled in 250 ha in 2012. As a project of developing Major Kaohsiung, the Kaohsiung government has set the filled land, 170 ha for “warehouse” for harbor relative
industries.

In 2009, the typhoon, Morakot brought a lot of mud which sedimented the river estuary, Taiwan government and local Kaohsiung government planned to put the sediment to the South Star Project (SSP) area. Therefore, Taiwan government hopes to re-promote the South Star Project (SSP) in order to develop urban area of Kaohsiung. Because of the heavy sediment brought by Morakot, the downstream of Kao-Ping River was sedimented; these sands could be used for land reclamation to develop harbor, offshore airport and bigger industries. It could also increase the financial development and be used as the base of Kaohsiung airplane migration (Chiu, 2014; Harbor, Planning and Design of Coastal and Harbor Engineering, 2005).

The South Star Project (SSP) (Figure 1) is proposed to be built near Kaohsiung airport and the second harbor, which is 3 by 1 km. It was calculated to be built as 3 square kilometer and was planned to be replaced by Kaohsiung airport and become the international airport of the South. However, as no funding was received from the government, the plan was proposed.

ADVANTAGES OF OFFSHORE AIRPORT

Developing offshore airport is a trend in the world, and we concluded six merits as follows: Firstly, the plane could take off or land at night, because the offshore airport is far away from the city and could fly or land at anytime without disturbance by the night. Second of all, because of the long distance between offshore airport and the city, the noise and air pollution could be reduced (Hou, 2005). In addition, it could make the fairway clear which could reduce the judgment error about the plane landing (Take the event of what happened in Da-yuan and Singapore as examples). More and more spaces are needed and become the major problem all over the world. Namely, how to use the spaces more properly has become the major point in the transportation design. The bigger the spaces, the more the quantity, the efficiency and more importance (Figures 2a and b).

It was designed by the famous Italian architecture team led by Renzo Piano. To Piano, the floating airport was under precise calculation and integrated with several techniques. Besides, take CHARLES DE GAULLE airport I Paris as an example; the designer, Paul Andrew made travelers who stand on the pathway to have a better view and ensure the position.

In addition, the roof of the airport was designed with 82,000 light steel frame, white color and as big wave which could reduce the influence by wind. It makes the airport look like a big white knight from the outside view. Inside the airport, the white base makes the airport look bigger and brighter (Japanese Professional Book Editing Committee, 1997).

The second case is the floating house in Holland (Figure 3). Not only thinking of the sinking city, but also a more complicated water prevention engineering is taken into account in Rotterdam. The major study was the floating house exhibited in Rotterdam. The concept is to build a house on the top of water while the city is sinking. The workers in the exhibition reported that the floating house is under experimental procedure, so the skills are kept secret (Chiu, 2014; Netherlands Pavilion Expo, 2010 Shanghai).

Through the show, a reporter saw that the floating house is built on the water beside the coast which is different to the building on the land. The floating house is based on a very strong and concrete material in which the foundation is set on the water, then the structure “net dome” was used based on Buckminster Fuller’s idea to build up a floating house (Chiu, 2014; Netherlands Pavilion Expo, 2010 Shanghai).

However, in the exhibition, the model is different to the demo show; under the dome, there is a basement which is similar to the area under the deck. It could be put in the water and the area on the water could be used as a guest room, and the underwater area could be used as a bed room. The worker in the exhibition reported that this
The method will be used in the exhibition of on the top of water, namely, we may see a “floating World Exposition” in the future.

Taiwan government and local Kaohsiung government planned to put the sediment to the South Star Project (SSP) area. Therefore, Taiwan government hopes to re-promote the South Star Project (SSP) in order to develop urban area of Kaohsiung. Because of the heavy sediment brought by Morakot, the downstream of Kao-Ping River was sedimented; these sands could be used for land reclamation to develop harbor, offshore airport and bigger industries. It could also increase the financial development and be used as the base of Kaohsiung airplane migration.

The South Star Project (SSP) is proposed to be built near Kaohsiung airport and the second harbor, which is 3 by 1 km. It is calculated to be built as 3x3(9) square kilometer for an offshore airport and will be planned to be replaced by the existing Kaohsiung airport and become the international airport of the South. By mimicking the floating house on the sea exhibited in Rotterdam, Holland, the South Star Project (SSP) will use engineering methods to increase the hinterland of the South Star Project (SSP) International Airport, and it will also function as the hinterland of the existing Kaohsiung Shaw-Gong Airport in the future to increase its flexibility. The ancillary facilities are used for the airport operational use, for example a free rise and fall, and they can also avoid natural disasters and prevent the damage caused by rising sea levels in the future. Figures 4a and b provide the detailed plane and profile map. The main principle of system is on the runway. Due to the consideration of bearing the weight, parts of the project apply the embankment filling; the remaining system can apply the floating style structure (Figure 5).

**Origin and aims of the plan**

Talinpu area is situated at low-lying land. A waste disposal site was established in Talinpu since 1980. It has been ten years since Talinpu Construction Wastes Disposal Site opened use in 1990. The area has functions of waste disposal keeping the nice appearance of the city. The wastes step by step dumped filling along the coast towards the sea. There is no protective seawall built and the wastes being washed away by sea waves pollute the neighboring sea regions.

**Aims of the plan**

Protecting the lives, properties and safety of citizens solve problem of dirty confused coast change and its attacked appearance. Given perfect re-planning waste disposal site meets disposal of construction wastes and harmless business wastes. Solving waste disposal-problem promotes the upgrading of Kaohsiung City to a shiny international city and increases the land area for municipal construction of an offshore International Airport with the related facilities. Geographical location of South of Kaohsiung 2nd entrance, promote use of stove stones by China Steel Corporation coal ash produced by Taiwan Power Company as materials of seawall achieve recycling effects of resources. Meteorological Conditions: directions of monsoon in summer and winter are WNW and NNW. July to September typhoon season wind...
Figure 4a. Alternated idea floating structure (side view); (b) Alternated idea floating structure (plan view).

Figure 5. Planning and Design Flow Chart of the South Star Project (SSP).
Table 1. Reclamation project of Kaoshiung South Star plan.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1st stage</th>
<th>2nd stage</th>
<th>3rd stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>50 ha</td>
<td>150 ha</td>
<td>170 ha</td>
</tr>
<tr>
<td>Seawall length</td>
<td>2060 m</td>
<td>-</td>
<td>4188 m</td>
</tr>
<tr>
<td>Capacity</td>
<td>3,500,000 m³</td>
<td>-</td>
<td>11,900,000 m³</td>
</tr>
<tr>
<td>Wastes involved (m³/year)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slag</td>
<td></td>
<td>2,280,000 m³/year</td>
<td></td>
</tr>
<tr>
<td>Fly ash</td>
<td></td>
<td>300,000 m³/year</td>
<td></td>
</tr>
<tr>
<td>Construction wastes</td>
<td></td>
<td>660,000 m³/year</td>
<td></td>
</tr>
</tbody>
</table>

speed is 38 m/s while greatest wind speed is 53 m/s. 100 years is a cycle of earthquake and the maximum acceleration rate of earthquake standard is 0.1 g.

Idea of the plan

The plan was implemented in various phases: avoid construction wastes being washed away by waves polluting sea regions, the filling of wastes carried out after completion of seawall. Filling wastes with regulations "Storage, Clearance, Disposal and Construction Standards of Business Wastes." Flying ash can be used to replace cement, construction material of seawall stove stones by China Steel Corporation to replace natural stone materials becoming back stuffing materials. Replacement of seawall construction materials by stove stones and flying ash achieves recycling effects which is a multi-functional project. Consider effects of ocean environment; outer seawall line is fixed at the depth of 8 m (Chiu, 2014; Japanese Professional Book Editing Committee, 1997; Ministry of Transportation and Communications, 2010).

Principles of the plan

The seawall line considered that the vertical building of seawall is to change moving route of littoral drift, thereby decreasing impacts towards current environment and towards the existing industries. Construction seawall takes safety economicalization as principles. Design seawall take safety as key importance environmental protection. Preventing fill from creating secondary pollution establishes anti-pollution facilities at the back of the seawall. Planning seawall line considers convenience for the transportation waste of fills easily filling.

Phase I: Project of Short-Term Plan is NT$500 million. The length of seawall is 2,155 m and depth is 8 m down to the sea; Area is 50 acres. The filling was completed in 1996. A disposal of 4.5 million cubic meters was completed.

Phase II: Project of short-Term Plan was suspended for the moving Hungmas Kang Village.

Region I: Project of Medium-Term Plan is NT$570 million and length is 1,650 m, depth is 8 m down to the sea; Area is 50 acres. The wastes were transported to fill the site in 1996. Filling was completed in 2000, and 3 million cubic meters wastes were completed.

Region 2: Project of Medium-Term Plan is NT$1.4 billion. Length of the seawall is 3,133 m, depth is 8 m down to the sea; Area is 120 acres. The wastes fill the site in 2000. Filling was to be completed in 2006. 13 million cubic meters wastes were completed (Table 1).

High-degree of economic growth brought industrial metropolitan development. Implementation of South Star Plan: Perfect planning, design, and material technical assistance, deals with the Kaohsiung territory’s construction wastes, and there was no pollution problem (Figure 6). The newly derived land increases the area of the city promotion of municipal construction. Promotion of South Star Plan received financial administrative assistance from Council for Economic Planning and Development (Environmental Protection Administration, Executive Yuan; Figures 7 -11).

We could see that it is a big challenge and opportunity for many harbor cities to develop and rebuild a harbor. The function of the original design of a harbor could be eliminated when the time goes by; many harbor cities face the same question about how to re-develop the unused harbor to be useful. During the procedure of policy making, decision making and executing, there are many unknown variables which could disturb the development. The only way to make the plan successful is to have a macro view and understanding of the purpose and take different dimensions into concern, such as sustained development, ecology, sight scene, industries and city competition.

In addition, the dimension of population in Taiwan should be considered as:

(1) 70% of the total population lives within 1600 km of the
Figure 6. Seawall protect reclaimed land (Japanese Professional Book Editing Committee, 1997; Ministry of Transportation and Communications, 2010).

Figure 7. Construction Stage of Seawall (a) Construction of the site; (b) Filling of Construction Material; (c) Protection of Seawall; (d) Key Stone Replacement (Ministry of Transportation and Communications, 2010).

(2) Population pressure could occur at crowdedly public beaches. Due to economic growth, proliferation of seaside utilization could destroy the esthetic value that originally drew people to the coast (Chiu, 2014; Japanese Professional Book Editing Committee, 1997; Ministry of Transportation and Communications, 2010).

Therefore, the purpose of this study was trying to analyze the development and re-building of Kaohsiung harbor. In addition, we'd like to give some suggestions about the relative planning from theoretical plan and application to see the possibility to establish an offshore airport in the South Star Project (SSP) are in Kaohsiung. In addition, we aimed to evaluate if there are many advantages while
building an offshore airport, such as ecological protection, sources recycle, prevention of city disaster and leisure.

Thus, the purpose of this study is to analyze the future development and expansion of Kaohsiung harbor. In addition, this study offers some suggestions from the perspective of theoretical and application, concerning the establishment an offshore airport in the South Star Project (SSP) area in Kaohsiung. Besides, this study aims to examine the advantages in building the offshore airport, including the ecological protection, the sources

Figure 8. Refilling Process and Protection of Seawall (a) Reclamation of harmless wastes; (b) Dumping of Stone; (c) Rubble Tire replaced along Seawall; (d) Rubble tire Prevent Wave Action; (e) Landmark of (South Star) plan; (f) Special Concrete Seawall with Rubble Tire.

Figure 9a. Kansai Offshore Airport Plan I; (b) Kansai Offshore Airport Plan II (Japanese Professional Book Editing Committee, 1997).
recycle, the prevention from city disaster and the function of leisure. The dual port program was proposed to support the development of the Port of Kaohsiung, and it needs to be carefully evaluated in building an offshore airport in “the Southern Star Project Zone”. According to the "Kaohsiung Overall Planning and Future Development Plans" in 2011, the Port of Kaohsiung had the pressure of insufficient container dock. Apart from this, the Kaohsiung Port faced the growing trend of large container ships, and it also needed to cope with the “close competition” with Hong Kong, Singapore, Busan, Shanghai, Shenzhen and many other harbors. To play its critical role as a transit center, the Port of Kaohsiung needs to make good use of its geographic proximity and the benefits of the Kaohsiung International Airport. Then, the following sub-plans need to be implemented as well, e.g. the "Plan of Outer Road System that links to the Port of Kaohsiung", "the extension project of Kaohsiung Airport runway", "the Kaohsiung Aviation and Container Park Project", and "the Kaohsiung Intercontinental Container Transit Center Plan". Through implementing these projects, it is expected that the Port of Kaohsiung can serve as a critical hub on both sea and air transportation, can improve the competitiveness to compete with Hong Kong, and can increase the efficiency of transportation as well as transit services. By doing these, both industrial and economic development can be promoted (Chiu, 2014; Ministry of Transportation and Communications, 2010).

In addition, the advantages of the "maritime airport" construction include ecological conservation, resource utilization and regeneration, as well as multiple functions of recreation. And the maritime airport is also one of the development trends for the airports which intend to strengthen its role in international transportation to become an air-sea hub. In order to solve the problems in Kaohsiung airport, e.g. the overloading air cargo and the short runway problem, etc., cautious re-evaluation in the planning process in building a new international airport in the South Star Project (SSP) (southern Taiwan) is important. And probably, the airport construction in the “Southern Star Project Area” according to the “Bamboo Planning” should be reconsidered (Chiu, 2014; Ministry of Transportation and Communications, 2010).

The construction of deep-water port in Taiwan

(1) In response to the trend of demand in the future for shipping and shipping type of ship tyrants of our country, it can open up the deep-water port to save transportation costs, garbage in the overall development of Taiwan
Ports and Harbors, and improve the external competitiveness. States and adaptation are important deep-water port, but in building new deep-water port, the product, engineering, port site selection and other issues, the necessary research, and planning stage should be thorough.

(2) There is a necessary in accordance with the status of shipping transportation analysis and prediction of Ports and Harbors, sentenced existing ports were unable to afford the future energy demand;... Open deep-water port, providing deep-water berths; serve the interest of large ship docked (Chiu, 2014; Ministry of Transportation and Communications, 2010).

(3) Species based on import and export of goods analysis; coal bulk of the bulk of the ore and crude oil will be directly benefited from the use of deep-water port. The provision of terminal facilities at the same time, a large number of new land reclamation shall meet user demand for land plant.

(4) An alternative port site plan selection by ethnic Review quasi analysis, according to engineering and technical operations and maintenance of Ports and Harbors Environmental Impact Financial Analysis and Development of Ports and Harbors economic policy assessments;... To Kaohsiung SPR is the best option.

The management of the hardware

(1) Expansion of Ports and Harbors hardware facilities, long-term gradual completion of construction, and the expansion of operation functions. Port handling and associated heretics planning, construction and improvement projects, such as:

(a) The inner harbor water land regional development.
(b) Overseas region for the development of: (1) Kaohsiung intercontinental container center plan: After the completion of the project in addition to meet the future needs of container transport in Kaohsiung, in order to enhance the international competitiveness of maintaining it to become intercontinental container hub port of advantages; and by the construction of petrochemical oil unloading storage center, the area is carried out in adjustment of Ports and Harbors to enhance overall efficiency, to meet at the southern petrochemical oil transportation needs, and promote the overall development of the port of Kaohsiung. (2) The long-range development plans containers: second project in the waters of Kaohsiung harbor north breakwater on the north side of the building is to mention about 322 ha of reclaimed land as a base for the development of long-
range container business, which led to death of future developments in the global shipping market. Planning accommodates the latest container ship to leave room for Kaohsiung to continue development of the container business.

(c) Port Union Road outside: (1) traffic engineering control; (2) Diplomacy access network planning.

(2) The auxiliary equipment

(a) Additional navigation facilities: offshore expansion plans with the addition of a second port in the south of the north breakwater lighthouse poles and other facilities, with the offshore part of the navigation system assigned to the implementation of additional waterway navigation buoy...

(b) The construction of Vessel Traffic Management System (VTMS): Setting the radar signal transmission equipment automatic tracking system, with the bit digital terrain data and computerized controls Chedi master maritime vessel traffic dynamic, effective control of vessels and safety...

(c) Environmental Planning: 1) a ship built Kaohsiung accepting waste treatment system; 2) setting Kaohsiung environmental quality automatic monitoring system; 3) Port handled green landscaping works...

(d) Other information systems: How to strengthen the body and function, with the information depends on the job Kaohsiung Harbor has completed for four years of information systems planning to incorporate information on the web. GATT Internet is an Internet in order to achieve automation and paperless purposes. Scraping the contents of the package are as follows: (1) IT operating system; (2) shipping information communication system (PORTNET). Construction of harbor system, navigation system, and the system stack port harbor contact networks, and domestic and international operations network connection; 3) vessel traffic management system (VTMS) to establish vessel traffic management computer system, so in the limited waters, energy and marine operations to improve efficiency and to maintain order and water boatmanship job security.

(3) The development of the island ocean system, strengthen the accessibility of the port of Keelung and Taichung - link international port and play integration.

(4) To change the international harbor management structure in Taiwan, and the introduction of business operation mode, should be the establishment of modern management concepts of Ports and Harbours, as follows:
(a) Shipping policy co-ordination and overall international port construction and development.  
(b) Management of Ports and Harbors Law and the principle of separation to create, adjust Kaohsiung organizational and management structure.  

(5) Offshore shipping center plan: to add second container space center operations, expand business operations in order to facilitate planning to set up the Free Trade Zone.  

(6) Planned free trade zone, promote cross-strait direct flights: on the basis of "free port regulations" and related sub-law, the establishment of Free Trade Zone, with our high-tech industries and high value-added professional services to the foundation, high efficiency clearance delivery job backing of local businesses to attract multinationals and strength, combined transport, warehousing, information processing and circulation, can improve and highlight the key role in Taiwan's economic integration plays, and gradually open direct, secure and enhance the "Greater China economic map" on the advantages in the world economy and trade.  

(7) Implement plans to promote the Port of Kaohsiung double, and critically assess the Southern Star Project Zone offshore airport plan: According to "Kaohsiung overall planning and future development plans," forecast, Kaohsiung 100 years since the Republic of China is facing the container Horse-head inadequate pressure, to be the trend of the development of large-scale container ships, as well as under pressure in Hong Kong. Singapore Busan, Shanghai, Shenzhen and other harbor "close competition", the Kaohsiung to consolidate the position of the transit center, must make good use of Kaohsiung and Kaohsiung Ports and Harbors Kaohsiung Airport near the geographical advantages, and actively promote the "outer road system linking Kaohsiung plan", "Kaohsiung Airport runway extension project", "aviation Kaohsiung container Park project", "Kaohsiung Intercontinental container Center plan" and other sub-plan, UTA play sea harbor function, while improving the competitiveness of Hong Kong double, and improve quickly efficiency of transport and storage transport services, to promote industrial and economic development.  

(8) The construction of "maritime airport" has its ecological conservation resource utilization regeneration. The advantage of recreating multiple functions to plan and also the trend of national water Space World sea and air hub development, and to solve the Kaohsiung airport or plot full runway is too short and other issues, so cautiously re-evaluation of re-evaluation in the planning of the bamboo, "southern Star project area" to build a new international airport in the south, all walks of life should be able to re-think the strategy Start from the beginning.  

Stability and growth in cargo sources and operational efficiencies combined with new operating strategies and systems will help the Port of Kaohsiung maintain its status as a strategic hub port and enter a new era of competitiveness and growth. Planning of an Offshore A 2016 airport as shown in Figure 12 will form Kaohsiung transform into Air-Sea transportation Inter-model, and therefore becomes Asia-Pacific Operation Hub. Figure 12 shows the Mega Container Terminal (yellow color) for accommodating the maximum container ship such as CMA CGM 18,000 TEU Vessel full load can be entered and loading freely. On April 9th, 2016 the maximum CMA CGM 18,000TEU (about half load, not full load) entered into the second entrance (the 4th container center No.108 wharf). After completion of Figure 12 (maybe the year of 2020), the Kaohsiung Port will be the Hub of the Asia-Pacific shipping line, Kaohsiung Offshore Airport will be the Air Hub of Pan-Pacific airlines. Kaohsiung will be a brilliant harbour and airport city to handle very busy Air-Sea Intermodal Transport (Chiu, 2014; Xiaogang High School, of Kaohsiung, Taiwan).  

Conclusion  
Kaohsiung Harbour from the beginning (1958) and her well developed (2000) as shown in Figure 10 always has rapid change and extension. The author (Dr Hou, Ho-Shong) was Deputy Mayor of Kaohsiung City and works as Chairman of Council of Kaohsiung Port and City (1999-2004). Dr Hou presides over the development and extension project of Kaohsiung Airport and Seaport. During the time, Kaohsiung Harbour became the 3rd biggest container port of the world. While Kaohsiung Airport became International Kaohsiung Airport, Kaohsiung City might be the capital city (same as Taipei). Tourism is also well developed and Kaohsiung Port needs to extend toward offshore and offshore airport through careful consideration. Figure 12 is planned (see “Planning and Design of Coastal and Harbour Engineering” by Ho-Shong Hou p.581-p.599). Figure 12 shows the offshore airport (brown color) on the left upward side, and offshore industrial area (green color for China Steel Corporation, China Petroleum Corporation and Taiwan Power Company etc.). Extended Mega Container wharf (yellow color, located outside the 2nd entrance of Kaohsiung Port). The red color shows offshore hydrofoil cruiser for passenger. In the long run, after completion of Kaohsiung offshore airport and seaport extension, Kaohsiung Port will become air hub and hub port of the Asia-Pacific area. Air-sea transportation Intermodal should be lighting up Kaohsiung Port City.  

REFERENCES  
Ministry of Transportation and Communications (2010). Planning of Free Trade Zone.
Xiaogang High School, of Kaohsiung, Taiwan
http://www.hkjh.kh.edu.tw/hkjh3d/map.jpg
Netherlands Pavilion Expo 2010 Shanghai.