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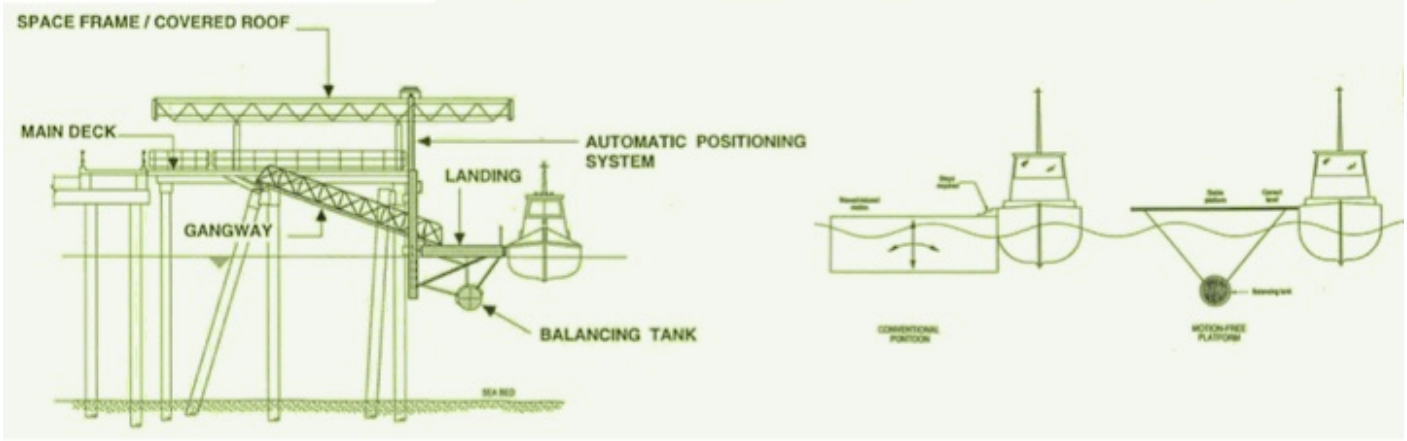
A BETTER ALTERNATIVE TO THE FLOATING PONTOON FOR ACCESS TO PASSENGER VESSELS

MOTION-FREE PASSENGER LANDING



A BETTER ALTERNATIVE TO THE FLOATING PONTOON FOR ACCESS TO PASSENGER VESSELS

Abstract

prepared by

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for Seminar on Port Design and Operations Technology
November 1999

A common way of providing an access platform to passenger vessels is by a floating pontoon. This automatically moves up and down with the tide, but has problems with wave motion, wear and tear and difficulty in accommodating vessels of differing freeboard.

An alternative system consisting of a submerged flotation tank and a computer controlled leveling system has been successfully implemented in Singapore. This system offers freedom from wave motion (and thus better safety for passengers), low maintenance, adjustability, relatively low cost, and is ideal for use in ferry terminals where safety and rapid passenger access are essential.

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1. INTRODUCTION

Providing safe, rapid access to small passenger vessels is a continuing problem for ferry terminal designers. For this purpose, it is desirable to have a level platform to be able to step easily on and off the vessel. This platform must be able to move up and down with the tide level and ideally should be adjustable to accommodate different sized vessels.

This paper describes a motion-free landing designed using state of the art technology for the provision of a stable landing between ferry and jetty. The landing is automatically synchronised with the tide by a computer controlled positioning system, providing maximum passenger safety and comfort in transit. The system is intended to replace the conventional floating pontoon landing, which is prone to excessive wave-induced motion and requires frequent maintenance.

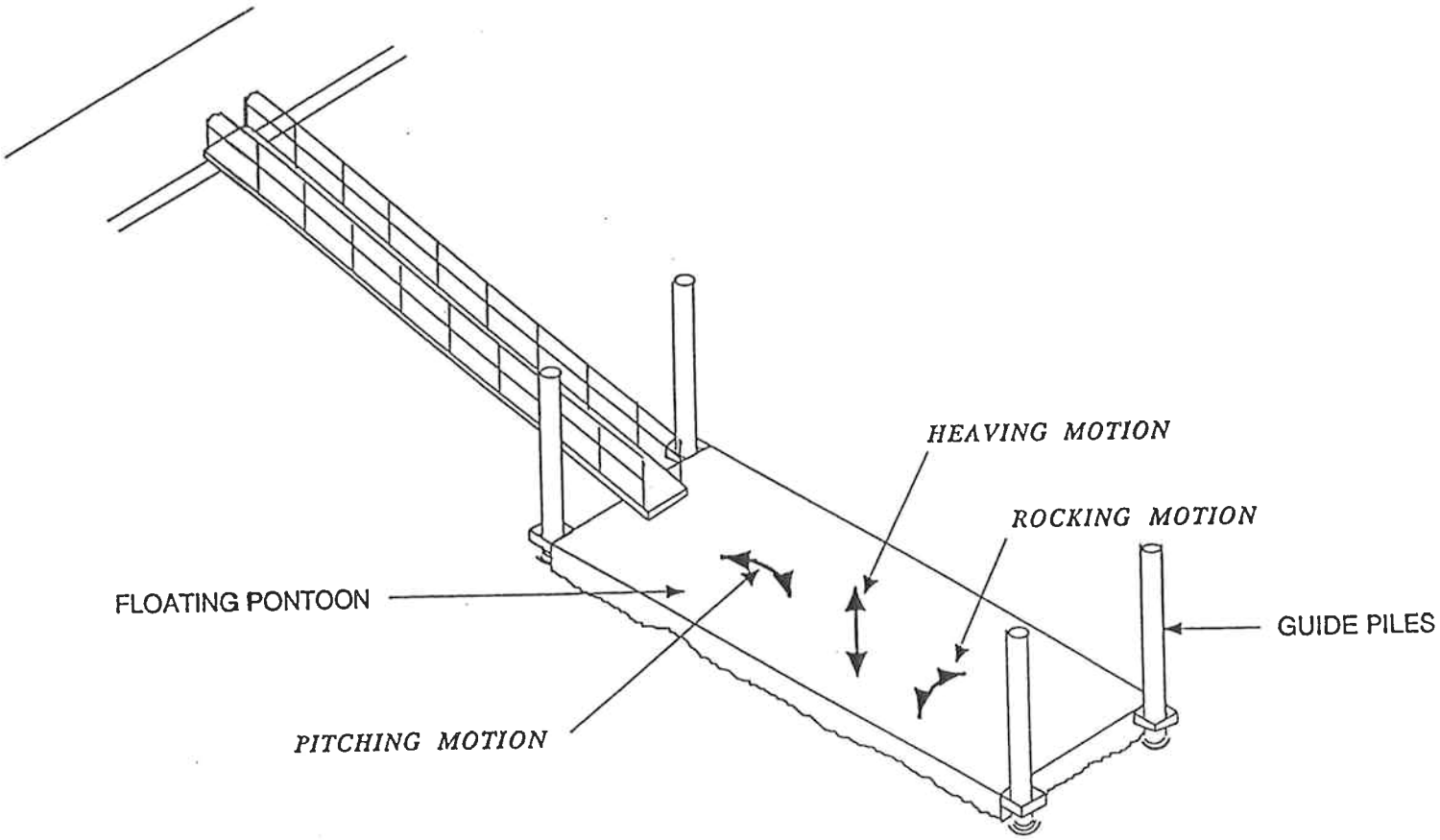
2. THE PONTOON - THE OLD WAY

The usual means for providing a passenger access platform from a shore to a boat or ferry is by means of a floating pontoon connected to shore by a hinged ramp. This system is found in many places along the coast of Singapore.

The major disadvantage of the pontoon system is that since the pontoon is floating in the water, it is subject to movement due to waves. Passing vessels can also cause large heaving and rocking motions in the pontoon which can be a hazard to safety in embarking or alighting from the ferries, especially with older, less mobile passengers or children.

The deck level of the pontoon is not easily adjustable relative to the water level, and this causes further problems if different sized vessels use the pontoon platform. The common solution is to have movable steps on the pontoon, but this causes further difficulty with access and safety.

Wave motion also causes rapid wear and tear of the guide restraint system of the pontoons. If the guide restraints are limited in an attempt to restrict the motion due to waves, the pontoon will tear the guides apart. If the guides allow too much slack, the movement will still cause a lot of banging and discomfort as well as damage to the guides.



CONVENTIONAL FLOATING PONTOON IS SUBJECT TO EXCESSIVE MOTION DUE TO PASSING WAVES

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3. A BETTER ALTERNATIVE

In researching the solution to wave-induced motion, a pontoon was instrumented and the motions compared with a laboratory model tested in a wave tank. Various measures were tried, some of which successfully reduced the wave-induced pontoon motion. However, the source of the problem is still the fact that the pontoon floats on top of the water surface. It will, therefore be affected by wave action, no matter how it is designed.

Expensive and complicated guide rollers are available to help reduce the motion of the pontoon relative to the guides.

A better solution can be achieved with a "clean sheet" design to completely eliminate wave-induced pontoon motion. This solution seeks to eliminate the cause of wave-induced motion, which is the large water-plane area of the pontoon.

4. THE SOLUTION - ELIMINATION OF WAVE-INDUCED MOTION

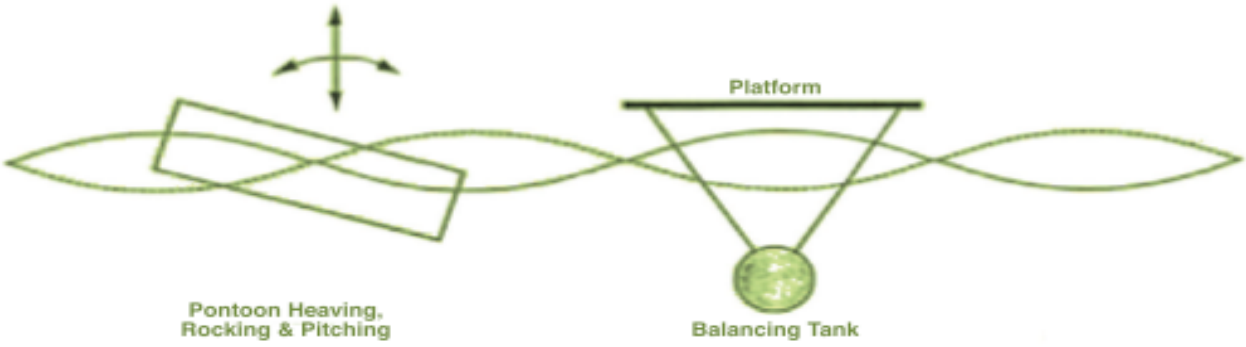
To effectively eliminate the problem of motion due to waves, the solution is to replace the floating pontoon entirely. The computerised boat landing system therefore uses a raised platform above the water level instead of a floating pontoon. A submerged **balancing tank** carries the weight of the platform, but being underwater, it is insulated from the effect of surface waves. Small structural members connect this submerged floatation tank to the platform. Thus the waterplane area is very small, and wave effect is negligible. (The waves can pass through the gap between platform and balancing tank)

In order to guide and control the motion of the platform in unison with the tidal movement, an **electro-mechanical positioning system** is used. This consists of a screw hoist for up and down movement activated by a microprocessor controlled levelling system, which automatically senses the tide level and positions the platform accordingly. The microprocessor automatically filters out the random wave perturbations while responding to tidal movements. The screw hoist ensures proper and smooth positioning of the platform level, as well as being self-locking for safety in case of power failure. There is also a provision to manually raise and lower the platform in case of power failure.

The major benefit of this system is *complete elimination of wave-induced motion*, thus ensuring greater passenger safety and comfort in boarding the ferries.

A second major advantage of this system is that the height of the platform can be easily adjusted relative to the water level for easiest and safest access to boats of varying sizes and freeboard. Compared with the old floating pontoon which requires access steps of differing heights to get into different vessels, there is a great improvement in convenience of operation and passenger safety.

ELIMINATION OF WAVE MOTION



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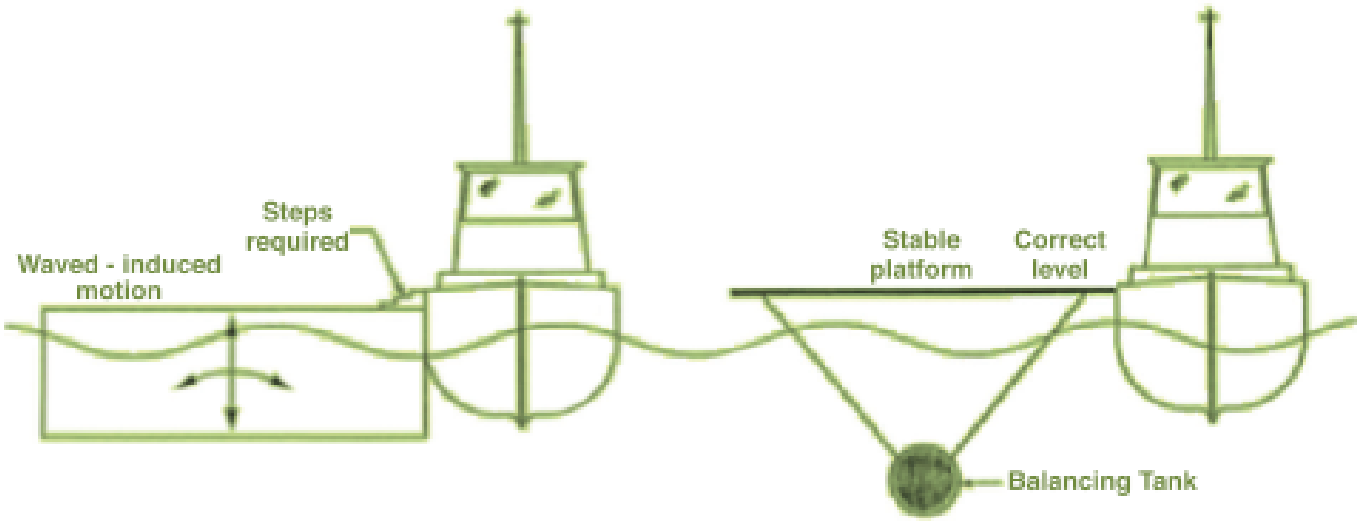
ENHANCED USER SAFETY



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The system consists of :

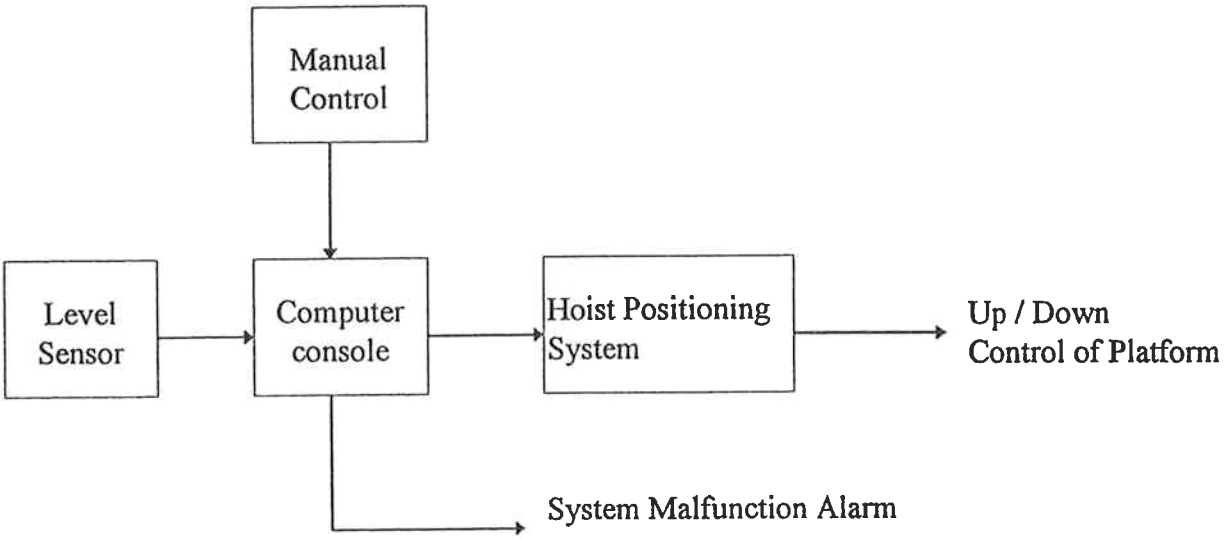
- a light weight structural platform
- submerged balancing tank
- cantilevered guide system
- hinged access ramp
- microprocessor controlled level positioning system

The design is simple, with an ultrasonic transducer to detect the changing water level and transmitting the signals to a key control computer system and thence activating the hoist positioning system to raise or lower the landing.

Ultrasonic level detection is combined with digital filtering by the computer control system to raise / lower the platform according to the tide level. The signal must be filtered to respond to the tide level changes, but not to waves.

To achieve perfect stability, the platform has teflon-coated stainless steel guides. A screw hoist positioned driven by an electric motor / gear combination provides the up / down movement control of the platform level.

To detect the ebb or surging tide levels an ultrasonic transducer is mounted at one corner of the landing so that it will not obstruct the main stream passenger traffic. The system is controlled by a compact key computer console (mounted on the deck waiting area). The entire operation is fully automatic. The console also incorporates a manual override console so that the landing level can be adjusted to suit different freeboard of varying vessels. Alarm signals are set to the operations control room in case of system malfunction.



SCHEMATIC OF LEVEL POSITIONING SYSTEM

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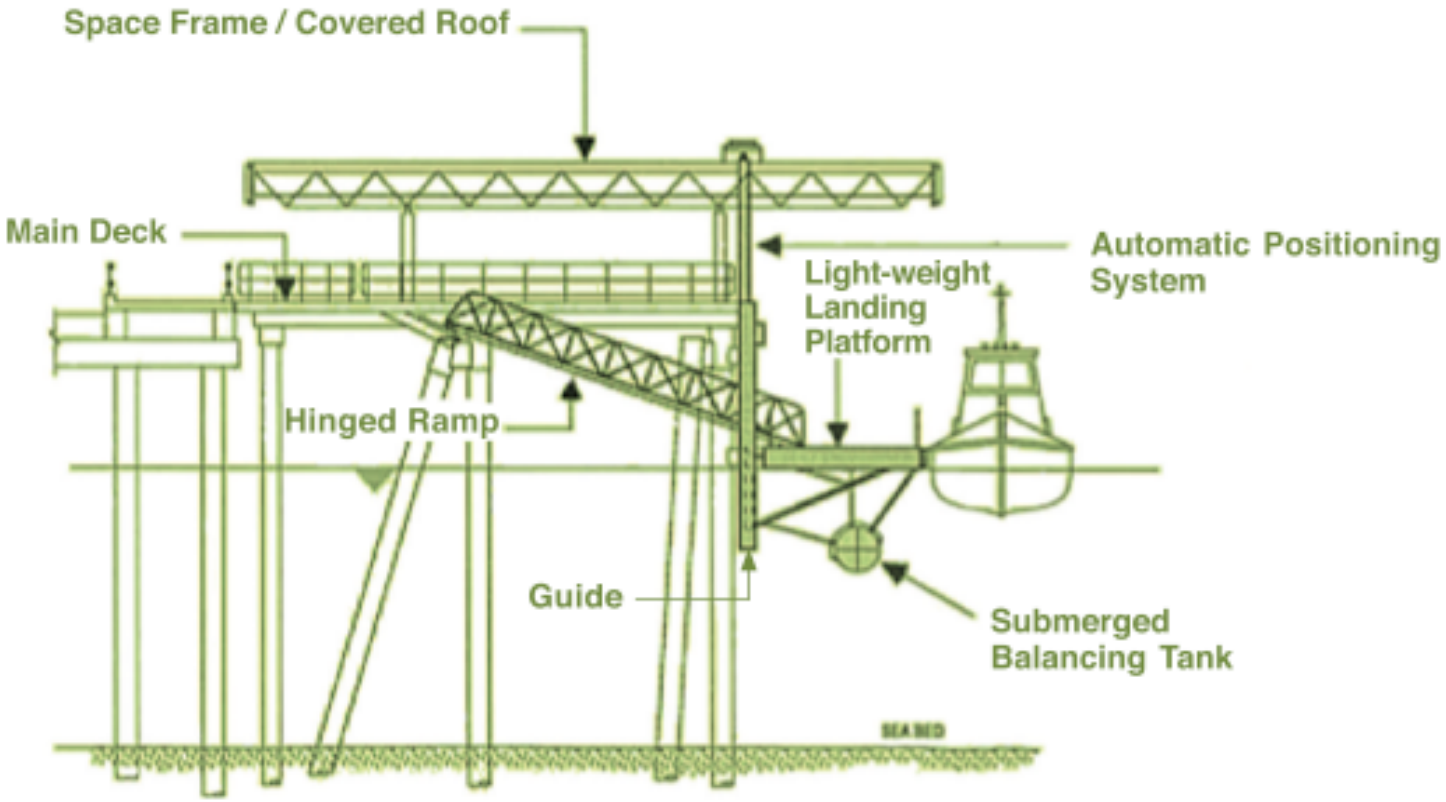
COMPUTER CONTROLLED

BOAT / FERRY LANDING SYSTEM



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5. INNOVATIVE FEATURES

Many innovative new ideas are incorporated into the design to make the system function better. They include :-

- Using a lightweight access platform with an underwater fiberglass balancing tank instead of a floating pontoon. The balancing tank relieves the load on the automatic hoisting system, and allows a much smaller sized screw hoist and motor drive. In addition, the load on the platform guides is almost eliminated, allowing the use of only 2 vertical guides mounted on one side of the platform. The platform is thus cantilevered from the 2 guides, but the load on the guides is only nominal. Without the balancing tank, the load on the guides would be excessive, leading to rapid wear, high loadings on the mechanism, and requiring additional guide supports, which would be difficult to locate. The balancing tank is filled with closed cell polyurethane foam for long life and assurance against leakage

- Locating the tank underwater using small structural members results in a very small waterplane area, and provides buoyancy to support the weight of the platform without the penalty of being affected by surface wave action

- The ramp from the access platform to shore is hinged at the platform and, rather than the shore end. This ensures that the load from the ramp onto the platform and the hoist system is constant regardless of the ramp angle and tide level

- The computer control system, is an innovative use of standard level control hardware. Therefore, the control system is easily sourced and the hardware well proven. Specially tailored software is required for proper functioning, and this can be easily tested and fine tuned on the prototype to suit the site conditions

- The software can allow for automatic adjustment of the platform level with tidal changes, as well as push button manual control of the platform level and the set-point. Therefore, the height of the platform above the water level can be automatically set as well as manually adjusted to suit different sized boats

- Teflon bearing pads running inside stainless steel guide channels ensure smooth control of movement. The teflon pads are mounted on a unique holder which can be easily changed without having to disrupt the functioning of the system

- The guides are designed such that the platform can be installed easily by floating into position on inflatable airbags. This greatly simplifies construction and especially alignment of the system

- The positioning hardware consists of an electric motor with a gear drive to a screw hoist. The screw hoist is self locking for better control of the platform motion and for safety in case of power failure. Manual operation of the screw hoist is incorporated to operate the system during a power failure

6. ADVANTAGES

Comparing to the conventional floating pontoon design, the new computer controlled landing is motion free and economically viable.

Competitive Advantages

- Provides a motion free platform for embarkation and disembarkation
- Fully automatic system
- Freeboard can be adjusted by the press of a button
- Provides maximum passenger safety and comfort
- No ballasting of the structure is required
- Aesthetically designed
- Platform shape can be custom made to suit user's requirements

Economic Advantages

- Structure is light (1/4 the weight of a pontoon) and can be fabricated by any fabrication yard. No seafront construction site is required
- Overall construction cost is cheaper
- Shorter construction and installation time
- Minimum maintenance, moving parts are made of durable high tech materials
- The structure can be easily lifted out of the water for maintenance or other work if required
- No compartment watertightness testing is required
- No SR (floating vessel) registration is required

7. TOTALLY STABLE PLATFORM

The result is a totally stable platform which is unaffected by wave motion.

Its advantages are

- totally stable platform
- adjustable platform height
- ease of operation
- low maintenance
- ease of construction and installation
- low initial cost
- unlimited platform shapes
- no need for marine certification
- reliable operation

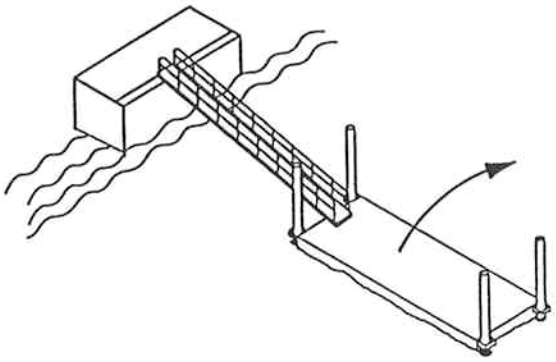
The system has been in use for over 15 years at several different sites.

The system is unique in that it totally eliminates the safety hazard due to wave motion, and provides automatic, yet adjustable control of the platform level. The most important gain is in passenger safety and convenience. Construction of the system is cheaper and easier due to the fact that the platform is much lighter.

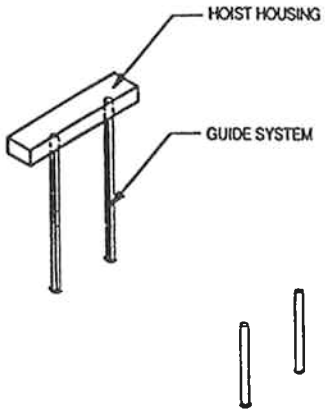
The system is ideally suited for ferry terminals where rapid, safe passenger access is required. It saves manpower and operating costs as well as downtime. Maintenance is easily achieved by merely raising the system above water level.

The system can be implemented both on new sites as well as directly replacing existing pontoon systems. Its safety and low maintenance make it a better alternative to the floating pontoon for access to small passenger vessels.

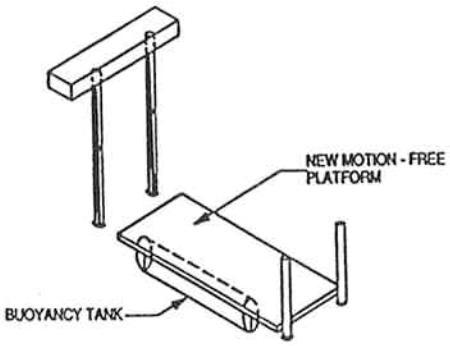
CONVERTING EXISTING PONTOON TO MOTION - FREE LANDING



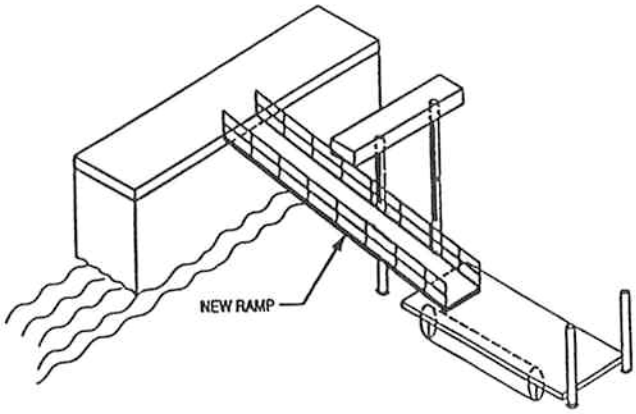
① EXISTING PONTOON REMOVED



② NEW HOIST AND GUIDE SYSTEM INSTALLED



③ NEW PLATFORM WITH BUOYANCY TANK INSTALLED



④ NEW RAMP INSTALLED
HOIST SYSTEM HOOKED UP
CONTROL SYSTEM COMMISSIONED