# MONO COLUMN OFFSHORE PLATFORM, SYSTEM AND METHOD OF DEPLOYING THE SAME

## CROSS REFERENCE TO RELATED APPLICATION

This application claims the priority of Singapore patent application 10201400119U, filed on 19 February 2014, the disclosure of which is incorporated by reference herein in its entirety.

## TECHNICAL FIELD

**[0001]** The present invention relates to the field of offshore rigs. In particular, it relates to a jack-up offshore rig and employment of the same in the oil and gas industries to perform, including, but not limiting to, drilling, production, storage, processing, field support, well/platform service, construction processes and/or any other offshore related projects/activities conducted in brown, marginal and/or green fields.

## BACKGROUND

**[0002]** A typical jack-up offshore platform usually consists of a platform structure (typically referred to as a deckbox or deck) and supporting legs movable in the vertical direction using control systems such as a set of gears, for example, to move the legs through the teeth of the gears. When in transit mode, and the rig is being dry/wet towed, the supporting legs are raised all the way up. Upon reaching a specific location, the legs are lowered until the legs reach the seabed. The process of lowering the legs is typically referred to as a "jack-down". The bottom of each leg is usually fitted with a 'shoe-like' structure, which is typically referred to as a "spudcan".

**[0003]** The spudcan is typically designed such that the supporting legs can smoothly penetrate or ease into the seabed. In order to ensure that the jack-up offshore platform is firmly in position, the rig undergoes a process called "preloading" whereby the jack-up offshore platform is subjected to additional loading by means of adding ballast water into its hull. The purpose of preloading is to increase and direct downward vertical forces on the supporting legs in order to ensure penetration of the supporting legs into the seabed. The penetration process ends when the supporting legs are

engaged firmly with the seabed thereby ensuring that the jack-up offshore platform is stable and firm. Thereafter, the platform is raised or jacked-up above sea-level to a specified height so that any of the aforesaid processes may be carried out. It is to be noted that hereafter, use of the term "jack-up unit" refers to the jack-up offshore platform as described above.

**[0004]** The design of the jack-up unit is traditionally single-purposed with ancillary equipment and systems being integrated therewith to form one complex system. Such a single-purpose built jack-up unit in any field will be re-deployed when its existing project comes to a conclusion and the said jack-up unit is required in some other location. Notwithstanding, the jack-up unit, along with its ancillary systems, may be re-deployed even before the end of an existing project. This may take place in cases where the extraction of the remaining reserve from a field is not commercially viable as compared to the conduct of operations at a new field where the potential yields outweigh the cost of continuing extracting operations of the remaining reserve at the earlier field. Two important implications arise from this.

**[0005]** First, this generally results in a high demand for jack-up rig units globally and a high cost is often associated with the need to deploy/re-deploy (mobilise) jack-up units beyond each field. Second, a project may require a few jack-up units each having specific systems to perform specific tasks working in conjunction with one another in order to extract crude oil from a field. Due to current technologies and applications used, there are often potential economic losses associated with delays in the scheduling and a lack of suitably equipped jack-up units from the time that exploration of a field is carried out to the time that a production unit can be deployed for first oil (hydrocarbon) extraction.

**[0006]** A marginal field is a field where the reserves may not be high enough to provide a sufficient yield for field owners to justify deploying a jack-up unit as that would be many times costlier or time consuming. Instead, field owners often prefer to derive a cost-effective solution vis-à-vis the volume of the natural reserves. However, as a result, very often the development and production activities in marginalised fields are not carried out and these fields remain unutilised despite seismic surveys showing, a collective potential of natural reserves in these fields. These marginal fields are often neglected as their field owners await more cost-effective solutions to commercially exploit the said marginal fields. The issues facing owners of marginal fields, including oil fields with proven huge reserves, are further elaborated on below:-

a. Time Interval between Exploration - Production

In a typical exploration-production cycle, the duration from exploration to production generally ranges from 2 – 5 years, depending on the complexity of the Front End Engineering Design (FEED), Basic Design and Detailed Design for the suitable platform as well as the cost efficiency of the project vis-à-vis the amount of resources available. **FIGURE 12** illustrates the average time taken to commence production at a field when relying on a conventional fixed platform.

b. Marginal Fields

In marginal fields, the discovery often shows the reserves as being not of sufficient yield to justify the economic cost of developing, building and deploying a jack-up unit. This is because of the high cost of procuring a complex platform at the risk of extracting insufficient reserves to cover the investment cost. As such, marginal fields are often neglected.

c. Configuration & Reconstruction

In the current oil and gas landscape, any discovery of natural reserves would logically lead to two outcomes:-

(i) To proceed with production after a prolonged time interval due to the time interval factor mentioned at (a), or

(ii) To abandon the fields as the cost of entering into production is prohibitive in most cases.

**[0007]** For the first outcome, a process comprising Pre-FEED, FEED, design and fabrication of a suitable jacket for production over the discovery well may take at least 3 years. This may involve mobilising existing jack-up units for refitting. Refitting involves the removal and installation of relevant equipment or systems in order to enable the jack-up unit to operate in a specific environment, according to the project phase.

**[0008]** Alternatively, a new jack-up unit may be ordered which takes approximately an additional 2 years for delivery. Under the above scenario, cost and time are heavily invested to either mobilise a jack up unit or to construct a jack-up unit to carry out the production. Where a jack-up unit is mobilised

for retrofitting, this also results in the loss of lease time which could be better spent in extracting and producing oil, and leads to the loss of valuable potential yields.

**[0009]** There are three presently known methods for addressing the problems facing the oil and gas industry:-

1. Following the traditional approach of procuring engineering solutions and taking any available jack-up units for retrofitting (reconfiguration and construction);
2. Deploying highly expensive and misfit jack-up units or semi-submersibles at prohibitive daily rates in order to carry out activities; or
3. In the case of marginal fields, leaving it untouched until a cost-efficient solution is available.

**[0010]** The overarching issue with the approach currently taken in oil and gas industry is that the seismic study, exploration and "solutioning" of a field for production purposes (which may be carried out by an oil company) is separate and distinct from the process of preparing the necessary resources for carrying out production, which does not commence until the exploration phase confirms that it is commercially viable to commence production processes and operations in a marginal field. Hence, the sequential approach to exploration and production lacks a holistic strategy. This is especially applicable to large oil fields which are hampered by long lead times and high cost.

**[0011]** In respect of the second method, European Patent EP0035023B1 discloses one such offshore platform. The offshore platform has a deck, a gravity base and a frame connecting the deck to the gravity base. The gravity base is designed such that it has to penetrate the seabed in order to fix the offshore platform in position to carry out operations. The European patent also discloses that the offshore platform is to be towed to a field whereupon it will be deployed for normal offshore drilling and/or production. However, the design of European Patent EP0035023B1 has the following disadvantages:-

a. The offshore platform requires its gravity base to penetrate the seabed, which means that the offshore platform can only operate in a high load-bearing seabed environment of dense soil and rock;

b. the offshore platform is designed to function as a stand-alone offshore platform thereby limiting any up-scaling of operations; and

c. The offshore platform uses a hydraulic mechanism to jack-up the deck, which limits the load-bearing capabilities of the offshore platform and the hydraulic mechanism cannot be transferred easily from one offshore platform to another for usage due to complicated plumbing requirements.

**[0012]** As such, despite the above-mentioned attempt as disclosed in the prior art, there is still a need for a mono column offshore platform, system and method of the same for carrying out exploration and production of oil fields, including marginal fields, that enables the same to be carried out in a timely and cost efficient manner. In this respect, the invention as described below, and as defined in the claims appended hereto, overcomes the difficulties and does not have the same disadvantages of the prior art while still providing the aforesaid benefits.

## DESCRIPTION OF THE INVENTION

**[0013]** A first aspect of the present invention relates to an offshore platform having a transit state and a deployed state. The offshore platform includes at least one substantially horizontally planar deckbox having a top side and a bottom side. The deckbox includes a modular interface on the top side of its planar surface. The modular interface of the deckbox is adapted to enable the installation and removal of oil drilling, oil production, offshore accommodation equipment and/or any other systems or equipment for offshore activities, in particular such equipment befitting of the particular offshore operation and the requirements of the project.

**[0014]** In one embodiment, the modular interface of the deckbox may include specific portions thereof that are designated to interface with drilling equipment. The drilling equipment may have a capacity ranging from 1000 to 3000 horsepower. Such drilling equipment may be interfaced to the deckbox and is capable of drilling from as little as one well to as many as twenty wells or more. The deckbox may also interface with a production unit. The number of productions units required is typically determined by the production capacity of the fields. As such, where need be, additional modular production units may be added to increase the production level. Apart from drilling and production equipment, the deckbox may also interface with an array of lifting cranes and accommodation modules capable of supporting offshore operations and any project(s).

**[0015]** The modular interface design of the deckbox permits the deckbox of the offshore platform to have production systems modularly installed and configured within just a short period after the drilling is done to commence production. Once deployed for production, the jack-up unit operates as though it is being utilized as a permanent jacket. As an illustrative example, after exploration is complete, the offshore platform may undertake an immediate reconfiguration or add-on of equipment/facility in-situ. This reconfiguration is possible due to the modular interface of the deckbox of the offshore platform. In summary, the mono column offshore platform is a two-in-one system (comprising a jacket and a jack up) performing the role of exploration drilling, production and extraction. In addition, the "modular interface" design means that the offshore platform can be:-

a. constructed within a very short duration and in a very cost efficient manner;

b. deployed at specific fields/locations with the right configuration and/or 'kit';

c. refitted with equipment/systems/facilities on a modular basis akin to a "LEGO™" model such that the equipment on board is able to utilise the deck space optimally. This means that there is no need to change the integrity or the underlying framework or infrastructure of the offshore platform in order to accommodate the requisite variable deck loads.

**[0016]** The offshore platform, with its vast deckspace, enables one or an array of modular equipment to be placed onto it. The specific placement and connectivity is dependent on the purpose of the equipment and the optimisation methodology of the deck space to meet the project's requirements. As mentioned, this is akin to the "LEGO™" concept such that the overall layout of the equipment on the deckbox can be built or reconfigured as needed. This relieves the need for engineering re-design and re-certification of the entire unit as an offshore jack-up unit. Depending on the operational requirements over the span of the project, it is possible to include additional equipment as 'add-ons' on the deckbox, or to 'reconfigure' the overall arrangement of the equipment on the deckbox.

**[0017]** The deckbox also includes at least one substantially vertical through-hole. The design of the vertical through-hole enables further utilisation of this potential space for other activities such as drilling, the placement of risers within the hole for production as well as any other related operations with the seabed and is not confined to topside activities. This also potentially protects the cabling and piping running down to the seabed from the deck.

[0018] The offshore platform also includes at least one substantially horizontally planar mat. The substantially horizontally planar mat has a top side and a bottom side. The substantially planar mat also includes at least one substantially vertical through-hole. Both substantially vertical through-holes on the mat and the deckbox are at least substantially concentric or contiguous. The mat includes at least one ballast tank. The mat is positioned relative to the deckbox such that the top side of the mat faces and is parallel to the bottom side of the deckbox and the respective through-holes of the deckbox and the mat overlap and may be at least substantially concentric or contiguous. This may result in at least a substantial overlap between the at least one through-hole of the deckbox and the at least one through-hole of the mat.

[0019] In one embodiment, the at least one substantially vertical through-hole extending from the top side to the bottom side of the deckbox, and the at least one substantially vertical through-hole extending from the top side to the bottom side of the mat may be completely overlapping, concentric or contiguous, such that the through-holes are dimensionally equivalent and matching. In another embodiment, the top side of the mat is of the same surface area as the bottom side of the deckbox, i.e., the deckbox and the mat are of the same size. In another embodiment, the surface area of the top side of the mat may be of a different size from the surface area of the bottom side of the deckbox. The size of the deckbox and mat are typically chosen based on the project's operational requirements. In another embodiment, the deckbox and mat may be of a shape selected from the group consisting of a circle, square, rectangle, quadrilateral, triangle or ellipse, or any shape so applicable. Likewise for the mat. Together, the deckbox and mat ought to have sufficient buoyancy to support the offshore platform in order for it to be transported, via wet or dry tow, to the desired site for deployment.

[0020] The offshore platform further includes at least one elongate truss column having a first end and a second or distal end. The elongate truss column is moveably engaged at one end with the deckbox. The engagement with the deckbox takes place by having one or more elongate truss column(s) threaded through one or more corresponding through-hole(s) of the deckbox. The second or distal end of the elongate truss column is rigidly fixed to the mat at or proximate to the at least one through-hole of the mat.

[0021] In one exemplary embodiment of the invention, the elongate truss column includes four chord truss legs that are rigidly fixed at the periphery of the at least substantially vertical through-hole of the

mat. The four chord truss legs ensure that pressure is equally or uniformly exerted and transferred onto the mat that is on the seabed. Four-chord truss legs are common in enabling the transfer of loads from the chord legs to the mat to ensure that the mat maintains its position consistently during operational processes. In three-legged jack ups, there is a need to harmonize the chords in each leg relative to the differentials between the legs during the movement of the deckbox along each leg at the global level. This increases operational risk considerably. However, it is nevertheless possible to have an elongate truss column having at least three chord truss legs or more provided the chord truss legs are in a polygonal arrangement.

**[0022]** The elongate truss column may be of any length. Typically the length is determined by the intended operational depth and environment of the offshore platform. In an exemplary embodiment, the elongate truss column may be of sufficient length to meet up to 500ft of water depth and the associated wave effects (i.e. air gap). Depending on the project, the length of the leg may vary to meet the operational environment of the oil field.

**[0023]** In one exemplary embodiment, the elongate truss column includes inverted K-truss members. In an alternative embodiment, the elongate truss members may be selected from a group consisting of K-truss members, X-truss members as well as any other design existing or preconceived, or any other configuration of bracings across the same or different horizontal planar segments within the through-hole.

**[0024]** With the positioning of the deckbox and mat as described above, the elongate truss column(s) is in a perpendicular orientation to the planar deckbox and mat. Accordingly, the deckbox is moveable along the elongate axes of the truss column(s) between a transit position and a deployed position.

**[0025]** In the transit position the deckbox is proximate or adjacent vertically, just above the mat and the second or distal end of the elongate truss column. In this position, a substantial portion of the elongate truss column is positioned above the top side of the deckbox. In the deployed position, the elongate truss column moves down via the through-hole(s) of the deckbox under the forces exerted by the jacking system facilitated by the effect of gravity. As the elongate truss column is rigidly fixed to the mat, the mat is also displaced accordingly. In the deployed position, the mat remains fixed to the second or distal end of the elongate truss column and comes to rest firmly on the seabed. However,

due to the movement of the column relative to the deckbox, the deckbox is now proximate to the first end, wherein the first end remains above the top side of the deckbox.

**[0026]** The movement of the mat takes place under the effect of gravity acting upon the mat in conjunction with the jacking mechanism acting on the elongate truss leg. In one exemplary embodiment, in order to assist in the movement of the mat, the weight of the mat may be varied. In this embodiment, the variation of the weight of the mat is achieved where the mat includes at least one ballast tank, which can be filled with fluid. Typically, when deploying the offshore platform, such a ballast tank may be filled with seawater.

**[0027]** In another embodiment of the invention, the bottom side of the mat is adapted to push down into and settle on a seabed thereby firmly supporting the offshore platform and holding it in place. This is assisted by the transference of loads via the elongate truss column to the mat. The mat, which is resting on the seabed, it acts as an integral part of the seabed. When a load force is applied to the offshore platform, the same is transmitted to the mat thereby acting on the mat just as it would act on the seabed. This reduces the risk of overbearing on specific points of the seabed. With the appropriate level of ballasting in the mat, the mat is pushed down firmly onto the seabed thereby further cementing its 'grip' onto the seabed resulting in stability to the offshore structure. The skirting along the periphery of the mat proximate to the seabed assists in securing the mat to the seabed, and may include a corrugated surface on the underside of the mat or any other design, existing or preconceived, to assist in increasing the frictional force between the bottom surface of the mat and the seabed.

**[0028]** In yet another embodiment, the deckbox further includes a cut-out section extending from the top side to the bottom side. The cut-out may be located along the periphery of the deckbox or as another through-hole on the deckbox. In this embodiment, the mat also includes a cut-out section extending from the top side to the bottom side along its periphery. In this embodiment, the positioning of the cut-out or through-hole of the deckbox and the positioning of the cut-out or through-hole of the mat are substantially coaxial. The coaxial cut-out or through-hole sections of the deckbox and the cut-out or through-hole in the mat are adapted such that drilling operations may be performed at the cut-out sections and concurrent oil production operations may be performed via the at least one substantially vertical through-hole extending from the top side to the bottom side of the deckbox, and the at least one substantially vertical through-hole extending from the top side to the bottom side of

the mat. The cut-out or through-hole may also be designed or utilised for any other offshore activities as required by the project such as drilling or production. In another embodiment, the cut-out or through-hole might be off-centre and situated at one of the portions of the deckbox and mat.

**[0029]** In the embodiment of the invention where the mat includes at least one ballast tank, the content of the at least one ballast tank may be released or relocated and the said at least one ballast tank utilised for the storage of oil subsequent to the bottom side of the mat settling into the seabed and the commencement of production.

**[0030]** In another embodiment, the bottom side of the mat may further include jetting or suction or both systems adapted to pump water under the mat to dislodge the mat from the seabed or to keep the mat to the seabed through suction if need be. The use of jetting system may be necessitated where the offshore platform has been deployed for a prolonged period of time in a particular deployment site and particulate matter has built up over time. The jetting would serve to dislodge the particulate matter thereby making it easier for the mat to be disengaged from the seabed. The use of suction system may be necessitated when additional force is needed to hold the mat to the seabed as part of the process or as an additional measure.

**[0031]** In yet another embodiment, the elongate truss column is moveably engaged with the deckbox via a rack and pinion mechanism, a hydraulic lift mechanism, pulley mechanism or any other appropriate lift mechanism. In the embodiment of the invention where the rack and pinion mechanism is utilised, the rack and pinion mechanism is portable and scalable. By this, it is meant that the rack and pinion mechanism is removable from the offshore platform it is currently on and transferable to another such offshore platform of the present invention. This feature of having a transferable rack and pinion mechanism allows for inter-operability with other offshore platforms of the present invention improves the reliability and redundancy of the offshore platform according to the present invention. Alternatively, the overall Variable Deck Load capability of the offshore jack-up unit may be varied by changing the number of jacking gears as appropriate for the project.

**[0032]** In a further embodiment of the invention, the various embodiments of the offshore platform as described herein may also include a helipad attached to the deckbox or as part of the accommodation or any other facility. The helipad is to facilitate the transport of personnel, equipment and supplies to the offshore platform during deployment.

[0033] In a further embodiment of the invention, the deckbox may include at least one locking mechanism proximate to its periphery. The locking mechanism is adapted to place the jack-up unit in position like that of a permanent jacket.

[0034] A second aspect of the present invention relates to linearly increasing the number of platforms, thus exponentially expand the functionality of the aggregated platforms. A system of offshore platforms may have at least two offshore platforms as described above. The two offshore platforms may be connected to each other via a bridge link or by a direct side-by-side connection of the deckbox, mat or both. Each of the at least two offshore platforms may be involved in performing any one or more of the processes selected from the group consisting of drilling, production, accommodation, power generation and production support.

[0035] A third aspect of the present invention relates to a method of deploying the various embodiments of the offshore platform described above. The method includes:-

a. towing the offshore platform to a deployment location in its transit state whereby the deckbox is adjacent to the mat;

b. positioning the offshore platform over an intended deployment site;

c. lowering the substantially horizontally planar mat until the said mat contacts the bed of the intended deployment site; and

d. jacking up the substantially horizontally planar deckbox vertically upwards along the elongate truss column.

[0036] The deployed state is reached when there is no further jacking operation and the deckbox is stationary with an pre-defined air gap between deckbox and water.

[0037] In one embodiment of the third aspect of the invention, lowering the substantially horizontally planar may be carried out by varying the weight of the mat. For example, if the weight of the mat is increased, the mat is lowered under the effect of gravity in tandem with the forces performed by the jacking systems. In a further embodiment of the third aspect, adjustments to the positioning of the offshore platform may be made when the mat is being lowered to the seabed such that the position of the offshore platform is maintained over the intended deployment site. Essentially, the offshore platform of the present invention is highly versatile. For exploration, on deployment to the site, the

offshore platform carries out drilling. Upon confirmation of the exploration, it performs the role as a jacket on which a production unit could be placed on the deck to perform production operations while drilling operations continue.

**[0038]** Although various aspects and embodiments of the present invention have been described above, the following illustrations of exemplary embodiments and accompanying description serve to further aid in the understanding and clarity of the various embodiments of the invention. However, it should be noted that the scope of the invention is by no means limited to the exemplary embodiments described and illustrated hereafter, but rather, as set out in the claims that are appended hereto.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0039]** **FIGURE 1** is an illustrative embodiment of an offshore platform of the present invention;

**[0040]** **FIGURE 2** is a side profile view of the embodiment of **FIGURE 1**;

**[0041]** **FIGURE 3** is a top view of an illustrative embodiment of a deckbox of the present invention;

**[0042]** **FIGURE 4** is a top view of an illustrative embodiment of a deckbox of the present invention with an arrangement of tanks;

**[0043]** **FIGURE 5** is a top view of an illustrative embodiment of a mat of the present invention;

**[0044]** **FIGURE 6** is a top view of an illustrative embodiment of a mat of the present invention with an arrangement of tanks;

**[0045]** **FIGURE 7** is an illustration of the deployment sequence of an exemplary embodiment of the present invention;

**[0046]** **FIGURE 8** is an isometric view of an exemplary embodiment of the present invention; and

**[0047]** **FIGURE 9** is an illustration of an embodiment of an aspect of the present invention wherein two mono column offshore platforms are connected to each other;

**[0048]** **FIGURE 10** is an illustration of another embodiment of the present invention wherein two mono column offshore platforms are connected to each other;

**[0049]** **FIGURE 11** is an illustration of another embodiment of the present invention wherein the platform is fitted with a drilling facility, an accommodation facility and a helideck; and

[0050] **FIGURE 12** is an illustration of the typical average time taken to commence production at a field when relying on a conventional fixed platform.

## DETAILED DESCRIPTION OF THE DRAWINGS

[0051] **FIGURE 1** is an illustrative embodiment of an offshore platform **10** of the present invention in its deployed state. The offshore platform **10** has a deckbox **12** and a mat **16** of approximately equal or possibly of a different size. The deckbox **12** is connected to the mat **16** via a truss column **14**. The deckbox **12** has a through-hole (not shown) situated approximately in the centre thereof. The mat **16** also has a through-hole (not shown) situated approximately in the centre thereof. The deckbox **12** and the mat **16** are arranged such that they overlap each other. More importantly, the alignment of the deckbox **12** with respect to the mat **16** is such that their respective through-holes are also aligned. This is to allow the truss column **14** to engage with the deckbox **12** and the mat **16** as described below.

[0052] One end of the truss column **14** is moveably engaged with the deckbox **12** via the through-hole of the deckbox **12**. The other end of the truss column **14** is rigidly fixed to the mat **16** at the through-hole of the mat. When engaged, the truss column **14** is perpendicular to both the planar deckbox **12** and the mat **16**. The deckbox **10** is moveable along the truss column **14** from approximately one end thereof into a position adjacent to the mat **16** such that the deckbox **12** is then proximate the second end of the truss column **14**.

[0053] **FIGURE 2** is a side profile view of the embodiment of **FIGURE 1**. **FIGURE 2** shows the offshore platform **20** in its deployed state resting on the seabed **21A** in the sea **21B**. The offshore platform **20** has a deckbox **22** and a mat **26**. The deckbox **22** and the mat **26** are connected to each other via truss column **24**. One end of the truss column **24** is connected to the deckbox **22** via the at least one through-hole (not shown) located in the deckbox **22**. The truss column **24** is moveably engaged with the deckbox **22** such that the deckbox **22** is capable of moving vertically along the truss column **24**.

[0054] In this exemplary embodiment, the mechanism used to move the deckbox **22** along the truss column **24** is a rack and pinion system **28**. The rack and pinion mechanism **28** is located on the deckbox **22**. In other exemplary embodiments, the rack and pinion mechanism may be removable

from the offshore platform and transferable to another offshore platform to perform the same function. This is an added advantage of using the rack and pinion mechanism as it ensures inter-operability between the various offshore platforms of the present invention. Further, where there is a plurality of such platforms operating together, each offshore platform's rack and pinion mechanism may serve as a backup for another offshore platform's rack and pinion mechanism thereby ensuring system redundancy.

**[0055]** In this exemplary embodiment, the truss column **24** is connected at its other end to the central region of, or in other exemplary embodiments to other regions of, the mat **26**. The truss column **24** is rigidly connected to the mat **26** such that when the truss column **24** slides vertically downwards from the deckbox **22**, the mat **26** is also displaced and is translated vertically downwards. The mat **26** is vertically displaced downwards until it reaches the seabed **21A** whereupon contact, the mat **26** will press firmly down to settle on the seabed **21A** thereby anchoring the offshore platform **20** in place to conduct operations. When the mat **26** is firmly pressed against the seabed **21A**, the rack and pinion mechanism **28** continues to run. The result is that the deckbox **22** is then pushed vertically upwards and lifted up from the surface of the sea **21B**, till the deckbox **22** reaches proximate to the end of the truss column **24** that is protruding from the sea **21B**.

**[0056]** **FIGURE 3** is a top view of an illustrative embodiment **30** of a deckbox **32** of the present invention. From the top view, the deckbox **32** of this exemplary embodiment is a square. The deckbox has a through-hole **36** via which the truss column **34** is moveably engages with the deckbox **32** using a rack and pinion mechanism **38**. The truss column **34** may include different configurations of bracings **33** either across or intersecting the same or different horizontal planar segments. The through-hole **36** of the deckbox **32** is aligned with the through-hole (not shown) of the mat (not shown) such that the truss column **34** will be vertically aligned with both the respective through-holes of the deckbox **32** and the mat.

**[0057]** **FIGURE 4** is a top view of an illustrative embodiment **40** of a deckbox **42** of the present invention with a possible arrangement of tanks **43** and the truss column **44** with possible bracings intersecting across same or different horizontal segments. The tanks **43** are capable of being filled with a fluid in order to act as ballast during the transit and deployment stages of the offshore platform. The tanks **43** are arranged within the deckbox **42**, and of possibly a variation of different sizes of tanks or a varying number of tanks. Upon deployment, the tanks **43** may be emptied of any fluid being

used as ballast in order to store operational materials such as fuel or crude oil extracted from an oil field in respect of on-going operations and pending transference of the same to a suitable vessel.

**[0058]** **FIGURE 5** is a top view of an illustrative embodiment **50** of a mat **54** of the present invention. In this embodiment, the mat **54** is a square or of different shape or size so specified. The mat **54** includes a through-hole **52** that is located in the central region of the mat **54** such that the through-hole **52** and the mat **54** are concentric. As mentioned in respect of the embodiment **30** of **FIGURE 3**, the through-hole **52** of the mat **54** is such that the truss column (not shown) will be vertically aligned with both the respective through-holes of the deckbox **32** and the mat **54**.

**[0059]** **FIGURE 6** is a top view an illustrative embodiment **60** of a mat **62** of the present invention with an arrangement of tanks **63** around the through-hole **66**. In this embodiment, the mat **62** has tanks **63**, which are distributed within the mat **62**. As with the tanks **43** described in respect of the embodiment **40** of **FIGURE 4**, the tanks **63** are also capable of being filled with a fluid in order to act as ballast during the transit and deployment stages of the offshore platform. When the offshore platform is being deployed, the tanks **63** may be filled with typically sea water or any fluid, for example, in order to increase the weight of the mat **62** such that a sufficient gravitational force overcomes the frictional forces within the rack and pinion mechanism described in respect of **FIGURE 3** thereby resulting in the downward movement of the mat **62**. Following deployment and during operations, the tanks **63** may be emptied of any fluid being used as ballast in order to store operational materials such as fuel or crude oil extracted from an oil field in respect of on-going operations and pending transference of the same to a suitable vessel.

**[0060]** When the offshore platform is being recovered following operations, the fluid in the tanks may be discharged and filled with air in order to aid the raising of the mat **62** from the seabed. In that regard, in this exemplary embodiment **60** of the mat **62**, the mat **62** includes suction points **65** and jetting outlets **64**.

**[0061]** The suction points **65** are used to provide additional forces to hold the mat **62** to the seabed. Where an offshore platform is deployed, a secondary force may be required to keep the mat **62** in position. Provision of the secondary force would be from the suction points **65** which would exert a suction force that would keep the mat **62** in position. On the other hand, the jetting outlets **64** are used to free the mat **62** from the seabed. This is because if an offshore platform has been deployed for an

extended period of time, particulate matter would have been collected on the mat **62** and may hinder the recovery process. The jetting outlets **64** shoot water jets, which exert forces to aid in the dislodgment of such accumulated particulate.

**[0062]** **FIGURE 7** is an illustration of various stages **70A** to **70D** of the deployment sequence of the embodiment of **FIGURE 1** of the invention. In **70A**, the offshore platform is considered to be in its transit stage. In this stage, the offshore platform may be transported to the location as which deployment thereof is intended. The deckbox **72** and the mat **74** are proximate to each other at one end of the truss column **76**. The various ballast tanks of the deckbox **72** and/or mat **74** may be filled with an appropriate fluid in order to assist in the control and transportation of the undeployed offshore platform. The transit can happen through either dry tow or wet tow.

**[0063]** When the offshore platform reaches the desired deployment site **71**, the sequence shown at **70B** shows the mat **74** being lowered. In order to accomplish this, the tanks **63** of the mat **62** (herein labelled as **74**) are filled with fluid, typically seawater, and with the combined weight of the mat **74** and the filled tanks **63**, the mat **74** is lowered under the effect of gravity in tandem with the forces exerted by the jacking mechanism. The truss column **76** connected to the mat **74** is moved vertically downward causing the mat **74** to descend. The truss column **76** slides down by way of the rack and pinion mechanism **78** via which it is engaged with the deckbox **72**.

**[0064]** At **70C**, the mat **74** has reached the seabed **71** and pushes into the seabed **71** due largely in part to the weight of the mat and overall structure **74**. At the end of the deployment stage, most of the truss structure **76** is beneath the surface of the sea and can no longer be displaced. Once the mat **74** is found to have stabilized on the seabed **71**, the deployment moves to the final stage. At **70D**, the deckbox **72** is jacked up along the truss column **76** by way of the rack and pinion mechanism **78** to a suitable height that is proximate to the end of the truss column **76** that is above the surface of the sea. The offshore platform is now deployed and ready to commence operations including, but not limited to, the installation, removal, placement of equipment, system or facilities in-situ (deployed mode).

**[0065]** **FIGURE 8** is an isometric view of an exemplary embodiment of the present invention. In this exemplary embodiment **80**, the deckbox **82** has a cut-out **83**. The deckbox **82** is connected to the mat **86** via the elongate truss column **84**. The mat **86** also has a cut-out **85**. In this exemplary embodiment **80** the cut-out **83** and the cut-out **85** are of different sizes. In other embodiments, the cut-outs **83** and

85 may be of similar sizes. The cut-outs 83 and 85 are coaxial, but in other embodiments, the cut-outs 83 and 85 may not necessarily be coaxial.

[0066] FIGURE 9 is an illustration of an embodiment 90 of the present invention wherein two mono column offshore platforms are connected to each other as adjoining or as one singular offshore platform. The offshore platforms that may be connected to each other are not limited to only similar or identical offshore platform units but may also include dissimilar offshore platforms having the same design principles as the present invention. The connection between the two mono column offshore platforms takes place at the deckbox 92 and the mat 96. However, if the deckbox 92 and mat 96 are of different dimensions, the connection may take place at the deckbox 92 or the mat 96. Each offshore platform has at least one single truss column 94 that connects the deckbox 92 to the mat 96. Each offshore platform also has a mechanism 98 to raise or lower the truss column 94 and the mat 96 connected thereto. A top view 91 of the embodiment 90 shows that the total area of the deckbox 92 has doubled as a result of connecting two mono column offshore platforms together. The total area of the deckbox 92 may be further multiplied according to the number of mono column offshore platforms that are connected together. The added surface area of the deckbox 92 will permit additional functions related to offshore activities to take place.

[0067] FIGURE 10 is an illustration of another embodiment 100 of the present invention wherein two mono column offshore platforms are connected to each other. The connection between the two mono column offshore platforms takes place at the deckbox 102 and the mat 106. However, if the deckbox 102 and mat 106 are of different dimensions, the connection may take place at the deckbox 102 or the mat 106. Both offshore platforms have a single truss column 104 that connects the deckbox 102 to the mat 106. Both offshore platforms have a mechanism 108 to raise or lower the truss column 104 and the mat 106 connected thereto.

[0068] A top view 101 of the embodiment 100 shows that the total area of the deckbox 102 has doubled as a result of connecting two mono column offshore platforms. The added surface area of the deckbox 102 allows for the inclusion of the processing module 109 as well as the helipad 107 to be part of the offshore platform.

[0069] FIGURE 11 is an illustration of another embodiment 110 of the present invention wherein the platform is fitted with a drilling facility 119, an accommodation facility 113 and a helideck 117. In this

embodiment **110**, deckbox **112** is connected to mat **116** via elongate truss column **114**. The mat **116** has a cut-out **115** along its periphery beneath the drilling facility **119**. The elongate truss column **114** is movable relative to the deckbox **112** by way of the movement mechanism **118**, which may be a rack and pinion mechanical system or other such suitable system.

**[0070]** As mentioned earlier, the above description of the exemplary embodiments of the present invention merely serve to aid in the understanding of the underlying principle behind the invention. The present invention is not to be construed as being limited to the illustrated embodiments but rather, to the extent as defined in the claims that follow.

## CLAIMS

What is claimed is:

1. An offshore platform (10) having a transit state and a deployed state, said offshore platform (10) comprising:

at least one substantially horizontally planar deckbox (12) having a top side and a bottom side, wherein said deckbox (12) comprises a modular interface on the top side of its planar surface adapted to enable the installation and removal of equipment for offshore activities; and at least one substantially vertical through-hole extending from the top side to the bottom side of the deckbox (12); and at least one ballast tank (43);

at least one substantially horizontally planar mat (16) having a top side and a bottom side, the bottom side of the mat being adapted to push down into and settle on a seabed (21A), thereby anchoring the offshore platform, to wherein said substantially planar mat (16) comprises at least one substantially vertical through-hole extending from the top side to the bottom side of the mat (16); and at least one ballast tank (63);

wherein the top side of the mat (16) faces and is at least substantially parallel to the bottom side of the deckbox (12); and

at least one elongate truss column (14) having a first end and a second end, wherein the elongate truss column (14) is moveably engaged with the deckbox (12) through the at least one through- hole of the deckbox (12), and the second end of the truss column (14) is rigidly fixed to the mat (16) at the at least one through-hole of the mat (16), such that the elongate truss column (14) is at least substantially perpendicular to the planar deckbox (12) and mat (16), such that the deckbox (12) is moveable along the truss column (14) into a position adjacent to the mat (16) and the second end of the truss column (14) during the transit state; and

wherein the elongate truss column (14) moves via the through-hole of the deckbox (12) thereby also displacing the planar mat vertically when the at least one ballast tank (63) of the mat (16) is filled; and

wherein at least one elongate truss column (14) is moveably engaged with the deckbox (12) through the at least one through-hole of the deckbox (12) via at least one removable and transferable rack and pinion mechanism (28), such that when the offshore platform (10) is in the deployed state, the at least one rack and pinion mechanism (28) is adapted to be removed and be transferred to another offshore platform.

2. The offshore platform (10) according to claim 1, the deckbox (12) comprising at least one locking mechanism proximate its periphery adapted to lock the deckbox (12) in position when the offshore platform (10) is in the deployed state.

3. The offshore platform (10) according to claim 1 or 2, the bottom side of the mat (16) comprising at least one jetting outlet (64).

4. The offshore platform (10) according to any of the preceding claims, wherein the at least one substantially vertical through-hole extending from the top side to the bottom side of the deckbox (12), and the at least one substantially vertical through-hole extending from the top side to the bottom side of the mat (16) are at least substantially concentric.

5. The offshore platform (10) according to any of the preceding claims, wherein the deckbox (12) further comprises at least one cut-out section (83) extending from the top side to the bottom side.

6. The offshore platform (10) according to claim 5, wherein the at least one cut-out section (83) is along the periphery of the deckbox (12).

7. The offshore platform (10) according to claim 5 or 6, wherein the mat (16) further comprises at least one cut-out section extending from the top side to the bottom side.

8. The offshore platform (10) according to claim 7, wherein the at least one cut-out section (85) is along periphery of the mat (16).

9. The offshore platform (10) according to claim 7 or 8, wherein the at least one cut-out sections (83, 85) of the deckbox (12) and mat (16) are such that the cut-out section (83) of the deckbox (12) and the cut-out section (85) of the mat (16) are at least substantially coaxial.

10. The offshore platform (10) according to claim 9, wherein the coaxial cut-out sections (83, 85) of the deckbox (12) and the mat (16) are adapted such that drilling or oil production operations are performed at the cut-out sections (83, 85) and concurrent oil production or drilling operations are performed interchangeably via the at least one substantially vertical through-hole extending from the top side to the bottom side of the deckbox (12), and the at least one substantially vertical through-hole extending from the top side to the bottom side of the mat (16).

11. The offshore platform (10) according to any of the preceding claims, wherein the content of the at least one ballast tank (63) of the mat may be released and the at least one ballast tank (63) of the mat may be utilised for the storage of liquid subsequent to the bottom side of the mat (16) settling into the seabed (21A).

12. The offshore platform (10) according to any of the preceding claims, wherein the bottom side of the mat (16) further comprises at least one suction point (65).

13. The offshore platform (10) according to any of the preceding claims, wherein the elongate truss column (14) comprises at least 3 chord truss legs in a polygonal arrangement that are rigidly fixed at the periphery of the at least substantially vertical through-hole of the mat (16).

14. The offshore platform (10) according to any of the preceding claims, wherein the length of the elongate truss column (14) is sufficiently long enough to suit the depth of any intended operating environment of the offshore platform (10).

15. The offshore platform (10) according to any of the preceding claims, wherein the top side of the mat (16) is at least substantially of the same surface area as the bottom side of the deckbox (12).

16. The offshore platform (10) according to any of the preceding claims, wherein the elongate truss column (14) comprises truss members selected from the group consisting of K-truss members, inverted K-truss members, and X-truss members.

17. The offshore platform (10) according to any of the preceding claims, wherein the deckbox (12) is of a shape selected from the group consisting of a circle, square, rectangle, quadrilateral, triangle or ellipse.

18. The offshore platform (10) according to any of the preceding claims, wherein the mat (16) is of a shape selected from the group consisting of a circle, square, rectangle, quadrilateral, triangle or ellipse.

19. The offshore platform (10) according to any of the preceding claims, wherein the modular interface of the deckbox (12) comprises specific portions thereof that are

designated to interface with equipment selected from the group consisting of drilling equipment (119), oil production equipment, lifting cranes and accommodation facilities (113).

20. The offshore platform (10) according to any of the preceding claims, further comprising a helipad (117) attached to the deckbox (12).

21. A method of deploying an offshore platform (10) having a transit state and a deployed state as defined in any of the preceding claims, said method comprising:

towing the offshore platform (10) to a deployment location in its transit state whereby the deckbox (12) is adjacent to the mat (16);

positioning the offshore platform (10) over an intended deployment site;

lowering the substantially horizontally planar mat (16) until the said mat (16) touches the seabed (21A) and settles completely on the intended deployment site; and

jacking up the substantially horizontally planar deckbox (12) vertically upwards along the elongate truss column (14).

22. The method of claim 21, wherein lowering the substantially horizontally planar mat (16) comprises varying the weight of the mat (16) such that the mat (16) is lowered under the effect of gravity.

23. The method of claim 21 or 22 further comprising making adjustments to the positioning of the offshore platform (10) when the mat (16) is being lowered to the seabed such that the position of the offshore platform (10) is maintained over the intended deployment site.