

MODULAR LANDING PLATFORMS AND STRUCTURAL MODULES FOR MODULAR LANDING PLATFORMS

FIELD

5 This invention relates to modular landing platforms and structural modules for modular landing platforms.

BACKGROUND

10 Landing platforms are known and can be designed according to specific needs. The design of the landing platform can be laborious and expensive as it may be bespoke depending on the application of the landing platform. Once the landing platform has been constructed, it can be difficult to adjust or change the landing platform. Landing platforms typically cannot be disassembled and reassembled without significant cost. Landing platforms also typically do not float on water, and must be supported on land.

15 It is an object of the invention to provide an improved landing platform and component parts or to at least provide the public with a useful choice.

SUMMARY

20 According to one example there is provided a structural module for a modular landing platform that can comprise a frame comprising a plurality of sides, and a plurality of coupling elements; wherein at least one coupling element can project from each side of the frame; each coupling element can comprise at least one fastening feature; and each coupling element can be configured to couple the structural module to a separate module of the modular landing platform.

25 According to a further example there is provided a modular landing platform that can comprise a first structural module comprising: a first frame having a plurality of sides, and a plurality of first coupling elements; wherein: at least one first

coupling element can project from each side of the first frame; and each first coupling element can comprise at least one fastening feature; and a second structural module that can comprise a second frame having a plurality of sides, and a plurality of second coupling elements; wherein: at least one second coupling
5 element can project from each side of the second frame; and each second coupling element can comprise at least one fastening feature; wherein the first structural module can be coupled to the second structural module via at least one first coupling element and at least one second coupling element.

Examples may be implemented according to any one of the dependent claims.

10 It is acknowledged that the terms “comprise”, “comprises” and “comprising” may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, these terms are intended to have an inclusive meaning – i.e., they will be taken to mean an inclusion of the listed components which the use directly references, and
15 possibly also of other non-specified components or elements.

Reference to any document in this specification does not constitute an admission that it is prior art, validly combinable with other documents or that it forms part of the common general knowledge.

BRIEF DESCRIPTION OF THE DRAWINGS

20 The accompanying drawings which are incorporated in and constitute part of the specification, illustrate examples of the invention and, together with the general description of the invention given above, and the detailed description of embodiments given below, serve to explain the principles of the invention, in which:

25 **Figure 1** depicts an example of a structural module for a modular landing platform.

	Figure 2	depicts a portion of an example of a modular landing platform comprising a plurality of coupled structural modules.
	Figure 3A	depicts a further example of a structural module incorporating a float.
5	Figure 3B	depicts a further example of a structural module incorporating four floats.
	Figure 4	depicts a further example of a structural module comprising a deck support.
10	Figure 5	depicts a further example of a structural module comprising a FATO plate.
	Figure 6A	depicts an example of a FATO plate.
	Figure 6B	depicts a further example of a FATO plate.
	Figure 7A	depicts a further example of a structural module comprising a drainage module.
15	Figure 7B	depicts a portion of an example of a drainage module.
	Figure 8	depicts an example of a modular landing platform comprising a drainage system.
	Figure 9	depicts an example of a fire suppression module.
20	Figure 10	depicts an example of a portion of a modular landing platform comprising a fire suppression system.
	Figure 11A	depicts an example of a modular landing platform comprising a guard rail module.

	Figure 11B	depicts an example of a portion of a guard rail module.
	Figure 12	depicts an example of a ramp module.
	Figure 13A	depicts an example of a modular landing platform comprising a stair module.
5	Figure 13B	depicts an example of a modular landing platform comprising a stair module with modular decking.
	Figure 14	depicts an example of a modular landing platform comprising three varieties of edge modules.
10	Figure 15	depicts a structural module including a pre-conditioned air (PCA) unit.
	Figure 16	depicts the structural module of Figure 15 with an air supply hose partially extended.
	Figure 17	depicts the structural module of Figure 15 with one deck section removed.
15	Figure 18	depicts the pre-conditioned air (PCA) unit within a frame when removed from the structural module of Figure 15.
	Figure 19	depicts a structural module for electric charging.
	Figure 20	depicts the structural module of Figure 19 with the charging cable and plug partially extended.
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DETAILED DESCRIPTION

Figure 1 shows an example of a structural module 100 for a modular landing platform 900. The structural module 100 comprises a frame 110 having a plurality of sides 116 and a plurality of coupling elements 120. At least one coupling element 120 can project from each side 116 of the frame 110 of the structural module 100. Each coupling element 120 can comprise at least one fastening feature 130 and can be configured to couple the structural module 100 to a separate module of the modular landing platform. In this way, a plurality of structural modules 100 can be coupled together via their respective coupling elements 120 to form at least a portion of the modular landing platform 900.

10 In the example of the structural module 100 depicted in Figure 1, the frame 110 is substantially rectangular and comprises four beams 112 defining the four sides 116 of the frame 110. The upper surfaces of the beams 112 are patterned with two rows of threaded holes 115 that are configured to receive bolts or screws. The beams 112 can be I-beams or H-beams and can be made from a suitable material, such as steel (e.g. hot-rolled Q345B). Other beam profiles can also be used. In still further examples, the individual member(s) that make up frame 110 may not be beams, and may be e.g. rectangular tubing. In examples where the structural module 100 will form part of a modular landing platform that is used on the ocean or a body of water, the beams 112 or other structural components of the structural module 100 can be weatherproofed. For example, their surfaces can be coated in marine grade zinc epoxy primer.

In other examples of structural module 100, the frame 110 can have a different shape and/or may comprise a different number of sides 116. The shape of the frame 110 can be chosen so that a plurality of structural modules 100 can fit together and tessellate to form a modular landing platform without significant gaps between modules. To this end, the modular landing platform 900 can comprise a plurality of structural modules 100 with frames 110 of different shapes and sizes (for example, frames 110 in the shape of triangles and pentagons.) In

other examples, the modular landing platform 900 can comprise a plurality of structural modules 100 with frames 110 that are substantially the same.

The coupling elements 120 of the example structural module 100 depicted in Figure 1 comprise flanges 120, with two flanges 120 projecting from each side 116
5 of the frame 110. The flanges 120 comprise fastening features 130 in the form of holes 130 that are configured to receive fasteners, such as bolts and nuts. When the structural module 100 is brought into contact with an adjacent structural module (e.g. as depicted in Figure 2), the flanges 120 of each respective structural module 100 abut against one another such that holes 130 are aligned. The aligned
10 holes 130 can then receive fasteners (e.g. bolts and nuts) to couple the adjacent structural modules 100 to one another.

The fastening features 130 and/or coupling elements 120 of the structural module 100 can be configured to allow for a small amount of play to allow for a small amount of relative movement between coupled structural modules 100. This can
15 be advantageous if the modular landing platform is configured for use on a body of water, where some amount of flexing or relative movement (caused by e.g. waves) is not uncommon.

The sides 116 of the structural module 100 at least partially define an interior 140 that can house functional components for the structural module 100 or modular
20 landing platform 900, as described in further detail below. The frame 110 of the structural module 100 can further comprise internal structural members, such as beam 142 of the example structural module 100 depicted in Figure 1, that do not form part of the sides 116. The beam 142 in this example can help improve the rigidity or structural integrity of the structural module 100. The beam 142 bisects
25 the interior 140 of the structural module 100 into two equal sub-interiors, 144 and 146. The two sub-interior regions 144 and 146 can house additional components

of the structural module 100 and/or modular landing platform, as described in more detail below.

In other examples, the internal structural member (e.g. beam 142) of the frame 110 may not be positioned at the mid-point of a side 116 of the structural module 100, so that the sub-interior regions 144 and 146 are not equal. In still further examples, the frame 110 can comprise more than one internal structural members so that the interior 140 defined by the sides 116 is divided into more than two sub-interior regions. The size and shape of these sub-interior regions can be equal or not equal depending on the requirements of the structural module 100. In still further examples, the frame 110 may lack an internal structural member, so that the interior 140 at least partially defined by sides 116 comprises a single space.

In other examples of structural module 100, the coupling elements 120 and/or fastening features 130 may differ from those depicted in Figure 1. For example, the coupling elements 120 can comprise dovetails that are received by corresponding slots, or using alignment pins. Other forms of coupling are also possible.

Modular landing platforms 900 that comprise a plurality of coupled structural modules 100 often use several different utilities (such as electricity and water) and will house corresponding utility lines. These utility lines can include, for example, pipes for water supplies or for drainage, cables or trunking for electrical power, and also dedicated lines for communications. The exact layout of the utilities and utility lines vary from modular landing platform to modular landing platform depending on, for example, the size and application of the modular landing platform. Furthermore, the exact layout of utility lines and utility use points can vary over the lifetime of the modular landing platform 900 if, for example, the modular landing platform 900 is expanded in size after it is originally assembled.

To this end, one or more of the members (e.g. beams 112) that make up the frame 110 of the structural module 100 can define apertures that are configured to receive at least one utility line. In the example structural module 100 depicted in Figure 1, all four beams 112 that make up the sides 116 of the frame 110 of the structural module 100 define apertures 113 that are configured to receive utility lines. The internal beam 142 also defines apertures 113 to receive utility lines. The apertures can have a typical diameter between 50 mm to 100 mm, although other diameters are possible depending on the size of the utility lines to be received.

The apertures 113 of the side beams 112 and internal beam 142 are aligned with each other so that a utility line can be routed from one side 116 of the frame 110, through central beam 142, to and through the opposite side 116. Utilities can therefore be delivered through the structural module 100 through to any adjacently coupled structural module 100 in the modular landing platform 900, and/or to any components housed within interior 140 or sub-interiors 144 and 146. In other examples of the structural module 100, only one pair of sides 116 may define apertures 113 for the reception of utility lines. In still further examples, only one side 116 may define apertures 113 if the utilities do not need to be delivered outside of the interior 140 of the structural module 100.

The apertures 113 can include cable glands or grommets to help protect the utility lines and to reduce the size of the aperture if required. Examples of utility lines that can be received by the apertures 113 can include water lines, electricity lines, drainage lines, networking lines, and lines for dedicated communication with sensors. Other kinds of utility lines are also possible. In some examples, the utility lines incorporated into the structural module 100 and modular landing platform 900 can comprise sensors including pressure sensors, flow sensors, fluid level sensors, current sensors, or voltage sensors.

Modular landing platforms 900 can be assembled by coupling a plurality of structural modules 100 to one another using the coupling elements of each structural module. For example, a modular landing platform 900 can comprise a first structural module and second structural module. Each structural module can
5 comprise a frame having a plurality of sides and a plurality of coupling elements, with at least one coupling element projecting from each side of each frame. The first structural module can be coupled to the second structural module via at least one coupling element of the first structural module, and at least one coupling element of the second structural module.

10 Figure 2 depicts a top-down view of an example of a portion of a modular landing platform 900 comprising four structural modules 100 that have been coupled to one another. In this example, each structural module 100 comprises a central beam 142 that divides interior 140 into two separate areas, 144 and 146. As each flange 120 projects a distance from its respective side 116 of the frame 110 of the
15 structural module 100, the coupled structural modules 100 define shared areas 148 (defined between adjacent pairs of structural modules 100) and shared central area 149 (defined between all four adjacent structural modules 100.) The shared areas 148 and shared central area 149 can be used to house additional components of the modular landing platform and/or structural module 100, as
20 described in more detail herein. The size, shape, and number of shared areas defined by coupled structural modules will depend on the geometry of the frame 110 of the structural module 100 and the number and geometry of the projecting coupling elements 120. More generally, the structural modules can be configured such that when a first structural module is coupled to a second structural module,
25 at least one coupling element of the first structural module and at least one coupling element of the second structural module at least partially define an interior region shared between the two structural modules.

Some examples of modular landing platforms 900 comprising a plurality of coupled structural modules 100 can be configured for use directly on a body of water, such as the ocean. In these examples, the modular landing platform must be sufficiently buoyant to support not only its own weight, but also the weight of a helicopter and associated personnel. To this end, each structural module 100 of the modular landing platform can incorporate at least one float. In the example depicted in Figure 1, the structural module comprises two locator plates 150 that are positioned at opposite corners of the interior 140 defined by the sides 116 of the frame 110. Each locator plate 150 defines an aperture 152 configured to receive a fastener. A corresponding float 300 (depicted in, for example, Figure 3A) is configured so that when the structural module 100 is overlaid with the float 300, the apertures 152 of the locator plate 150 align with a corresponding aperture of the float 300. This can simplify the act of locating and securing the structural module 100 to the float 300. To this end, the dimensions of the float 300 and the position and location of its receiving apertures can be based on the overall dimensions of the frame 110 and locator plates 150 of the structural module 100.

Although the example structural module 100 shown in Figure 1 comprises two locator plates 150, the total number and position of the locator plates 150 can vary in other examples. For instance, other structural modules 100 with a rectangular frame 110 can comprise four locator plates 150 at each corner within interior 140. In further examples, the locator plates 150 may not be positioned at the corners, and/or may be positioned outside of the interior 140 (for instance, spanning between coupling element 120 and side 116.)

Each float 300 can be configured to have a footprint that is the same as – or smaller than – the footprint of the structural module 100 so that when the float 300 is overlaid with the structural module 100 (as shown in Figure 3A), the float 300 does not extend beyond the coupling elements 120 that project from the frame 110 of the structural module 100. This can ensure that the float 300 will tessellate in the

same way as the structural module 100 so that when the structural modules 100 are coupled to form a modular landing platform 900, the floats 300 do not obstruct one another. In some examples, the floats 300 can have coupling elements that allow adjacent floats 300 to couple together. Figure 3b illustrates an example
5 where four floats 301 (one indicated) are attached to the bottom of a structural module 100. One or more float may be hollow or include a cavity to accommodate equipment, such as charging or air conditioning units or other equipment.

In other examples, the structural module can alternatively or additionally include other forms of floats. For instance, the float may be in-built into the frame of the
10 structural module, or may be formed with or on the underside the frame of the structural module.

In some examples, the float 300 provides sufficient buoyancy to support the weight of the structural module 100. In further examples, the float 300 can be configured to provide sufficient buoyancy to support a weight that is at least four
15 times the weight of the structural module 100. The Applicant has found that this is level of buoyancy is typically sufficient for the modular landing platform to support the collective weight of the plurality of structural modules 100, in addition to the weight of a landed helicopter and associated personnel. The exact buoyancy of the float 300 will typically depend on the size of the modular landing platform
20 and the weight of any aircraft used with the modular landing platform.

When each structural module 100 of the modular landing platform 900 incorporates a float 300, the load supported by each structural module 100 of the modular landing platform 900 can be substantially equal, with the load of the modular landing platform 900 distributed substantially evenly across the plurality
25 of structural modules 100. In contrast, other landing platforms that may be configured to operate or float on a body of water may have floats that are positioned only at the periphery of the landing platform. This geometry causes the

landing platform to effectively act as a span between the periphery floats that support the ends of the landing platform, thereby creating very large bending moments and deflection across the landing platform with a maximum at the midway point (which is typically where the helicopter lands.) If the structural
5 modules 100 of the modular landing platform 900 each incorporate a float 300, the length of any span between two supports is greatly reduced, thereby minimising forces experienced by the modular landing platform/structural modules 100.

In some examples of modular landing platforms 900 comprising a plurality of
10 coupled structural modules 100, the configuration or material of the decking or upper surface of the modular landing platform can vary across the modular landing platform. For instance, the surface used for the final approach and take-off (FATO) area must be sufficiently robust to support the weight of a landed helicopter and to deal with the mechanical stresses involved in take-off and
15 landing. In contrast, other portions of the surface of the modular landing platform, such as the areas peripheral to the FATO, may not be used to directly support a helicopter and may be subject to less stringent functional requirements. The particular material or configuration used for a given surface of the modular landing platform can depend on the function of the surface and its aesthetic requirements,
20 and these can vary across the surface of the modular landing platform. Although structural modules 100 can be prepared with dedicated and pre-determined upper surfaces that are specifically to be used in certain areas of the modular landing platform (e.g. the FATO area), in other examples, the structural modules 100 can include provisions for modular decking.

25 To this end, the structural module 100 can comprise at least one deck support 160. The at least one deck support 160 can be configured to couple with at least one modular decking 164. An example structural module 100 having a plurality of deck supports 160 is depicted in Figure 4. In this example, a plurality of deck supports

160 are secured to beams 112 and central beam 142 using threaded holes 115. The deck supports 160 extend from the sides 116 of the structural module 100 towards central beam 114. In other examples of structural modules 100 that lack a central beam 142 or any internal structural members, the deck supports 160 can span from one side 116 to another side 116. The deck supports 160 can also include ribs 161 to increase the structural integrity of the deck supports 160.

Each deck support 160 comprises a plurality of deck support fasteners 162 that are configured for coupling modular deck 164 to the deck support 160. The type of deck support fasteners 162 can depend on the modular deck 164 and the application of the structural module 100. For instance, the deck support fastener 162 can comprise a tail that dovetails into a corresponding socket formed on the underside of modular deck 164. Alternatively, the deck support fastener 162 can comprise a tongue that fits into a groove formed on the underside of modular deck 164. In still further examples, the deck support fastener can comprise a threaded hole that is configured to receive a screw or bolt that is aligned with a corresponding hole formed in the surface of the modular deck 164. This can be particularly useful when the modular deck 164 is made of metal, such as steel. In other examples, the modular deck 164 may be made from other materials (e.g. wood) depending on the application of the modular deck.

In other examples, the modular deck 164 can couple directly to the structural module 100 without using additional deck supports 162. Figure 5 illustrates an example structural module 100 with modular deck 164 in the form of FATO plates 1641. In this example, FATO plates 1641 are coupled directly to the beams 112 of the frame 110 of structural module 100 via holes 115 and appropriate fasteners. Two FATO plates 1641 span from the sides of the structural module 100 to central beam 142 (not visible in Figure 5). In this example, the outer row of holes 1151 on the upper surface of the beams 112 is free to either receive deck supports 160 or

additional FATO plates from adjacent structural modules 100, as indicated by FATO plates 1642 and 1643.

In addition to modular decking that spans spanning the frame 110 and any internal structural members of structural module 100, the structural module 100 and
5 modular landing platform 900 can comprise modular decking that spans two or more coupled structural modules 100. For instance, the example portion of modular landing platform 900 depicted in Figure 2 shows four structural modules 100 that are coupled together, thereby defining shared areas 148 and shared central area 149. Modular decking can be coupled to the frames 110 and/or
10 coupling elements 120 of two adjacent structural modules 100 (or corresponding deck supports thereof) in order to span a shared area 148. The shared central area 149 can be spanned by modular decking that coupled to the frames 110, coupling elements 120, or deck supports of all four structural modules 100.

In some examples, functional components can be integrated into the modular
15 decking. Figure 6A depicts an example of a FATO plate 1645 that is configured to span an area between two or more coupled structural components 100. In this particular example, the FATO plate 1645 comprises a light 1000, and the FATO plate 1645 is configured to cover a shared central area 149 formed by four coupled structural modules 100, as shown in Figure 2 (i.e. equivalent to FATO plate 1643
20 in Figure 5). The light 1000 can be connected to power and/or necessary communication lines via, for example, utility lines that pass through apertures 113 defined by the frames 110 of the structural modules 100. In another example shown in Figure 6B, FATO plate 1647 comprises a nozzle 1010 used for fire suppression. In other examples, other functional components may be integrated
25 into the modular decking.

In some examples, the modular deck 164 can incorporate one or more sensors. For example, the modular deck 164 can incorporate motion sensors, cameras,

weather sensors or a weather station, LIDAR sensors, moisture sensors, and lux sensors. These sensors can be connected to associated utility lines (such as power lines and communication lines) housed within the structural module 100.

Functional components can not only be integrated into the modular decking used
5 with the structural module 100 / modular landing platform 900, but can also be integrated into the structural module 100 itself or shared between multiple structural modules 100. Figure 7A depicts an example of a portion of a modular landing platform 900 and structural module 100 comprising a drainage module 200. The drain module 200 is situated between a shared area 148 defined by a pair
10 of coupled structural modules 100. The drainage module 200 in this example comprises a grate 210 and drainage tray 220 (shown in Figure 7B) defining a drainage inlet 225. The drainage tray 220 comprises a flange 224 that runs around the periphery of the drainage tray 220 and is configured to span the adjacently coupled structural modules 100. In this example, the flange 224 is patterned with
15 holes that align with holes defined on the upper surface of the beams 112 and coupling elements 120 of the structural modules 100 so that the flange 224 can be fastened to each respective structural module 100 via e.g. bolts. In other examples, the drainage tray 220 can be fixed to either or both structural modules 100 using alternative means, such as clips or clamps. Grate 210 defines similar
20 holes about its periphery so that it can be fixed to the drainage tray 220 and structural modules 100.

In other examples, the grate 210 and drainage tray 220 may be integrated so as to form a single component. In still further examples, the drainage module 200 may omit a grate 210 if the drainage module 200 is sufficiently small. Furthermore,
25 although the example drainage module 200 depicted in Figure 7A occupies shared area 148, in other examples, the drainage module 200 can be situated elsewhere on modular landing platform 900 and/or structural module 100. For example, the grate 210 and drainage tray 220 can span the entire frame 110 of a single

structural module 100 without being coupled to additional structural modules 100. In still further examples, the drainage module 200 can be configured to occupy shared central area 149 defined between four adjacent coupled structural modules 100.

5 Figure 8 depicts an example of a portion of a modular landing platform 900 comprising a plurality of coupled structural modules 100 and a drainage system 250. The drainage system 250 comprises a plurality of drainage inlets 225, which in this example are provided by drainage modules 200. The drainage inlets 225 are configured to drain liquid from a surface of the modular landing platform. For
10 instance, each drainage inlet can drain rain, seawater, spilled fuel, or water used during firefighting from the surface of the landing platform. The drainage system 250 further comprises a drainage reservoir 260. The drainage reservoir 260 is in fluid communication with the plurality of drainage inlets 225 via utility lines that can be, for example, received in apertures 113 defined by the frame 110 of at least
15 some of the coupled structural modules 100. In some examples, the drainage reservoir 260 can be a tank (such as a flexible water tank) that is stored within an interior of a structural module 100. For example, the drainage reservoir 260 can be stored in one of interior regions 144 or 146 of the structural module 100.

The drainage reservoir 260 can be used to temporarily store runoff or fluids that
20 drain through the plurality of drainage inlets 225. The drainage system further comprises a drainage outlet 270 that is in fluid communication with the drainage reservoir 260. The drainage outlet 270 is configurable between a closed state (to collect runoff in the drainage reservoir 260) and an open state (to allow the drainage reservoir 260 to be emptied.) The drainage outlet 270 can be configured
25 so that the drainage outlet 270 is in the open state when the modular landing platform 900 is operated in a default state. This means that runoff collected via drainage inlets 225 will, by default, exit drainage outlet 270 unless the drainage outlet 270 is intentionally closed. This can occur when adverse or abnormal

conditions are detected on the landing platform in order to prevent pollutants from entering the environment. For example, the drainage outlet 270 may close when a temperature sensor on board the modular landing platform 900 detects a fire, or when a fuel spill sensor detects a fuel spill during refuelling of a docked
5 helicopter. The drainage outlet 270 can also be closed for predetermined and routine testing of fire suppression systems within modular landing platform 900.

In still further examples, the drainage system 250 can comprise a plurality of drainage reservoirs 260. The plurality of drainage reservoirs 260 can share a common drain pipe that ensures the plurality of drainage reservoirs are in fluid
10 communication with one another. This can help increase the total capacity of the drainage system 250 and can help ensure that the weight of water collected via drainage inlets 225 is distributed across the modular landing platform 900.

Additionally or alternatively to drainage modules 200, further examples of modular landing platforms can also incorporate one or more fire suppression
15 modules. Figure 9 depicts an example of a fire suppression module 400. The fire suppression module 400 comprises a water reservoir 410 in fluid communication with a water pump 420. The water pump 420 is in fluid communication with nozzle 430. The fire suppression module 400 can further comprise an aqueous film forming foam (AFFF) pump 440 that is in fluid communication with an aqueous
20 film forming foam (AFFF) reservoir 445 and in fluid communication with nozzle 430. The AFFF pump 440 can be configured to mix foam with water at a ratio of substantially 3%. In some examples, the fire suppression module 400 can comprise a plurality of nozzles. Components of the fire suppression module 400 – for example the water pump 420, AFFF pump 440, and AFFF reservoir 445 – can be
25 located on a skid 450 for integration into modular landing platform 900.

Figure 10 depicts an example of a portion of a modular landing platform 900 incorporating a fire suppression module 400. In this example, the fire suppression

module comprises two water reservoirs 410 and 412 that are positioned within interior regions 144 and 146 of a structural module 100 of the modular landing platform 900. The skid 450 of the fire suppression module 400 is positioned in shared area 148 defined between two adjacent structural modules 100, while the
5 nozzle 430 is positioned within shared area 149.

In some examples, the modular landing platform 900 can further comprise at least a second fire suppression module 400. The second fire suppression module can also comprise at least one second water reservoir in fluid communication with a second water pump. The second water pump can be in fluid communication with
10 a second nozzle such that the first fire suppression module 400 is independent of the second fire suppression module 400. The second fire suppression module can further comprise a dedicated AFFF pump and AFFF reservoir that are not in fluid communication with any components of the first fire suppression module 400.

Incorporating two or more independent fire suppression modules 400 into the
15 modular landing platform 900 can increase the redundancy of critical safety systems and can simplify engineering. The total number of nozzles 430 needed for fire suppression in landing platform can vary with the size and shape of the modular landing platform, and in centrally fed systems, the corresponding piping and supporting infrastructure may be a bespoke design (e.g. to account for the
20 number of pipes, the bends in the pipes, etc.) to ensure adequate flow rates at the nozzles. In comparison, compartmentalising each nozzle, water reservoir, and associated pump into individual and independent fire suppression modules means that the entire fire suppression system can be scaled up or down for a given modular landing platform by incorporating a fewer or greater number of individual
25 fire suppression modules. The individual fire suppression modules can also be placed where needed or moved after installation to accommodate for changes to the overall size of the modular landing platform 900.

In some examples, the water reservoir 410 can be housed within the interior 140 of a structural module 100 of the modular landing platform 900. For example, the water reservoir 410 can be a flexible water tank or flexible water bag that is stored in interior region 144 or 146 of structural module 100. In some examples, the first
5 fire suppression module 400 can comprise a second water reservoir 412. The first water reservoir 410 and second water reservoir 412 can respectively be stored in interior regions 144 and 146. Similarly, in some examples, the pump 420 can be stored in a shared area 148 defined by two coupled structural modules 100. In still further examples, the nozzle 430 can be located at a surface of the landing
10 platform that covers shared central area 149 defined by four adjacent coupled structural modules. For example, the nozzle 430 can be integrated into a FATO plate covering shared central area 149, as shown in Figure 6B. A number of fire suppression modules 400 and associated nozzles 430 can be situated in and around the FATO area to ensure sufficient sprinkler coverage of the FATO area.
15 The number and layout of fire suppression modules 400 and nozzles 430 can depend on the size and shape of the modular landing platform 900 and the size and shape of the individual structural modules 100 that comprise modular landing platform 900.

In examples of modular landing platforms that comprise one or more fire
20 suppression modules 400 and one or more drainage modules 200 (and/or drainage system 250), components of the fire suppression module 400 can be in fluid connection with the drainage modules 200 or drainage system 250. For example, one or more water reservoirs 410 can be in fluid connection with drainage reservoir 260, drainage outlet 270, or drainage inlet 225. This means that
25 water or other fluids used in firefighting can be captured by drainage infrastructure and reintroduced into the water reservoir(s) of the fire suppression system, which can simplify the periodic testing of the fire suppression system. In some examples, there may be one or more filters or filtration stages between the intake of the drain (e.g. inlet 225) and the water reservoir 410.

Further examples of modular landing platforms can also or alternatively include one or more power modules that can be integrated into an individual structural module 100 or shared between multiple structural modules 100. For example, a single power module can comprise one or more batteries, one or more charge
5 controllers, and one or more inverters. The power modules can be designed to collectively power the entire modular landing platform including e.g. the lights, electronic systems, sensors, pumps, and fire suppression modules of the modular landing platform. In this way, the modular landing platform may not require any power connections to external power sources.

10 Each power module can be configured so that the entire power module fits within an interior region 144 or 146 of the structural module 100, thereby allowing the number of power modules to be easily scaled in a modular fashion in proportion to the total number of structural modules 100 of the modular landing platform 900. The total capacity of each power module can be configured, for example, to
15 have capacity to support four fire suppression modules 400 while also being dimensioned to fit within interior region 144 or 146. The power modules can also be linked together to one another to ensure power redundancy for the modular landing platform 900. For instance, a modular landing platform that requires three power modules to reliably function can include four power modules in total, so
20 that the modular landing platform can function without interruption if any single power module electrically fails or suffers an unintentional battery drainage. Other examples of modular landing platforms 900 can include different numbers of power modules or different levels of redundancy.

The modular landing platform 900 can further comprise one or more solar panels
25 that are used to provide energy to the batteries of the power module. In some examples, these solar panels can form one or more portions of modular deck 164 on the modular landing platform 900. The solar panels can also be placed in between adjacent structural modules 100, such as shared area 148 defined by two

adjacent structural modules 100. In further examples, the solar panels can be positioned at the very edge of the modular landing platform (e.g. spaces 848) using one or more edge modules, as described below. The number and size of the solar panels can depend on the overall demands of the modular landing platform and the total number of power modules. In some examples, the modular landing platform can be configured to include a sufficient number of solar panels to keep the power modules sufficiently charged so that no connection to an external power source is needed.

In some examples of modular landing platforms 900, some of the coupling elements 120 that project from the sides 116 of the outer-most structural modules 100 at the edge of the modular landing platform 900 are not coupled to other structural modules 100, and are left “dangling”. In some examples, these “dangling” coupling elements can be used to anchor the structural module 100 or modular landing platform 900 to another structure.

For instance, in examples where the modular landing platform 900 is floating on water, the dangling coupling elements 120 can be coupled to a bridge or gangplank allowing for pedestrian access to the modular landing platform 900. In further examples, the dangling coupling elements 120 can additionally or alternatively be coupled to a structure that anchors the floating modular landing platform 900 in a particular location. In still further examples, the dangling coupling elements 120 can be configured as a tow point for the modular landing platform 900 so that it can be towed or manipulated on the water’s surface.

Figure 12 depicts an example of a ramp module 600 that is configured to couple to an outer-most structural module 100 of a modular landing platform 900. In this example, the ramp module 600 two comprises coupling elements 620 that are configured to couple to two coupling elements 120 that project from a single side of a structural module 100. The ramp module 600 is particularly suited for use with

examples of modular landing platforms 900 that are configured for use on land, especially when the modular landing platform 900 is not countersunk into the ground. For example, the ramp module 600 can be used to bring equipment or wheeled vehicles on or off the modular landing platform 900 and can be used to
5 improve accessibility to the modular landing platform (e.g. to facilitate wheelchair users). In the example ramp module 600 depicted in Figure 12, the ramp module 600 is as wide as an individual structural module 100 of the modular landing platform. Multiple adjacent ramp modules 600 can be coupled to adjacently coupled structural modules 100 to determine extend the width of the ramp.

10 The ramp module 600 can also be configured to receive modular decking, similar to modular decking 164 of structural module 100. For example, beams 660 that help provide structural integrity to the ramp module 600 can also be used as deck supports so that modular decking can be coupled to the ramp module 600. In some examples, the modular decking may be simple decking materials such as wooden
15 decking or metal plates. In other examples, the modular decking can comprise functional components, such as lights and sensors.

In other examples of ramp modules 600, the ramp module 600 can comprise a different number of coupling elements 620. The number and layout of coupling elements 620 can be at least partially determined by the number and layout of the
20 corresponding coupling elements 120 of the structural module 100. Furthermore, although the ramp module 600 shown in Figure 12 is configured to couple to a single side of a single structural module 100, this can differ in other examples of ramp module 600. For example, the ramp module 600 can have a width that is greater than the width of a single structural module 100, and can be configured to
25 multiple structural modules 100 via their respective the coupling elements 120. Furthermore, although the ramp module 600 depicted in Figure 12 is only configured to couple to a single side of a structural module 100, other examples of ramp module 600 can be configured to multiple sides of the structural module

100. For example, the ramp module 600 may couple to two sides of the structural module 100 about a corner of structural module 100, so that the ramp module 600 is substantially L-shaped.

5 Figure 13A depicts an example of a stair module 700 that is configured to couple to an outer-most structural module 100 of a modular landing platform 900. The stair module 700 is particularly suited for use with examples of modular landing platforms 900 that are configured for use on land, especially when the modular landing platform 900 is not countersunk into the ground, and can be used by personnel to access the modular landing platform 900. The stair module 700
10 comprises a plurality of coupling elements 720 that are configured to couple to coupling elements 120 of structural module 100. In this particular example, the stair module 700 comprises five coupling elements 720. Four of these coupling elements 720 couple to the coupling elements 120 of a single structural module, while one of the coupling elements (720') couples to a coupling element 120 of an
15 adjacently coupled structural module 100.

The stair module 700 can further comprise a plurality of deck supports 760 that are configured to couple with at least one modular decking 764. Figure 13B depicts the example stair module 700 with modular decking 764 coupled to deck supports 760. In this example, the modular decking 764 is wooden decking, although other
20 examples can use metallic decking and/or functional components integrated into the modular decking 764, such as lights and sensors.

In other examples of stair module 700, the stair module 700 can comprise a greater or fewer number of coupling elements 720. This can depend on the desired shape of the stair module 700 and the corresponding shape of the structural
25 modules 100 that make up the modular landing platform 900. For instance, in some examples, the stair module 700 can be as wide as a single side of structural module 100, equivalent to ramp module 600 depicted in Figure 12, so that

adjacent stair modules 700 can be coupled to adjacently coupled structural modules 100 to create stairs of varying widths.

Figure 14 depicts examples of different edge modules that are coupled to an outer-most structural module 100 of a modular landing platform 900. In this example, each edge module is coupled to the structural module 100 to define a space therebetween. Three separate varieties of edge modules are depicted in Figure 14. The first variety of edge module 810 comprises a beam 812 and two arms 814 projecting from the beam 812 so that edge module 810 has a substantially square u-shape. In this example, the beam 812 is substantially longer than each arm 814. Each arm 814 is configured to couple with coupling elements 120 of structural module 100. Due to the overall shape of edge module 810, the two arms 814 couple with a pair of coupling elements 120 that project from a single side of the frame 110 of a structural module 100. In this example, each edge module 810 is configured such that when the edge module 810 is coupled to its respective structural module 100, the edge module 810 and structural module 100 define a space 848 between the edge module 810 and the side from which the coupling elements 120 project. In this example, the space 848 has the same shape and layout as the shared space 148 that is defined between pairs of adjacent coupled structural modules 100 (as shown in e.g. Figure 2).

Similarly, edge module 820 also comprises a beam 822 and two arms 824 that project from the beam 822, such that edge module 820 also has a substantially square u-shape. In this example, the beam 822 has the same length as each arm 824, and each arm 824 is configured to couple to a coupling element 120 of separate structural modules 100. In other words, the edge module 820 is configured to couple to a pair of adjacent coupled structural modules 100 due to the shape of the edge module 820 and shape of the structural modules 100. When the edge module 820 is coupled to a pair of adjacent coupled structural modules 100, the edge module 820 and pair of adjacent coupled structural modules 100

define a space 849. In this example, the space 849 has the same shape and layout as the shared space 149 that is defined between four adjacent coupled structural modules 100 (as shown in e.g. Figure 2).

5 Finally, edge module 830 comprises a right-angle 832 from which two arms 834 project perpendicularly. The arms 834 project towards one another but do not meet, such that the edge module 830 is substantially in the shape of an open quadrilateral. Each arm 834 is configured to couple to a coupling element 120 of a structural module 100. The two coupling elements 120 to which edge module 830 is coupled belong to the same structural module 100, but project from different
10 sides of the structural module 100. When the edge module 830 is coupled to structural module 100, the edge module 830 and structural module 100 define a space 849'. In this example, the space 849' has the same shape and layout as the shared space 149 that is defined between four adjacent coupled structural modules 100 (as shown in e.g. Figure 2).

15 Edge modules 810, 820, or 830 can be used to define additional spaces (e.g. 848, 849, 849') for housing different components or modules of the modular landing platform 900, such as fire suppression modules 400, drain modules 200, or elements of a FATO area. These modules or elements can be positioned at the very edge of the modular landing platform 900 by virtue of the edge modules. For
20 example, additional spaces 848 can be used to house solar panels that are positioned at the very edge of the modular landing platform 900 to supply power to one or more power modules as described above.

Of course, it should be noted that the shape and size of edge modules 810, 820, and 830 that are shown in Figure 14 are only examples. In other examples, the
25 edge modules can have different shapes, sizes, and layouts. The shape, size, and layout of the edge module can depend on the shape of the structural module 100 and the overall arrangement of its coupling elements 120. Furthermore, as the

shape and size of the edge module and structural module(s) determine the overall size and shape of space defined therebetween, the shape and size of the edge module or structural module 100 can be at least partially dictated by the requirements of the spaces defined therebetween. In still further examples, the coupling elements 120 of the outer-most structural modules 100 of the modular landing platform 900 can be used to support guardrails or other functional modules. Figure 11A depicts an example of a portion of a modular landing platform 900 comprising a plurality of coupled structural modules 100 and guardrails 510. The guardrails 510 can couple to the outermost structural modules 100 of the modular landing platform 900 via the dangling coupling elements 120. In some examples, a guardrail module 500 can comprise guardrail 510 and can be coupled to structural module 100 via one or more coupling elements 120 of the structural module 100. The guardrail module 500 can further comprise a guardrail actuator 520 configured to raise or lower guardrail 510. If the modular landing platform 900 comprises a plurality of guardrail modules 500, the guardrail 510 of each guardrail module 500 can be raised or lowered independently of the guardrails 510 of the other guardrail modules 500. The guardrail actuator 520 can be powered through utility lines housed within the structural module 100.

Figure 11A depicts example guardrail modules 500 comprising guardrail 510 and guardrail actuator 520. The guardrail module 500 further comprises a flange 530 (depicted more clearly in Figure 11B) that is patterned with holes 535 configured to align with the fastening features 130 (i.e. holes 130 in the example structural module 100 depicted in Figure 1) of coupling element 120 of structural module 100. The flange 530 comprises a pivot 537 about which guardrail 510 rotates via guardrail actuator 520, thereby allowing the guardrail 510 to be raised or lowered. In other examples, the guardrail 510 may not be a separate module, and may be integrated with structural module 100.

Figure 15 to 18 depict a structural module 900 containing a pre-conditioned air (PCA) unit 901 mounted to a frame 902. Depending upon the climatic conditions in which a landing platform is operating the interior of an aircraft may require heating or cooling whilst it is on the landing platform so as to provide desirable temperature conditions for passengers when they enter the aircraft. A standard marine all in one condenser and evaporator/blower unit such as a Gree commercial air conditioner of the CYR family, may be suitable for use in this application. Suitable units can include a heat exchanger. Such units can be capable of heating or cooling air supplied to an aircraft. Where the landing platform is deployed on water one or more heat exchange coil of the heat exchanger can be immersed in water to use it as a heat source. Where the landing platform is deployed on land one or more heat exchange coil of the heat exchanger can be buried in ground supporting a structural module to utilise a ground heat source.

A PCA unit draws air from the environment, rather than re-circulating air from the aircraft, as there is no return duct. PCA units are designed to cool/heat the ambient air temp by up to about 15-20°C. This may be adequate when the temperature differential is not too great. In some regions temperatures of 40-50°C may be experienced in summer and so one PCA unit may only lower the temperature to 30-35°C in the worst case, which is not enough. In such a situation dual PCA units may be employed. A first PCA (the same as PCA 901) provided under deck 907 may provide a first stage of cooling by supplying cooled air to the environment surrounding PCA 901 under deck 904 so that the air taken in by PCA 901 is pre-cooled. So we are looking at a tandem system with two separate AC units. By working in tandem air of 40-50°C supplied to the first PCA may be brought down to 10-15°C, which is the desired inlet temperature to rapidly cool the cabin and other systems within the aircraft.

A hatch 903 may be provided in deck 904 which may be opened to allow access to an air supply hose. The hatch can be a waterproof slide or pivoting type hatch that remains secured to the deck when opened or closed. The hose can consist of an outer protective sleeve 906 (such as a large diameter ridged drain pipe) and a collapsible hose 905 transferring air from the PCA. The length of the hose may be limited to ensure that it cannot engage aircraft blades. Different adaptors may be provided to couple hose 905 to an aircraft. The hose may include a retraction mechanism. A switch may be provided in deck 904 to activate the PCA or this may be done remotely or via remote control.

Referring to Figures 19 and 20 an electric battery charging system may also be provided. A main electrical power supply system may be located off the deck (although it could also be on the deck in some situations) with an electrical supply cable running under the deck to structural module 910. A hatch 911 may be opened (see Figure 20 with hatch raised and supported by gas shocks) to allow a charging cable 912 to be extended therefrom so that plug 913 may be plugged in to an aircraft to provide electricity. The cable 912 may be or a short length of about 2 to 4 meters for safety. Cable 912 can be retractable so that it recoils back within structural module 910. As suitable systems are developed to supply the requisite power a wireless power transfer transmitter may be incorporated into or above a structural module. The wireless power transmitter may be able to raise and lower relative to the deck for close coupling with a wireless power receiver of an aircraft.

In summary, modular landing platforms comprising a plurality of coupled structural modules have been disclosed, in addition to structural modules for modular landing platforms. The modular landing platforms and structural modules disclosed herein allow for the flexible design and assembly of the modular landing platform to suit different and unique sets of needs. The size, layout, and other characteristics of the modular landing platform can be configured depending on

the needs of the modular landing platform. Furthermore, the size, layout, or configuration of the modular landing platform can be adjusted over time if the requirements of the modular landing platform change. For instance, a modular landing platform can be expanded or made smaller by simply adding or removing structural modules. The entire modular landing platform can also be disassembled and reassembled at a different location if necessary.

Incorporating modular drainage and fire suppression infrastructure into the modular landing platform can simplify the design of critical infrastructure for a given landing platform, as the design does not need to be bespoke for the individual landing platform. This can also simplify changes to the modular landing platform as there minimal or no requirement to re-engineer the feed systems and drainage systems of the modular landing platform. The use of modular decking also means that certain parts of the modular landing platform, such as the FATO area, area can be adjusted or changed if needed, and the design and construction of the FATO area can be simplified. Other modular decking components can also be adjusted to suit needs of users of modular landing platform. The size, shape, and other characteristics of the modular landing platform can also be adjusted to ensure that modular landing platform stays up to date with changing laws and regulations.

Incorporating floats into the structural modules of the modular landing platform can allow for the assembly of modular landing platforms that float on water. This can greatly expand the available area for the assembly of the landing platform and allows for construction or assembly of landing platforms in remote places or places where conventional landing platforms aren't feasible. This can also reduce the cost associated with designing and fabricating the landing platform.

Coupling elements that extend from the outermost structural modules at the edge of the modular landing platform can further be used for anchoring, support, or

other functional uses including connections for modular guard rails. In other examples, specific structural modules can be designed for the edge of the landing platform that lack “dangling” coupling elements.

5 In this specification, the term “landing platform” is used broadly to denote modular landing platforms designed for vertical take-off and landing (VTOL) vehicles, as well as short take-off and landing (STOL) vehicles. The term “landing platform” used herein encompasses, but is not limited to, heliports, helidecks, helicopter landing sites, vertical landing sites, vertipads, vertidecks, and vertiports. This terminology includes landing platforms suitable for use with a wide array of
10 aerial vehicles such as helicopters, drones, tiltrotor aircraft, thrust-vectoring airplanes, and other aircraft capable of vertical or short take-offs and landings. This terminology also encompasses future landing platforms suitable for emerging and future VTOL and STOL technologies.

15 Similarly, although the term ‘helicopter’ is used in this specification, it should be understood that the modular landing platforms disclosed herein are also suited for use with other kinds of VTOL and STOL vehicles including drones, tiltrotor aircraft, and thrust-vectoring airplanes amongst others. While the present invention has been illustrated by the description of the embodiments thereof, and while the embodiments have been described in detail, it is not the intention of the
20 Applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, representative apparatus and method, and illustrative examples shown and described. Accordingly, departures may be made from such details
25 without departure from the spirit or scope of the Applicant’s general inventive concept.

CLAIMS:

1. A structural module for a modular landing platform, the structural module comprising:
5 a frame comprising a plurality of sides, and
a plurality of coupling elements; wherein:
at least one coupling element projects from each side of the frame;
each coupling element comprises at least one fastening feature;
and
10 each coupling element is configured to couple the structural module to a separate module of the modular landing platform.
2. The structural module of claim 1, wherein the frame defines at least one aperture configured to receive a utility line.
3. The structural module of claim 1 or claim 2, wherein the structural module
15 comprises a float.
4. The structural module of claim 3, wherein the float provides sufficient buoyancy to support the weight of the structural module.
5. The structural module of claim 3 or claim 4, wherein the float provides
20 sufficient buoyancy to support a weight that is at least four times a weight of the structural module.
6. The structural module of any one of claims 3 to 5, wherein the structural module comprises a locator plate configured to couple the structural module to the float.
7. The structural module of any one of claims 3 to 5, wherein the float is
25 integrally formed with the structural module.

8. The structural module of any one of claims 1 to 7, wherein the structural module comprises at least one deck support.
9. The structural module of any one of claims 1 to 8, wherein the structural module comprises a modular deck.
- 5 10. The structural module of any one of claims 1 to 9, wherein the structural module comprises a drainage module.
11. The structural module of any one of claims 1 to 10, wherein the coupling element comprises a flange.
12. The structural module of any one of claims 1 to 11, wherein the fastening
10 feature comprises a threaded hole.
13. The structural module of any one of claims 1 to 12, wherein the structural module comprises a fire suppression module.
14. The structural module of claim 13, wherein the fire suppression module comprises a water reservoir, a water pump, and a nozzle.
- 15 15. The structural module of claim 13 or claim 14, wherein the fire suppression module comprises an AFFF pump and AFFF reservoir.
16. The structural module of any one of claims 13 to 15, wherein the fire suppression module comprises a first water reservoir and a second water reservoir.
- 20 17. The structural module of any one of claims 13 to 16, wherein the water reservoir comprises a flexible bag.
18. The structural module of any one of claims 13 to 17, wherein the water reservoir is housed within an interior of the structural module.

19. The structural module of any one of claims 1 to 18, wherein the structural module comprises an internal structural member.
20. The structural module of claim 19, wherein the internal structural member bisects an interior of the structural module.
- 5 21. The structural module of any one of claims 1 to 20, wherein the structural module comprises a guard rail.
22. The structural module of claim 21, wherein the structural module comprises a guard rail module.
23. The structural module of claim 21 or claim 22, wherein the guard rail is
10 configured to be raised or lowered.
24. The structural module of any one of claims 21 to 23, wherein the structural module comprises a first guard rail and a second guard rail, wherein the first guard rail is configured to be raised or lowered independently of the second guard rail.
- 15 25. A modular landing platform, the modular landing platform comprising:
a first structural module comprising:
a first frame having a plurality of sides, and
a plurality of first coupling elements; wherein:
at least one first coupling element projects from each side
20 of the first frame; and
each first coupling element comprises at least one
fastening feature; and
a second structural module comprising:
a second frame having a plurality of sides, and
25 a plurality of second coupling elements; wherein:

- at least one second coupling element projects from each side of the second frame; and
each second coupling element comprises at least one fastening feature;
- 5 wherein the first structural module is coupled to the second structural module via at least one first coupling element and at least one second coupling element.
26. The modular landing platform of claim 25, wherein the modular landing platform comprises a fire suppression system comprising a first fire suppression module and a second fire suppression module.
- 10 27. The modular landing platform of claim 26, wherein the first fire suppression module is independent of the second fire suppression module.
28. The modular landing platform of any one of claims 25 to 27, wherein the modular landing platform comprises a drainage system.
- 15 29. The modular landing platform of claim 28, wherein the drainage system comprises a plurality of drainage modules.
30. The modular landing platform of claim 28, wherein the modular landing platform further comprises:
- 20 a drain inlet configured to drain liquid from a surface of the modular landing platform,
a drainage reservoir in fluid communication with the drainage inlet,
and
a drainage outlet in fluid communication with the drainage reservoir;
wherein:
- 25 the drainage outlet is configurable between a closed state and an open state, and

the drainage outlet is in the open state in a default operating mode of the modular landing platform.

31. The modular landing platform of any one of claims 25 to 30, wherein the modular landing platform is configured to float on water.
- 5 32. The modular landing platform of claim 31, wherein:
a load of the modular landing platform is supported by a plurality of structural modules, and
the load supported by each structural module of the modular landing platform is substantially equal.
- 10 33. The modular landing platform of any one of claims 25 to 32, wherein the modular landing platform comprises a structural module as claimed in any one of claims 1 to 24.
34. A modular landing platform as claimed in any one of claims 25 to 33 including an electric battery charging system.
- 15 35. A modular landing platform as claimed in claim 34 wherein the electric battery charging system includes a retractable charging cable that is retractable into a structural module when not in use.
36. A modular landing platform as claimed in claim 34 wherein the electric battery charging system includes a wireless power transmitter.
- 20 37. The structural module of any one of claims 1 to 24 or a structural module of a modular landing platform of any one of claims 25 to 36 including a pre-conditioned air unit.
38. The structural module of claim 37 wherein the pre-conditioned air unit provides heating or cooling of air.

39. The structural module of claim 37 or claim 38 wherein the pre-conditioned air unit includes a heat exchanger.
40. The structural module of claim 39 wherein one or more heat exchange coil of the heat exchanger is configured to be immersed in water supporting the structural module in use.
- 5
41. The structural module of claim 39 wherein one or more heat exchange coil of the heat exchanger is configured to be buried in ground supporting the structural module in use.
42. The structural module of any one of claims 37 to 41 wherein the pre-conditioned air unit includes a plurality of stages to provide a greater differential between input and output air temperature.
- 10
43. The structural module of any one of claims 37 to 42 wherein the pre-conditioned air unit is housed within the structural module.
44. The structural module of any one of claims 37 to 43 wherein a retractable hose connected to an outlet of the pre-conditioned air unit can extend from and retract into the structural module.
- 15
45. The structural module of claim 44 wherein the hose comprises an outer protective sleeve and an inner collapsible hose.
46. The structural module of claim 44 or claim 45 wherein the hose is configured to extend through a hatch.
- 20
47. The structural module of claim 46 wherein the hatch is configured to close an opening through which the hose extends when the hose is retracted.