Title: Methods, systems and apparatus for autonomous robot platform - for assisting small airplanes to land, takeoff and move; also for cargo carts and passenger pods; and related, for airports; and control and management of driverless for hire or mass transit vehicles at their depots and passenger stops.

Inventor: Michael Chung.

Aristides Simonides. Illustrations; co-inventor of electromagnetic means for landing gearless craft Fig 8.

Invention background, summary, etc.

Methods, systems and apparatus for robot platform for carrying and moving about small airplanes and automating takeoffs, landings and movements for small airplanes (crafts), especially small vertical and/or short take-off and landing (V/STOL) pilotless or piloted passenger crafts; also for robotic cargo carts and passenger seat pods; and a variant for ground vehicles, especially the driverless for hire or mass transit to control and manage the vehicle movements at depots and passenger stops.

The platform mechanics: An electrically-powered, 4-wheel, aircraft catcher, carrier, and catapult.

The invention includes assisting airplanes (‘craft/s’) in particular the envisioned pilotless Sky Taxi* crafts - to move, land and takeoff at their designated airports. It includes the airport system to provide and enable such activities.

This document focuses on pilotless crafts (including drones, both civilian and military) and passenger related activities. However, the invention includes adaptions for ground vehicles, especially driverless for hire; as well as other automations for a small airplane such as loading/unloading pods that have seated passengers; as well as extending the automation to have driverless luggage carts able to go to the larger airplanes to have their luggage loaded/unloaded; etc.

A preferred embodiment for the small airplanes is a wheeled robotic platform onto which the airplane will land on or after landing to be loaded onto, then the platform will ferry/carry the craft to the passenger embarking areas, even do some maintenance ‘in route’ such as charging/swapping the craft’s batteries, also to the maintenance areas if needed, then for the take off to carry the craft to the runway, and accelerate down the runway, turn on the active noise cancellation system on the platform or on the airport grounds to offset the propulsion sounds and optionally tilt the bed of the platform to assist in the take off. *Either the craft will control the platform for the landing phase, or the platform and the airport will control the craft in order for the platform and the craft to mate (in addition, there is a ‘override switch and decision loop’ for the platform to stop or move out of way and the craft to either break off the landing for another attempt or to directly and normally land on the tarmac, the override can include to call for human operator at the airport or the craft’s operation center to take over or decide), also a part of the bed of the platform (which has the craft’s front wheel on it) can rise up and raise the nose (if desired) of the craft say from 5 to 10 degrees if such will improve its takeoff profile and reduce power load on craft’s propulsion system.*

A craft (e.g., a VTOL) that will exclusively use the platform to take off or land would not need landing gears, and could have a skid system and save weight and power.

Also, the fixed wing Sky Taxi crafts are envisioned to be landing near their stall speeds of approximately 35 mph. An alternate means for loading the craft to the platform is for an extended arm from the platform to grab a bottom part element of the craft and to bring it to it.

Also, the bed of the platform can be designed, alternatively, to rise several feet into the air, and also to angularly tilt if desired, or while flat move side to side or forward and backwards (in relation to the platform), so that it can better mate to the landing movement of the craft, and once the craft touches say three points on the elevate-bed and the bed senses the force of the craft, then the bed can start to lower the bed to the platform.

Also, the top of the platform or its bed (interchangeable) can have grooves for rain to roll off faster; or even be honeycombed for rain to pass thru; grooved to better adhere the craft wheels to its surface; heated for snowy/ice conditions – and thus, with added springs on the platform for cushion, and perhaps with appropriate sized large and textured wheels, the platform may compensate for rough spots on the runway, bad weather, and even on 'dirt' runways. A bit like a single airplane aircraft carrier, for land or sea uses.

About the sky-taxi:

'…an aerial taxi service that would eventually become fully autonomous, hauling people on short-to-medium range trips in small, electric aircraft that would fly out of very small airports…' http://sustainableskies.org/eas-ix-dr-seeleys-magnum-opus/

'Future, on-demand, electrically-powered Sky Taxi aircraft must be able to deliver both people and packages at high proximity 'pocket airparks' that minimize the length of 'last mile' surface travel for the short-range trips that people most often make. These are sub-100 mile trips that stay within metropolitan 'mega-regions'.' (Dr. Brien Seeley, CAFE Foundation, Regional Sky Transit)

'Electric propulsion offers the following unique capabilities that other propulsion systems can't provide for short range Vertical Takeoff and Landing (VTOL) aircraft; elimination of engine noise and emissions.' Mark Moore. NASA Puffin Electric Tailsitter VTOL Concept.

Such crafts are for shorter hops, the airports to be located in closer proximity to human habitats, to have increased flight cadence (even as frequent as 10 seconds* – e.g., for 2 passenger crafts), and eventual pilotless, etc. *Dr. Brien Seeley, Regional Sky Transit

Until now the designs for the Sky Taxi crafts envision them moving, landing and taking off on their own power and with 'conventional' airport ground behaviors/actions.

For example, for takeoff the electric powered platform can accelerate from 0 to 60 mph in 60 yards moving a total mass (the platform and craft) of about 5,000 lbs. at about 1 G. The crafts are expected to be about 1,800 lbs. empty.

An invention thesis is to 'offload or delegate' to automate with robotics, AI and 'smart systems' as much as practical to the ground based support, assistance and the local system. The invention envisions to assist in the moving, landing and taking off activities so that, the burden on the crafts own systems, power and the craft's noise factors are reduced as well as in cadence.

Also, it teaches how the local system (the airport; or the bus stop for ground vehicles) can more efficiently command and control the vehicles coming into its area of control.

For this, the invention teaches an 'API' type of strategy so that the common resource (i.e., the airport, battery charge stations for ground vehicles) can be more efficiently be set up to be used by various third party transportation services including driverless ground vehicles for hire (Uber, Didi, Google, etc.). The software, systems and protocols can model the API model, not just in data and software resources but in the protocols and rules of determining and giving 'command and control' between the station/airport, the platform and the craft.

The goals of the platform for the airplane crafts invention include

- Reduce the power needs of the craft to take off by assisting the craft to reach flight speed and angle, and the optimum direction into the wind.
- Reduce the wear on the craft's mechanical systems, the complexity of its own self-guiding software and manpower.
- Assign 'as much' of the craft's ground-movement, takeoff and landing tasks to the ground system in order to reduce the burden of the craft.
- Improve the cadence of the flights, including to use swarm intelligence of all the crafts in its area of responsibility and control.
- Improve safety – as the local system ought to be much more aware of the environment, even the conditions of its runway (e.g., a cracked area to avoid), respond to non-orchestrated (e.g., emergency) events faster.

The invention highlights, variations, others

Invention will be highly dependent on the AI, self-driving robotics and software systems, LIDAR; sensors, and location and environment aware solutions. The more these systems are mature the more the reliance, the more the invention's automation – i.e., so that the airport and the crafts can be a bit analogous to automated package or containers handling system.

1. A semi/autonomous robotic wheeled and motorized platform-cart/vehicle…

(referred as platform in this document) onto which airplanes (crafts) can land on or take off from and to be ferried about. This system will require the airport, the platform and the crafts and vehicles, pilotless or piloted to have the invention system and to cooperate with each other. The platform's features include:

a) The platform or its top (the bed) onto which the craft can land onto, be loaded onto (from the runway, tarmac), and optional means to elevate the front wheel of the craft to improve its angle of attack at takeoff.
b) The entire system can utilize one or combination of the wheeled platforms or ground mounted tracks for the platform (e.g., conveyor systems, or where the platforms or beds are mounted on the ground or an in-tarmac elevator (referred to as platform-elevator later in this document) to raise and lower the platform.
c) Guiding means for the platform such as beacons, sensors, camera recognizable images, etc. are placed at appropriate spots such as the edges of the runway, the turning areas, the path to the docks, dock area, path to the maintenance areas, etc. These are in addition to what is on the platform and the craft. The platform and craft will each monitor their environment and the actions of other, where the craft (when on the platform) could override an action by the platform, etc.

d) The platforms can be built into the driveway, e.g., for personal VTOL crafts that may be housed at the homes of the owners.
e) Noise cancellation systems can be mounted on the platform (or in combination with ground based systems, e.g., sensors or speakers near the perimeter of the airport) to reduce noise and sound to the habitations nearby.
f) The platform can have certain additional designs to aid in the aerodynamics of the take offs and landings – i.e., to raise the nose of the craft.
g) The inventor envisions the platform to be autonomous in doing their instructed task, however they can be instructed, steered and otherwise commanded or overridden, remotely by human operators who may be on the tarmac, in the platforms' airport command center, or even by the operation center of the presently being-ferried craft. Such remote system and interface can be a console, on a tablet, or via headset with voice commands (e.g., to speak commands such as 'stop', 'now proceed at 3 mph to bay 6 by way of the lane 9'.

2. The invention includes modification to the airport itself…

e.g., in the physical infrastructure (placing sensors, machine readable signage, etc.), the command, control and communication system, and the software and hardware for the invention ferrying system (i.e., the platform, docks for the platform, conveyors for the passenger pods, etc.). These include:

h) Software, systems (e.g. AI, LIDAR, Sensors) and protocols for the airport and the platform/s and the crafts to synchronize with each other including the protocols and software and their processes to hand off control and to coordinate with each other.
i) LIDAR, radar and/or cameras are mounted on the platform and the craft so that they will be able to see each other, gauge each other location, orientation, angle of approach and momentum and for the platform and craft to mate.
j) There can be markings on the craft and the platform for them to orient, know the distance, etc. to better meet each other.
k) The location sensing and tracking by and of the platforms, crafts and the airport (to determine the location, motion, momentum and orientation of the platforms and crafts) will utilize from among the current arts. These include radio transponders, beacons, GPS, accelerometers, markings on the tarmac or roads or signs and images recognizable by camera, perhaps infrared, sounds (non-human audible), LIDAR, radar, etc.; third party data such as GPS coordinates; their respective software; and AI and robotics (e.g., Robot Operating System); etc.
l) The invention envisions to 'tag all' of the workers, equipment, vehicles, etc. by using tracking and identification and their respective software and management solutions. The reasons include for safety (and to aid in the platform and the crafts navigation on the tarmac) of the human workers and other robots, equipment, crafts, carts (e.g., baggage and containers); manned or driverless trucks and service vehicles; mounted in-ground things (signs, lamp posts, airport walls, etc.); etc. that are moving/roaming about on the tarmac. Also, some objects may have more than one tag (e.g., a truck can have on each of its corners). Thus, each object/thing (mobile, stationary or mounted in-ground) is in awareness of another; and additionally where there can be rankings of overrides, control and prioritization, for example the platform can give higher weight (to the stimuli) to decision from an object wearing the 'human worker' tag which unplanned may be in its path; or the platform will yield the right of way to a firetruck.
    i) For example:

(1) Human and robots (robotic service workers, etc.) will wear radio tags to identify them; they may further have machine recognizable images on their uniforms as back up to the radio tags.
(2) The platforms; trucks; baggage handling conveyors; fire trucks; third party service vehicles; etc. will have such.

3. Pods-platform for passengers and cargo and means…

for such to move, be conveyed, placed and secured into and out of the small crafts – where for example, the passengers are pre-boarded* (i.e., seated) at waiting areas onto the pods and then the pods are moved into the crafts. A benefit is that there is time savings and increased safety as the passengers do not have to walk to and board onto the craft (e.g., smaller crafts may be bit harder/intimating to board for certain passengers).

m) *The pods can additionally have means to collect or confirm fares and the identification of the ticket holder, so that, on a smartphone application a passenger will see the flight and seating availabilities, purchase; then at the pod have the QR code scanned by the said fare means.
n) This fare means assembly can be in the arm rest of the seat. Also there are display means (images, speakers (to communicate to each passenger or optionally via BLE to their smartphone app.
o) If desired to confirm the identity of the passenger, biometrics (eye scan), thumb or palm print, scanning of radio tag/s in their body, etc. can be mounted in the pod, in the armrest, etc.
p) The pod is generally open, including the top; and the sides may or may not have doors per se to give the feel of still being in the waiting area. However, there are expected to be bars for grabbing, hand/and side rails. The seats have belts, rated for airplane safety, etc.
q) Scale – the pod (and each seat) will have a weight monitoring means to know the respective weight.
r) Others: Passenger controlled stop button; various safety means – before pod moves, 'is the passenger buckled and/or pressure/weight sensors (of the seated passenger) in the seat bottom and backside at correct reading', is the gate to the pod locked; various feedback means (audio and/or visual) to the passengers of the status.
s) Means to move the pod include a robot tug attached to the rear of the pod or a rhomba like robot to be under the pod and which additionally, can lift the front wheels of the pod off the pavement and steer it.

4. Autonomous/Robot cart system for airports: cargo carts, container carts, mobile passenger stairs, etc.

t) A robotic platform-cart (robotic cart), configured to carry the luggage/baggage or containers (per the use case) that will move about - on its own power and be used singularly or in groups (i.e., the robotic carts are optionally 'electronically tethered' to each other to keep a certain range of distance to each other, e.g., one to the 'rear' of the robotic cart in front of it) without the use of a hitch or a tow bar.
u) For uses such as:
    i) Ferrying the baggage of the passengers to and from the airplane to the baggage loading or unloading areas.
    ii) Ferrying the cargo containers (carried in the airplanes), to and from the airplane to the container loading/unloading areas.

v) (In general, this invention part teaches the use of robotic carts for ferrying cargo on airport tarmac so that the driver is not needed.)

5. Other invention variations, systems and embodiments include…

w) For a ground vehicle version of the invention: A bus stand/stop or taxi station system (collectively station) where the station takes control over (or has areas of control, overriding the vehicle system) the vehicle when it enters the station area as the station can have more situational awareness and 'has responsibility' for the station.
   i) The invention system includes uses where the driverless taxi and bus move about at the taxi stand or bus stop (the stations) - but where the above mentioned platform or tug component of the invention (for the airplanes) is not to be generally used as the vehicle itself is a ground vehicle.
      (1) However, the invention's software, hardware, sensors, its AI, protocols, etc. can be modified to be used for controlling the driverless taxi or bus at the stand or stop. They will communicate with each other, handshake, etc. and to temporarily allow the stand or stop (aka station master system) to 'take over control' over the vehicle/s when the vehicles are in the 'station zone'.
      (2) The thesis is that the local station's AI or intelligence can be more aware of its station environment or has newer information, and that the 'station master' can better manage the traffic and passengers (loading or offloading) especially if multiple driverless vehicle services are using the stations.

x) For battery charging or swapping station: A system for managing and controlling a group of vehicles at a battery charging or swapping station – by having the station to temporary take over the control of the vehicles in the zone. Where the station takes over control over the vehicle while at the station including to move them to the charging stations and then to move them away when done, etc. This system can substantially use the preceding systems and methods for the taxis and buses.
   i) E.g., a driver will drive his electric vehicle to his commuter railroad station (or sky taxi airport) and drop it off near the charging station (or even at the 'passenger drop off area of the commuter station) and go to work. His vehicle will be 'automatically' moved to the charging station while he is at work, then at end of day he will pick up his car at the regular parked area.
   ii) E.g., where the electric vehicle (driverless or with driver) comes to a charging station – the invention teaches where the charging station 'takes control' over the vehicles to cause them to be moves to charging dock (where the chargers are) and then after charging, will move the vehicle away from the charging dock to a parking area where the vehicles can be then found by their owners and driven away. Also, instead of charging, the station can be for battery swapping.)
   iii) There will be provision and protocols for the vehicle to allow the station to have limited control over it. These can include being located in the station area, the driver having given such permission, and the vehicle system to allow the station system to have certain and limited operational control over it (e.g., access to the motion controls, even maintenance logs but not to the vehicle personal spaces such as the trunk and interior).

- iv) The vehicle will yield limited and agreed to ‘jurisdiction’ or control over itself at the charging station to the station master. This control includes control over its movement system to allow the station master AI to instruct the vehicle to be moved.

6. A tug means - instead of the platform…

for certain activities such as for personal piloted airplanes (e.g., smaller types) at ‘regular’ airports – where the crafts will roll on to the platform or be made to attach to a tug after landing so that the platform/tug will ferry the craft to its parking area, hanger or dock without manual guidance by the pilot or power by the craft.

- y) Benefits: Recreational pilots can fly into unfamiliar airports. After landing, the pilots are responsible to correctly follow the turns and paths; look on the airport map (‘resting on their laps’, etc.) and taxi the craft. With the invention, the pilot once landed, need not do anything other than to direct the craft on/to the platform/tug. Then, the platform will take over and ferry the craft to where it is supposed to go. If a tug is used – it can attach to the front wheel assembly or tow a carriage for the front wheel to roll onto to it (e.g., a cradle/hitch for the front wheel). The tug is power and self-guiding.
- z) (Note: This tug-part of the invention is covered in part/perhaps substantially by the prior art ---- US 2013/0333971, a towbarless robotic airplane tug:
    - i) ‘The present invention relates to novel robotic tugs for taxiing airplanes from a gate to a take-off runway without using the aircraft jet engines. In accordance with a preferred embodiment of the present invention, the robotic tugs preferably operate in an airplane pilot-controlled taxi mode wherein the airplane pilot steers and brakes as if the airplane were moving under its own engine power and the tug speed is controlled by a controller. Upon completion of the airplane taxi the tug preferably returns autonomously to a pre-pushback location at the gate, controlled by an airport command and control system. Preferably, a tug driver performs the pushback operation, after which he leaves the tug and the airplane pilot controls the tug during taxi. In accordance with an alternative embodiment of the present invention, the tug may operate in an autonomous mode of operation during airplane taxi. The term “autonomous” is used throughout in a broad sense to include operation under the control of an airport command, control and communication system, preferably subject to airplane pilot override.’
    - ii) In general the above prior art is related to assisting the airplane from the pushback to the taxiing and where the tug lifts and controls the front wheel assembly.

Figures descriptions, some prior arts

Fig 1 – The platform

Is a robotic platform with bed on a chassis mounted on a plurality of wheels, at least some of said plurality of wheels being steerable wheels; the platform able to carry and support a small craft; has power (e.g., battery).

The platform’s frame/chassis is mounted with the various systems typical for self-driving or remote controlled ground systems, including: motors for the various functions and uses such as for the locomotion, the rails wheels, the platform’s ramp/lifts means; computer and various software for the platform’s operation, AI; housings (2a) for the various LIDAR, sensors, GPS, communication; noise cancellation system (9), software and protocols to sync the platform, with the craft’s system and the

Figures 1 to 7

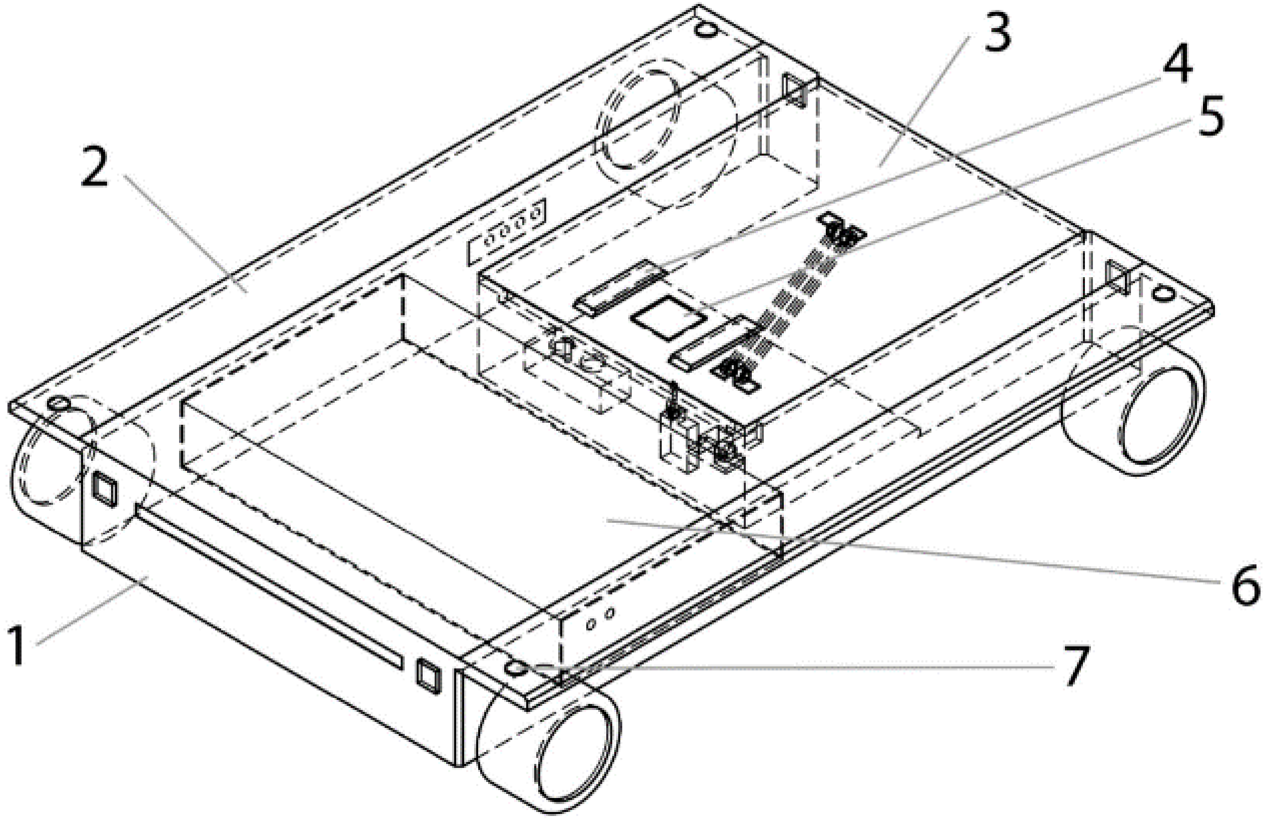

Fig. 1

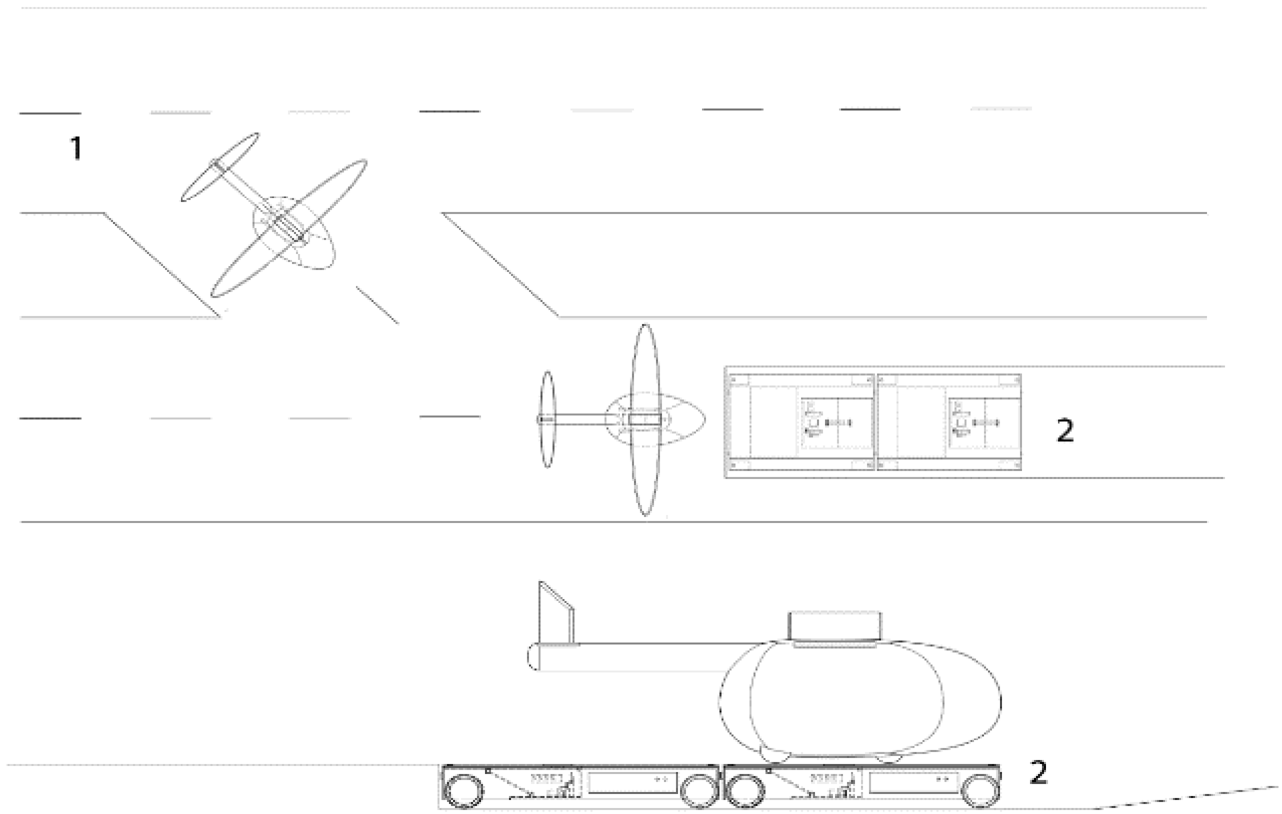

Fig. 2

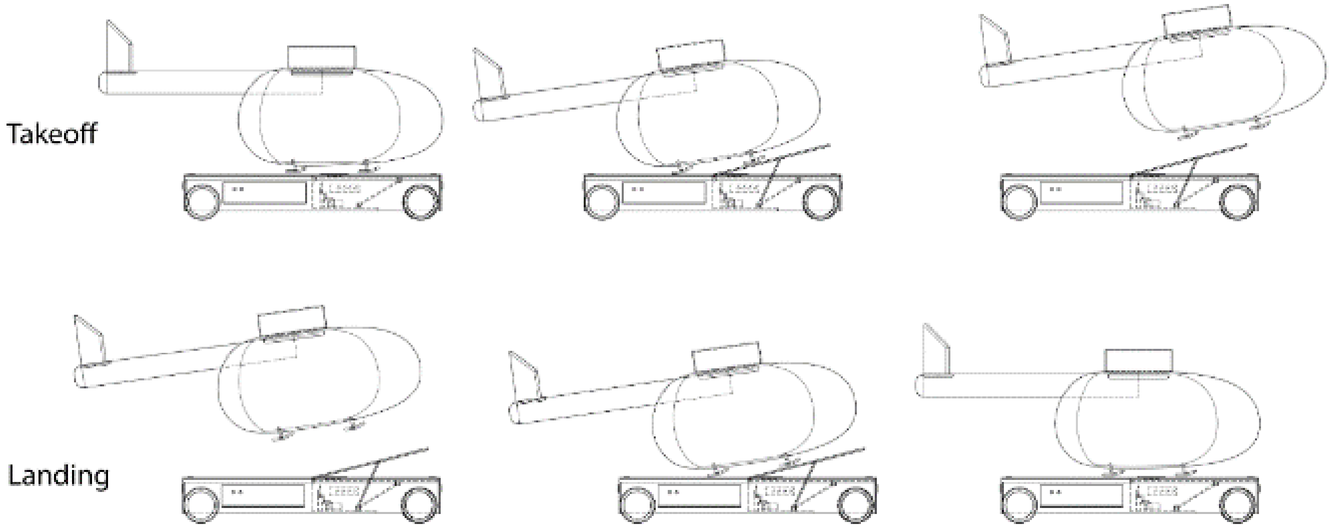

Fig. 3

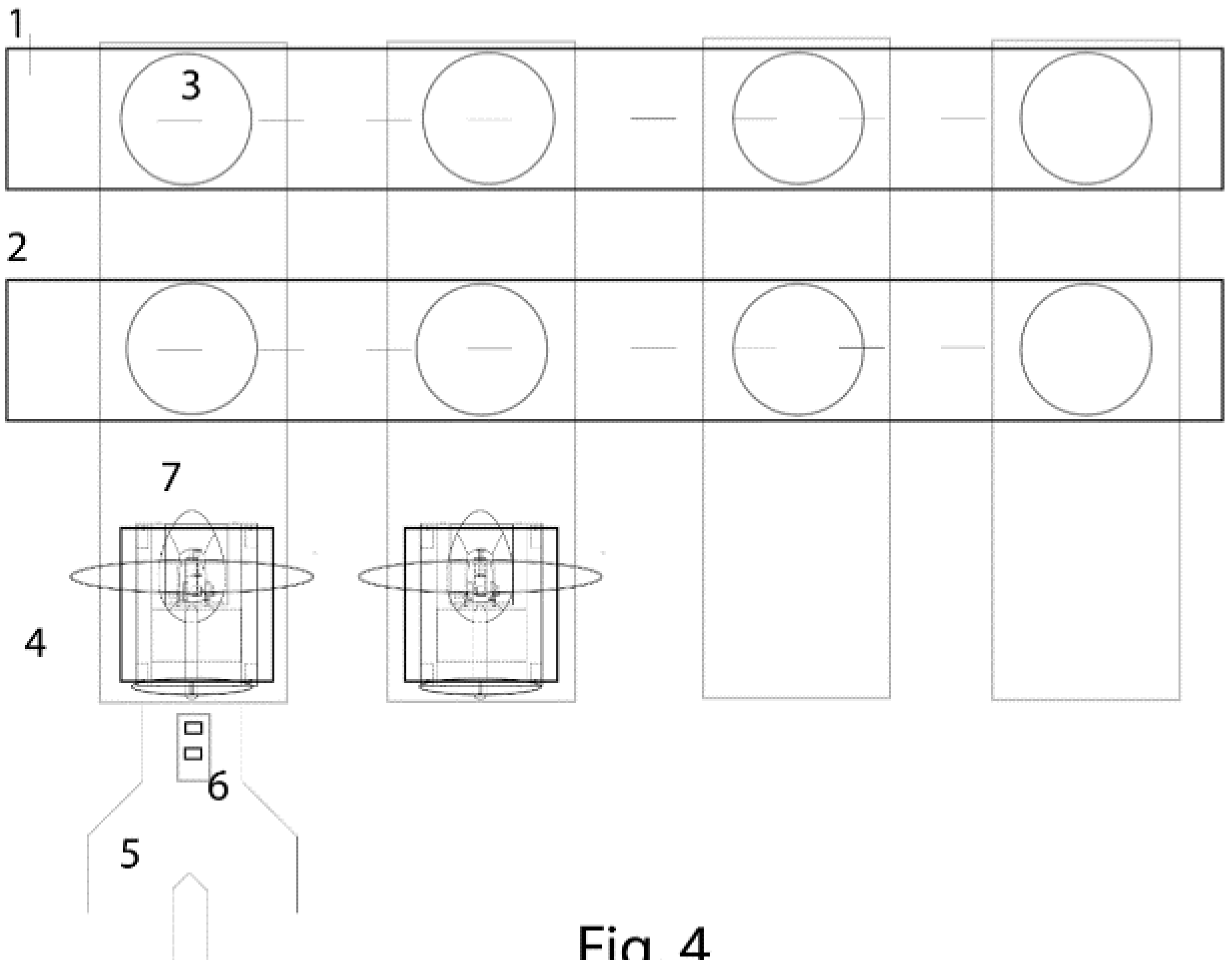

Fig. 4

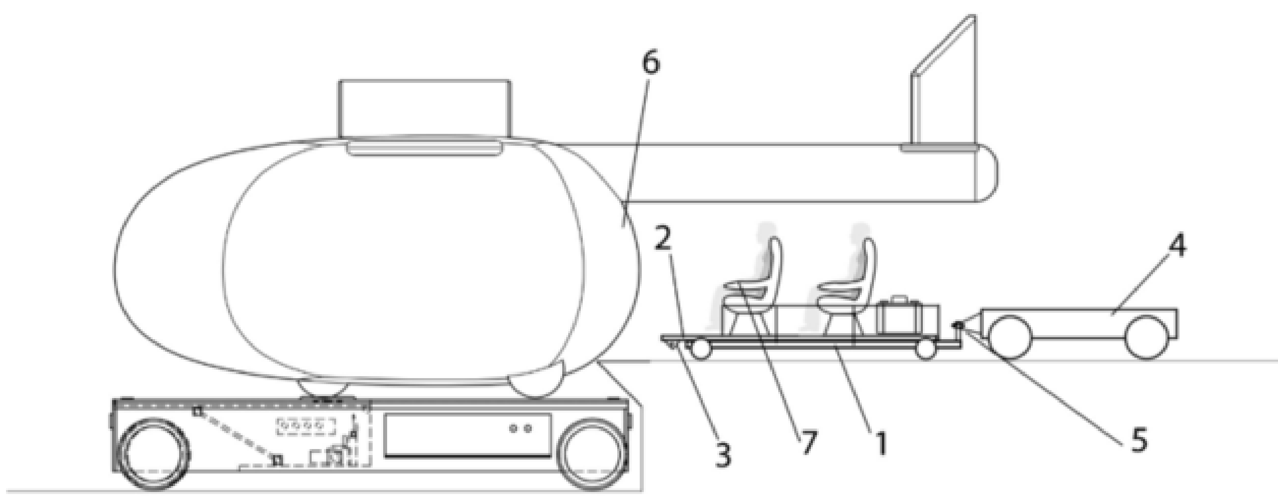

Fig. 5

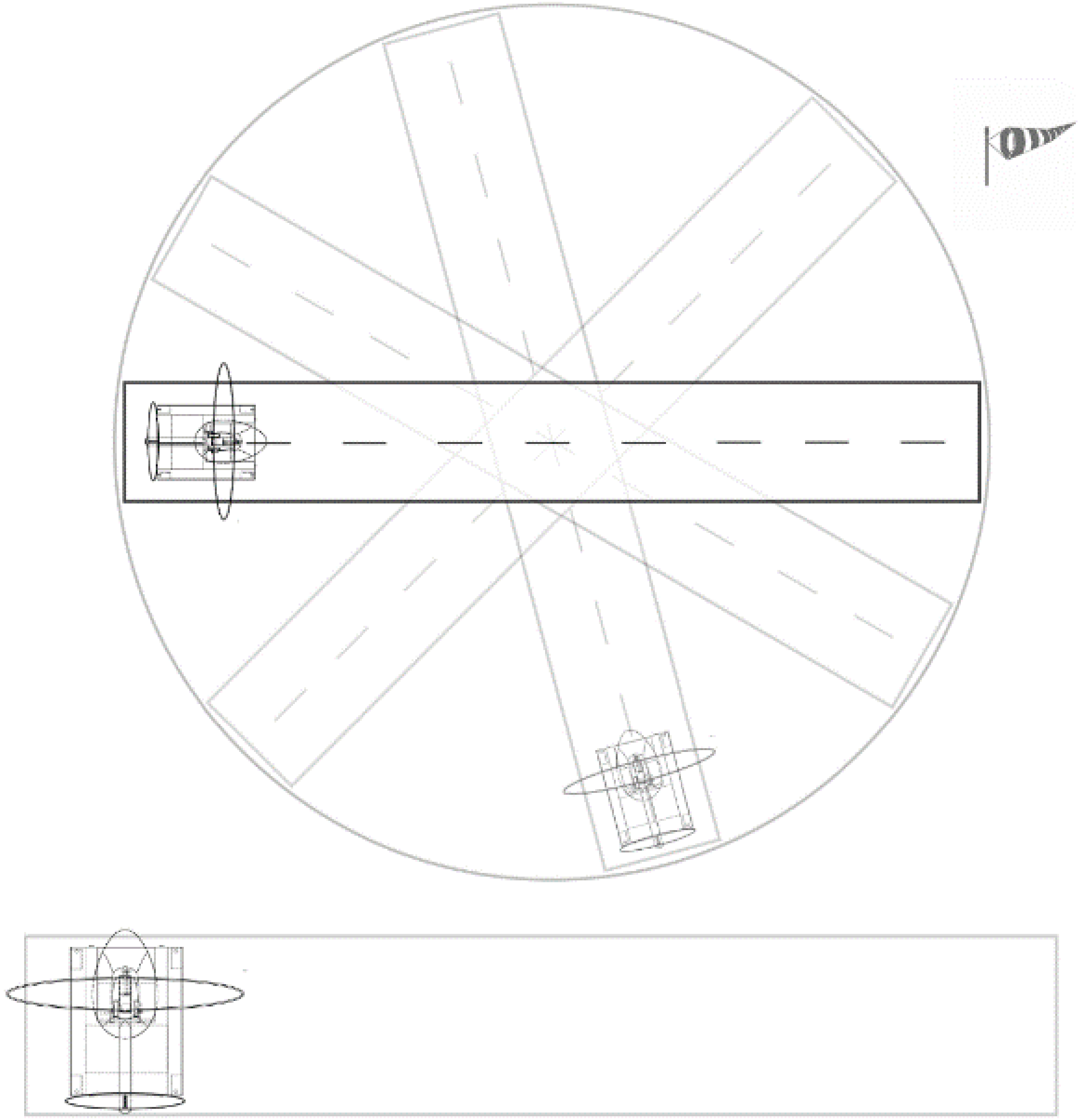

Fig. 6

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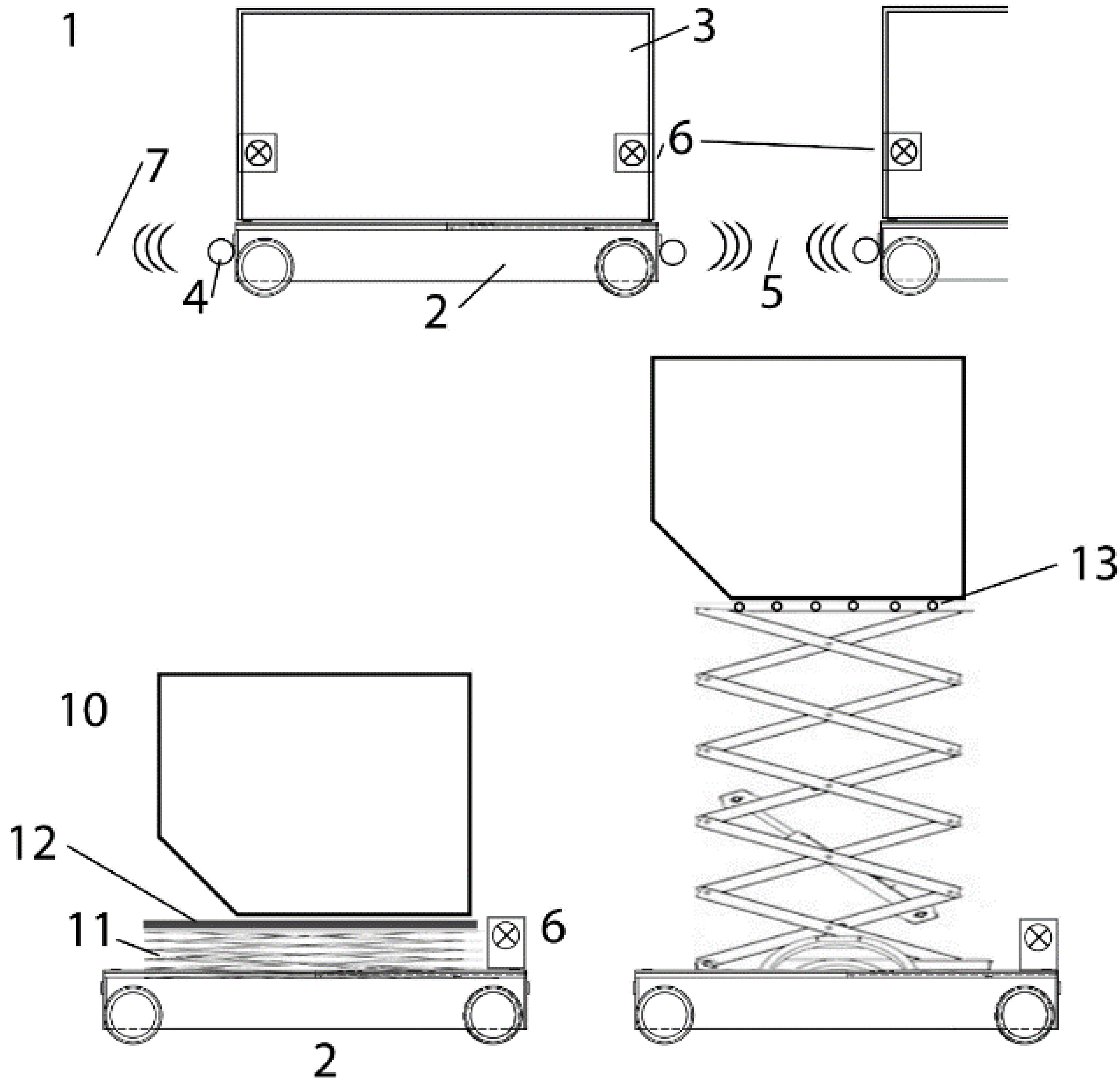

Fig. 7

Title: Regional Sky Transit System

Inventors: Michael Chung and Aristides Symeonidis

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Utility Patent Application (Provisional)

Regional Sky Transit System

Michael Chung, Aristeidis Symeonidis

SPECIFICATION

ABSTRACT OF THE DISCLOSURE

[001] A system of electric aircraft, automotive platforms with electromagnets, and short-runway airports integrated to provide rapid, automated passenger air travel.

BACKGROUND OF THE INVENTION

[002] The broadest field of the invention is transportation. Specifically, the invention is in the technical field of aviation. In addition, the invention is in the field of auxiliary ground transportation of passengers, cargo and aircraft.

[003] Presently, the state of the technical field of aviation makes private personal aviation affordable only to a minority of people. Apart from prohibitively-expensive private jets, passenger jets in general have significant inconveniences. There are only a predetermined number of routes flown by airliners on a fixed schedule. Passengers must pass through an airport with security and boarding procedures lasting hours, and can only fly to a handful of distantly-spaced airports due to their large land requirements. Passenger disembarking at destination airports adds substantial delay in commuting.

SUMMARY OF THE INVENTION

[004] The invention is a system to dramatically improve aerial transportation. This is done by implementing airport, aircraft, and automotive platforms with electromagnets in an integrated and automated way.

[005] The invention's passenger aircraft is electrically-powered, seats 2-4 people, and has no bulky landing gear found on every other present passenger aircraft. The lower body of the aircraft is made of a smooth surface of steel, a ferromagnetic and strong structural material. The shape of the aircraft's body fits the ground platform's controllable surfaces and during landing is attracted to the platform's computer-controlled electromagnet.

[006] The ground platform is an electrically-powered, 4-wheel, aircraft catcher, carrier, and catapult. The top surfaces are implanted with electromagnets to attract and secure the body of the aircraft during landing, taxiing, and takeoff launching. Ground platforms are equipped with a powerful array of computers and sensors to intelligently perform many functions, thus automating and accelerating the entire sky transit experience for passengers.

[007] Making the invention requires using commercially available parts along with custom-fabricated ones. A preferred method: The platform uses a hydraulic piston controlled by an electrical signal from the platform's system computer. The electromagnet capture mechanism on the cart surfaces is constructed by coiling copper wire circumferentially around thin, circular wafer pieces of iron machined from pure iron ingot and then structurally embedded into the flat surfaces of the platform and hydraulic ramp. At least 100 complete circumferential coils of wire should wrap the core. The current flowing through these electromagnet coils must be controlled by the system computer and adjusted by the computer's program's processes from sensors about ambient and operating conditions.

[008] To perform a landing, the platform and aircraft both receive an approval key, runway and timestamp from the skypark's traffic management system. As the aircraft's computers or pilot target a trajectory to land at the beginning of the runway, the platform senses the speed and trajectory of the incoming craft with its own sensors and redundantly with a direct data connection to the craft. When the steel undercarriage of the craft is hovering within 10', the computer begins to pulse direct current between 200-1000 Amps through the electromagnet coils to have intermittent moments of magnetization and magnetic attraction, so as to make a gentle but affirmative pull on the craft's body. When the craft has landed on the platform, the platform keeps the electromagnets on in a high-current state to provide additional frictional clamping force while the platform decelerates itself and the onboard craft to the skypark's regular taxiing speed.

[009] The invention is an integrated transportation system enabling rapid cadence of boarding, launching, landing, and tarmac taxiing. Transportation is an essential economic and infrastructural service that is an input cost to nearly every other product or service.

DETAILED DESCRIPTION OF THE INVENTION

[010] The invention is an infrastructure system able to revolutionize personal and cargo aviation. Specifically, aviation over distances up to 300 kilometers in the near term, and further as commercially-available battery energy density increases. The invention is unique and unprecedented because it is a complete airport, aircraft, and passenger convenience system far surpassing the relatively inefficient airborne transportation available using present aircraft and airports.

[011] The platform has a smart full suspension on all 4 wheels by means of an electronically-adjustable shock absorber connected to the platform's computer. During landing, the shock absorbers are stiffened to provide the resistance necessary to avoid bottoming out in a hard landing possibly caused by untimely gusts of wind or other environmental factors.

[012] During takeoff, the platform accelerates at a comfortable rate of about 6 m/s^2 until the aircraft's takeoff speed has been reached, after which the retention of the electromagnet is turned off to allow the aircraft to begin ascending with its own power. After successfully catapulting the aircraft into takeoff, the platform sends the skypark's traffic management system a signal that it is available to be dispatched to the next task or that it is en route to maintenance.

[013] After capturing an aircraft, the platform taxis the craft to an available gate for passenger disembarking and new passenger embarking.

[014] The aircraft is designed to be a component of this system optimized for flight travel efficiency. As such no aerodynamic-decreasing landing gear protrusions are necessary by utilizing the ferromagnetic properties of the structural steel underbody for landing and taxiing by the platform.

[015] The aircraft is designed to be able to embark and disembark passengers quickly by automatically opening a front canopy at the gate while loaded on the platform. The craft may also be equipped with airbags underneath and aft in the event of an emergency landing without a receiving platform. The stall speed of this aircraft can be less than 50 MPH, and the electric motor can quickly reverse torque to provide braking drag during impact.

DESCRIPTION OF THE DRAWINGS

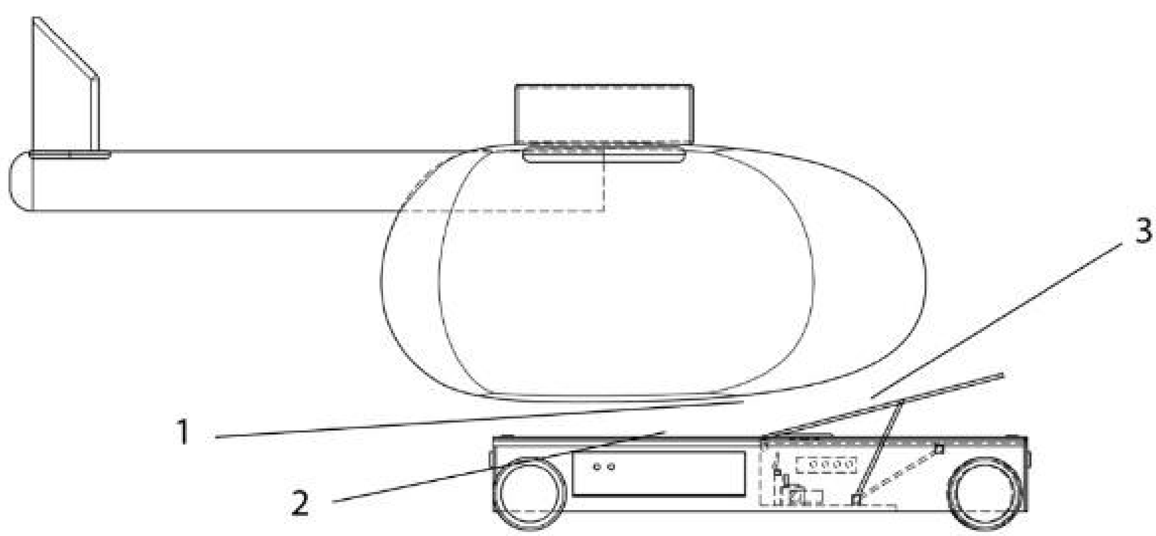

Fig. 8

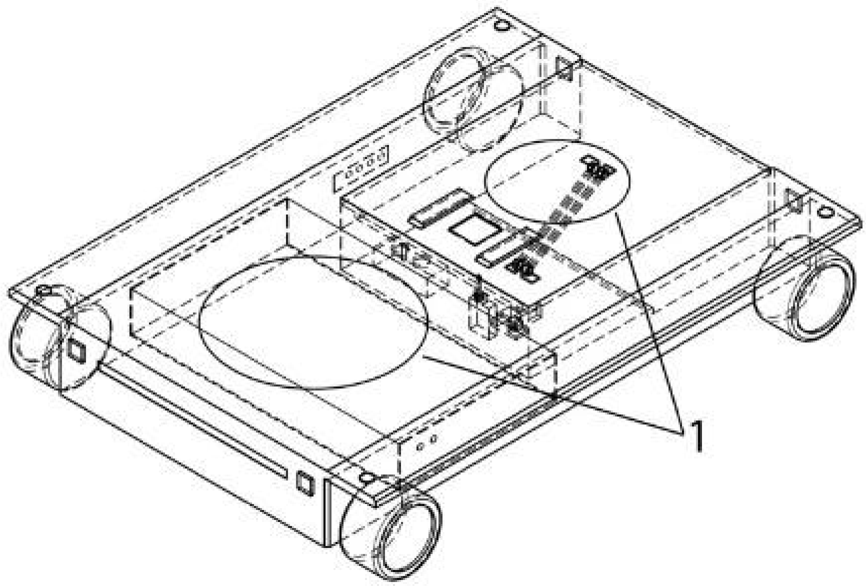

Fig. 9

[016] Fig. 8 is a side view of an aircraft landing on the platform with attraction by the platform's electromagnets. 1 is the steel underbody of the craft shaped to conform to the platform's receiving shape. 2 is the electromagnet on the flat surface of the platform. 3 is the electromagnet on the optionally-lifted front ramp.

[017] Fig. 9 is a view of the platform equipped with circular electromagnets (1). The electromagnet wires are wrapped circumferentially around the iron discs so that the induced north pole of the electromagnet points either directly upwards or downwards, perpendicular to the flat surface of the magnet and the bottom surface of the craft. The instantaneous magnetization of the ferromagnetic material of the craft will be along the magnetic field lines created by the electromagnets, causing a south magnetic pole to point downwards out of the body of the craft, thus attracting it to the north poles of the platform's electromagnets.

CLAIMS

Automotive platform with electromagnet and mechanical tools to capture, transport, and launch aircraft.

Electric high-glide-efficiency aircraft needing absolutely no landing gear, using a ferromagnetic body material to couple with electromagnet-equipped ground platform for landing, deceleration, and gate taxiing.

Integrated airport system enabling rapid cadence of boarding, launching, landing, and tarmac taxiing.

(Note to reader: Figures are also at pages 61 - 70 of this provisional-document.)