

ANIMAL CONTAINMENT SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application Nos. 63/586,908, filed September 29, 2023; 63/591,640, filed October 19, 2023; 63/605,254, filed December 1, 2023; 63/605,273, filed December 1, 2023; 63/607,382, filed December 7, 2023; 63/613,453, filed December 21, 2023; 63/568,211, filed March 21, 2024; 63/575,902, filed April 8, 2024; 63/631,070, filed April 8, 2024, which are incorporated by reference as if fully set forth.

TECHNICAL FIELD

[0002] The present disclosure relates generally to a pet containment system. In particular, the present disclosure relates to a pet containment system for securing a pet or an animal in a vehicle.

BACKGROUND

[0003] Many people regard their pets as family members or companions. As such, pet owners often travel with their pets via automobile to vacation destinations, trips to the veterinarian, or around town. Pet transport devices are available that cooperate with safety belts or other anchor points of a vehicle to prevent a pet from roaming within and/or escaping from a vehicle. However, these devices generally do not adequately secure a pet in the case of a sudden change in vehicle speed or direction, and can be difficult to install in a vehicle. An improperly restrained pet is more likely to be injured and to injure occupants of a vehicle during a crash.

[0004] Some dog crates lack safety features and the ability to securely attach them to a vehicle. Additionally, dog crates that do attach to the vehicle often take up considerable room in the cargo area when not in use. These dog crates can also be difficult to install and remove.

SUMMARY

[0005] Aspects of this disclosure relate to an assembly animal containment system for a vehicle. In accordance with one aspect, an animal containment system for installation in an interior cargo area of a vehicle comprises an animal containment unit configured to contain an animal, and at least one strap assembly including a first strap extending from the animal containment unit. The strap assembly can include at least one mounting device configured to engage an exterior portion of the vehicle to restrain movement of the animal containment unit. The strap assembly can further include a strap retractor that allows extension and retraction of the first strap to adjust a length of the first strap. The strap retractor can be configured to maintain a length of the first strap when a shock load is applied to the first strap. The first strap can be a retractable strap connector. The first strap can be biased toward a stowed position within the animal containment unit. The first strap can include a plug configured to sit flush with a panel of the animal containment unit when the first strap is in the stowed position. The mounting device can be configured to mount to an exterior anchoring point of the vehicle including at least one of: a vehicle rear door panel, a vehicle door hinge, a vehicle corner panel, a vehicle side panel, a vehicle roof, a vehicle bumper, a vehicle tow hitch component, or a vehicle frame member. The strap assembly can be removably attachable to the animal containment unit, whereby the strap assembly can remain mounted to the vehicle when the animal containment unit is removed from the interior cargo area. The animal containment unit can include at least one movable load leg movably connected to the animal containment unit, the at least one movable load leg adapted to engage a surface of the vehicle, wherein the movable load leg is movable between a retracted position and an extended position. The at least one movable load leg can be adapted to engage a ceiling of the vehicle. The at least one movable load leg can be adapted to engage a seatback of a vehicle.

[0006] IN accordance with another aspect, an animal containment system for installation in an interior cargo area of a vehicle comprises an animal containment barrier configured to contain an animal within the interior cargo area, and a strap assembly for securing the animal containment barrier. The strap assembly can include one or more mounting devices configured to engage an exterior surface of the vehicle.

[0007] In accordance with another aspect, a method of assembling an animal containment unit comprises attaching first and second side panels to a base panel, attaching a top panel to the side panels, attaching a rear panel to the top panel and the base panel by sliding two or more stubs of the rear panel into corresponding receivers of the top panel and the base panel, attaching a front panel to the top panel and the base panel by sliding two or more stubs of the front panel into corresponding receivers of the top panel and the base panel, and fastening a securement mechanism to secure at least two panel together.

[0008] The securement mechanism can include a latch assembly. The latch assembly can include a rod associated with a first panel and a latch member including a latch arm associated with a second panel, and the latch arm is configured to engaged the rod to secure the panels first and second panels together. The fastening the securement mechanism can include rotating the latch arm of the latch member over center. The fastening a securement mechanism can include installing a fastener.

[0009] In accordance with another aspect, a cam bolt assembly for securing first and second panels of an animal containment unit comprises a cam plate having a cam surface and being supported on the first panel, a slotted hole extending through the cam plate and first panel, a threaded bore in the second panel, and a fastener. The fastener extends through the cam plate and the first panel and is received in the threaded bore of the second panel, and a head of the fastener impinges upon the cam surface during tightening of the fastener resulting in sliding relative

movement between the first and second panels in a direction perpendicular to a central axis of the threaded bore.

[0010] In accordance with another aspect, an animal containment system for installation in a vehicle comprises an animal containment unit configured to contain an animal, and at least one load leg movably connected to the animal containment unit, the at least one movable load leg adapted to engage a surface of the vehicle. The load leg is movable between a retracted position and an extended position.

[0011] The movable load leg can be biased towards the extended position. The at least one movable load leg can be telescopically movable between the retracted position and the extended position. A first biasing member can bias the at least one movable load leg towards the extended position. A second biasing member can bias the at least one movable load leg towards the extended position, the second biasing member can be capable of applying a greater biasing force to the at least one movable load leg than the first biasing member. The first biasing member can apply a continuous biasing force to the at least one movable load leg and the second biasing member can only apply biasing force to the at least one movable load leg in response to a shock load being applied to the at least one movable load leg. The at least one movable load leg can be rotatably movable between the retracted position and the extended position. The system can further include: a base and a plurality of panels defining a containment volume above the base, wherein the at least one movable load leg extends from the base, and/or a door, wherein the at least one movable load leg extends away from a side of the animal containment unit including the door to engage a vehicle liftgate, and/or wherein the at least one movable load leg extends away from a side of the animal containment unit not including the door to engage either a vehicle seatback or a vehicle ceiling. The movable load leg can extend from a top of the animal containment unit. The movable load leg can be pivotably attached to the top of the animal containment unit. The movable load leg can include a telescoping section. The system can

further include at least one strap assembly including a first strap extending from the animal containment unit, the strap assembly can be configured to engage the vehicle to restrain movement of the animal containment unit. The strap assembly can be configured to engage an exterior anchoring point of the vehicle. The strap assembly can include at least one mounting device configured to engage an exterior surface of the vehicle.

[0012] In accordance with another aspect, an animal containment system comprises an animal containment unit including a base panel and at least one panel defining a containment volume above the base panel, and a strap assembly fixed to the animal containment unit, the strap assembly having a first strap extending from the animal containment unit, a second strap configured to extend rearward toward a tailgate of the vehicle, the strap assembly including a distal mounting pod configured to mount to an exterior portion of the vehicle and configured to connect to the second strap. The strap assembly is configured to shorten the second strap after the distal mounting pod is attached to the vehicle exterior, and the second strap is configured to pass through a door jamb of the vehicle tailgate when the tailgate is closed. The strap assembly can include a retraction pod located intermediate the distal mounting pod and the animal containment unit.

[0013] In accordance with another aspect, an animal containment system for installation in a cargo area of a vehicle comprises an animal containment unit having two or more sidewalls extending from a base panel, a strap for attaching the animal containment unit to a vehicle, and a strap mounting assembly on one of the sidewalls, the strap mounting assembly comprising a housing and a buckle insertable into the housing, the buckle movable in the housing from an insertion position to an engaged position. In the engaged position, the buckle is rotatable about approximately 180 degrees while the strap is engaged with the vehicle.

[0014] The buckle can include a protrusion adapted to be received in a tapered slot of the housing. The housing can include a magnet for retaining the protrusion in the engaged position.

The housing can include a cover for closing the tapered slot when the protrusion is not received therein, the cover being pivotable and biased towards a closed position. The protrusion can be inserted in the tapered slot, the cover can urge the protrusion towards the engages position of the buckle. The system can include a third panel and a low-friction surface on the third panel, wherein the low-friction surface is engageable with a support surface when the animal containment unit is tilted toward the third panel. A handle can be provided on a first of the two or more sidewalls and at least one wheel on a second of the two or more sidewalls, wherein the at least one wheel is engageable with a support surface when the animal containment unit is lifted via the handle.

[0015] In accordance with another aspect, an animal containment unit for installation in a vehicle comprises a base, at least one side panel extending upward from the base and having a thickness, and a front panel extending upward from the base, the front panel comprising an exterior panel and an inner impact panel resulting in a greater thickness in the front panel than in the at least one side panel.

[0016] The front panel can further comprise at least one intervening structure between the exterior panel and the inner impact panel. At least one movable load leg movably connected to the animal containment unit can be provided, the at least one movable load leg adapted to engage a surface of the vehicle, wherein the movable load leg is movable between a retracted position and an extended position. The at least one movable load leg can be adapted to engage a ceiling of the vehicle. The at least one movable load leg can be adapted to engage a seatback of a vehicle. The load leg can be retractable into the base of the animal containment unit. The load leg can include a translating frame telescopically received in a stationary frame mounted to the base. At least one locking mechanism for locking the telescoping frame against movement relative to the stationary frame can be provided. The at least one locking mechanism can include a pivoting lock. The pivoting lock can be movable between engaged and disengaged positions. An actuator

can be coupled to the pivoting lock, the actuator being linearly movable to move the pivoting lock between engaged and disengaged positions. The pivoting lock can be biased towards the engaged position. At least one strap assembly including a first strap extending from the animal containment unit can be provided, the strap assembly configured to engage the vehicle to restrain movement of the animal containment unit. The strap assembly can be configured to engage an exterior anchoring point of the vehicle. The strap assembly can include at least one mounting device configured to engage an exterior surface of the vehicle.

[0017] In accordance with another aspect, an animal containment system for installation in a cargo area of a vehicle comprises an animal containment unit having two or more sidewalls extending from a base panel, and a plurality of strap connection points for securing the animal containment unit to anchor points of a vehicle.

[0018] In accordance with another aspect, an animal containment system for installation in a cargo area of a vehicle comprises a containment structure having a rigid structural component, and at least one strap connection point for securing the animal containment unit to a vehicle anchor point. The at least one strap connection point is movable between a stowed position and a deployed position, the at least one strap connection point including: a first strap, and a plug secured to the first strap. The first strap is secured to the rigid structural component of the containment structure, and the plug conceals the first strap when the loop is in the stowed position.

[0019] A resilient member that biases the loop to the stowed position can be provided. The first strap can comprise a loop of webbing.

[0020] In accordance with another aspect, an anchor for an exterior of a vehicle comprises a pod including a mount for securing a strap, and a mounting pad securable to a surface of an exterior of a vehicle. The pod is selectively mountable to the mounting pad.

[0021] The pod can be comprised of a metal material. The mount can include a webbing loop configured to pass through a threshold of a vehicle door.

[0022] In accordance with another aspect, an animal containment unit comprises a door, and a latch mechanism for the door comprising a striker, a handle actuator on the door, the handle being operatively coupled to a linkage, the linkage being selectively engageable with a pawl, the pawl being rotatable and selectively engageable with the at least one striker to secure the door in the closed state. Actuation of the handle releases the linkage from the pawl allowing the pawl to rotate to a position to release the striker thereby allowing the door to open.

[0023] The pawl can be biased towards the position to release the striker. The handle can be biased towards engagement of the linkage with the pawl. The linkage can be guided by a ramp during movement. The pawl can automatically engage the striker when the door is closed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The following description of the illustrative embodiments may be better understood when read in conjunction with the appended drawings. It is understood that potential embodiments of the disclosed systems are not limited to those depicted.

[0025] Fig. 1 is a perspective view of a first exemplary strap assembly for anchoring an animal containment unit in accordance with the present disclosure.

[0026] Fig. 2 is a perspective view of a second exemplary strap assembly for anchoring an animal containment unit in accordance with the present disclosure.

[0027] Fig. 3 is a perspective view of a third exemplary strap assembly for anchoring an animal containment unit in accordance with the present disclosure.

[0028] Fig. 4. is a perspective view of a fourth exemplary strap assembly for anchoring an animal containment unit in accordance with the present disclosure.

- [0029] Fig. 5 is a perspective view of a fifth exemplary strap assembly for anchoring an animal containment unit in accordance with the present disclosure.
- [0030] Fig. 6 is a perspective view of a several of the exemplary strap assemblies installed to a vehicle with the vehicle door closed in accordance with the present disclosure.
- [0031] Fig. 7 is a side view of a sixth exemplary strap assembly for anchoring an animal containment unit in accordance with the present disclosure.
- [0032] Fig. 8 is a side view of the sixth exemplary strap assembly installed to a vehicle with the vehicle door closed in accordance with the present disclosure.
- [0033] Fig. 9 is a perspective view of a seventh exemplary strap assembly for anchoring an animal containment unit in accordance with the present disclosure.
- [0034] Fig. 10 is a perspective view of an animal containment unit in accordance with the present disclosure.
- [0035] Fig. 11 is an exploded perspective view of the animal containment unit of Fig. 10.
- [0036] Fig. 12 is a perspective view of a disassembled animal containment unit of Fig. 10.
- [0037] Fig. 13 is a sideview of the disassembled animal containment unit of Fig. 10.
- [0038] Fig. 14 is a cutaway view showing an exemplary latch mechanism for joining panels of an animal containment unit.
- [0039] Fig. 15 is another cutaway view of the latch mechanism of Fig. 14.
- [0040] Figs. 16a-16c are cross-sectional views of a cam bolt assembly for joining panels of an animal containment unit.
- [0041] Fig. 17 is an exploded perspective view of another animal containment unit in accordance with the present disclosure.
- [0042] Figs. 18a-18c are perspective views of the animal containment unit of Fig. 17 in various stages of assembly.

[0043] Fig. 19 is a side view of another animal containment unit in accordance with the present disclosure in a first configuration.

[0044] Fig. 20 is a side view of the animal containment unit of Fig. 19 in a second configuration.

[0045] Fig. 21 is a cross-sectional view of a load leg assembly for an animal containment unit in accordance with the present disclosure.

[0046] Fig. 22 is another cross-sectional view of a load leg assembly for an animal containment unit in accordance with the present disclosure.

[0047] Fig. 23 is a perspective view of an animal containment unit with a load leg in accordance with the present disclosure.

[0048] Fig. 24 is a side view of another an animal containment unit with a load leg in a first configuration in accordance with the present disclosure.

[0049] Fig. 25 is a side view of the animal containment unit of Fig. 24 in a second configuration in accordance with the present disclosure.

[0050] Fig. 26 is a perspective view of another strap assembly for securing an animal containment unit in accordance with the present disclosure.

[0051] Fig. 27 is a perspective view of another animal containment unit with a load leg in accordance with the present disclosure.

[0052] Fig. 28 is a perspective view of the animal containment unit of Fig. 27 with the load leg deployed in accordance with the present disclosure.

[0053] Fig. 29 is a side view of the animal containment unit of Fig. 27 with the load leg deployed in accordance with the present disclosure.

[0054] Fig. 30a is a side view of another animal containment unit with a load leg in accordance with the present disclosure.

[0055] Fig. 30b is a side view of the animal containment unit of Fig. 30a with the load leg deployed in a first configuration in accordance with the present disclosure.

[0056] Fig. 30c is a side view of the animal containment unit of Fig. 30a with the load leg deployed in a second configuration in accordance with the present disclosure.

[0057] Fig. 30d is a perspective view of the animal containment unit of Fig. 30c.

[0058] Fig. 31a is a side view of another animal containment unit with a load leg in accordance with the present disclosure.

[0059] Fig. 31b is a side view of the animal containment unit of Fig. 31a with the load leg deployed in a first configuration in accordance with the present disclosure.

[0060] Fig. 31c is a side view of the animal containment unit of Fig. 31a with the load leg deployed in a second configuration in accordance with the present disclosure.

[0061] Fig. 31d is a perspective view of the animal containment unit of Fig. 31c.

[0062] Fig. 32a is a side view of another animal containment unit with a load leg in accordance with the present disclosure.

[0063] Fig. 32b is a side view of the animal containment unit of Fig. 32a with the load leg deployed in a first configuration in accordance with the present disclosure.

[0064] Fig. 32c is a side view of the animal containment unit of Fig. 32a with the load leg deployed in a second configuration in accordance with the present disclosure.

[0065] Fig. 32d is a perspective view of the animal containment unit of Fig. 32c.

[0066] Fig. 33 is a perspective view of another exemplary animal containment unit in accordance with the present disclosure.

[0067] Fig. 34 is a perspective view of an exemplary connection mechanism in accordance with the present disclosure.

[0068] Fig. 35 is a side view of the connection mechanism of Fig. 34.

[0069] Fig. 36 is another side view of the connection mechanism of Fig. 34.

[0070] Figs. 37a-37b and 38a-38b are cross-sectional views of the connection mechanism of Fig. 34 during sequential stages of coupling.

[0071] Fig. 39 is a perspective view of the connection mechanism in a couple configuration.

[0072] Fig. 40 is a side view of another exemplary animal containment unit in accordance with the present disclosure.

[0073] Fig. 41 is a bottom view of the animal containment unit of Fig. 40.

[0074] Fig. 42 is a perspective view of a first side of a foot for an animal containment unit in accordance with the present disclosure.

[0075] Fig. 43 is a perspective view of a second side of the foot for an animal containment unit in accordance with the present disclosure.

[0076] Fig. 44 is a cross-sectional view of the foot for an animal containment unit in accordance with the present disclosure.

[0077] Fig. 45 is a bottom view of another exemplary animal containment unit including wheels in accordance with the present disclosure.

[0078] Fig. 46 is a perspective view of a wheel of the animal containment unit of Fig. 45.

[0079] Fig. 47 is an enlarged side view of a wheel of the animal containment unit of Fig. 45.

[0080] Fig. 48 is a side view of another exemplary animal containment unit including sliders in accordance with the present disclosure.

[0081] Fig. 49 is another side view of an exemplary animal containment unit including sliders in accordance with the present disclosure.

[0082] Fig. 50 is a side view of another exemplary animal containment unit including a handle mechanism in accordance with the present disclosure.

[0083] Fig. 51 is a perspective view of the handle mechanism.

[0084] Fig. 52 is an enlarged portion of the handle mechanism.

- [0085] Fig. 53 is a cross-sectional view of another exemplary animal containment unit in accordance with the present disclosure.
- [0086] Fig. 54 is a perspective view of an impact panel in accordance with the present disclosure.
- [0087] Figs. 55 and 56 are cross-sectional views of another exemplary animal containment unit in accordance with the present disclosure.
- [0088] Fig. 57 is a partial view of an exemplary door latch mechanism with certain parts omitted in accordance with the present disclosure.
- [0089] Fig. 58 is a perspective view of the door latch mechanism of Fig. 57.
- [0090] Fig. 59 is a cross-sectional view taken through a handle (actuator) of the door latch mechanism of Fig. 57.
- [0091] Fig. 60 is a cross-sectional view taken through a latch of the door latch mechanism.
- [0092] Fig. 61 is an exploded view of another exemplary animal containment unit in accordance with the present disclosure.
- [0093] Fig. 62 is a perspective view of an exemplary frame of an animal containment unit in accordance with the present disclosure.
- [0094] Fig. 63 is a perspective view of another exemplary animal containment unit in accordance with the present disclosure with a load leg stowed.
- [0095] Fig. 64 is a perspective view of the exemplary animal containment unit of Fig. 63 with the load leg deployed.
- [0096] Fig. 65 is a side view of the exemplary animal containment unit of Fig. 63 installed in a vehicle.
- [0097] Fig. 66A is an enlarge portion of the exemplary animal containment unit of Fig. 64.
- [0098] Fig. 66B is a perspective view of the components of the exemplary animal containment unit of Fig. 63 prior to assembly.

[0099] Fig. 67 is a perspective cutaway view of the exemplary animal containment unit of Fig. 63 showing the load leg deployed.

[0100] Fig. 68 is a perspective cutaway view of the exemplary animal containment unit of Fig. 63 showing the load leg stowed.

[0101] Fig. 69 is a perspective view of a locking mechanism for a load leg in accordance with the present disclosure.

[0102] Fig. 70 is a perspective cross-sectional view showing the locking mechanism of Fig. 69 in a locked state.

[0103] Fig. 71 is a cross-sectional view showing the locking mechanism of Fig. 69 in a locked state with the load leg deployed.

[0104] Fig. 72 is a cross-sectional view showing the locking mechanism of Fig. 69 in a released state with the load leg deployed.

[0105] Fig. 73 is a cross-sectional view showing the locking mechanism of Fig. 69 in a locked state with the load leg deployed.

[0106] Fig. 74 is a cross-sectional view showing the locking mechanism of Fig. 69 in a locked state with the load leg stowed.

[0107] Fig. 75A is a side view of another exemplary animal containment unit secured to a vehicle in a first manner in accordance with the present disclosure.

[0108] Fig. 75B is a perspective view of the exemplary animal containment unit of Fig. 75A secured to a vehicle in a second manner in accordance with the present disclosure.

[0109] Fig. 75C is a perspective view of the exemplary animal containment unit of Fig. 75A secured to a vehicle in a third manner in accordance with the present disclosure.

[0110] Fig. 76 is a perspective view of an exemplary animal containment unit with strap connection points deployed.

[0111] Fig. 77 is a perspective view of an exemplary animal containment unit with side strap connection points stowed.

[0112] Fig. 78 is a cross-sectional view showing a side strap connection point in a deployed configuration.

[0113] Fig. 79 is a cross-sectional view showing a side strap connection point in a stowed configuration.

[0114] Fig. 80 is a perspective view of an exemplary animal containment unit with upper strap connection points deployed.

[0115] Fig. 81 is a perspective view of an exemplary animal containment unit with upper strap connection points stowed.

[0116] Figs. 82 and 83 illustrate an exemplary animal containment unit secured to hinges of a liftgate of a vehicle.

[0117] Figs. 84 and 85 illustrate external attachment pods mounted to a vehicle in accordance with the present disclosure.

[0118] Figs. 86 and 87 are perspective views of an attachment pod and vehicle mount in accordance with the present disclosure.

[0119] Fig. 88 is a side view of an attachment pod and vehicle mount installed on an exterior surface of a vehicle in accordance with the present disclosure.

[0120] Figs. 89 and 90 are cross-sectional views of another exemplary animal containment unit having wheels in accordance with the present disclosure.

[0121] Fig. 91 is a perspective view of a wheel assembly in accordance with the present disclosure prior to installation.

[0122] Fig. 92 is a perspective view of the wheel assembly in accordance with the present disclosure.

[0123] Fig. 93 is a perspective view of an exemplary animal containment unit having internal webbing in accordance with the present disclosure.

[0124] Fig. 94 is a cutaway view of the animal containment unit having internal webbing.

[0125] Fig. 95 is a perspective view of a frame and bracket of an animal containment unit in accordance with the present disclosure.

[0126] Figs. 96 and 97 are a perspective views of another exemplary animal containment unit with a handle in stowed and deployed states in accordance with the present disclosure.

[0127] Fig. 98 is a side view of the animal containment unit with the handle in a stowed state.

[0128] Fig. 99 is an enlarge view of a door of the animal containment unit including latches.

[0129] Fig. 100 is a rear view of the animal containment unit.

[0130] Fig. 101 is a cross-sectional view of the animal containment unit taken along the line 101-101 in Fig. 100.

[0131] Fig. 102 is a cross-sectional view of a latch in three position (a), (b) and (c), taken along the line 102-102 in Fig. 99.

DETAILED DESCRIPTION

[0132] The present disclosure sets forth various aspects of a pet containment system for a vehicle including a containment structure for containing a pet. The pet containment system includes one or more strap assemblies for mounting/securing the animal containment unit in a vehicle.

[0133] It should be noted that the illustrations and descriptions of the examples and embodiments shown in the figures are for exemplary purposes only, and should not be construed limiting the disclosure. One skilled in the art will appreciate that the present disclosure contemplates various embodiments. Additionally, it should be understood that the concepts

described above with the above-described examples and embodiments may be employed alone or in combination with any of the other examples and embodiments described above. It should further be appreciated that the various alternative examples and embodiments described above with respect to one illustrated embodiment can apply to all examples and embodiments as described herein, unless otherwise indicated.

[0134] Unless explicitly stated otherwise, each numerical value and range should be interpreted as being approximate as if the word “about,” “approximately,” or “substantially” preceded the value or range.

[0135] Conditional language used herein, such as, among others, “can,” “could,” “might,” “may,” “e.g.,” and the like, unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments include, while other embodiments do not include, certain features, elements, and/or steps. Thus, such conditional language is not generally intended to imply that features, elements, and/or steps are in any way required for one or more embodiments or that one or more embodiments necessarily include logic for deciding, with or without author input or prompting, whether these features, elements and/or steps are included or are to be performed in any particular embodiment. The terms “comprising,” “including,” “having,” and the like are synonymous and are used inclusively, in an open-ended fashion, and do not exclude additional elements, features, acts, operations, and so forth. Also, the term “or” is used in its inclusive sense (and not in its exclusive sense) so that when used, for example, to connect a list of elements, the term “or” means one, some, or all of the elements in the list.

[0136] The exemplary embodiments may be further understood with reference to the following description and the related appended drawings, wherein like elements are provided with the same reference numerals. The exemplary embodiments describe an assembly and/or associated apparatuses for safely transporting animals, e.g., large dogs, in a vehicle cargo area. In some

embodiments, the assembly features an animal containment unit, e.g., crate, for holding the animal that can be secured in a cargo area of a vehicle to securely transport the animal in the vehicle.

[0137] The animal containment unit may be referred to alternatively as a crate, a dog crate, etc. Those skilled in the art will understand that the animal containment unit is configured to safely hold an animal during, e.g., transportation of the animal in a moving vehicle and/or for transportation of the animal outside the vehicle. The animal containment unit can include or can be configured to cooperate with one or more load legs and/or straps or other securing members to position and secure the animal containment unit within the vehicle.

[0138] The animal containment system can provide crash safety of rear seat human occupants in a vehicle when a dog is behind them in the animal containment unit in the rear cargo area. The animal containment system can also provide crash safety for the dog in the rear cargo area. The animal containment system can also provide a "universal" fit in a majority of SUV rear cargo areas. The animal containment unit can comprise a material that is durable and has the strength of heavy-duty kennels with some of the flexibility & aesthetics of soft-sided crates.

[0139] During a typical crash with impact on the front or rear of the vehicle, when the containment unit is located in the vehicle cargo area, the crash forces will tend to cause the containment unit to move forward (i.e., toward the vehicle seats and occupants), upward toward the ceiling, and/or rotationally forward and up (e.g., sending the top of the containment unit over the vehicle seatback). Accordingly, features of the present disclosure aid in absorbing and/or counteracting such forces. In various embodiments, the containment unit is part of an animal containment system that may include one or more features that positively retains and/or blocks the containment unit in the cargo area, preventing the unit from becoming a projectile or inducing harm to animal or human occupants. As such, embodiments provide crash safety of rear seat human occupants when an animal or other cargo (e.g., a dog) is behind them in the rear cargo area along with crash safety of the animal/cargo itself.

[0140] In the following description, the terms “front” and “rear” are generally used with respect to a front and rear of a vehicle in which aspects of the present disclosure are used or intended to be used, unless otherwise stated. Thus, for example, a rear of an animal containment unit is oriented toward a rear of vehicle or refers to a portion of the animal containment unit intended to be orientated towards a rear of a vehicle.

[0141] It should be further understood that reference to a "side" of the animal containment unit is provided for ease of explanation, and that multiple different components of the animal containment unit can define the exterior of the animal containment unit and these exterior components are not necessarily orthogonal to the other "sides." Additionally, the terms "inside" and/or "interior" and/or "internal" may refer to features in a direction toward the center of the animal containment unit, relative to a certain component of the animal containment unit, and the terms "outside" and/or "exterior" and/or "external" may refer to features in a direction away from the center of the animal containment unit, relative to a certain component of the animal containment unit.

[0142] Although the disclosure may illustrate different embodiments, it is contemplated that aspects of individual embodiments may be combined or omitted. Therefore, the disclosure and claims are not intended to be limited to the illustrated embodiments.

[0143] Figs. 1-9 show various embodiments of strap assemblies to anchor an animal containment unit 10 in a rear cargo area 14 of a vehicle 18. In some embodiments, one or more straps may extend from the animal containment unit 10 through a door jamb 20 to an exterior of the vehicle such that when a liftgate 22 (or other door) of the vehicle is closed, the straps are configured to restrain the animal containment unit 10 in the event of a collision event or the like. Generally, FIGS. 1-9 along with FIGS. 75A-B and FIGS. 82-85 illustrate embodiments of animal containment units with one or more straps that mount to an exterior anchoring point of a vehicle.

[0144] Fig. 1 illustrates a first type of strap 30 having first and second ends 34a and 34b attached to a base portion of the animal containment unit 10. The strap 30 is wrapped around or otherwise engaged with a hitch receiver 38 of the vehicle 18 serving as the exterior anchoring point. The strap 30 can include structure adapted to mate with the receiver 38, or may be looped around the receiver 38 in a secure manner. The strap 30 can include a retractor (shown in later embodiments) for removing slack in the strap 30. The strap 30 is generally thin and web-like such that it does not interfere with closing the liftgate 22.

[0145] Fig. 2 illustrate straps 40 of a second type connected between a base portion of the animal containment unit 10 and a frame (not shown) of the vehicle 18 serving as the exterior anchoring point. The straps 40 can connect to portions of the vehicle frame or other anchor points with, for example, fasteners or the like. The straps 40 can include a retractor (shown in later embodiments) for removing slack in the straps 40. The straps 40 are generally thin and web-like such that they do not interfere with closing the liftgate 22.

[0146] Fig. 3 illustrate straps 50 of a third type connected between respective sides of the animal containment unit 10 and extending through the door jamb 20. Each strap 50 includes a mounting pod 52 that is configured to attach to an exterior of a vehicle body panel serving as the exterior anchoring point (e.g., quarter panel, side panel, roof panel, door, etc.). In the illustrated example, the mounting pods 52 are attached to respective quarter panels 56a/56b of the vehicle 18. In some embodiments, the mounting pods 52 include magnets and/or adhesives for securing to the body panels. The straps 50 can include a retractor (shown in later embodiments) for removing slack in the straps 50. The straps 50 are generally thin and web-like such that they do not interfere with closing the liftgate 22.

[0147] Fig. 4 illustrate straps 60 of a fourth type connected between a top portion of the animal containment unit 10 and the liftgate 22 of the vehicle 18 serving as the exterior anchoring point. Each strap 60 includes a mounting pod 52 that is configured to attach to an exterior of a vehicle

body panel (e.g., quarter panel, side panel, roof panel, door, etc.). In the illustrated example, the mounting pods 52 are attached to the liftgate 22 of the vehicle 18. In some embodiments, the mounting pods 52 include magnets and/or adhesives for securing to the body panels. The straps 60 can include a retractor (shown in later embodiments) for removing slack in the straps 60. The retractors can allow the liftgate 22 to be opened without removal of the mounting pods 52 by allowing the straps 30 60 to extend when the liftgate 22 is opened and retract when the liftgate 22 is closed. The straps 60 are generally thin and web-like such that they do not interfere with closing the liftgate 22. The straps 60 are routed under a bottom edge 64 of the liftgate 22 in this embodiment.

[0148] Fig. 5 illustrate straps 70 of a fifth type connected between sides of the animal containment unit 10 and the liftgate 22 of the vehicle 18 serving as the exterior anchoring point. Each strap 70 includes a mounting pod 52 that is configured to attach to an exterior of a vehicle body panel (e.g., quarter panel, side panel, roof panel, door, etc.). In the illustrated example, the mounting pods 52 are attached to the liftgate 22 of the vehicle 18. In some embodiments, the mounting pods 52 include magnets and/or adhesives for securing to the body panels. The straps 70 can include a retractor (shown in later embodiments) for removing slack in the straps 70. The retractors can allow the liftgate 22 to be opened without removal of the mounting pods 52 by allowing the straps 70 to extend when the liftgate 22 is opened and retract when the liftgate 22 is closed. The straps 70 are generally thin and web-like such that they do not interfere with closing the liftgate 22. The straps 70 are routed around sides 74a and 74b of the liftgate 22 in this embodiment.

[0149] Turning to Fig. 6, the vehicle 18 is shown with several strap types mounted to several exterior anchoring points in use with the liftgate 22 closed. It will be appreciated that the illustrated strap types include the straps 30, 40, 50 and 70 of Figs. 1, 2, 3 and 5, respectively. It will also be appreciated that each of the strap types can be used alone, or in combination with, any of the other

strap types. Only the mounting pods 52 of straps 30 and 40 are visible in Fig. 6. During a collision, the mounting pods 52 comprise a rigid component that is captured between the liftgate 22 and body of the vehicle 18 preventing forward and/or lateral movement of the animal containment unit 10. Similarly, the straps 30 and 40 are secured to the vehicle 18 as described above and prevent forward and/or lateral movement of the animal containment unit 10.

[0150] Figs. 7 and 8 show an exemplary strap assembly 70 including a retractor 72 and mounting pod 52 that can be used in connection with any of the exemplary embodiments. The retractor 72 includes a retractor housing 74 selectively mountable to the animal containment unit 10 in which a retractable strap (e.g., strap 60) is supported. The retractable strap 60 includes a hook 76 at a leading end for attaching to a loop 78 of the mounting pod 52. It will be appreciated that other types of connectors can be provided for securing the strap 60 to the mounting pod 52. The retractor 72 can include an automatic retraction mechanism for retracting the strap 60 into the retractor housing 74. The retractor 72 can be an automatic emergency locking retractor, another known belt tensioner, or the like. The retractor 72 can be manual, e.g. ratchet. In some embodiments, the retractor 72 can be mounted on the animal containment unit 10 or at a mid-point of the strap 60 such that only a portion of the strap 60 is retractable. In some embodiments, the retractor 72 is configured to maintain the strap 60 in tension throughout the motion of the liftgate 22 (e.g., when fully open as shown in Fig. 7 and when fully closed as shown in Fig. 8, and in between). In some embodiments the retractor 72 can include an inertial or other locking mechanism similar to a seat belt locking mechanism.

[0151] Fig. 9 shows a barrier 80 mounted in the cargo area of the vehicle 18. The barrier 80 can be used with or without an animal containment unit 10 to restrict forward movement of objects/animals in the cargo area. In one embodiment, the barrier 80 comprises a net secured to various anchor points of the vehicle which can include LATCH anchors, portions of the seat and/or

seatback of the vehicle 18, and/or with mounting pods such as mounting pods 52 described above.

The barrier 80 can also comprise a rigid fence.

[0152] Figs. 10-13 illustrate an exemplary animal containment unit 100 in accordance with the present disclosure. The animal containment unit 100 can be assembled/disassembled by fastening/unfastening various panels of the animal containment unit 100 (see also FIGS. 17, 61, and 66B, showing additional embodiments of various panel structures that may be assembled together). Various fastening mechanisms for securing the various panels together are described below. The animal containment unit 100 can be used in a vehicle to prevent and/or restrain movement of an animal and also provide crash safety features. The animal containment unit 100 can be installed in the cargo area of a vehicle, for example an SUV, crossover or hatchback. The animal containment unit may provide a "universal" fit to mount in a majority of SUV rear cargo areas (from large SUVs down to midsize and small/crossover SUVs and hatchbacks). The animal containment unit may be used in various other vehicles, including vans and pickup trucks. The animal containment unit can be installed to align with a seat back portion of the vehicle (or front of a cargo area of the vehicle). In certain embodiments, the animal containment unit is sized for dogs up to 75-80 lbs.

[0153] The animal containment unit 100 includes a base panel 108, a rear panel 112, a front panel 116, side panels 120 and a top panel 124. Each of the panels includes interlocking features for securing the panels together to form the assembled animal containment unit 100. The interlocking features can include, for example, press-fit components and/or snap-fit components, latch mechanisms and/or fasteners. In the illustrated example, the side panels 120, top panel 124 and/or base panel 108 include tubes 128 configured to receive stubs 132 of the rear and front panels 112 and 116.

[0154] The front panel 116 of the animal containment unit 100 may have one or more features for improved strength relative to the other panels. For example, the front panel 116 can include a

wire meshing overtop of the rear panel (or manufactured within or as part of the front panel) to increase strength. In other embodiments, such as shown in Fig. 11, the front panel 116 may be a panel subassembly including an inner impact panel 198. The inner impact panel 198 reduces the spacing d between an animal in the animal containment unit 100 and the front of the animal containment unit 100 to reduce a potential impact force on the animal in the event of a vehicle collision. The impact panel 198 can be a separate panel or can be part of a front panel of an animal containment unit.

[0155] The front panel 116 and/or inner impact panel 196 may provide additional structural reinforcement of the containment unit 100, and the panel subassembly may provide improved crash performance by dissipating impact energy or cushioning animal impact. The panel subassembly of the front panel 116 and inner impact panel 196 may also have space between the inner impact panel 196 and the exterior panel. and embodiments with such space may include one or more intervening structure such as ribs, voids, foam, or the like. In some embodiments, one or more of the inner impact panel 198 and intervening structure can be configured to flex or otherwise deform in a resilient or non-resilient manner to absorb impact energy. In a general sense, the front panel 116 of such embodiments may be considered a “crash panel” that is distinct from the other panel(s) of the containment unit 100 by being thicker, stronger, and/or more cushioned than the other panels. Moreover, the crash panel of such embodiments, contrasted from the other panel(s) of the containment unit 100, may have additional features that improve crash performance and protection of the animal within the unit.

[0156] Figs. 12 and 13 illustrate the animal containment unit 100 in a disassembled condition (e.g., for shipping and/or storage).

[0157] Figs. 14 and 15 illustrate a latch assembly 150 (e.g., securement mechanism) for releasably securing together two panels of the animal containment unit 100. The two panels in

the illustrated example can be the base panel 108 and a side panel 120, but it will be appreciated that the latch assembly 150 can be used to connect other panels.

[0158] The latch assembly 150 includes a rod 154 associated with the side panel 120 and a latch member 158 associated with the base panel 108. The latch member 158 is supported for pivoting movement relative to the base panel 108 by pivot 162. A pivotable latch arm 166 of the latch member 158 is adapted to engage the rod 154 and a handle portion 170 of the latch member 158 is used to rotate the latch member 158 over-center to draw the rod 154 to the right to the position shown in Fig. 15 thereby securing the side panel 120 to the base panel 108.

[0159] Figs. 16-18 illustrate a cam bolt assembly 180 for securely interlocking first and second panels P1 and P2 of the animal containment unit 100. It will be appreciated that the first and second panels P1 and P2 can be any of the above-described panels. Panel P1 includes a threaded bore 182 for receiving a bolt 184. Panel P2 includes a cam plate 186 mounted thereto. A slotted hole 188 extends through the panel P2 and the cam plate 186 for passage of the bolt 184, as shown in Fig. 16. Initially the panels P1 and P2 are aligned as shown in Fig. 16 and the bolt 184 is passed through the slotted hole 188 and threaded into the threaded bore 182. Upon tightening of the bolt 184, a head 190 of the bolt 184 impinges a cam surface 192 of the cam plate 186 which tends to force the bolt 184 and, consequently, the panel P1 to the right as shown in Fig. 17 to the position shown in Fig. 18 thereby drawing panels P1 and P2 together to a secured final position.

[0160] Fig. 17 shows an animal containment unit 100a. The animal containment unit 100a can be assembled and disassembled making shipping and/or storage of the animal containment unit 100a more convenient. The animal containment unit 100a includes a base panel 108a, a rear panel 112a, a front panel 116a, side panels 120a and a top panel 124a. Each of the panels includes interlocking and/or mating features for securing the panels together to form the assembled animal containment unit 100a. The interlocking and/or mating features can include, for example, press-fit components and/or snap-fit components. In the illustrated example, the side panels 120a, top

panel 124a and/or base panel 108a include tubes 128a configured to receive stubs 132a of the rear and front panels 112a and 116a. The side panels 120a further include bolt holes 136a for receiving bolts/screws for further securing the rear panel 112a and front panel 116a to the side panels 120a. To assemble the animal containment unit 100a, a user will first assemble the side panels 120a to the base panel 108a. Next, the top panel 124a is assembled to the side walls 120a. Finally, the rear panel 112a and front panel 116a are positioned and bolted to the side panels 120a.

[0161] Turning to Figs. 18a-18c, another embodiment of an animal containment unit 100b is illustrated. The animal containment unit 100b can be assembled and disassembled making shipping and/or storage of the animal containment unit 100b more convenient. The animal containment unit 100b includes a base panel 108b, a rear panel 112b, a front panel 116b, side panels 120b and a top panel 124b. Each of the panels includes interlocking features for securing the panels together to form the assembled animal containment unit 100b. The interlocking features can include, for example, press-fit components and/or snap-fit components. In the illustrated example, the side panels 120b, top panel 124b and base panel 108b include receivers (e.g., tubes) 128b configured to receive stubs 132b of the rear and front panels 112b and 116b. One or more of the panels can be constructed as a one-piece plastic (e.g. polypropylene) part with, for example, an over molded mesh. It will be appreciated that FIGS. 11, 61, and 66B illustrate additional embodiments of panels that may be assembled by similar methods.

[0162] Figs. 18a-18c illustrate an assembly sequence wherein the side panels 120b are secured to the base panel 108b (Fig. 18a), the top panel 124b is secured to the side panels (Fig. 18b), the rear and front panels 112b and 116b are secured to the base panel 108b, side panels 120b and/or top panel 124b (Fig. 18c).

[0163] In Figs. 19-26, embodiments are shown and described for an animal containment unit 200 having a safety device extending toward the rear of the vehicle, e.g. toward the tailgate 22 or other rear door of the vehicle. In most cases, the safety device extends away from a side of the

animal containment unit 200 including a door since the animal containment unit 200 will typically be placed in a cargo area of a vehicle with the door facing towards a rear liftgate for ease of loading an animal.

[0164] Referring to Figs. 19-23, the animal containment unit 200 may include a door 202 and a load leg 204 that is extendable toward the rear of the vehicle away from a side of the animal containment unit 200 including the door 202. When the liftgate 22 is closed, the load leg 204 extends rearwardly in the vehicle and is positioned near or pressing against the liftgate 22. In this manner, during a crash, the load leg 204 helps to absorb and divert impact forces, and helps to prevent the animal containment unit 200 from moving forward in the vehicle (e.g., toward human occupants).

[0165] As the liftgate 22 of the vehicle closes, the load leg (or legs) 204 is configured to be compressed by the liftgate 22 during automatic or manual closure thereof. In other words, the force pressing the load leg 204 to extend/deploy is less than the force driving the liftgate 22 to close. The load leg 204 may have a sufficient amount of travel length available to be compatible with many different vehicle cargo areas. In effect, the rearward load leg is self-adjusting to reach the liftgate of a wide range of vehicles.

[0166] In some embodiments, and as shown in Figs. 21 and 22, to allow the liftgate 22 to compress the load leg 204, while still allowing the load leg 204 to absorb the impact of a crash after the liftgate 22 is closed, two separate compression systems are provided. A first, smaller spring (first spring 208) is always active and applies relatively light spring pushback on the load leg 204 allowing easy compression to accommodate different liftgates. Upon a significant amount of movement or acceleration of the load leg 204 (e.g., a shock load), a second, larger spring (second spring 212) is released and applies a relatively heavy spring pushback on the load leg 204. Fig. 21 illustrates a normal compressed configuration of the second spring 212 and Fig. 22 illustrates the second spring 212 after release in an uncompressed configuration. Dampers, such as gas struts,

can also be used to dissipate energy in the event of a collision. The load leg 204 is configured to move linearly between compressed and extended configurations.

[0167] Referring to Figs 24 and 25, a load leg 204' is rotationally coupled to the animal containment unit 200. The load leg 204' generally operates in a similar manner to load leg 204 except that load leg 204' is configured to rotate between retracted and extended configurations, as shown. Like load leg 204, load leg 204' can include first and second torsion springs that provide two levels of spring pushback. The load leg 204' is U-shape and secured to the animal containment unit 200 via pivot connections 220.

[0168] In Fig. 26, an animal containment system 300 includes an animal containment unit 304 and a pair of strap assemblies 320 to prevent the animal containment unit 300 from moving significantly forward during a crash. Each strap assembly 320 includes a distal (exterior) mounting pod 324 that mounts outside the vehicle 18 and a first strap 328 extending from the distal mounting pod 324 to an internal retraction pod 332. A second retractable strap 336 extends from the internal retractable pod 332 to the animal containment unit 304. The second strap 336 retracts into the internal retraction pod 332 when it is not connected to the animal containment unit 304. The second strap 336 includes a buckle 340 for coupling with a buckle receiver 344 of the animal containment unit 304. When the liftgate 22 (or other rear door, not shown in Fig. 26) is closed, the strap 328 extends through the door jamb 20; however, the distal mounting pod 324 is unable to pass through the door jamb 20, providing secure retention of the strap 328 in a similar to above-described mounting units. In other embodiments, the features of the retraction pod 332 can be incorporated with the animal containment unit 304 or the external pod 324, as previously described.

[0169] Referring to Figs. 27-29, an animal containment unit 400 may include a top panel 402 and a front panel 404, a rear panel 408, side panels 412 and a base panel 416. A load leg 420 may be movable between a stowed position (Fig. 27) and a deployed position (Figs. 28 and 29) in which

it extends beyond an envelope of the animal containment unit 400. In the illustrated embodiment, the load leg 420 in the stowed position is nested within the front panel 404. In other embodiments, the load leg 420 is stowed within the base panel 416, one or more side panels 412, or the top panel 402 of the animal containment unit 400. In the illustrated embodiment, the load leg 420 is a generally flat panel-like structure that is hingedly connected to the front panel 404. In other embodiments, the load leg 420 may be a bar or frame structure. The load leg 420 is sized and positioned such that, in the deployed position, the load leg 420 engages with a seatback 424 of a vehicle. In certain embodiments, the load leg 420 engages with a lower portion of the seatback 424 of the vehicle. In this manner, the load leg 420 is able to transfer impact forces toward the bottom supporting structure of the seat and may avoid causing the seatback 424 to significantly pivot/fold forward. The load leg 420 may be designed to crumple or partially collapse to absorb impact forces, while also maintaining its deployed position and not collapsing during a crash.

[0170] Referring to 30a-d, 31a-d and 32a-d, in embodiments a top load leg 450, 450' and 450'' may be movable between a stowed position and a deployed position in which it extends beyond the envelope of the containment unit. In the illustrated embodiments, the top load leg 450, 450' 450'' in the stowed position is nested within the top panel 402 of the animal containment unit 400. In other embodiments, the top load leg can be stowed within/against another panel of the containment unit 400. In the illustrated embodiments, the top load leg 450, 450', 450'' is a wide U-shaped bar structure pivotably connected to the top panel 420 and extending across a majority of the width of the animal containment unit 400. As will be appreciated, various deployment mechanisms are shown in the illustrated embodiments. In Figs. 30a-d, the top load leg 420 is supported by a support leg 454, which also may move from a stowed position to a deployed position. In Figs. 31a-d, the top load leg 450' is supported by ratcheting hinges 458. In Figs. 32a-d, the top load leg 450'' includes a telescoping section 462 that extends from a base section 464. A gas spring or other actuating mechanism can bias the telescoping section 462 towards an

extended position. In some embodiments, the top load leg 450, 450', 450'' is biased toward a deployed position and will extend until it reaches a maximum height or reaches the vehicle ceiling. The top load leg 450, 450', 450'' is sized and positioned such that, in the deployed position, the top load leg 450, 450', 450'' engages with the ceiling 460 of a vehicle. In this manner, the top load leg 450, 450', 450'' is able to transfer impact forces to the vehicle body and moreover is able to block the animal containment unit 400 from moving upward/forward in the vehicle. The top load leg 450, 450', 450'' may be designed to crumple or partially collapse to absorb impact forces, while also maintaining its deployed position and not collapsing during a crash.

[0171] The top load leg 450, 450', 450'' functions to prevent excess movement during a collision by bracing the animal containment unit 400 against the vehicle ceiling to limit movement and/or rotation of the animal containment unit 400. In some embodiments the top load leg 450, 450', 450'' can remain locked down in the stowed position until an actuator is engaged. The actuator will then deploy the top load leg 450, 450', 450'' to rise either automatically (e.g., using a gas spring) or otherwise release the top load leg 450, 450', 450'' to be raised manually by a user. The top load leg 450, 450', 450'' may lock itself into position once reaching its maximum height or the vehicle's ceiling height. The top load leg 450, 450', 450'' can be configured to extend 5" or more above the top panel 402 of the animal containment unit 400. During a crash, the top load leg 450, 450', 450'' is configured to remain in a deployed state to brace the animal containment unit 400. In some embodiments, the top load leg 450, 450', 450'' may be two separate load legs proximate the sides of the animal containment unit 400 without a bar spanning across between them, to allow greater visibility to the vehicle driver out the rear window.

[0172] The forward load leg 420 and the top load leg 450 can be formed of various materials, e.g. either metal tubing or a plastic part.

[0173] Fig. 33 illustrates an exemplary animal containment unit 500 including first and second connection members for securely coupling one or more straps (not shown) to the animal

containment unit 500. In the illustrated embodiment, two keyhole connection mechanisms 508 are provided on a side panel 512 of the animal containment unit 500. It will be appreciated that additional keyhole connection mechanisms 508 can be provided in other location on the animal containment unit 500 as desired. The keyhole connection mechanisms 508 are configured to securely couple with a buckle of a strap, which strap can then be secured to the vehicle in any suitable manner including the above-described manners. The keyhole connection mechanisms in some embodiments may be rigidly and/or directly coupled to a structural frame element of the containment unit 500, for example the crossbar 2124 shown in FIG. 93.

[0174] Fig. 34 shows a keyhole connection mechanism 508 and a mating buckle 518 in accordance with the present disclosure. The buckle 518 includes a body 522 having a protrusion 526 and a slot 530. The slot 530 is configured to receive a strap (not shown) for securing the strap to the buckle 518. The keyhole connection mechanism 508 includes a housing 534 having a keyhole opening 538 adapted to receive the protrusion 526 of the buckle 518. As will be described below, a head 542 of the protrusion 526 is adapted to be received in an enlarged end 544 of the keyhole opening 538. The buckle 518 is then advanced such that the protrusion 526 is aligned with a tapered portion 548 of the keyhole opening 538 whereat the head 542 of the protrusion 526 restricts separation of the buckle 518 from the keyhole connection mechanism 508.

[0175] With additional reference to Fig. 35, an exploded view of the keyhole connection mechanism 508 is shown. The keyhole connection mechanism 508 includes an inside housing 552 that supports a keyhole cover 556 which is biased to a closed position by a spring 560. A magnet 564 is supported adjacent a terminal end of the tapered portion 548 of the keyhole opening 538. Suitable fasteners (not shown) such as press-fit pins are used to couple the respective components together.

[0176] In Fig. 36, a side view of the buckle 518 and an overhead view of the keyhole connection mechanism 508 illustrate the manner in which the buckle 518 is configured to couple

with the keyhole connection mechanism 508. The protrusion 526 is T-shape in cross-section and the head 542 of the protrusion 526 has a first diameter A that is greater than a diameter B of a body portion 568 of the protrusion 526. The initial insertion location labeled "1" on the housing 534 has a diameter or geometry such that it is larger than the mating geometry of the head 542 of the protrusion 526. As such, the head 542 of the protrusion 526 can be advanced through the keyhole opening 538 from a first side (i.e., outside) of the housing 534 to a second side (i.e., inside) of the housing 534. The final "locked" or engaged position on the housing 534 labeled "2" has a diameter or other geometry such that it is smaller than the initial mating geometry of the head 542 but larger than the body portion 568 of the protrusion labeled "B."

[0177] Figs. 37a-b and 38a-b illustrate progressive stages of coupling the buckle 518 with the keyhole connection mechanism 508. In Fig. 37a, prior to insertion of the protrusion 526 into the keyhole opening 538, the keyhole cover 556 is flush with an outside surface of the housing 534. In Fig. 37b, the protrusion 526 is inserted into the keyhole opening 538 along an axial direction of the protrusion 526 depressing the keyhole cover 556 until the head 542 of the protrusion 526 clears the housing 534. In Fig. 38a, the buckle 518 is pushed to the right to the final engaged position shown in Fig. 38b. It should be appreciated that both the spring bias of the keyhole cover 556 and the magnetic force of the magnet 564 help to urge protrusion 526 to the right. In the final engaged position of Fig. 38b, the buckle 518 may freely rotate about the axis A but cannot be pulled upwards out of the housing 534 due to the geometry of the keyhole opening and the protrusion.

[0178] Fig. 39 illustrates the manner in which the buckle 518 is rotatable relative to the housing 534 of the keyhole connection mechanism 508 in the coupled state. While the buckle 518 can be rotated 360 degrees, it should be appreciated that the buckle 518 will remain fully engaged with the keyhole connection mechanism 508 with a strap in tension through approximately 180 degrees.

[0179] Figs. 40 and 41 show the assembled animal containment unit 600. The animal containment unit 600 in this embodiment includes four feet 638 located on the bottom of assembly. The feet 638 are located near the corners of the base panel 608 for stability and to resist sliding on a floor of a vehicle or other surface. The feet 638 can 1) be made of a variety of materials, 2) have a variety of shapes, 3) have many different textural finishes.

[0180] Figs. 42-44 illustrate further details of the feet 638. In some embodiments, the feet can include a rubber material 640 over-molded on a plastic body 642. The feet 638 can be affixed to the bottom of the base panel 608 with a screw, rivet, or the like. Alignment features, such as a recess 644, may be provided.

[0181] With reference to Figs. 45-47, wheels 646 may be provided on at least one side of the animal containment unit 600. In the illustrated example embodiment, the wheels 646 are riveted through a wheel housing 644 and inserted into a hole in a tubular portion 648 of the animal containment unit 600. The wheels 646 may be arranged just above floor height so they are not dragging when not in use. When the animal containment unit 600 is tilted, the wheels 646 begin to make contact with a supporting surface and can spin, allowing the animal containment unit 600 to roll. Tilting of the animal containment unit 600 may occur when an opposite end of the animal containment unit 600 is lifted.

[0182] The animal containment unit 600 can also include structure for aiding in sliding the animal containment unit 600 such as, for example, when positioning the animal containment unit 600 in a vehicle. In Figs. 48 and 49, low-friction (ski) strips 650 are attached to the rear panel 616 of the animal containment unit 600. In the illustrated embodiment, the strips 650 are attached with bosses on the inside of the animal containment unit 600. The strips are assembled by being inserted through a hole (not shown) in the rear panel 616 from an interior of the animal containment unit 600 to extend to an exterior of the animal containment unit 600. strip extends just outward of tube exterior profile so that the tube does not drag when in use. The strips 650 may be positioned to

only engage a floor or other supporting surface when tilting the animal containment unit 600 backward to slide into vehicle, e.g. from the tailgate area toward a vehicle seatback.

[0183] Figs. 50-52 illustrate an exemplary retractable handle assembly 660 including a carry handle 664 for lifting (e.g., tilting) the animal containment unit 600 and/or sliding the animal containment unit 600. The carry handle 664 is configured to stow flush with a side panel 620 (or other panel) of the animal containment unit 600 when not in use. The retractable handle assembly 660 includes a housing 668 adapted to be secured to a panel of the animal containment unit 600. The housing 668 supports the carry handle 664 for movement between a use position (Fig. 51) and a stowed position (Fig. 52). First and second ends 670a and 670b of the carry handle 664 are secured to respective fasteners 674. The fasteners 674 are received in respective slots 678a and 678b of the housing 668. The fasteners 674 are configured to translate within the slots 678a and 678b to allow the carry handle 664 to move between the stowed position and the use position. A spring 682 extends between the first and second end 670a and 670b of the carry handle 664 and/or fasteners 674 to bias the carry handle 664 towards the stowed position. The carry handle 664 can be a leather or other generally flexible material.

[0184] In use, a user simply grabs the carry handle 664 to extend the carry handle 664 from the housing 668. Upon release of the carry handle 664, the spring 682 returns the carry handle 664 to the stowed position.

[0185] Figs. 53 and 54 illustrate another exemplary animal containment unit 1000. The animal containment unit 1000 is similar to the animal containment units described above but the front panel 1006 includes both an exterior panel 1008 and an impact panel 1010. The impact panel 1010 reduces the spacing d between an animal in the animal containment unit 1000 and the front of the animal containment unit 1000 to reduce a potential impact force on the animal in the event of a vehicle collision. The impact panel 1010 can include voids/ribs or other intervening structure 1012 filled with an impact-absorbing material such as foam, for example. The impact panel 1010

can be a separate panel or can be part of a front panel of an animal containment unit. The front panel 1006 may provide additional structural reinforcement of the containment unit 1000, and the panel subassembly may provide improved crash performance by dissipating impact energy or cushioning animal impact. The panel subassembly of the front panel 1006 may also have space between the inner impact panel 1010 and the exterior panel 1008, and embodiments with such space may include one or more intervening structure(s) 1012 such as ribs, voids, foam, or the like. In some embodiments, one or more of the inner impact panel 1010 and intervening structure can be configured to flex or otherwise deform in a resilient or non-resilient manner to absorb impact energy. In a general sense, the front panel 1006 of such embodiments may be considered a “crash panel” that is distinct from the other panel(s) of the containment unit 1000 by being thicker, stronger, and/or more cushioned than the other panels. Moreover, the crash panel of such embodiments, contrasted from the other panel(s) of the containment unit 1000, may have additional features that improve crash performance and protection of the animal within the unit.

[0186] Figs. 55 and 56 illustrate an exemplary animal containment unit 1100 with a door 1106 and a gas strut 1110. The door 1106 is secured to the body of the animal containment unit with a hinge 1114 such that the door 1106 opens upwardly allowing access to an interior of the animal containment unit. A door latch 1118 is configured to selectively secure the door 1106 in a closed state. The gas strut 1110 is configured to maintain the door 1106 in an open state and/or assist in moving the door from a closed state to an open state. The gas strut 1110 can be mounted such that when the door 1106 is closed, the gas strut 1110 rotates over center and applies a force to the door 1106 that tends to maintain the door 1106 in a closed state. In this case, the door 1106 remains in a generally closed state until a user lifts the door 1106 at least partially open.

[0187] Figs. 57-60 illustrate the door latch 1118 in more detail. The door latch 1118 generally includes a handle 1122 coupled to a linkage rod 1126 which is rotatably supported in the door 1106 and coupled to first and second latch members 1130. The first and second latch members

1130 are configured to selectively engage respective strikers 1134 of the animal containment unit 1100 to maintain the door 1106 in a closed state. Actuation of the handle 1122, such as by lifting up on the handle 1122, rotates the latch members 1130 out of engagement with the strikers 1134 allowing the door 1106 to be opened.

[0188] In some embodiments of the door latch 1118, a first biasing component 1138 (e.g., a compression spring as shown) may be provided to bias the handle 1122 toward its non-actuated position such that the latch 1118 is biased to maintain the door 1106 in a closed state. Similarly, a second biasing component 1131 (e.g., a torsion spring as shown) may be provided with one or more of the latch members 1130 to bias the latch member(s) to the engaged position with the corresponding striker(s) 1134. Each of the latch members 1130 may include an angled surface 1133 and a catch surface 1135, whereby a closing motion of the door 1106 automatically causes the door latch 1118 to engage the striker 1134 and thereby maintain a closed door position. As shown in FIGS. 58 and 59, the angled surface 1133 is positioned to contact the striker 1134 as the door 1106 moves from the open position to the closed position, causing the latch member 1130 to temporarily rotate upwardly as it moves across the striker toward the closed position. Subsequently, the bias against the latch member 1130 causes it to rotate back downward for the catch surface 1135 to engage and hold the striker 1134.

[0189] A latch housing 1133 may be affixed to the door 1106 and at least partially shroud components of the door latch 1118. In some embodiments, the latch housing 1133 supports the biasing component 1128 and enshrouds the handle 1122. In the illustrated embodiment, the latch housing 1133 extends along the door 1106 to enshroud the latch members 1130.

[0190] Fig. 61 shows another exemplary embodiment of an animal containment unit 1600. The animal containment unit 1600 can be assembled and disassembled making shipping and/or storage of the animal containment unit 1600 more convenient. The animal containment unit 1600 includes a base panel 1608, a rear panel 1612, a front panel 1616, side panels 1620 and a top panel

1624. Each of the panels includes interlocking and/or mating features for securing the panels together to form the assembled animal containment unit 1600. The interlocking and/or mating features can include, for example, press-fit components and/or snap-fit components. In the illustrated example, the side panels 1620, top panel 1624 and/or base panel 1608 include tubes 1628 configured to receive stubs 1632 of the rear and front panels 1612 and 1616. The side panels 1620 further include bolt holes 1636 for receiving bolts/screws for further securing the rear panel 1612 and front panel 1616 to the side panels 1620.

[0191] To assemble the animal containment unit 1600, a user will first assemble the side panels 1620 to the base panel 1608. Next, the top panel 1624 is assembled to the side walls 1620. Finally, the rear panel 1612 and front panel 1616 are positioned and bolted to the side panels 1620.

[0192] Turning to Figs. 62-74, another exemplary animal containment unit 1700 is shown. The animal containment unit 1700 in this embodiment can include a continuous frame 1704. The continuous frame 1704 can be a single continuous monolithic structure or can be comprised of multiple sections connected together. In the illustrated example, the continuous frame 1704 includes two spaced-apart base portions 1708 and front and rear portions 1712 and 1716 extending from opposite sides of the base portions 1708. Each of the front and rear portions 1712 and 1716 comprise generally u-shape structures extending between the base portions 1708. The continuous frame 1704 may be further reinforced by additional structural features, for example the crossbar 2124 shown in FIGS. 93-95. Like the above-described animal containment units, the animal containment unit 1700 includes panels secured to the frame 1704 defining an interior for containing an animal, a door for accessing the interior, handles for manipulating the animal containment unit 1700, etc.

[0193] A base 1720 of the animal containment unit 1700 in embodiments may support a load leg 1724 that is movable between a stowed and a deployed position as shown in Figs. 63 and 64. The load leg 1724 is configured to contact a rear-facing surface, such as a seatback 1728, of an

interior of a vehicle to transfer impact forces to the vehicle. The load leg 1724 includes a stationary frame 1732 rigidly mounted to the base 1728. The stationary frame 1732 includes two parallel tubular members 1736 that are connected by a structural tube 1740 extending therebetween. The stationary frame 1732 can be a welded structure that is riveted or otherwise secured to the frame 1704 of the animal containment unit 1700. A translating frame 1744 of the load leg 1724 comprises two parallel tubular members 1748 and a structural cross tube 1752 extending between them. The two tubular members 1748 of the translating frame 1744 are sized to fit inside the tubular members 1736 of the stationary frame 1732. Locking mechanisms 1756 lock the translating frame 1744 to the stationary frame 1732 in at least the deployed position such that collision forces can be transferred from the translating frame 1744 through the locking mechanisms 1756 to the stationary frame to the frame 1704.

[0194] Each locking mechanism 1756 is supported in a respective one of the tubular members 1748 and configured to selectively engage a recess 1760 in the base 1720. The locking mechanisms 1756 comprise a pivoting lock 1762, an actuator 1764, and an end cap 1766. The actuator 1764 is received in a slot 1768 on the pivoting lock 1762 and coupled thereto. The end cap 1766 is received over a boss 1770 on pivot axis PA of the pivoting lock 1762 to create a locking mechanism sub-assembly 1772. The sub-assembly 1772 is slid into the translating frame tube 1748 and connected to the tube 1748 by a rivet 1774 through the pivot axis PA of the pivoting lock 1762. Between the pivoting lock 1762 and the end cap 1766 a spring 1776 biases the pivoting lock 1762 to a locked position whereat a protrusion 1777 of the pivoting lock 1762 is received in the recess 1760. When assembled, an actuation member 1778 of the actuator 1764 aligns with an opening 1780 in the tube 1748, allowing the user to actuate the locking mechanism 1756 by sliding the activation member 1778. When the user slides the actuation member 1778 back, the actuator 1764 forces the pivoting lock 1762 to rotate to an unlocked position (e.g., disengage from recess 1760). The user can now move the load leg 1724 to the stowed position. When stowed, the load

leg locking mechanism 1756 temporarily locks into a recess 1782 on the interior frame of the base 1720. The load leg 1724 can be pulled outwards to from the stowed position without use of the actuator 1764 as a leading surface of the protrusion 1777 is angled to allow the pivoting lock 1762 to pivot upwardly in response to a force applied to deploy the load leg 1724. The load leg 1724 is configured to telescope underneath a floor panel of the animal containment unit 1700.

[0195] Figs 75A-81 illustrate another exemplary animal containment unit 1800 with strap connections for anchoring the unit. In the illustrated embodiment, the containment unit 1800 has six strap connection locations, symmetric about the center plane. The strap connection locations include four side strap connection points SS and two upper strap connection points US. The side strap connection points SS of the illustrated embodiment are used with anchor points AP on the floor or walls of the cargo area of the vehicle. The upper strap connection points US of the illustrated embodiment are used with the upper anchor points UAP described later. The upper anchor connection points UAP are generally located at an intersection between the roof and hatch of the vehicle, and may be generally considered to be another embodiment of an exterior anchoring point. It will be appreciated that a variety of strap configurations can be used, and that not all strap connection points may be used and/or the strap connection points can be coupled to other anchor points depending on a particular installation. For example, in Fig. 75B rear straps are not utilized and the upper strap connection points US are coupled to an exterior anchoring point proximate to the roof of the vehicle, for example, an exterior panel (roof, liftgate, rear windshield) or a hinge H of the vehicle (see, for example, Figs. 82-85) with an adjustable strap 1808. The adjustable strap 1808 includes an adjustment mechanism 1812 for adjusting a length of the strap 1808. In various embodiments, connectors such as carabiners 1816 are also provided for quick connection/disconnection of the adjustable straps 1808 to the connection points US, SS. In Fig. 75C, upper straps are omitted. Any suitable securing straps, cables, etc. can be used for the adjustable straps 1808, including non-adjustable straps. The strap connection points SS and US on

the crate are made from flexible webbing material that is structurally anchored to the crate, such as to the frame. A user connects adjustable straps 1808 between the crate connection points SS, US and the anchor points AP on the vehicle. The flexible connection points on the crate make easy attachment points for the adjustable straps and allow the anchor-strap-connection system to be more flexible for different vehicle anchor locations. In FIG. 75C, only the side strap connection point SS are utilized.

[0196] In the embodiment of Figs. 78 and 79, the strap connection points SS and US comprise a webbing loop 1820 that is extendable away from the containment unit 1800 and is biased towards a stored position within the containment unit. The webbing loop 1820 is wrapped around or otherwise secured to a structural pin 1824 of the animal containment unit 1800. A plug 1828 is connected to one end of the loop 1820 and a biasing member 1832 (e.g., an elastic strap, spring, or the like) is connected to the other end of the loop 1820. When a user pulls the strap connection point SS/US out to attach the vehicle straps, the biasing member 1832 stretches. When the user releases the strap connection point SS/US, the biasing member 1832 pulls the strap connection point SS/US back to the stored position. The plug 1828 is configured to fit generally flush with the outer surface of the animal containment unit 1800 in the stored position, and may be pulled by a user to extend the strap connection point to allow for connection to vehicle straps. It should be appreciated that in some embodiments, some of the strap connection points SS/US may not include a biasing member 1832. The strap connection points SS and US are associated with the sides and upper portions of the animal containment unit 1800 but could also be provided in different positions on the animal containment unit 1800. In embodiments, the strap connection points SS and US are directly coupled to a structural component of the containment unit 1800 (such as the continuous frame 1704 or the crossbar 2124) so that, during a crash event, the containment unit 1800 remains anchored in the cargo area of the vehicle.

[0197] Turning to Figs. 86-90, an embodiment of an external pod 1900 configured to mount to an exterior of the vehicle is shown. The external pod 1900 is adapted to provide an anchor point for securing a strap between an animal containment unit and the anchor point 1900. The external pod 1900 includes a webbing loop 1904 that extends through a vehicle hatch (or other opening) into an interior of the vehicle. A user connects this webbing loop 1904 to, for example, an upper strap connection point US using an adjustable vehicle strap (e.g., strap 1808) or the like. In the event of a crash, the force through the strap tries to pull the pod 1900 through the jamb of the vehicle hatch. The webbing loop 1904 is attached to a rigid steel structure that is larger than the jamb and won't be able to pull through, thereby keeping the animal containment unit held back. The external pod 1900 cooperates with a vehicle mounting pad 1910. The vehicle mounting pad 1910 can include adhesive on the underside that is used to affix it to a body panel of the vehicle. A user then connects the external pod 1900 to the vehicle mounting pad 1910 and fishes the webbing loop 194 through the door jamb to the interior of the vehicle. When the user installs the animal containment unit in the vehicle, they connect an adjustable vehicle strap (e.g., strap 1808) between the upper strap connection point US and the webbing loop 1904 from the external pod 1900. Since the external pod 1900, through the vehicle mounting pad 1910, is connected to the vehicle, the user can add tension to the adjustable strap.

[0198] In Figs. 89-92, an exemplary animal containment unit 2000 includes wheels 2004 for transporting the animal containment unit 2000. The wheels 2004 are located adjacent to a side of a base 2008 of the animal containment unit 2000. A handle 2012 extends from an opposite side of the base 2008. Anti-skid pads 2016 are located inwardly from the wheels 2004 and handle 2012. When the handle 2012 is used to tilt the animal containment unit 2000 (FIG. 90), the wheels 2004 contact the ground or other supporting surface as the remainder of the base 2008 is elevated allowing the animal containment unit 2000 to be rolled. With reference to Figs. 91 and 92, each wheel 2004 is mounted on an axle 2020 adapted to be received in a wheel bracket 2024 of the base

2008. A wheel cover 2028 is secured over the wheel 2004. In the illustrated embodiment, the wheel bracket 2024 is rigidly and directly secured to the continuous frame 1704 at an opening in the continuous frame. The bracket 2024 provides sufficient strength to maintain the structural integrity of the continuous frame 1704,

[0199] In some embodiments, internal webbing is provided for distributing impact loads on an impact panel of an animal containment unit to the frame or other structural components of the animal containment unit. In Figs. 93-95, for example, an animal containment unit 2100 is illustrated including internal webbing 2104 attached to a frame element 1712/1716 of the continuous frame 1704. The internal webbing 2104 extends across the animal containment unit 2100 between a front panel 2108 of the animal containment unit 2100 and an impact panel of the animal containment unit 2100 (impact panel not shown in Figs. 93-95). In this manner, the internal webbing 2104 has a high tensile strength that is suitable to distribute loads during an impact event while having significantly lower weight and taking up less space than rigid frame elements.

[0200] The animal containment unit 2100 of the illustrated embodiment includes brackets 2112 welded or otherwise secured to the frame 2108. The brackets 2112 include a connection point 2116 for the internal webbing 2104 and a connection point 2120 for attaching a side strap for connection to a vehicle anchor point, for example the side strap connection point SS shown in FIGS. 75A-83. A structural crossbar 2124 spans between respective brackets 2112. The crossbar 2124 is rigidly connected to the rigid frame 1704 such that they may be collectively be considered the frame of the containment unit, and may be considered rigid structural elements of the containment unit. The arrows in Fig. 93 illustrate the distribution of loads during a crash event. Accordingly, various components (such as anchoring vehicle straps and/or internal webbing 2104) are directly anchored to a rigid structural element of the containment unit 2100.

[0201] Turning to Figs. 96-101, another exemplary animal containment unit 2200 is illustrated. The animal containment unit 2200 includes openings 2204 on the top and/or sides for ventilation and/or viewing. The opening 2204 can have various shapes and/or sizes. The animal containment unit 2200 includes a handle 2208. The handle 2208 can be movable from a stowed configuration to a use configuration. The handle 2208 can be pivotably attached for pivoting movement between the stowed and use positions. A retention feature can be provided to retain the handle in the stowed and/or use positions. The retention feature can include a magnet.

[0202] The animal containment unit 2200 includes a door 2220 having a handle 2224. The handle 2224 is operatively coupled to two spaced-apart latches 2228 by a linkage 2232 adapted to releasably engage structure of the animal containment unit 2200 to secure the door 2224 in a closed position.

[0203] Fig. 102 illustrates a latch 2228 in three different positions (a), (b) and (c). Each latch 2228 includes a pawl 2236 mounted for rotation between a latched position (a) whereat the pawl 2236 is engaged with a striker 2240 and an unlatched position (c) whereat the pawl 2236 is disengaged from the striker 2240 (position (b) is an intermediate position between positions (a) and (c)).

[0204] When a user squeezes the handle 2224 on the door 2220, the linkage 2232 (which connects the left and right door latches 2228 together) will travel along a ramp 2244 disengaging it from a linkage slot 2248 of the pawl 2236. The pawl 2236 is spring-biased in the counter-clockwise direction in Fig. 102 such that when the linkage 2232 clears the pawl 2236, the pawl 2236 will rotate counter-clockwise thereby disengaging from the striker 2240 from striker slot 2252 at which point the door 2220 is unlatched and can be opened.

[0205] Upon closing the door 2220, a user (and/or a gas spring or the like) applies pressure to the door 2220 whereby the pawl 2236 is cause to rotate clockwise as the pawl 2236 is pressed against the striker 2240. The linkage 2232 and/or handle 2224 is biased towards the latched

configuration of position (a). Accordingly, as the door 2220 is pressed closed, the pawl 2236 rotates back to position (a) whereat the linkage 2232 is once again received by the pawl 2236.

[0206] The containment units of the present disclosure can be comprised of, for example, a base and one panel, a base and two panels, a base and three panels, a base and four panels, a base and five panels. In some embodiments, the containment units can comprise, for example, three panels and no base panel.

[0207] Although the disclosure may illustrate different embodiments, it is contemplated that aspects of individual embodiments may be combined or omitted. Therefore, the disclosure and claims are not intended to be limited to the illustrated embodiments.

[0208] While certain examples have been described, these examples are not intended to limit the scope of the inventions disclosed herein. Thus, nothing in the foregoing description is intended to imply that any particular feature, characteristic, step, module, or block is necessary or indispensable. Indeed, the novel methods and systems described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions, and changes in the form of the methods and systems described herein may be made without departing from the spirit of the inventions disclosed herein. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of certain of the inventions disclosed herein.

[0209] It will be appreciated by those skilled in the art that changes may be made to the embodiments described above without departing from the inventive concept thereof. It should further be appreciated that structural features and methods associated with one of the embodiments can be incorporated into other embodiments. It is understood, therefore, that this invention is not limited to the particular embodiment disclosed, but rather modifications are also covered within the scope of the present invention as defined by the appended claims.

[0210] It should be understood that the steps of the exemplary methods set forth herein are not necessarily required to be performed in the order described, and the order of the steps of such methods should be understood to be merely exemplary. Likewise, additional steps may be included in such methods, and certain steps may be omitted or combined, in methods consistent with various embodiments of the present invention.

[0211] Although the elements in the following method claims, if any, are recited in a particular sequence with corresponding labeling, unless the claim recitations otherwise imply a particular sequence for implementing some or all of those elements, those elements are not necessarily intended to be limited to being implemented in that particular sequence.

[0212] The words “inward,” “outward,” “upper,” and “lower” refer to directions toward or away from, respectively, the geometric center of the component.

[0213] It will be understood that reference herein to “a” or “one” to describe a feature such as a component or step does not foreclose additional features or multiples of the feature. For instance, reference to a device having, comprising, including, or defining “one” of a feature does not preclude the device from having, comprising, including, or defining more than one of the feature, as long as the device has, comprises, includes, or defines at least one of the feature. Similarly, reference herein to “one of” a plurality of features does not foreclose the invention from including two or more of the features. For instance, reference to a device having, comprising, including, or defining “one of a protrusion and a recess” does not foreclose the device from having both the protrusion and the recess.

CLAIMS

What is claimed is:

1. An animal containment system for installation in an interior cargo area of a vehicle, the animal containment system comprising:
 - an animal containment unit configured to contain an animal; and
 - at least one strap assembly including a first strap extending from the animal containment unit;
 - wherein the strap assembly includes at least one mounting device configured to engage an exterior portion of the vehicle to restrain movement of the animal containment unit.
2. The animal containment system of claim 1, wherein the strap assembly further includes a strap retractor that allows extension and retraction of the first strap to adjust a length of the first strap.
3. The animal containment system of claim 2, wherein the strap retractor is configured to maintain a length of the first strap when a shock load is applied to the first strap.
4. The animal containment system of claim 1, wherein the first strap is a retractable strap connector.
5. The animal containment system of claim 4, wherein the first strap is biased toward a stowed position within the animal containment unit.
6. The animal containment system of claim 5, wherein the first strap includes a plug configured to sit flush with a panel of the animal containment unit when the first strap is in the stowed position.

7. The animal containment system of claim 1, wherein the mounting device is configured to mount to an exterior anchoring point of the vehicle being at least one of: a vehicle rear door panel, a vehicle door hinge, a vehicle corner panel, a vehicle side panel, a vehicle roof, a vehicle bumper, a vehicle tow hitch component, or a vehicle frame member.
8. The animal containment system of claim 1, wherein the strap assembly is removably attachable to the animal containment unit, whereby the strap assembly can remain mounted to the vehicle when the animal containment unit is removed from the interior cargo area.
9. The animal containment system of claim 1, further comprising at least one movable load leg movably connected to the animal containment unit, the at least one movable load leg adapted to engage a surface of the vehicle;
wherein the movable load leg is movable between a retracted position and an extended position.
10. The animal containment system of claim 9, wherein the at least one movable load leg is adapted to engage a ceiling of the vehicle.
11. The animal containment system of claim 9, wherein the at least one movable load leg is adapted to engage a seatback of a vehicle.
12. An animal containment system for installation in an interior cargo area of a vehicle, the animal containment system comprising:

an animal containment barrier configured to contain an animal within the interior cargo area; and

a strap assembly for securing the animal containment barrier;

wherein the strap assembly includes one or more mounting devices configured to engage an exterior surface of the vehicle.

13. A method of assembling an animal containment unit, comprising:

attaching first and second side panels to a base panel;

attaching a top panel to the side panels;

attaching a rear panel to the top panel and the base panel by sliding two or more stubs of the rear panel into corresponding receivers of the top panel and the base panel;

attaching a front panel to the top panel and the base panel by sliding two or more stubs of the front panel into corresponding receivers of the top panel and the base panel; and

fastening a securement mechanism to secure at least two panel together.

14. The method of claim 13, wherein the securement mechanism includes a latch assembly.

15. The method of claim 14, wherein the latch assembly includes a rod associated with a first panel and a latch member including a latch arm associated with a second panel, and wherein the latch arm is configured to engaged the rod to secure the panels first and second panels together.

16. The method of claim 15, wherein fastening the securement mechanism includes rotating the latch arm of the latch member over center.

17. The method of claim 13, wherein the fastening a securement mechanism includes installing a fastener.
18. A cam bolt assembly for securing first and second panels of an animal containment unit comprising:
- a cam plate having a cam surface and being supported on the first panel;
 - a slotted hole extending through the cam plate and first panel
 - a threaded bore in the second panel; and
 - a fastener;
- wherein the fastener extends through the cam plate and the first panel and is received in the threaded bore of the second panel; and
- wherein a head of the fastener impinges upon the cam surface during tightening of the fastener resulting in sliding relative movement between the first and second panels in a direction perpendicular to a central axis of the threaded bore.
19. An animal containment system for installation in a vehicle, the animal containment system comprising:
- an animal containment unit configured to contain an animal;
 - at least one load leg movably connected to the animal containment unit, the at least one movable load leg adapted to engage a surface of the vehicle;
 - wherein the load leg is movable between a retracted position and an extended position.
20. The animal containment system of claim, wherein the movable load leg is biased towards the extended position .

21. The animal containment system of claim 19, wherein the at least one movable load leg is telescopically movable between the retracted position and the extended position.

22. The animal containment system of claim 19, further comprising a first biasing member for biasing the at least one movable load leg towards the extended position.

23. The animal containment system of claim 22, further comprising a second biasing member for biasing the at least one movable load leg towards the extended position, the second biasing member capable of applying a greater biasing force to the at least one movable load leg than the first biasing member.

24. The animal containment system of claim 23, wherein the first biasing member applies a continuous biasing force to the at least one movable load leg and the second biasing member only applies biasing force to the at least one movable load leg in response to a shock load being applied to the at least one movable load leg.

25. The animal containment system of claim 19, wherein the at least one movable load leg is rotatably movable between the retracted position and the extended position.

26. The animal containment system of claim 19, further comprising a base and a plurality of panels defining a containment volume above the base, wherein the at least one movable load leg extends from the base.

27. The animal containment system of claim 19, further comprising a door, wherein the at least one movable load leg extends away from a side of the animal containment unit including the door to engage a vehicle liftgate.

28. The animal containment system of claim 19, further comprising a door, wherein the at least one movable load leg extends away from a side of the animal containment unit not including the door to engage either a vehicle seatback or a vehicle ceiling.

29. The animal containment system of claim 28, wherein the movable load leg extends from a top of the animal containment unit.

30. The animal containment system of claim 29, wherein the movable load leg is pivotably attached to the top of the animal containment unit.

31. The animal containment system of claim 30, wherein the movable load leg includes a telescoping section.

32. The animal containment system of claim 19, further comprising at least one strap assembly including a first strap extending from the animal containment unit;
wherein the strap assembly is configured to engage the vehicle to restrain movement of the animal containment unit.

33. The animal containment system of claim 32, wherein the strap assembly is configured to engage an exterior anchoring point of the vehicle.

34. The animal containment system of claim 33, wherein the strap assembly includes at least one mounting device configured to engage an exterior surface of the vehicle.

35. An animal containment system for installation in a vehicle, the animal containment system comprising:

an animal containment unit including a base panel and at least one panel defining a containment volume above the base panel; and

a strap assembly fixed to the animal containment unit, the strap assembly having a first strap extending from the animal containment unit, a second strap configured to extend rearward toward a tailgate of the vehicle, the strap assembly including a distal mounting pod configured to mount to an exterior portion of the vehicle and configured to connect to the second strap;

wherein the strap assembly is configured to shorten the second strap after the distal mounting pod is attached to the vehicle exterior, and

wherein the second strap is configured to pass through a door jamb of the vehicle tailgate when the tailgate is closed.

36. The animal containment system of claim 35, wherein the strap assembly includes a retraction pod located intermediate the distal mounting pod and the animal containment unit.

37. An animal containment system for installation in a cargo area of a vehicle comprising:

an animal containment unit having two or more sidewalls extending from a base panel; a strap for attaching the animal containment unit to a vehicle; and

a strap mounting assembly on one of the sidewalls, the strap mounting assembly comprising a housing and a buckle insertable into the housing, the buckle movable in the housing from an insertion position to an engaged position;

wherein, in the engaged position, the buckle is rotatable about approximately 180 degrees while the strap is engaged with the vehicle.

38. The animal containment system of claim 37, wherein the buckle includes a protrusion adapted to be received in a tapered slot of the housing.

39. The animal containment system of claim 38, wherein the housing includes a magnet for retaining the protrusion in the engaged position.

40. The animal containment system of claim 39, wherein the housing includes a cover for closing the tapered slot when the protrusion is not received therein, the cover being pivotable and biased towards a closed position.

41. The animal containment system of claim 40, wherein, when the protrusion is inserted in the tapered slot, the cover urges the protrusion towards the engages position of the buckle.

42. The animal containment system of claim 37, further comprising a third panel and a low-friction surface on the third panel, wherein the low-friction surface is engageable with a support surface when the animal containment unit is tilted toward the third panel.

43. The animal containment system of claim 37, further comprising a handle on a first of the two or more sidewalls and at least one wheel on a second of the two or more sidewalls, wherein the at least one wheel is engageable with a support surface when the animal containment unit is lifted via the handle.

44. An animal containment unit for installation in a vehicle, the containment unit comprising:
- a base;
 - at least one side panel extending upward from the base and having a thickness; and
 - a front panel extending upward from the base, the front panel comprising an exterior panel and an inner impact panel resulting in a greater thickness in the front panel than in the at least one side panel.
45. The animal containment unit of claim 44, the front panel further comprising at least one intervening structure between the exterior panel and the inner impact panel.
46. The animal containment unit of claim 44, further comprising at least one movable load leg movably connected to the animal containment unit, the at least one movable load leg adapted to engage a surface of the vehicle;
- wherein the movable load leg is movable between a retracted position and an extended position.
47. The animal containment unit of claim 44, wherein the at least one movable load leg is adapted to engage a ceiling of the vehicle.
48. The animal containment unit of claim 44, wherein the at least one movable load leg is adapted to engage a seatback of a vehicle.
49. The animal containment unit of claim 44, wherein the load leg is retractable into the base of the animal containment unit.

50. The animal containment unit of claim 49, wherein the load leg includes a translating frame telescopically received in a stationary frame mounted to the base.
51. The animal containment unit of claim 50, further comprising at least one locking mechanism for locking the telescoping frame against movement relative to the stationary frame.
52. The animal containment unit of claim 51, wherein the at least one locking mechanism includes a pivoting lock.
53. The animal containment unit of claim 52, wherein the pivoting lock is movable between engaged and disengaged positions.
54. The animal containment unit of claim 53, wherein an actuator is coupled to the pivoting lock, the actuator being linearly movable to move the pivoting lock between engaged and disengaged positions.
55. The animal containment unit of claim 54, wherein the pivoting lock is biased towards the engaged position.
56. The animal containment unit of claim 44, further comprising at least one strap assembly including a first strap extending from the animal containment unit;
wherein the strap assembly is configured to engage the vehicle to restrain movement of the animal containment unit.

57. The animal containment unit of claim 56, wherein the strap assembly is configured to engage an exterior anchoring point of the vehicle.
58. The animal containment unit of claim 57, wherein the strap assembly includes at least one mounting device configured to engage an exterior surface of the vehicle.
59. An animal containment system for installation in a cargo area of a vehicle comprising:
an animal containment unit having two or more sidewalls extending from a base panel;
and
a plurality of strap connection points for securing the animal containment unit to anchor points of a vehicle.
60. An animal containment system for installation in a cargo area of a vehicle comprising:
a containment structure having a rigid structural component; and
at least one strap connection point for securing the animal containment unit to a vehicle anchor point;
wherein the at least one strap connection point is movable between a stowed position and a deployed position, the at least one strap connection point including:
a first strap, and
a plug secured to the first strap;
wherein the first strap is secured to the rigid structural component of the containment structure; and
wherein the plug conceals the first strap when the strap connection point is in the stowed position.

61. The animal containment system of claim 60, further comprising a resilient member that biases the strap connection point to the stowed position.
62. The animal containment system of claim 60, wherein the first strap comprises a loop of webbing.
63. An anchor for an exterior of a vehicle comprising:
a pod including a mount for securing a strap; and
a mounting pad securable to a surface of an exterior of a vehicle;
wherein the pod is selectively mountable to the mounting pad.
64. The anchor of claim 63, wherein the pod is comprised of a metal material.
65. The anchor of claim 63, wherein the mount includes a webbing loop configured to pass through a threshold of a vehicle door.
66. An animal containment unit comprising:
a door;
a latch mechanism for the door, comprising:
a striker,
a handle actuator on the door, the handle being operatively coupled to a linkage,
the linkage being selectively engageable with a pawl,
the pawl being rotatable and selectively engageable with the at least one striker to secure the door in the closed state;

wherein actuation of the handle releases the linkage from the pawl allowing the pawl to rotate to a position to release the striker thereby allowing the door to open.

67. The animal containment unit of claim 66, wherein the pawl is biased towards the position to release the striker.

68. The animal containment unit of claim 66, wherein the handle is biased towards engagement of the linkage with the pawl.

69. The animal containment unit of claim 66, wherein the linkage is guided by a ramp during movement.

70. The animal containment unit of claim 66, wherein the pawl automatically engages the striker when the door is closed.