vehicles such as at the edges of plates result in bending about a localized pivot point during an explosion.

[0005] Recognizing these and other problems, manufactures have attempted to develop alternative blast-protection schemes. Many of those alternative schemes have, unfortunately, proven inefficient and unworkable. For example, increasing the thickness of the hull or raising the hull height can improve a vehicle's performance when an explosion occurs. However, these design changes— increasing thickness and raising height— create other problems: they reduce a vehicle's mobility and payload and reduce the available stroke for mitigating the black shock which affects occupant survivability.

[0006] These are just a few known problems with existing vehicle designs.

Summary of the Embodiments

[0007] In an exemplary embodiment, a blast-resistant structure for the hull of a land vehicle having a vehicle centerline is disclosed. The blast-resistant structure comprises ~~a base, two vertex structures, each vertex structure being defined by an inside and outside wall, and a concave structure having at least one substantially flat surface, wherein the concave structure is defined in part by the inside wall of each vertex structure~~two vertex structures, each vertex structure having a planar inner wall joined to a planar outer wall along a bottom edge thereof to form an apex line along a longitudinal length of the vehicle, the outer wall extending upwardly and outwardly from the apex and the inner wall extending upwardly and inwardly from the apex; and a downwardly concave structure connecting and being supported by the inner walls, the concave structure having a substantially flat horizontal upper portion and being symmetric about a structure centerline that is coplanar with the vehicle centerline; wherein the vertex structures and the concave structure are collectively configured so that when the blast-resistant structure is subjected to an explosion between the two vertex structures, a shockwave resulting from the explosion will impact the inner wall of each vertex structure before impacting the substantially flat horizontal upper portion of the concave structure, causing horizontal deformation of the inner walls of the vertex structures producing a downward force on the substantially flat horizontal upper portion of the concave structure.

[0008] In another exemplary embodiment, a structure for a vehicle is disclosed. The structure comprises a first wall being designed to deflect in a direction away from the bottom of the structure, a second wall being designed to deflect in a direction away from the bottom of the structure, and a third wall being designed to deflect in a direction towards the bottom of the structure as a result of the first and second wall deflecting away from the bottom of the structure.

~~What is claimed is:~~

1. A structure for the hull of a vehicle, the structure comprising:

a base, comprising:

two vertex structures, each vertex structure being defined by an inside and outside wall; and

a concave structure having at least one substantially flat surface;

wherein the concave structure is defined in part by the inside wall of each vertex structure.

2. The structure of claim 1, wherein the base, when subjected to an explosion between the two vertex structures, deforms along at least one inside wall to create a downward force on the at least one substantially flat surface of the concave structure.

3. The structure of claim 2, wherein the downward force created by the deformation of the inside wall counteracts an upward force from the explosion on the concave structure.

4. The structure of claim 1, wherein the two vertex structures extend substantially along the length of a vehicle.

5. The hull of claim 1, wherein the two vertex structures have an apex angle of about 30° to about 110°.

6. The hull of claim 1, wherein the two vertex structures are oppositely located near the quarter-line of the structure relative the width.

7. The hull of claim 1, wherein the concave structure is configured and dimension to receive the driveshaft and differentials of a vehicle.

8. The hull of claim 1, wherein a floor is disposed inside of the structure above the concave structure.

9. The hull of claim 1, wherein the hull comprises steel, ballistic steel, metal alloy, or ballistic metal alloy, or a combination thereof.

10. A structure for a vehicle, the structure comprising:

a first wall, the first wall being designed to deflect in a direction away from the bottom of the structure;

a second wall, the second wall being designed to deflect in a direction away from the bottom of the structure; and

a third wall, the third wall being designed to deflect in a direction towards the bottom of the structure as a result of the first and second wall deflecting away from the bottom of the structure.

11. The structure of claim 10, wherein the first, second, and third wall extend substantially along the entire length of a vehicle's hull.

12. The structure of claim 10, wherein the first wall is further designed to deflect in a direction towards a side of the structure.

13. The structure of claim 10, wherein the second wall is further designed to deflect in a direction towards a side of the structure.

14. The structure of claim 10, wherein the first, second, and third walls are connected.

15. The structure of claim 14, wherein the structure comprises a first vertex structure and a second vertex structure.

16. The hull of claim 15, wherein the two vertex structures have an apex angle of about 30° to about 110°.

17. The hull of claim 15, wherein the two vertex structures have an apex angle of about 45° to about 90°.

18. The structure of claim 15, wherein the first and second vertex structures are configured to define a concave structure therebetween.

19. The structure of claim 18, wherein the third wall is part of the concave structure and substantially flat.

20. The structure of claim 10, wherein internal reinforcements are configured such that the first, second, and third wall will deflect in the designed way when subjected an explosive load.

What is claimed is:

1. A blast-resistant structure for the hull of a land vehicle having a vehicle centerline, the structure comprising:

two vertex structures, each vertex structure having a planar inner wall joined to a planar outer wall along a bottom edge thereof to form an apex line along a longitudinal length of the vehicle, the outer wall extending upwardly and outwardly from the apex and the inner wall extending upwardly and inwardly from the apex; and

a downwardly concave structure connecting and being supported by the inner walls, the concave structure having a substantially flat horizontal upper portion and being symmetric about a structure centerline that is coplanar with the vehicle centerline;

wherein the vertex structures and the concave structure are collectively configured so that when the blast-resistant structure is subjected to an explosion between the two vertex structures, a shockwave resulting from the explosion will impact the inner wall of each vertex structure before impacting the substantially flat horizontal upper portion of the concave structure, causing horizontal deformation of the inner walls of the vertex structures producing a downward force on the substantially flat horizontal upper portion of the concave structure.

2. A blast resistant structure according to claim 1, wherein an apex angle between the inner and outer walls of each vertex structure is in a range of 30° to 110°.

3. A blast resistant structure according to claim 1, wherein an apex angle between the inner and outer walls of each vertex structure is in a range of 45° to 90°.

4. A blast resistant structure according to claim 1,
wherein the outer walls each have an upper edge, a distance between the upper edges of the outer walls defining a hull width, and

wherein at least one of the apex lines is spaced inwardly from one of the upper edges by one quarter of the hull width.

5. A blast resistant structure according to claim 4 wherein the upper edge of each outer wall is connected to a sponson that extends outwardly therefrom.

6. A blast resistant structure according to claim 5 wherein the sponson and the outer wall are formed from a single sheet of material.

7. A blast resistant structure according to claim 5 wherein the sponson comprises a substantially horizontal planar member.

8. A blast resistant structure according to claim 1, wherein the horizontal upper portion of the concave structure is higher than an axle of the vehicle and the apex lines are lower than the axle of the vehicle.

9. A blast resistant structure according to claim 8 wherein each of the inner and outer walls has a passage formed therethrough, the passage being configured to receive a portion of the axle, the passages being collectively configured to allow the axle to pass from one side of the vehicle to the other.

10. A blast resistant structure according to claim 9 wherein each passage is funned as a notch extending through the bottom edge of the inner or outer wall in which the passage is formed.

11. A blast resistant structure according to claim 1 further comprising for each vertex structure:

a weld joining the inner wall to the outer wall along the apex line; and

an elongate cap overlying a longitudinal length of the weld.