A disaster shelter and disaster shelter system. The disaster shelter includes a substantially hollow shelter cell having an interior and an exterior. The shelter cell is made up of three parts; a shelter body, an end cap section and an entranceway section. The shelter body is made up of a plurality of cell sections, each having a substantially identical double elliptical toroid shape, with the endmost cell sections forming an entrance end and a cap end respectively. The end cap section is joined to the cap end of the shelter body an entranceway section is joined to the entrance end of the shelter body. An entranceway is attached to the entranceway section of the shelter cell.
FIG. 7
DISASTER SHELTER AND SHELTER SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates to the field of disaster shelters and, in particular, to prefabricated disaster shelters and disaster shelter systems that assembled at a remote location.

BACKGROUND OF THE INVENTION

[0002] In spite of a large amount of misinformation that has been presented to the public, there is convincing scientific and technical information available that it is possible for most people to survive a full-scale exchange of nuclear weapons, provided that proper advance preparations are made.

[0003] It is acknowledged that there would be little incentive for an individual to survive such a nuclear holocaust if, as a result, all life on earth were doomed to extinction or marginal existence. However, the National Academy of Sciences (NAS) has produced extensive reports on the atmospheric effects from various war scenarios, which contradict any such idea. In reality, therefore, the question today is not whether persons can survive a nuclear holocaust, but whether people have the will and determination to prepare for survival.

[0004] Some efforts have been made to prepare shelters capable of providing some degree of protection in the event of a nuclear blast or multiple detonations. Most such shelters were designed to afford a measure of protection from fallout. However, these fallout shelters provide no blast protection, nor do they protect against any number of other surface effects, such as a burst of nuclear radiation, the fireball which can reach millions of degrees Fahrenheit, thermal radiation transmitted from the fireball, fire storms produced by the thermal radiation, pressure waves (both under and over pressure), and blast wind.

[0005] A number of underground disaster shelters have been developed to overcome the problems attendant to traditional fallout shelters. The typical backyard, or personal, shelter has the capability of providing shelter for a small number of people, such as a family unit and incorporates features to protect its occupants against some of the effects of nuclear weapons. These shelters have traditionally been built on-site, in a manner similar to “stick” construction of a home. Unfortunately, this method provides a number of drawbacks.

[0006] First, with shelters built on site, cost overruns are the rule, not the exception. Many well-intentioned handymen and contractors have constructed shelters that ended up running well over budget and still did not produce an operable shelter. When a shelter is built on site, you really don’t know what you will end up with.

[0007] Second, shelters built on site require extensive, time consuming, and expensive research to develop a “shelter system” capable of providing dependable life support-fresh filtered air, blast protection, clean water, light, corrosion resistance, toilet facilities, air filtration for radioactive fallout, chemical and biological agents, etc. Even good architects or mechanical and civil engineers, do not have the expertise to develop a good dependable shelter system especially when it must function without local electricity.

[0008] Third, concrete shelters built on site, and shelters requiring concrete foundations, are not able to be excavated and re-installed at another location and they are very hard to make waterproof, especially under the floor.

[0009] Fourth, steel shelters have a number of specific problems attendant to them. In particular, they may require registration because its intended use is for storage of petroleum and/or chemical products; a horizontal cylinder is a poor structural shape because it behaves as flexible conduit; it must also be cathodically protected or fiberglass coated; and steel underground structures suffer from condensation on the inside walls.

[0010] Fifth, shelters built on site require a building permit and confirmation by a local professional engineer because it involves actual construction, including a septic design.

[0011] Finally, shelters built on site often require many days or weeks to complete construction. During this time, children are exposed to the danger of falling in the hole and curiosity seekers are afforded ample time to see what is being constructed.

[0012] In order to overcome the problems of site-built shelters, the inventor has developed a number of different prefabricated shelters and shelter systems. One of the first such systems is disclosed in U.S. Pat. No. 4,660,334, issued on Apr. 28, 1987, which is incorporated herein by reference. In this patent, the inventor of the current invention describes a shelter capable of producing survival for its occupants during and after one or more nuclear blasts. Such a shelter is capable of withstanding large doses of neutrons and gamma radiation, ground shock, and substantial over pressures, as well as a variety of other conditions, both short and long term, enumerated in my patent.

[0013] In U.S. Pat. No. 5,115,613 issued on May 26, 1992, also incorporated herein by reference, the inventor of the current invention describes an improved shelter having an enhanced ability to resist the blast effect resulting from the detonation of a nuclear device. The shape of this shelter was rendered more compact and less expensive to manufacture and install than that of the shelter described in U.S. Pat. No. 4,660,334 and the construction of the connecting shaft below the command station was improved such that the system better absorbed the downward forces on the command station.

[0014] In U.S. Pat. No. 6,438,907, issued Aug. 27, 2002, also incorporated herein by reference, the inventor of the current invention describes a further improved shelter that includes an entranceway that includes an emergency escape manway and an entranceway that is joined to the shelter cell via a seismic joint that allows the entranceway to move relative to the shelter cell in any manner except translation.

[0015] Each of these patented shelters is effective at resisting a blast effect from the detonation of a nuclear or other explosive device, and allowing its occupants to survive such a blast. In addition, each may be sealed to prevent intruders from flushing out the occupants with gasoline, water, fire, etc., and each protects against the use of a vehicle to force open the hatch. Further, as the inventor has continually sought to improve these products, each shelter has improved upon the prior one.

[0016] In the time since the development of the shelter and entranceway disclosed by U.S. Pat. No. 6,438,907, the inventor has identified a number of areas in which the shelter and entranceway disclosed by U.S. Pat. No. 6,438,907, is lacking. First, the substantially hollow paraboloid shape of the shelter cell identified in this patent requires that a relatively large number of molds be used during manufacture. This vastly complicates the manufacturing process and effectively restricts the size of the shelter to the size that may be manu-
factured using the existing molds. Second, the hollow para-baloid shape, can only be made in one piece to a maximum size limited by the maximum allowed shipping dimensions. Third, although the seismic joint disclosed in U.S. Pat. No. 6,438,907, allows for the entranceway to move relative to the shelter cell in any manner except translation, there are circumstances where movement in translation is required in order to protect this joint. For example, the seismic joint would need to move in translation when subjected to certain blast waves in certain soils, and especially in areas where the ground is under deep frost and the shelter is below the frost line. Fourth, the entranceway hatch disclosed in U.S. Pat. No. 6,438,907 is a hinged hatch that opens in an upward direction. Although a jack is provided to allow the hatch to be opened even if debris has fallen over it, extremely heavy objects may not be able to be lifted by such a jack and, in some cases, damage to the hinge may prevent operation thereof. Therefore, a hatch that does not open in such a manner would be desirable. Fifth, the use of an entranceway that runs straight downward make it difficult to carry supplies into the shelter especially with a backpack because it requires two hands to be on the ladder. Therefore, an entranceway design that allows both hands to be free when entering the shelter to carry supplies would be desirable. Finally, because the entranceway and shelter displace water, the entranceway and shelter are typically secured using a gravity dome and a cable attached from the dome to the entranceway and/or shelter cell. However, over time, the tension on typical cables can vary, resulting in excessive slack and/or excessive stress on shelter. Accordingly, a device that would allow this tension to be adjusted would likewise be desirable.

Therefore, there is a need for a disaster shelter for protecting shelterists during disasters such as tornadoes, storms, forest fires, power failures, nuclear power plant accidents, nuclear terrorism, and a full scale protracted nuclear, chemical, and biological war, that includes an entranceway that is impervious to intruders, that may be built remotely from the site where it is to be installed, that reduces the complexity of the manufacturing process, that allows a larger shelter to be manufactured and still be able to be shipped on the highway, that allows shelters of a variety of sizes by adjusting the length, that allows each cell to move independently allowing it to be made to have a length that is greater than 5 times the diameter without placing in a high risk of catastrophic failure, that allows for a significant amount of flexure making it substantially impervious to failure during larger seismic events, that includes a seismic joint that allows the entranceway to move relative to the shelter cell in any manner including translation, that includes an entranceway hatch that does not open upward, that includes an entranceway that reduces the amount of such radiation entering the shelter, and that includes a device that would allow tension on the cables securing the shelter to a gravity dome to be adjusted.

**SUMMARY OF THE INVENTION**

The present invention is a disaster shelter and disaster shelter system that overcomes the drawbacks of the prior art. In one embodiment of the invention, the disaster shelter includes a substantially hollow shelter cell in the shape of a double elliptical arch having an interior and an exterior. The shelter cell is made up of three parts: a shelter body, an end cap section and an entranceway section. The shelter body is made up of a plurality of cell sections, each having a substantially identical elliptical toroid shape, with the endmost cell sections forming an entrance end and a cap end respectively. The end cap section is joined to the cap end of the shelter body an entranceway section is joined to the entrance end of the shelter body. Finally, an entranceway is attached to the entranceway section of the shelter cell.

In the preferred embodiment, the entranceway is an elliptical entranceway attached in non-perpendicular relation to the shelter body such that it extends at an angle upward to the level of the ground. The preferred entranceway has a sliding hatch cover and an elliptical hatch dome ring having a slide pocket disposed therein. In such embodiments, the sliding hatch cover and the slide pocket of the hatch dome ring are each dimensioned to allow the sliding hatch cover to slide within, and be retained by, the slide pocket. A reduced friction material is preferably disposed upon one of the sliding hatch cover and the slide pocket. The reduced friction material is preferably PTFE, which has a substantially low coefficient of friction to allow the hatch cover to slide easily within the slide pocket. In order to allow the hatch cover to be moved when blocked by fallen debris, the preferred entranceway also includes an expanding rod removably attached to the hatch dome and the sliding hatch cover. The expanding rod is preferably a ratchet expanding rod having a ratchet mechanism and a handle, and is dimensioned to force the sliding hatch cover to slide within the slide pocket when the expanding rod is expanded.

The preferred disaster shelter also includes a seismic joint connecting the entranceway to the entrance section of the shelter cell. The preferred seismic joint is a triple axis seismic joint that is dimensioned to allow the entranceway to move in any direction relative to the shelter cell.

The preferred disaster shelter includes a floor, disposed within the shelter cell, which is not attached to the shelter cell. This is preferably accomplished by affixing a plurality of floor joint brackets attached to the interior of the shelter cell and laying a plurality of floor planks upon the floor joint brackets, which are disposed and dimensioned to support the plurality of floor planks.

The shelter cell of the preferred disaster shelter includes a bathroom having a mixing exhaust manifold in communication therewith. The mixing exhaust manifold is adapted to take in gases from both the bathroom and a remainder of the shelter cell and exhaust the gases from the shelter cell.

The preferred disaster shelter also includes an air filtration system disposed within the entranceway. The preferred air filtration system includes an air inlet pipe, a pre-filter, a gas agent test port, a HEPA filter, an ultraviolet light and a blower, wherein each of the pre-filter, gas agent test port, HEPA filter, and ultraviolet light are in fluid communication with the air inlet and the blower.

In another embodiment of the invention, the disaster shelter includes a substantially hollow shelter cell having an interior and an exterior and an entranceway, and a triple axis seismic joint that connects the substantially hollow shelter cell to the entranceway. In such embodiments, the triple axis seismic joint is dimensioned to allow the entranceway to move in any direction relative to the shelter cell.

The disaster shelter system of the present invention includes a substantially hollow shelter cell in the shape of a double elliptical arch having an interior and an exterior, an entranceway attached to the shelter cell, and an entranceway anchor attached to the entranceway via a cable. A cable ten-
tion adjuster is attached to the cable and is dimensioned to absorb shock imposed upon the entranceway. The preferred cable tension adjuster includes a substantially convex dome comprising a top half, a bottom half and a substantially flexible center donut plate. The center donut plate includes a first cable attachment, the bottom half includes a second cable attachment, and the top half includes an opening therethrough that is dimensioned to allow the cable to pass therethrough and attach to the first cable attachment.

[0026] In the preferred embodiment of the disaster shelter system, the shelter cell includes a toilet and the shelter system includes a leaching septic tank disposed a distance away from the shelter cell and in fluid communication with the toilet.

[0027] Therefore, it is an aspect of the invention to provide a disaster shelter that is capable of resisting a blast effect from the detonation of a nuclear or other explosive device, and allowing its occupants to survive such a blast.

[0028] It is a further aspect of the invention to provide a disaster shelter including an entranceway that is impervious to intruders.

[0029] It is a further aspect of the invention to provide a disaster shelter that prevents intruders from flushing out the occupants with gasoline, water, fire, etc.

[0030] It is a further aspect of the invention to provide a disaster shelter that protects against the use of a vehicle to force open the hatch.

[0031] It is a further aspect of the invention to provide a disaster shelter that has a low profile and may be easily concealed.

[0032] It is a further aspect of the invention to provide a disaster shelter that is fully fire resistant.

[0033] It is a further aspect of the invention to provide a disaster shelter that does not include exposed bolts that may be removed to provide ingress to intruders.

[0034] It is a further aspect of the invention to provide a disaster shelter that allows the air filtration and septic systems to be accessed from within the shelter.

[0035] It is a further aspect of the invention to provide a disaster shelter that may be assembled remotely from the site where it is to be installed.

[0036] It is a further aspect of the invention to provide a disaster shelter that reduces the complexity of the manufacturing process.

[0037] It is a further aspect of the invention to provide a disaster shelter that does not require a large number of molds to manufacture.

[0038] It is a further aspect of the invention to provide a disaster shelter that allows shelters of a variety of sizes to be manufactured using the same molds.

[0039] It is a further aspect of the invention to provide a disaster shelter that allows for a significant amount of flexure making it substantially impervious failure during larger seismic events.

[0040] It is a further aspect of the invention to provide a disaster shelter that includes a seismic joint that allows the entranceway to move relative to the shelter cell in any manner including translation.

[0041] It is a further aspect of the invention to provide a disaster shelter that includes an entranceway hatch that does not open upward.

[0042] It is a further aspect of the invention to provide a disaster shelter that includes an entranceway that allows both hands to be free when entering the shelter.

[0043] It is a still further aspect of the invention to provide a disaster shelter that includes a device that would allow tension on the cables securing the shelter to a gravity dome to be adjusted.

[0044] These aspects of the invention are not meant to be exclusive and other features, aspects, and advantages of the present invention will be readily apparent to those of ordinary skill in the art when read in conjunction with the following description, appended claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] FIG. 1 is a cut away side view of one embodiment of the disaster shelter of the present invention.

[0046] FIG. 2 is a cut away top view of the disaster shelter of the disaster shelter system of FIG. 1.

[0047] FIG. 2 is a cross sectional view taken across line A-A of FIG. 1A showing the interior of the disaster shelter.

[0048] FIG. 3 is an exploded isometric view of one embodiment of the entranceway of the present invention.

[0049] FIG. 4 is a top view of the preferred hatch dome ring and hatch cover of the present invention.

[0050] FIG. 5 is a cut away side view of the hatch dome ring, hatch cover and a portion of the entranceway.

[0051] FIG. 6A is a cut away side view of the hatch dome ring and hatch cover with the hatch cover in a closed position.

[0052] FIG. 6B is a cut away side view of the hatch dome ring and hatch cover of FIG. 6A with the hatch cover in a partially opened position.

[0053] FIG. 6C is a cut away side view of the hatch dome ring and hatch cover of FIGS. 6A and 6B with the hatch cover in a partially opened position.

[0054] FIG. 6D is a cut away side view of the hatch dome ring and hatch cover of FIGS. 6A, 6B and 6C with the hatch cover in a fully opened position.

[0055] FIG. 7 is a cut away side view of the preferred cable tension adjuster of the disaster shelter system of the present invention.

[0056] FIG. 8 is a side view of the preferred mixing exhaust manifold of the disaster shelter system of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0057] Referring first to FIGS. 1A, 1B and 2, one embodiment of the disaster shelter system 10 of the present invention is shown. The disaster shelter system 10 includes a disaster shelter 12 that is made up of substantially hollow shelter cell 14 and an entranceway 30 attached to the shelter cell 14.

[0058] The shelter cell 14 has an interior 15 and an exterior 16, and is made up of three parts; a shelter body 17 an end cap section 18 and an entranceway section 19. The shelter body 17 is made up of a plurality of cell sections, 24 each having a substantially identical double elliptical toroid shape, with the endmost cell sections 21 forming an entrance end 23 and a cap end 24 respectively. The end cap section 18 is joined to the cap end 23 of the shelter body 17 and the entranceway section 19 is joined to the entrance end 23 of the shelter body 17.

[0059] The shelter cell 17 and entranceway 30 are preferably made of structural fiberglass manufactured to underground storage tank standards of Underwriters Laboratory, American Society of Testing and Materials, and shelter engineering standards set forth in Walton W. McCarthy, M.E., PRINCIPLES OF PROTECTION, U.S. Handbook of NBC Weapon Fundamentals and Shelter Engineering Standards,
Fifth Edition, 2002. Fiberglass is preferred because of its extremely high resiliency and corrosion resistance plus its ability to be shaped into a structure having compound curves. The fiberglass design of the preferred shelter cell provides forty pounds per square inch of external pressure resistance, with no earth arching, which is constant over 100 years and does not have to be de-rated like steel each passing year due to corrosion. Fiberglass also forms a complete vapor barrier, which provides a dry atmosphere when placed below ground, and has proven to be sound in the underground storage tank industries. In addition, one of the greatest characteristics of fiberglass is its ability to “remain intact” if overstressed. The interior 15 of the shelter cell 17 is preferably smooth, curved, and white to create maximum brightness with minimal light, is easily cleaned with common detergents, and is easily repaired. Although fiberglass is preferred, it is recognized that the shelter cell 17 and/or entranceway 30 may be manufactured of different materials to achieve acceptable results.

The preferred shelter cell 17 is dimensioned to include more than four thousand cubic feet of interior space, with headroom of between ninety inches and one hundred and four inches from floor 25 to ceiling 27. This is preferred as it allows for normal living and a very spacious feeling. The preferred shelter cell also includes more than four hundred cubic feet of storage space under the floor 25 and more than one hundred and seventy cubic feet of storage under the lower bunks 26. Such storage is preferred to allow for the large amount of food and water necessary to sustain shelterists for extended periods of time following a disaster. Notwithstanding these preferred sizes, it is recognized that shelter cells 17 may be manufactured to a variety of different dimensions and that the invention should not be seen as being limited to the sizes set forth herein.

The preferred disaster shelter 12 includes a shelter floor 25, disposed within the shelter cell 17, which is not attached to the shelter cell 17. This is preferably accomplished by affixing a plurality of floor joint brackets 29 attached to the interior 15 of the shelter cell 17 and laying a plurality of floor planks 31 upon the floor joint brackets, which are disposed and dimensioned to support the plurality of floor planks 31. The preferred floor joint brackets 29 are manufactured of fiberglass, are shaped as shown in FIG. 2, and are attached to the interior 15 of the shelter cell 17 via fiberglass. Further the use of a plurality of independent floor planks 31 is preferred in order to allow shelterists to easily access items stored beneath the floor 25. However, it is recognized that other flooring systems may be utilized to achieve similar results.

As shown in FIGS. 1A and 1B, it is preferred that thirty 12-volt deep-cycle sealed batteries 35 be stored in under the floor 25 to provide power to the shelter 12 over long periods of time. Such batteries 35 are preferred as the normal loss of power therefrom is approximately 1.5% per month. However, a photovoltaic panel (not shown) can be used to maintain the batteries 35 if desired. Further, a battery charging cable can also be connected from the batteries 35 in the shelter 12 to the battery in a car or to an external power grid to charge the batteries 35.

The preferred shelter cell 17 includes a bathroom 123 having a mixing exhaust manifold 125 in communication therewith. The mixing exhaust manifold 125 is adapted to take in gasses from both the bathroom 125 and a remainder of the shelter cell and exhaust the gasses from the shelter cell. As shown in FIG. 8, the preferred mixing exhaust manifold 125 includes . . .

The mixing exhaust manifold 125 is mounted on the shelter ceiling 27, which has a vent pipe 202 extending to the ground surface. The purpose of the mixing exhaust manifold is to maintain negative pressure in the bathrooms to contain bathroom odors and to still remove warm spent air, which collects at the top of the shelter 27. The air from the bathrooms enter the bottom pan 204 which is under negative pressure created by a 12 volt blower positioned on blower plate 206 in the blower housing 208 which operates under positive pressure. The two larger intakes on the bottom pan are sized to allow 88% of the negative pressure to be relieved through a flexible duct connected to the bathroom and 12% to be relieved by taking air through a smaller hole in the bottom pan 204. To prevent insects from entering the mixing exhaust manifold, a 125 micron stainless steel screen is used in connection to a screen housing 210 located on the top of the blower housing 208.

The entranceway 30 is attached to the entranceway section 19 of the shelter cell 17. In the preferred embodiment, the entranceway 30 includes an elliptical entrance manway 34 attached in non-perpendicular relation to the shelter body 17 such that it slopes upward at an angle to the level of the ground 100. The use of a sloped elliptical shaped entrance manway 34 is preferred as it reduces the cross sectional area of the entranceway 30, thereby reducing the amount of radiation entering the shelter cell 18 while still allowing a six foot tall person 120 enough headroom to stand up and use the stairs 33. In fact, the use of an elliptical shape reduces the cross sectional area of the entranceway by 43% when compared to a corresponding round pipe, which leads to a corresponding decrease in radiation exposure. Although this design is preferred, as shown in FIG. 3, the entranceway 30 may extend perpendicular to the shelter body 17 and the entrance manway 34 may be of a round cross section to achieve acceptable results.

As shown in FIGS. 3-5, regardless of whether the entranceway 30 is perpendicular or angled, or whether the entrance manway 34 is elliptical or has some other cross sectional shape, the entranceway 30 preferably has a sliding hatch cover 52 and an elliptical hatch dome ring 50 having a slide pocket 53 disposed therein. In such embodiments, the sliding hatch cover 52 and the slide pocket 53 of the hatch dome ring 50 are each dimensioned to allow the sliding hatch cover 52 to slide within, and be retained by, the slide pocket 53. A reduced friction material is preferably disposed upon one of the sliding hatch cover 52 and the slide pocket 53 at the interface thereof. This material is preferably PTFE, which has a substantially low coefficient of friction to allow the hatch cover 52 to slide easily within the slide pocket 53. However, other materials may be substituted to achieve similar results.

The hatch dome ring 50 is preferably elliptical in shape and includes an air intake vent 57 and an air exhaust vent 61 disposed therethrough. Below the hatch dome ring 50 a pocket 51 for an air filtration system 43 is preferably formed within the entrance manway 34 and in communication with an air intake pipe 54 and a leaching septic tank 70 is preferably attached to the outside surface of the entrance manway 34. An air outlet manifold 74 is disposed through the entrance manway 34 in communication with the septic vent 76 for exhausting carbon dioxide, heat and moisture from the shelter 12. The air outlet manifold 74 preferably includes a stainless
steel micronic screen (not shown) that prevents pests, such as insects, scorpions, snakes or the like, from entering the shelter 12 through the manifold 74. The manifold also includes a female threaded port (not shown) to accept a threaded plug that will allow the outlet manifold to be closed from the outside atmosphere such as times of floods or fires on the surface.

[0068] Referring to FIGS. 3 and 4, the preferred air filtration system 43 is disposed within the entrance manway 34 and includes a number of filter stages. Contaminated air enters the air intake vent 57 on the hatch dome ring 56. It then travels around under the hatch dome ring 50 where the air velocity slows, allowing rain and heavy particles to fall out. Contaminated air then travels into the vertical air intake pipe 54 under the hatch dome and past a ball valve 56, which allows the filtration system 34 to be sealed when not in use. The contaminated air then travels into the stainless steel micronic washable screen/pre-filter 58, which removes more of the heavier particles. The air then travels into the gas agent test housing, into which a gas agent test port 60 is disposed. This test port 60 allows the incoming air to be tested using a chemical agent test kit (not shown). The contaminated air then travels into the core of a HEPA/Carbon filter 202, which is preferably designed to remove 99.99% of particles that are 0.3 micron and larger, including carriers of biological warfare agents. The air then preferably travels into the activated carbon layer (not shown) to remove radioactive iodine gas, through a Whirelizer/TEDA carbon layer (not shown) to remove any chemical warfare agents, and through a filter fabric (not shown) to remove any carbon fines. The last stage of filtration is the ultraviolet light chamber 64, where viruses and bacteria are preferably exposed to more than 11,000 microwatts/cm2, effectively killing all airborne viruses and bacteria. The filtered air then enters the air blower 66, which preferably includes a centrifugal reverse curve motorized impeller, and is exhausted into the shelter 12.

[0069] Because the air blower 66 pumps filtered air into the shelter 12, the shelter 12 is slightly pressurized. This positive pressure, plus the heat generated in the shelter 12 from body heat, cooking, and showering, forces the spent air to the highest point in shelter 12 near the top of the entranceway 30, where it is exhausted through the air outlet manifold 74 and out of the elliptical hatch dome air outlet vent 61. Some air will pass through and around the hatch dome 50 because the hatch dome 50 is not intended to be airtight. As the air passes around the underside of the hatch dome 50, it equilibrates with the outside air resulting in little or no thermal signature because there is little thermal difference between the spent air and ambient air.

[0070] Referring now to FIGS. 6A-6D, the preferred shelter entranceway 30 includes an expanding rod 55 removably attached to the hatch dome 50 and the sliding hatch cover 52. It is dimensioned to force the sliding hatch cover 52 to slide within the slide pocket 53 when the expanding rod 55 is expanded. In the event that heavy debris falls on the hatch cover 52, the expanding rod 55 may be used to force the sliding hatch cover 52 open. The expanding rod 55 is preferably stored behind the ladder (not shown) and is removed and placed in position with quick acting pins 75. The rod 55 is turned manually using the ratchet lever 73 attached to produce 10,000 pounds of force to open the hatch.

In use, the expanding rod 55 is connected as shown in FIG. 6B. The ratchet lever 73 is used to expand the expanding rod 55 to the position shown in FIG. 6B. The end of the expanding rod 55 that is attached to the hatch cover 52 is removed and the expanding rod 55 is retracted and attached to a second hole in the hatch cover 52 such as shown in FIG. 6C. The expanding rod 55 is then expanded again, in the same manner as described above, to force the hatch cover 52 open. It is recognized that, although this method is preferred, other methods may be used. For example, hydraulic jacks or other art recognized means may be used to force the hatch cover 52 open. However, the use of an expanding rod 55 is preferred due to its low cost, high reliability and ease of storage and use.

[0071] Referring again to FIG. 3, the preferred disaster shelter 12 also includes a seismic joint 40 connecting the entranceway to the entrance section of the shelter cell. The preferred seismic joint is a triple axis seismic joint that is dimensioned to allow the entranceway to move in any direction relative to the shelter cell. The entranceway cylinder 44 gets pushed down overpressure causing the projected annular knob of the seismic joint 40 to push inward. The projecting knob of the seismic joint will react to uneven downward forces and will also allow folding during a translation movement making the design qualify as a triple axis joint. The current design is manufactured of fiberglass having a thickness of approximately one inch and is sixty-two inches in diameter for a thirty-six inch diameter pipe. It allows triple axis movement plus translation while maintaining water tightness, which is necessary since virtually all underground shelter are below water table at some point in time.

[0072] Referring again to FIG. 1, the disaster shelter system 10 of the present invention includes an entranceway anchor 180 which is a fiberglass dome attached to the entranceway 30 via a cable 184, which is secured to a bracket 186 attached to the entranceway proximate to the surface 100 of the ground. However, as a cable 184 can impose a very concentrated shock load on the entranceway 30 during ground movement, a cable tension adjuster 182 was developed in order to absorb shock and prevent shock loads from being applied to the entranceway.

[0073] As shown in detail in FIG. 7, the preferred cable tension adjuster 182 includes a substantially convex dome comprising a top half 193, a bottom half 196 and a substantially flexible center donut plate 194. The center donut plate 194 includes a first cable attachment 192 and the top half 196 includes an opening 190 therethrough that is dimensioned to allow the cable 184 to pass therethrough and attach to the first cable attachment 192. The bottom half 196 includes a second cable attachment 199 to which a second cable 188 is attached. The second cable 188 connects the cable tension adjuster 182 to the anchor 180. In operation, an upward load on the entranceway 30 will cause the cable 184 to be placed in tension, which causes the center donut plate 194 to flex upward, effectively relieving this load. The range of motion is approximately two inches for a thirty-six inch diameter fiberglass dome which has a wall thickness of approximately three quarters of an inch. The annular knob is placed in a cantilever load position, allowing it to flex upward.

[0074] As shown in FIG. 1, the shelter cell 17 of the preferred embodiment of the disaster shelter system 10 includes a bathroom 123 having a toilet 124 and the shelter system 10 includes a leaching septic tank 142 disposed a distance away from the shelter cell 17 and in fluid communication with the toilet 124. The preferred septic tank 142 is a half paraboloid shaped fiberglass structure, similar in construction to the disaster shelter described and claimed in the inventor's U.S. Pat. No. 6,385,919. However, rather than an entranceway, the
septic tank 142 includes a gas vent 124 in communication with the surface of the ground, and the exterior of the tank 142 includes a plurality of holes 144 through which sewage may leach. Although a half paraboloid shaped tank 142 is preferred, it is recognized that any number of art recognized septic tank designs may be substituted to achieve similar results.

[0075] As also shown in FIG. 1, the preferred disaster shelter system 10 also includes a separate water tank 150 that communicates with the shelter. The preferred water tank 150 is a full paraboloid shaped fiberglass tank that is designed for external pressure. However, tanks of other shapes or construction materials may be substituted to achieve similar results.

[0076] Although the present invention has been described in considerable detail with reference to certain preferred versions thereof, other versions would be readily apparent to those of ordinary skill in the art. Therefore, the spirit and scope of the appended claims should not be limited to the description of the preferred versions contained herein.

1. A disaster shelter comprising:
   a substantially hollow shelter cell having an interior and an exterior, said shelter cell comprising:
   a shelter body comprising a plurality of cell sections, wherein each cell section has a substantially identical double elliptical toroid shape, and wherein said shelter body comprises an entrance end and a cap end, an end cap section joined to said cap end of said shelter body; and
   an entranceway section joined to said entrance end of said shelter body; and
   an entranceway attached to said entranceway section of said shelter cell.

2. The disaster shelter as claimed in claim 1, wherein said entranceway comprises an elliptical entranceway attached in non-perpendicular relation to said shelter body.

3. The disaster shelter as claimed in claim 1 wherein said entranceway comprises a sliding hatch cover.

4. The disaster shelter as claimed in claim 3 wherein said entranceway comprises an elliptical hatch dome ring having a slide pocket disposed therein, wherein said sliding hatch cover and said slide pocket of said hatch dome ring are each dimensioned to allow said sliding hatch cover to slide within, and be retained by, said slide pocket.

5. The disaster shelter as claimed in claim 4 further comprising a reduced friction material disposed upon one of said sliding hatch cover and said slide pocket, said reduced friction material having a substantially low coefficient of friction.

6. The disaster shelter as claimed in claim 4 further comprising an expanding rod removably attached to said hatch dome and said sliding hatch cover, wherein said expanding rod is dimensioned to force said sliding hatch cover to slide within said slide pocket when said expanding rod is expanded.

7. The disaster shelter as claimed in claim 6 wherein said expanding rod is a ratchet expanding rod comprising a ratchet mechanism and a handle.

8. The disaster shelter as claimed in claim 1 further comprising a seismic joint connecting said entranceway to said entrance section of said shelter cell.

9. The disaster shelter as claimed in claim 8 wherein said seismic joint is a triple axis seismic joint that is dimensioned to allow said entranceway to move in any direction relative to said shelter cell.

10. The disaster shelter as claimed in claim 1 further comprising a shelter floor disposed within said shelter cell, wherein said shelter floor is not attached to said shelter cell.

11. The disaster shelter as claimed in claim 10 further comprising a plurality of floor joint brackets attached to said interior of said shelter cell, wherein said shelter floor comprises a plurality of floor planks, and wherein said floor joint brackets are disposed and dimensioned to support said plurality of floor planks.

12. The disaster shelter as claimed in claim 1 wherein said shelter cell comprises a bathroom having a mixing exhaust manifold in communication therewith, wherein said mixing exhaust manifold is adapted to take in gasses from both said bathroom and a remainder of said shelter cell and exhaust said gasses from said shelter cell.

13. The disaster shelter as claimed in claim 1 further comprising an air filtration system disposed within said entranceway.

14. The disaster shelter as claimed in claim 13 wherein said air filtration system comprises an air inlet pipe, a pre-filter, a gas agent test port, a HEPA filter, an ultraviolet light and a blower, wherein each of said pre-filter, gas agent test port, HEPA filter, and ultraviolet light are in fluid communication with said air inlet and said blower.

15. A disaster shelter comprising:
   a substantially hollow shelter cell having an interior and an exterior; an entranceway; and
   a triple axis seismic joint that connects said substantially hollow shelter cell to said entranceway, wherein said triple axis seismic joint is dimensioned to allow said entranceway to move relative to said shelter cell in all directions except rotation.

16. A disaster shelter system comprising:
   a substantially hollow shelter cell having an interior and an exterior; an entranceway attached to said shelter cell; an entranceway anchor; a cable attaching said entranceway to said entranceway anchor; and a cable tension adjuster attached to said cable, wherein said cable tension adjuster is dimensioned to absorb shock imposed upon said entranceway; wherein said cable tension adjuster comprises a substantially convex dome comprising a top half, a bottom half and a substantially flexible center donut plate, wherein said center donut plate comprises a first cable attachment, wherein said bottom half comprises a second cable attachment, and wherein said top half comprises an opening therethrough dimensioned to allow said cable to pass therethrough and attach to said first cable attachment.

17. (canceled)

18. The disaster shelter system as claimed in claim 16 wherein said shelter cell further comprises a toilet and wherein said shelter system further comprising a leaching septic tank disposed a distance away from said shelter cell and in fluid communication with said toilet.