Claims

1. A multiple redundant safety control system for use with gas transfer, vehicle fueling, or fuel storage operations, wherein the safety system comprises at least two independent, operational, isolated control systems with separate power sources, comprising:

one or more of the following for use with each of the two or more control systems: a processor; a network; a sensor set; an actuator set; a human interface; and a peripheral;

two or more redundant seismic or vehicle omni-vector movement and/or motion systems, wherein each movement system utilizes one or more first sensors for detecting one or more of the following conditions: vehicular movement during fueling; seismic activity; fuel transfer events;

two or more gas detection systems, wherein each gas detection system utilizes one or more second sensors from one or more of the following groups: magnetic sensors; paramagnetic sensors, catalytic sensors; optical sensors; elector-chemical, chemical sensors; and

two or more fire and/or explosion systems, wherein each system utilizes one or more third sensors of one or more of the following types: magnetic; optical; ultrasonic; infrasonic; pressure; and sound waves;

wherein, at least one of the two independent operational isolated control systems is configured to shut down or disable gas transfer or fueling, upon detection of one or more of the following conditions: vehicle motion at a greater than a predetermined value; gas concentration above a predetermined level; fire or explosion; the exceeding of a predetermined sensor input limit; or seismic activity greater than a predetermined level.

2. The multiple redundant safety control system of Claim 1, wherein the gas comprises compressed or liquefied gas, and the first sensor comprises one or more of the following: mechanical tethers; switches; magnetic sensors; optical sensors; ultrasonic sensors; accelerometers; inertial motion units; gyros; quantum gyros; or gyroscopic (MEMS) effect instruments.

3. The multiple redundant safety control system of Claim 1, wherein:

at least one of the two or more control systems comprises processors, or an array of processors, functioning standing alone or arrayed or combined via one or more networks, chosen from one or more of the following group: CPUs; GPUs; GPUPUs; GPUs with optically-enhanced processing; OPUs; quantum processing units; neural processing units; quantum logic gates; distributed control systems; distributed networks; and cloud computing systems; and

the system includes or utilizes one or more of the following: evolutionary algorithms; automated planning and scheduling; global language identification; language models; deep learning; machine translation; machine languages; speech generating devices; natural language user interfaces; long-short term memory; large memory storage and retrieval neural networks; group method data handling; deep stacking networks.

4. The multiple redundant safety control system of Claim 1, wherein at least one of the two or more control systems comprises one or more of the following: modules; nodes; network fencing systems; cyber-security elements; network interfaces; computer clusters; electro-optical or optical-electric converter; optical computing; binary computing; wide area networks, local area networks; bridging networks; optical communications including fiber optic or free space optical communications; optical wireless communications; Qubits; quantum bus; quantum networks; quantum internet; and diodes.

5. The multiple redundant safety control system of Claim 1, wherein at least one of the two or more control systems are used for one or more of the following:

satellite communications, including inter-satellite, satellite to ground, satellite to vehicle or phone; or

data communications, utilizing one or more, or an array, of antennaes, which communicate wirelessly by radio or light, and which include an automatically adjustable or sectorized antennae utilizing multiple wavelengths or frequencies, for wireless data communications, utilizing multiple wavelengths or frequencies, wirelessly by radio and/or by light via one or more automatically adjustable and/or sectorized antennaes.

6. The multiple redundant safety control system of Claim 1, wherein:

the two or more gas detection systems are capable of detecting one or more of the following gases: methane; hydrogen; hydrazine, ammonia; propane; ethane; butane; and oxygen; and,

the two or more movement detection systems operate standing alone or combined, and are chosen from one or more of the following group: optical; magnetic; ultrasonic; inertial motion units; gyros; MEMS units, quantum gyros; accelerometers, including tri-axial accelerometers; FOG; RLG; HRG; CRG; PG; PV; TFG; VSG; CVG; WGR; or Q-gyro, sensors.

7. The multiple redundant safety control system of Claim 1, wherein:

the vehicles comprise one or more of the following: ships, tugs, barges, aircrafts, spacecrafts, satellite(s), rockets or drones;

the vehicles are on-road, off-road, rail, or marine vehicles, or vehicles capable of combating gravity or capable of exceeding gravitational forces;

the vehicles are powered by internal combustion engines, turbines, compressed and/or liquified gas fuel cell(s), electric fuel cells, or any combination thereof, including hybrid battery or electric; and,

the transfer/fueling system(s) comprises one or more inerting systems;

the vehicle systems comprise an emission quantification system, which includes live-streamed or recorded emission data; and

the vehicles contain oxygen concentration systems for fuel cell or I.C.E. performance enhancement, utilizing turbos or compressors to increase air and/or oxygen flow to system intakes.

8. The multiple redundant safety control system of Claim 1, wherein the gas transfers, vehicle fueling, or fuel storage are monitored by redundant video systems, which are live-streamed or recorded, and infrared explosion proof video monitoring system(s) used to detect fires or explosions, and relay alerts used to facilitate monitoring of fire or explosion systems.

9. The multiple redundant safety control system of Claim 1, further comprising one or more redundant system shut-downs or emergency shut-downs, which are accomplished by either processors or control systems, based on monitoring of one or more of these predetermined parameters: pressure, temperature, level, flow, vibrations, motions, gas detection, fire and/or explosion detection, local or remote operations, automated or manual operations, communications, signal loss, communication errors, electrical power interruption, resets, human assists (overrides), override counter(s), or process equipment upsets, process system upset(s).

10. The multiple redundant safety control system of Claim 1, wherein the system uses:

one or more of the following to process information: artificial intelligence; machine learning; or language model systems; and

one or more of the following for communication or security protocol: gesture recognition; speech recognition; voice-activated commands; optical mark recognition; biometric recognition; convoluted neural networks; neural network; hybrid neural networks; or one or more or an array: of microphones, speakers, photo-diodes, cameras, infrared readers, optical readers, large storage memory and retrieval, long-short term memory, data recall, image recall.

11. The multiple redundant safety control system of Claim 1, wherein the system utilizes robotic systems comprising cerebellar model articulation fueling controls for compressed or liquefied gas processing, storage, transfer, or fueling systems.

12. The multiple redundant safety control system of Claim 1, wherein the system utilizes vacuum-jacketed storage tank systems and vacuum-jacketed transfer lines, including one or more of the following: vacuum monitoring systems; seismic detection systems; seismic isolation connection sensors; pressure regulation valves; two or more internally-recirculating spray bar or ball tank cooling systems; or two or more re-liquefaction systems.

13. The multiple redundant safety control system of Claim 1, wherein the system employs one or more storage tank systems comprising cryogenic vacuum-jacketed, double-walled storage tanks of the pressurized type or atmospheric type, and wherein the one or more storage tank systems comprise of upper tank access, with no bottom connections nor lower instrumentation connections.

14. The multiple redundant safety control system of Claim 1, wherein the vehicle are charged externally, or use on-board generated power, via redundant batteries, inverters and power distribution systems, and wherein one or more of the following are used: electric motor monitoring systems; power monitoring systems; battery monitoring systems; Variable drives or Triac drives and/or invertors; magnetic levitation drive systems; electrically redundant safeties as overloads; breakers; MOL; and transfer switches.

15. The multiple redundant safety control system of Claim 1, further comprising one or more vacuum-jacketed insulated tanks with vacuum monitoring systems, including inlet and outlet safety valves and pressure regulators, one or more level controls, one or more pressure controls, one or more temperature controls, and wherein the one or more vacuum-jacketed tanks are exchangeable, with sensors for tank position detection, and wherein all instrumentation, power, and fuel connections utilize magnetic, ultrasonic, or optical sensors for connection sensing.

16. The multiple redundant safety system of Claim 3, wherein:

the processors are used for one or more of the following vehicle operations: positioning; navigation; routing; mapping; GPS; altitude; omni-directional vehicle positioning or motions; collision avoidance; vehicle clearance; distance sensing; fuel monitoring; ETA; traffic avoidance; on-board Wi-Fi connection; voice-activated commands; and voice recognition; and

further comprising a vehicle positioning system (VPS) providing independent, redundant, isolated vehicle position data, wherein the VPS performs a comparison update to data provided by a GPS system, and self-corrects based upon the comparison, and wherein the VPS data includes one or more of the following characteristics of the vehicle: location; position; heading; speed; elevation; vector; roll; axis; pitch; and yaw axis.

17. The multiple redundant safety control system of Claim 1, wherein the system comprises one or more quality control gas analyzers from the following group: gas chromatographs;

spectrometers; optical spectrometers; and TDLA, which utilize fiber optic sensors and fiber optic communications.

18. The multiple redundant safety control system of Claim 2, further comprising onboard separation systems for cleaving or cracking molecules of the compressed or liquefied gas, or for separating air molecules utilizing oxygen concentrators or generators, comprising one or more of the following processes: reforming; high-temperature reforming; cracking reforming or reacting; pressure swing absorption.

19. The multiple redundant safety control system of Claim 18, wherein the system is capable of providing one or more of these chemical processes:

as to hydrogen: splitting, cleaving, reforming or generating from one or more of the following: water, natural gas, ammonia, carbon dioxide;

as to ammonia: splitting, cleaving, reforming or generating from one or more of the following: natural gas; hydrogen; or carbon dioxide;

as to natural gas: splitting, cleaving, reforming or generating from one or more of the following: synthetic gas; bio-gas; carbon dioxide; well-head gases; propane; natural gas; or cumene;

as to butane: splitting, cleaving, reforming or generating from one or more of the following: natural gas; well-head gases; or butane;

as to ethane: splitting, cleaving, reforming or generating from one or more of the following: natural gas; or well-head butane;

as to propane: splitting, cleaving, reforming or generating from one or more of the following: natural gas; hydrogen; or cumene;

as to oxygen: splitting, cleaving, reforming or generating from one or more of the following: oxygen; air; or ozone; and

as to nitrogen: splitting, cleaving, reforming or generating from one or more of the following: oxygen; air; or ammonia.

20. The multiple redundant safety control system of Claim 19, further comprising the step of onboard separation, cracking and reforming of compressed liquefied ammonia (NH3) into nitrogen and hydrogen, using:

high temperature reforming and cracking using fuels or tail gases, in which combustion are assisted using oxygen, and using one or more of the following processes or reactions: electro-thermal; MEMS systems; micro-reformers; thermos; photovoltaic reformers or generators; optical-assisted molecule cracking; thermoelectric reformers or generators; and

one or more of the following fuels: LNG; natural gas; propane; ethane; butane; hydrogen; ammonia; tail and/or exhaust gas.

21. The multiple redundant safety control system of Claim 1, used for remote vehicle operations and/or vehicle control, wherein:

the remote vehicle operations include the remote control of one or more vehicles, and the remote control vehicle operations include control of one or more of these vehicle characteristics: speed, vector, route, elevation, roll, pitch, yaw; and

one more more control inputs and outputs are chosen from one or more of the group comprising: optical, magnetic, ultrasonic, IMUs, accelerometers, tri-axial accelerometers, gyros, mems gyros, quantum-gyro(s), FOG, RLG, CRG, PG, PV, TFG, CRG, WGR, camera(s), high speed camera(s), optical 3D sensor(s), and/or live streaming video system(s).

22. The multiple redundant safety control system of Claim 1, wherein the system utilizes one or more cryogenic insulated storage tanks, comprising of upper tank access, no bottom connections nor lower instrumentation connections, and further comprising one or more of the following: for land-based tanks, seismic detection sensors and systems, including seismic connection sensors, including pressure regulation systems, comprising two or more internally recirculating spray bar or ball systems and/or two or more re-liquefication systems, wherein the one or more cryogenic insulated storage tanks comprise vacuum-jacketed insulation systems.

23. The multiple redundant safety control system of Claim 1, wherein the system utilizes two or more redundant safety Isolation valve(s), for compressed and/or liquified gas(s) chosen from the group comprising of Liquified Natural gas(LNG), Liquified ethane gas (LEG), or liquified Hydrogen gas(LH2); along with pressure regulation valve(s) located between said isolation valve(s), and said pressure regulation valve are actuated by self actuation and/or by one of the two or more control system(s), further, the actuation are initiated via differential pressure, pressure, back pressure, piloted sensing, and/or pilot valve operated, and wherein one of the two or more safety isolation valves are chosen from the group consisting of: 2-way, 3-way, 4-way or reversing valve(s), and each valve comprises of an actuator, positioner, and a positive feedback signal.