CLAIMS

1. A system, comprising:

an underwater component; and

a shape memory alloy thermostat ~~coupled to~~ disposed within the underwater component, wherein the shape memory alloy thermostat comprises a plurality of openings configured to expose a shape memory alloy material of the shape memory alloy thermostat to seawater within an interior of the underwater component, wherein the shape memory alloy material is configured to undergo a phase change between a first phase and a second phase in response to a temperature change of the seawater, and the shape memory alloy material is configured to open or close a fluid path fluidly coupling the interior of the underwater component and an environment surrounding an exterior surface of the underwater component in response to the phase change.

2. The system of claim 1, wherein the shape memory alloy material is configured to open the fluid path in response to the phase change.

3. The system of claim 1, wherein the shape memory alloy material is configured to close the fluid path in response to the phase change.

4. The system of claim 1, wherein the fluid path ~~extends between an interior of the underwater component and an exterior of the underwater component, and the fluid path comprises a water path~~ comprises a water path.

5. The system of claim 4, wherein the underwater component comprises a thermally insulated enclosure having the interior ~~and the exterior~~, an internal component disposed within the interior of the thermally insulated enclosure, and a heat source disposed within the interior.

6. The system of claim 5, wherein the internal component comprises electronics.

7. The system of claim 5, wherein the heat source comprises a fluid conduit, a flow control device, or a combination thereof.

8. The system of claim 1, wherein the shape memory alloy thermostat comprises a first biasing element made of the shape memory alloy material, wherein the first biasing element is configured to provide a first biasing force in the first phase, the first biasing element is configured to provide a second biasing force in the second phase, and the first and second biasing forces are different from one another.

9. The system of claim 8, wherein the shape memory alloy thermostat comprises a second biasing element opposing the first biasing element, and the second biasing element is configured to provide a third biasing force greater than the first biasing force and less than the second biasing force.

10. The system of claim 9, wherein the shape memory alloy thermostat comprises a stationary portion and a movable portion, ~~and~~ the first ~~and second~~ biasing element~~s are~~ is disposed between the stationary and movable portions, and the second biasing element is disposed within the stationary portion to control movement of the movable portion relative to the stationary portion to open or close the fluid path.

11. The system of claim 10, wherein the stationary portion comprises a stationary tube, the movable portion comprises a movable tube, the stationary and movable tubes are concentric with one another, the first biasing element is configured to move the movable portion in a first direction in the second phase of the shape memory alloy material, and the second biasing element is configured to move the movable portion in a second direction in the first phase of the shape memory alloy material.

12. The system of claim 11, wherein the shape memory alloy thermostat comprises a shaft coupled to a first end portion of the movable tube and extending through a second end portion of the stationary tube, the first biasing element is disposed in a first volume about the shaft inside the movable tube between ,the first and second end portions, and

the second biasing element is disposed in a second volume about the shaft inside the stationary tube between the second end portion and a spring retainer coupled to the shaft.

13. The system of claim 12, wherein the stationary tube comprises the fluid path, and the movable tube comprises a fluid port into the first volume.

14. The system of claim 1, wherein the underwater component comprises a subsea component, a mineral extraction component, a flow control device, a controller, a sensor, electronics, or a combination thereof.

15. A system, comprising:

an underwater container;

a fluid conduit extending through the underwater container;

an underwater component disposed within the underwater container external to the fluid conduit; and

a shape memory alloy thermostat, wherein the shape memory alloy thermostat comprises a shape memory alloy material configured to undergo a phase change between a first phase and a second phase in response to a temperature change, and the shape memory alloy material is configured to open or close a fluid path fluidly coupling an interior volume of the underwater container and an exterior surface of the underwater container in response to the phase change.

16. The system of claim 15, wherein the first phase comprises a Martensite phase and the second phase comprises an Austenite phase, and the phase change is configured to occur at a transition temperature.

17. The system of claim 16, wherein the transition temperature is less than a threshold temperature to protect a material strength of equipment or to protect electronics from overheating.

18. The system of claim 15, wherein the shape memory alloy thermostat is a subsea equipment thermostat, a mineral extraction equipment thermostat, a flow control device thermostat, or a combination thereof.

19. A system, comprising:

a shape memory alloy thermostat, comprising:

a first biasing element comprising a shape memory alloy material, wherein the first biasing element is configured to provide a variable first biasing force based on a phase of the shape memory alloy material;

a second biasing element configured to provide a second biasing force that opposes the variable first biasing force; ~~and~~

a stationary portion comprising a body;

a movable valve portion comprising a sleeve, wherein the moveable valve portion is configured to open or close depending on whether the variable first biasing force is less than or greater than the second biasing force; and

a rod extending through the sleeve and into the body,

wherein the sleeve is disposed at least partially about the body, and the first and second biasing elements are disposed about the rod.

20. The system of claim 19, wherein the shape memory alloy thermostat is a subsea equipment thermostat, a mineral extraction equipment thermostat, a flow control device thermostat, or a combination thereof.