CLAIMS

1. A sailboat comprising:
a plurality of hulls arranged parallel to each other and coupled together by a truss arrangement,
a wingsail structure that is rotatable about a first axis of rotation that is orthogonal to a plane of the hulls, and a second axis of rotation that is parallel to the hulls, and
an auto-righting system that is configured to rotate the wingsail structure about the second axis of rotation when a capsize of the sailboat is detected.

2. The sailboat of claim 1, wherein the wingsail structure includes a buoyancy element that serves to facilitate righting of the sailboat when the auto-righting system rotates the wingsail structure.

3. The sailboat of claim 2, wherein the buoyancy element includes a wingsail.

4. The sailboat of claim 3, wherein the buoyancy element includes a flotation bulb above the wingsail.

5. The sailboat of claim 1, including a keel that is rotatable about a keel axis of rotation that is parallel to the hulls.

6. The sailboat of claim 5, wherein the keel is fixedly attached to the wingsail structure, and the keel axis of rotation corresponds to the second axis of rotation.

7. The sailboat of claim 1, including a control system that detects whether a capsize has occurred, and activates the auto-righting system when the capsize is detected.

8. The sailboat of claim 7, wherein the control system detects a heeling angle and activates the auto-righting system before the capsize is detected, based on the detected heeling angle.

9. The sailboat of claim 1, including one or more solar panels that provide the energy

required to enable the auto-righting system.

10. The sailboat of claim 1, including a rudder, and a navigation control system that controls an orientation of the rudder to create a direction of travel of the sailboat toward a target area.

11. The sailboat of claim 1, wherein the wingsail structure includes a wingsail that provides lift to propel the sailboat forward.

12. The sailboat of claim 11, wherein the wingsail structure includes a wind vane that pivots on the wingsail structure so as to consistently be aligned with a current wind direction.

13. The sailboat of claim 12, wherein the wingsail structure includes a balance element that facilitates the rotation of the wingsail structure about the first axis of rotation.

14. The sailboat of claim 12, including a coupling rod that controls a difference between an orientation of the wingsail structure and an orientation of the wind vane.

15. The sailboat of claim 14, wherein the truss structure includes a cam coupled to the coupling rod to control the difference between the orientation of the wingsail structure and the orientation of the wind vane based on an orientation of the truss structure.

16. The sailboat of claim 15, wherein the cam includes a cam slot that is shaped to provide a desired angle of attack of the wingsail based on the orientation of the truss structure.

17. The sailboat of claim 1, including one or more watertight compartments for installation of monitoring equipment.

18. The sailboat of claim 17, including one or more communication systems for communicating information from the monitoring equipment to a remote monitoring station.

19. The sailboat of claim 18, wherein the one or more communication systems include a satellite transceiver.

20. The sailboat of claim 19, wherein the one or more communication systems include a SENS transmitter.

21. The sailboat of claim 1, including a motor that controls rotation of the wingsail structure about the first axis of rotation.

22. The sailboat of claim 21, wherein the motor may be configured as a generator that generates energy as the wingsail structure fluctuates about the first axis of rotation.

23. A sailboat comprising:
a plurality of hulls arranged parallel to each other and coupled together by a truss arrangement,
a wingsail structure that is rotatable about a first axis of rotation that is orthogonal to a plane of the hulls, and
an autotrim system that controls rotation of the wingsail structure about the first axis of rotation;
wherein:
the wingsail structure includes:
a wingsail that provides lift to propel the sailboat forward,
a wind vane that pivots on the wingsail structure so as to consistently be aligned with a current wind direction, and
a coupling rod that controls a difference between an orientation of the wingsail structure and an orientation of the wind vane; and
the autotrim system includes a cam attached to the truss arrangement and coupled to the coupling rod to control the difference between the orientation of the wingsail structure and the orientation of the wind vane based on an orientation of the truss structure.

24. The sailboat of claim 23, wherein the wingsail structure includes a balance element that facilitates the rotation of the wingsail structure about the first axis of rotation.

25. The sailboat of claim 23, wherein the cam includes a cam slot that is shaped to provide a

desired angle of attack of the wingsail based on the orientation of the truss structure.

26. The sailboat of claim 23, including a motor that controls rotation of the wingsail structure about the first axis of rotation.

27. The sailboat of claim 24, wherein the motor may be configured as a generator that generates energy as the wingsail structure fluctuates about the first axis of rotation.

28. A method of righting a capsized sailboat in a body of water comprising rotating a buoyant mast structure about an axis that is parallel to a surface of the body of water, so as to move a center of buoyancy of the capsized sailboat away from a center of gravity of the capsized sailboat, thereby introducing a righting torque.

29. A method of self-trimming a sailboat comprising:
providing a wingsail structure that provides lift to the sailboat at a given angle of attack;
providing a windvane structure the indicates a direction of wind relative to the sailboat;
coupling the wingsail structure and the windvane structure via a cam that controls the angle of attack of the wingsail based on the direction of wind indicated by the windvane structure.

30. The method of claim 29, wherein the cam is rigidly affixed to the sailboat, such that its relative orientation is consistent with an orientation of the sailboat, and is coupled to the windvane structure such that a rotation of the windvane structure causes the wingsail structure to rotate relative to the orientation of the sailboat.