CLAIMS

What is claimed is:

1. A dewar drying apparatus for a dewar, comprising:

a housing resting entirely on top of a dewar cover;

the dewar cover positioned at a bottom of the housing and supporting the entire housing, the dewar cover also being removably positioned on top of an opening of a neck of the dewar and completely covering the opening, wherein the dewar cover is larger than the opening in two or more directions, so that the dewar cover rests against and so that both the dewar cover and the housing resting entirely on top of the dewar cover are supported solely by the neck of the dewar when the dewar cover is positioned on top of the opening;

a first elongate member attached to the bottom of the dewar cover and extending cantilevered from the bottom of the dewar cover and having a proximal end attached to the bottom of the dewar cover and a distal end away from the dewar cover;

a second elongate member attached to the bottom of the dewar cover and spaced away from the first elongate member, the second elongate member extending cantilevered from the bottom of the dewar cover and having a proximal end attached to the bottom of the dewar cover and a distal end away from the dewar cover and also spaced apart from the distal end of the first elongate member,

wherein both the first elongate member and the second elongate member extend through the opening of the neck of the dewar and entirely through the neck of the dewar into a payload area of the dewar at an opposite side of the neck relative to the opening,

a heating element disposed at the distal end of the first elongate member and inside the payload area of the dewar;

a sensor disposed at the distal end of the second elongate member and inside the payload area of the dewar and spaced apart from the heating element,

wherein the sensor is nearer to the dewar cover than is the heating element,

wherein the heating element and the sensor are both removably insertable into the payload area within the dewar through the opening of the neck of the dewar by removably resting the dewar cover on top of the neck, wherein the heating element is configured to produce heat that warms the payload area within the dewar; and

a controller inside the housing and coupled to the heating element and configured to:

determine or detect, using the sensor, a temperature within the payload area of the dewar, and

control, using the heating element, the temperature within the payload area of the dewar to evaporate a liquid or a gas within the payload area.

2. The dewar drying apparatus of claim 1, wherein to control the temperature within the payload area of the dewar the controller is configured to:

activate the heating element; and

increase, using the heating element, the temperature within the payload area of the dewar to evaporate the liquid or the gas when the temperature is below a first threshold temperature.

3. The dewar drying apparatus of claim 2, wherein the controller is configured to deactivate the heating element when the temperature within the payload area of the dewar is greater than or equal to a second threshold temperature.

4. The dewar drying apparatus of claim 3, wherein the second threshold temperature is greater than the first threshold temperature.

5. The dewar drying apparatus of claim 4, wherein the controller is configured to:

deactivate the heating element;

after the deactivating, then measure an amount of time for the temperature to decrease from the second threshold temperature to the first threshold temperature; and

determine that the payload area within the dewar is dry when the amount of time is greater than a threshold amount of time, the threshold amount of time corresponding to a duration associated with there being a presence of remaining cryogen that is cooling the payload area during the duration.

6. The dewar drying apparatus of claim 1, wherein the housing that encloses the controller also has an indicator configured to visually indicate when the payload area within the dewar is dry, wherein the controller is configured to:

activate the indicator to visually indicate that the payload area is dry.

7. The dewar drying apparatus of claim 1 wherein the first elongate member is an elongate member that has a hollow tubular structure that surrounds one or more wires that deliver electrical energy from a power source to the heating element, wherein the distal end of the elongate member is positioned within the payload area of the dewar so that the heating element extends into the payload area.

8. The dewar drying apparatus of claim 1,

wherein the sensor comprises a thermocouple device configured to measure the temperature within the payload area of the dewar, wherein the controller is coupled to the thermocouple device and configured to:

determine or detect the temperature within the payload area of the dewar using the thermocouple device.

9. A dewar drying system, comprising:

a first dewar having a first payload area;

a second dewar having a second payload area;

a first dewar drying device comprising a first dewar cover completely covering and sitting on top of a first opening of a first neck of the first dewar so that the first dewar cover is supported by the first neck of the first dewar when the first dewar cover is positioned on top of the first opening, the first dewar drying device further comprising a first heating element connected to the first dewar cover by a first elongate tube extending cantilevered from the first dewar cover and having a proximal end attached to the first dewar cover and a distal end away from the first dewar cover and supporting the first heating element on the first dewar cover, the first heating element disposed at the distal end of the first elongate tube and configured to be inserted into the first dewar and produce heat that warms the first payload area of the first dewar,

wherein the first dewar drying device further comprises a first sensor connected to the first dewar cover by a second elongate tube extending cantilevered from the first dewar cover and having a proximal end attached to the first dewar cover and a distal end away from the first dewar cover and supporting the first sensor on the first dewar cover, the first sensor disposed at the distal end of the second elongate tube and configured to be inserted into the first dewar, wherein the first sensor and the first heating element are spaced apart inside the first dewar by the first and second elongate tubes, and also wherein the first sensor is between the first dewar cover and the first heating element;

a second dewar drying device comprising a second dewar cover completely covering and sitting on top of a second opening of a second neck of the second dewar so that the second dewar cover is supported by the second neck of the second dewar when the second dewar cover is positioned on top of the second opening, the second dewar drying device further comprising a second heating element connected to the second dewar cover by a third elongate tube extending cantilevered from the second dewar cover and having a proximal end attached to the second dewar cover and a distal end away from the second dewar cover and supporting the second heating element on the second dewar cover, the second heating element disposed at the

distal end of the third elongate tube and configured to be inserted into the second dewar and produce heat that warms the second payload area of the second dewar,

wherein the second dewar drying device further comprises a second sensor connected to the second dewar cover by a fourth elongate tube extending cantilevered from the second dewar cover and having a proximal end attached to the second dewar cover and a distal end away from the second dewar cover and supporting the second sensor on the second dewar cover, the second sensor disposed at the distal end of the fourth elongate tube and configured to be inserted into the second dewar, wherein the second sensor and the second heating element are spaced apart inside the second dewar by the third and fourth elongate tubes and also wherein the second sensor is between the second dewar cover and the second heating element; and

a controller coupled to the first dewar drying device and the second dewar drying device, and configured to:

control, using the first heating element, a first temperature within the first payload area,

measure an amount of time for the first temperature to decrease from an initial threshold to a subsequent threshold,

determine, using the first sensor, that the first payload area is dry when the amount of time is greater than a threshold amount of time, and

control, using, the second heating element, a second temperature within the second payload area.

10. The dewar drying system of claim 9, further comprising:

a power source configured to deliver electrical energy to the first heating element and the second heating element, wherein the controller is configured to control, using the first heating element, the first temperature and control, using the second heating element, the second temperature independently.

11. The dewar drying system of claim 10, wherein to control the first temperature and control the second temperature, the controller is configured to:

deliver a first amount of the electrical energy to the first heating element to increase the first temperature; and

deliver a second amount of the electrical energy to the second heating element to increase the second temperature.

12. The dewar drying system of claim 11, wherein the first amount is different from the second amount or the first amount is delivered before or after the second amount is delivered.

13. The dewar drying system of claim 9, further comprising:

a first indicator configured to visually indicate when the first payload area within the first dewar is dry; and

a second indicator configured to visually indicate when the second payload area within the second dewar is dry.

14. The dewar drying system of claim 9, wherein the first dewar and the second dewar remain upright when the first dewar drying device evaporates a liquid or gas within the first dewar and the second dewar drying device evaporates a liquid or gas within the second dewar.

15. A dewar drying apparatus for a dewar, comprising:

a dewar cover comprising a disk-shaped member with a first circumference;

a housing disposed entirely within the first circumference and attached to an upper side of the disk-shaped member;

a first rod attached to a lower side of the disk-shaped member and extending away from the lower side of the disk-shaped member;

a second rod attached to the lower side of the disk-shaped member and spaced apart from the first rod,

wherein the first rod and the second rod extend in a parallel orientation,

wherein the first rod is longer than the second rod,

a heating element attached to a distal-most end of the first rod,

a sensor attached to the second rod, wherein the sensor is nearer to the disk-shaped member than is the heating element;

a dewar having a neck with an opening, and a payload area connected to the neck opposite the opening;

wherein the dewar cover rests entirely supported on only the neck and the first rod and the second rod extend into the opening and through the neck and into the payload area,

wherein both the sensor and the heating element are disposed in spaced apart relation inside the payload area and not contacting any portion of the dewar, but are supported only by the second rod and the first rod respectively;

a controller inside the housing and coupled to the heating element and configured to:

determine or detect, using the sensor, a temperature within the payload area of the dewar, and

control, using the heating element, the temperature within the payload area of the dewar to evaporate a liquid or a gas within the payload area.