CLAIMS

What is claimed is:

1. A diagnostic substrate, comprising:

a baseplate, the baseplate having a global plane;

a plurality of image sensors on the baseplate, wherein the plurality of image sensors comprises circumferentially alternating horizontal image sensors and angled image sensors, each of the horizontal image sensors facing away from the global plane of the baseplate at an orthogonal angle with respect to the global plane of the baseplate, and each of the angled image sensors having a field of view in a direction tilted away from the global plane of the baseplate at a non-orthogonal angle with respect to the global plane of the baseplate;

a printed circuit board (PCB) on the baseplate; and

a controller on the baseplate, wherein the PCB electrically couples the controller to the plurality of image sensors.

~~2. The diagnostic substrate of claim 1, wherein the plurality of image sensors comprises:~~

~~first image sensors that are oriented horizontal to the baseplate; and~~

~~second image sensors that are oriented at a non-orthogonal angle to the baseplate, wherein the second image sensors face towards a center of the baseplate.~~

~~3. The diagnostic substrate of claim 2, wherein the first image sensors are positioned proximate to an edge of the baseplate and proximate to a center of the baseplate.~~

42. The diagnostic substrate of claim 1, further comprising:

a light source.

~~5~~3. The diagnostic substrate of claim 42, wherein the light source comprises a plurality of light emitting diodes (LEDs), wherein the plurality of LEDs are attached to the PCB.

~~6~~4. The diagnostic substrate of claim ~~5~~3, wherein the plurality of LEDs are individually controllable or controllable in groups.

~~7~~5. The diagnostic substrate of claim 1, further comprising:

a battery.

~~8~~6. The diagnostic substrate of claim ~~7~~5, wherein the battery is housed within a hermetically sealed enclosure.

~~9~~7. The diagnostic substrate of claim ~~8~~6, further comprising:

a pressure sensor and/or a volatile organic compound (VOC) sensor ~~-~~within the hermetically sealed enclosure.

~~10~~8. The diagnostic substrate of claim 1, further comprising:

a temperature sensor and/or a vibration sensor.

~~11~~9. The diagnostic substrate of claim 1, further comprising:

a diffuser cover over the baseplate, the PCB, and the controller.

~~12~~10. The diagnostic substrate of claim ~~11~~9, wherein a thickness of the diagnostic substrate is less than 10mm.

~~13~~11. The diagnostic substrate of claim 1, wherein the image sensors allow for imaging in the visible spectrum and thermal imaging.

~~14~~12. A method of imaging the interior of a chamber, comprising:

providing a diagnostic substrate, wherein the diagnostic substrate comprises a plurality of image sensors and a light source, the image sensors on a base plate having a global plane, wherein the plurality of image sensors comprises circumferentially alternating horizontal image sensors and angled image sensors, each of the horizontal image sensors facing away from the global plane of the baseplate at an orthogonal angle with respect to the global plane of the baseplate, and each of the angled image sensors having a field of view in a direction tilted away from the global plane of the baseplate at a non-orthogonal angle with respect to the global plane of the baseplate;

inserting the diagnostic substrate into the chamber, wherein the chamber is maintained at a sub-atmospheric pressure;

turning on the light source; and

obtaining images of an interior of the chamber with the plurality of image sensors.

~~15~~13. The method of claim ~~14~~12, wherein a multiplexer architecture is used to obtain images from each of the image sensors.

~~16~~14. The method of claim ~~14~~12, further comprising:

stitching two or more of the obtained images together to provide a stitched image.

~~17~~15. The method of claim ~~14~~12, further comprising:

logging temperature levels at given times to predict failure of a battery or ~~absolute max allowable~~ conditions that trigger replacement of the battery.

~~18~~16. The method of claim ~~14~~12, wherein machine learning is applied to image data from the interior of the chamber to recognize chamber drift over time and/or to trigger cleaning or other maintenance items.

~~19~~17. A diagnostic substrate, comprising:

a baseplate, the baseplate having a global plane;

a first plurality of image sensors on the baseplate, wherein each of the first plurality of image sensors face away from the global plane of the baseplate at an orthogonal angle with respect to the global plane of the baseplate~~are oriented horizontal to the baseplate~~;

a second plurality of image sensors on the baseplate, wherein each of the second plurality of image sensors has a field of view in a direction tilted away from the global plane of the baseplate at a non-orthogonal angle with respect to the global plane of the baseplate, wherein ones of the second plurality of image sensors are circumferentially alternating with ones of the first plurality of image sensors~~are oriented at a non-orthogonal angle to the baseplate~~;

a printed circuit board (PCB) on the baseplate;

a controller on the baseplate, wherein the controller is communicatively coupled to the first plurality of image sensors and the second plurality of image sensors by the PCB; and

a diffuser lid over the baseplate, the PCB, and the controller.

~~20~~18. The diagnostic substrate of claim ~~19~~17, wherein non-orthogonal angle is between 0° and 20° from an orthogonal angle to the global plane of the baseplate.