CLAIMS

1. A cannula locator device comprising:

a catheter adapter having a proximal end and a distal end, the catheter adapter including a catheter that extends from the distal end of the catheter adapter;

a needle hub having a proximal end and a distal end, the needle hub including a cannula that extends from the distal end of the needle hub, the cannula being positioned within and extending through the catheter adapter and the catheter such that a distal tip of the cannula extends distally beyond a distal end of the catheter;

a flash chamber coupled to the proximal end of the needle hub, the cannula forming a fluid pathway into the flash chamber;

a needle shield having a proximal end and a distal end, the distal end of the needle shield being coupled to the proximal end of the catheter adapter, the needle hub and the flash chamber being contained within the needle shield;

a sheath having a proximal end and a distal end, the distal end of the sheath being positioned adjacent the distal tip of the cannula, the sheath extending proximally through the cannula, the flash chamber and out through the proximal end of the needle shield;

one or more emitting optical fibers and one or more receiving optical fibers contained within the sheath, a distal end of each of the one or more emitting optical fibers and the one or more receiving optical fibers being positioned at the distal end of the sheath, a proximal end of each of the one or more emitting optical fibers and the one or more receiving optical fibers extending within the sheath through the proximal end of the needle shield;

a light emitter that is configured to emit light into the proximal end of each of the one or more emitting optical fibers; and

circuitry that is configured to receive reflected light from the proximal end of each of the one or more receiving optical fibers, the circuitry being configured to process the reflected light to detect when the distal tip of the cannula is within a patient's vasculature.

2. The cannula locator device of claim 1, wherein the proximal end of the flash chamber includes an air permeable membrane, the sheath extending through the air permeable membrane.

3. The cannula locator device of claim 1, wherein the needle hub retracts proximally into the needle shield.

4. The cannula locator device of claim 3, wherein the proximal end of the needle hub extends proximally through the proximal end of the needle shield when the needle hub is retracted proximally into the needle shield.

5. The cannula locator device of claim 3, wherein the distal tip of the cannula and the distal end of the sheath are secured within the needle shield when the needle hub retracts proximally into the needle shield.

6. The cannula locator device of claim 3, wherein the needle shield is detachable from the catheter adapter after the needle hub retracts proximally into the needle shield to thereby separate the cannula and the sheath from the catheter adapter.

7. The cannula locator device of claim 1, wherein the circuity comprises a waveguide detector.

8. The cannula locator device of claim 7, wherein the waveguide detector comprises a prism or diffraction grating and one or more photodiodes.

9. The cannula locator device of claim 7, wherein the circuitry further comprises a signal processor.

10. The cannula locator device of claim 1, wherein the circuitry comprises a camera.

11. The cannula locator device of claim 1, wherein the circuitry detects when the distal tip of the cannula is within a patient's vasculature based on a color of the reflected light.

12. The cannula locator device of claim 1, wherein the circuitry is configured to output an alarm when the circuitry detects that the distal tip of the cannula is within a patient's vasculature.

13. The cannula locator device of claim 1, wherein the sheath and the one or more emitting optical fibers and one or more receiving optical fibers contained within the sheath are configured to move within the cannula to thereby enable the sheath and the one or more emitting optical fibers and one or more receiving optical fibers to be advanced distally beyond the distal tip of the cannula.

14. The cannula locator device of claim 1, wherein the light emitter and the circuitry are located external to the needle shield.

15. A cannula locator device comprising:

a catheter adapter having a proximal end and a distal end, the catheter adapter including a catheter that extends from the distal end of the catheter adapter;

a needle hub having a proximal end and a distal end, the needle hub including a cannula that extends from the distal end of the needle hub, the cannula being positioned within and extending through the catheter adapter and the catheter such that a distal tip of the cannula extends distally beyond a distal end of the catheter;

a flash chamber coupled to the proximal end of the needle hub, the cannula forming a fluid pathway into the flash chamber;

a needle shield having a proximal end and a distal end, the distal end of the needle shield being coupled to the proximal end of the catheter adapter, the needle hub and the flash chamber being contained within the needle shield;

a sheath having a proximal end and a distal end, the distal end of the sheath being positioned adjacent the distal tip of the cannula, the sheath extending proximally through the cannula, the flash chamber and out through the proximal end of the needle shield;

optical fibers contained within the sheath, a distal end of each of the optical fibers being positioned at the distal end of the sheath, a proximal end of each of the optical fibers extending within the sheath through the proximal end of the needle shield;

a light emitter that is configured to emit light into the proximal end of one or more of the optical fibers; and

circuitry that is configured to receive reflected light from the proximal end of one or more of the optical fibers, the circuitry being configured to process the reflected light to detect when the distal tip of the cannula is within a patient's vasculature.

16. The cannula locator device of claim 15, wherein the proximal end of the flash chamber includes an air permeable membrane, the sheath extending through the air permeable membrane.

17. The cannula locator device of claim 15, wherein the needle shield is detachable from the catheter adapter after the needle hub retracts proximally into the needle shield to thereby separate the cannula and the sheath from the catheter adapter.

18. The cannula locator device of claim 15, wherein the sheath and the optical fibers contained within the sheath are configured to move within the cannula to thereby enable the sheath and the one or more optical fibers to be advanced distally beyond the distal tip of the cannula.

19. A cannula locator device comprising:

a catheter adapter having a proximal end and a distal end, the catheter adapter including a catheter that extends from the distal end of the catheter adapter;

a needle hub having a proximal end and a distal end, the needle hub including a cannula that extends from the distal end of the needle hub, the cannula being positioned within and extending through the catheter adapter and the catheter such that a distal tip of the cannula extends distally beyond a distal end of the catheter;

a flash chamber coupled to the proximal end of the needle hub, the cannula forming a fluid pathway into the flash chamber;

a needle shield having a proximal end and a distal end, the distal end of the needle shield being coupled to the proximal end of the catheter adapter, the needle hub and the flash chamber being contained within the needle shield;

a sheath having a proximal end and a distal end, the distal end of the sheath being positioned adjacent the distal tip of the cannula, the sheath extending proximally through the cannula, the flash chamber and out through the proximal end of the needle shield;

one or more emitting optical fibers and one or more receiving optical fibers contained within the sheath, a distal end of each of the one or more emitting optical fibers and the one or more receiving optical

fibers being positioned at the distal end of the sheath, a proximal end of each of the one or more emitting optical fibers and the one or more receiving optical fibers extending within the sheath through the proximal end of the needle shield;

a light emitter that is configured to emit light into the proximal end of each of the one or more emitting optical fibers; and

circuitry that is configured to receive reflected light from the proximal end of each of the one or more receiving optical fibers, the circuitry being configured to process the reflected light to detect when the distal tip of the cannula is within a patient's vasculature;

wherein the sheath and the optical fibers contained within the sheath are configured to move within the cannula to thereby enable the sheath and the one or more optical fibers to be advanced distally beyond the distal tip of the cannula; and

wherein the needle hub retracts proximally into the needle shield, the needle shield being detachable from the catheter adapter after the needle hub retracts proximally into the needle shield to thereby separate the cannula and the sheath from the catheter adapter.

20. The cannula locator device of claim 19, wherein the circuitry detects when the distal tip of the cannula is within a patient's vasculature based on a color of the reflected light.