What is claimed is:

1. A light detection and ranging (LIDAR) system for a vehicle comprising:

a first device including a laser source and one or more optical components, the first device configured to output an optical signal associated with a local oscillator (LO) signal; and

a second device coupled to the first device, the second device including:

an optical amplifier array device including an integrated optical component and configured to amplify the optical signal, an input of the optical amplifier array device coupled to a first output of the first device through a bend in the integrated optical component for receiving the optical signal; and

a transceiver device configured to transmit the amplified optical signal to an environment and receive a returned optical signal that is reflected from an object in the environment, a first input of the transceiver device coupled to an output of the optical amplifier array device for receiving the amplified optical signal and a second input of the transceiver device coupled to a second output of the first device for receiving the LO signal.

2. The LIDAR system of claim 1, wherein the integrated optical component includes a U-shaped passive waveguide for receiving the optical signal from the first output of the first device and guiding the optical signal into the input of the optical amplifier array device for amplification.

3. The LIDAR system of claim 1, wherein the input and the output of the optical amplifier array device are on a particular side of the optical amplifier array device.

4. The LIDAR system of claim 1, wherein a waveguide end of the output of the optical amplifier array device is aligned and coupled to a waveguide end of the first input of the transceiver device.

5. The LIDAR system of claim 1, wherein:

the optical amplifier array device includes at least one of a plurality of cascaded optical amplifier array devices in the second device.

6. The LIDAR system of claim 5, wherein:
the transceiver device includes at least one of a plurality of cascaded transceiver devices in the second device.

7. The LIDAR system of claim 6, wherein:
the optical amplifier array device includes a plurality of semiconductor optical amplifiers, each of the plurality of semiconductor optical amplifiers receiving the optical signal through a corresponding input and outputting the amplified optical signal through a corresponding output.

8. The LIDAR system of claim 7, wherein an output optical power of each of the plurality of semiconductor optical amplifiers is at least 200 milliwatts.

9. The LIDAR system of claim 1, wherein the second device further includes a splitter assembly and the first device is configured to provide the optical signal to the optical amplifier array device through the splitter assembly.

10. The LIDAR system of claim 9, wherein an output of the splitter assembly is coupled to the input of the optical amplifier array device and an input of the splitter assembly is coupled to the first output of the first device.

11. The LIDAR system of claim 1, wherein the transceiver device is further configured to determine an amplitude and a phase of the returned optical signal.

12. The LIDAR system of claim 1, wherein the first device includes III-V semiconductor circuitry.

13. The LIDAR system of claim 1, wherein the second device includes at least one of silicon photonics circuitry, programmable logic controller (PLC), or III-V semiconductor circuity.

14. An autonomous vehicle control system, comprising:
a LIDAR system comprising:

a first device including a laser source and one or more optical components, the first device configured to output an optical signal associated with a local oscillator (LO) signal; and

a second device coupled to the first device, the second device including:

an optical amplifier array device including an integrated optical component and configured to amplify the optical signal, an input of the optical amplifier array device coupled to a first output of the first device through a bend in the integrated optical component for receiving the optical signal; and

a transceiver device configured to transmit the amplified optical signal to an environment and receive a returned optical signal that is reflected from an object in the environment, a first input of the transceiver device coupled to an output of the optical amplifier array device for receiving the amplified optical signal and a second input of the transceiver device coupled to a second output of the first device for receiving the LO signal; and

one or more processors configured to:

determine at least one of a range to the object or a velocity of the object using the returned optical signal; and

control operation of an autonomous vehicle responsive to the at least one of the range or the velocity.

15. The autonomous vehicle control system of claim 14, wherein the integrated optical component includes a U-shaped passive waveguide for receiving the optical signal from the first output of the first device and guiding the optical signal into the input of the optical amplifier array device for amplification.

16. The autonomous vehicle control system of claim 14, wherein the input and the output of the optical amplifier array device are on a particular side of the optical amplifier array device.

17. The autonomous vehicle control system of claim 14, wherein a waveguide end of the output of the optical amplifier array device is aligned and coupled to a waveguide end of the first input of the transceiver device.

18. The autonomous vehicle control system of claim 14, wherein: the optical amplifier array device includes at least one of a plurality of cascaded optical amplifier array devices in the second device.

19. The autonomous vehicle control system of claim 18, wherein: the transceiver device includes at least one of a plurality of cascaded transceiver devices in the second device.

20. An autonomous vehicle, comprising:

a LIDAR system comprising:

a first device including a laser source and one or more optical components, the first device configured to output an optical signal associated with a local oscillator (LO) signal; and

a second device coupled to the first device, the second device including:

an optical amplifier array device including an integrated optical component and configured to amplify the optical signal, an input of the optical amplifier array device coupled to a first output of the first device through a bend in the integrated optical component for receiving the optical signal; and

a transceiver device configured to transmit the amplified optical signal to an environment and receive a returned optical signal that is reflected from an object in the environment, a first input of the transceiver device coupled to an output of the optical amplifier array device for receiving the amplified optical signal and a second input of the transceiver device coupled to a second output of the first device for receiving the LO signal;

a steering system;

a braking system; and

a vehicle controller comprising one or more processors configured to:

determine at least one of a range to the object or a velocity of the object using the returned optical signal; and

control operation of at least one of the steering system and the braking system responsive to the at least one of the range or the velocity.