CLAIMS

WHAT IS CLAIMED IS:

1. A monolithic fiber-lens array comprising:

a plurality of optical fibers integrated into a fiber block; and

a plurality of lens elements integrated into a lens block, each lens element corresponding to a respective one of the plurality of optical fibers,

wherein:

the fiber block is coupled to the lens block via a transparent adhesive layer,

a tip of each optical fiber is aligned with a focal point of the corresponding lens element, and

each corresponding lens element comprises a lens profile configured according to a measured position, orientation, pointing direction or combination thereof, of the corresponding optical fiber, to compensate for a positional offset, a pointing offset, or both, of the corresponding optical fiber.

2. The array of claim 1, wherein the fiber block comprises a first substrate having a first surface configured to include the tips of the plurality of optical fibers in a first position configuration.

3. The array of claim 2, wherein the lens block comprises a second substrate having a first surface configured to include focal points of the plurality of lens elements in a second position configuration.

4. The array of claim 3, wherein a thickness of the second substrate is equal to a focal length of the plurality of lens elements.

5. The array of claim 3, wherein the first position configuration is identical to the second position configuration, and wherein the first surface of the first substrate is adhered to the first surface of the second substrate such that the first position configuration corresponds to the second position configuration.

6. The array of claim 3, wherein the second substrate comprises a wedged substrate that is configured to reduce backscattered light returning into the plurality of optical fibers.

7. The array of claim 6, wherein focal lengths of the plurality of lens elements vary with a respective position on the wedged substrate.

8. The array of claim 7, wherein a focal length of each of the plurality of lens elements is equal to a thickness of the second substrate at the respective position on the wedged substrate.

9. The array of claim 7, wherein the plurality of lens elements comprises a plurality of thin-film lenses, and wherein each thin-film lens has a size smaller than an atmospheric cell size.

10. A method of manufacturing a monolithic fiber-lens array, the method comprising:

fabricating a fiber block including a plurality of optical fibers;

determining a position, an orientation, a pointing direction or a combination thereof, of each optical fiber;

determining, for each corresponding thin-film lens, a lens profile configured to compensate for a positional offset, a pointing offset, or both, of the corresponding optical fiber based on the determined position, orientation, pointing direction, or combination thereof;

fabricating a lens block including the plurality of thin-film lenses having the respective determined lens profiles;

coupling the fiber block to the lens block by using a transparent adhesive layer; and

aligning tips of the plurality of optical fibers with respective focal points of the corresponding thin-film lenses.

11. The method of claim 10, wherein fabricating the fiber block comprises embedding the plurality of optical fibers in a first substrate and positioning tips of the plurality of optical fibers in a first position configuration on a first surface of the first substrate.

12. The method of claim 11, wherein fabricating the lens block comprises realizing the plurality of thin-film lenses on a first surface of a second substrate so that respective focal points of the plurality of thin-film lenses form a second position configuration on a second surface of the second substrate, wherein the second position configuration matches the first position configuration.

13. The method of claim 12, wherein coupling the fiber block to the lens block comprises joining the first surface of the first substrate to the second surface of the second substrate so that the tips of the plurality of optical fibers are aligned with the respective focal points of the plurality of thin-film lenses, and wherein the second substrate comprises a wedged substrate.