



## Optics

# Three-Dimensional Range Imaging Apparatus and Method

Enabling low-cost, lightweight, and reliable range imaging with high image quality

Three-dimensional range imaging is utilized in numerous science and industrial applications. Standard devices that perform these tasks predominately use mechanical scanning such as galvanometer-controlled mirrors, oscillating or spinning mirrors, rotating optical edges, nutating mirrors, or other mechanical means for producing a linear displacement of a laser beam for scanning a remote target. Such devices often exhibit limitations that include large weight & size, low reliability, high component count, manufacturing complexity, low image quality, shorter lifespan, high power consumption. They may also experience momentum-induced perturbations and thermal-mechanical misalignment. NASA's lightweight, and reliable range-imaging system produces high-quality images without these limitations.

## BENEFITS

- Provides an inexpensive, lightweight, and reliable range imaging system that produces high quality images including tens, hundreds, or even thousands of pixels
- Target surface characteristics with high resolution including reflectivity, roughness, and density (of semi-solid objects such as clouds or vegetation)
- Acquires images of large target area without the use of any moving mechanical parts such as moving mirrors or scanning optics
- Produces a controllable illumination pattern for a wide variety of ranges, angular extents, and resolutions by regulating the direction, timing, and beam quality of light emitters

technology solution

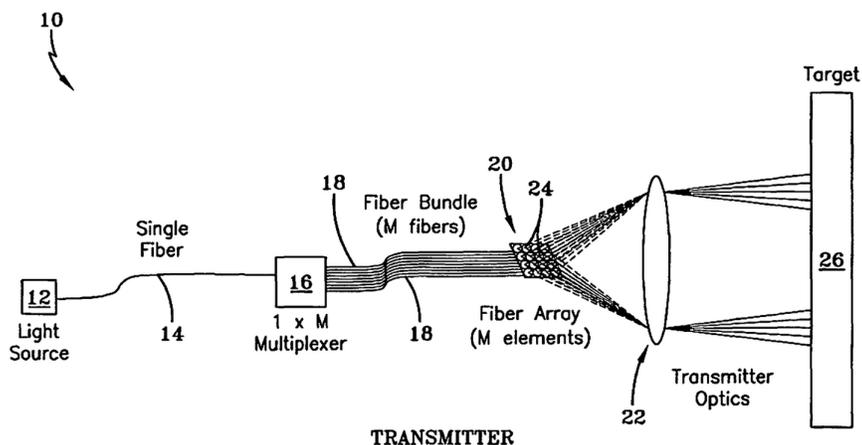


# NASA Technology Transfer Program

Bringing NASA Technology Down to Earth

## THE TECHNOLOGY

NASA's invention is a method of three-dimensional range imaging. The method involves providing a modulated light signal, forming a fixed fiber array with ends of optical fibers, switching the modulated light signal successively into multiple optical fibers to form a pixel pattern at the fixed fiber array, and projecting the pixel pattern onto a target.



Transmitter for the Three-dimensional Range Imaging Apparatus

## APPLICATIONS

The technology can be used in a host of applications that include:

- Robotic vision and guidance
- Surface characterization
- Terrestrial surveying
- Vehicle anti-collision systems

## PUBLICATIONS

U.S. Patent 7,978,312

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