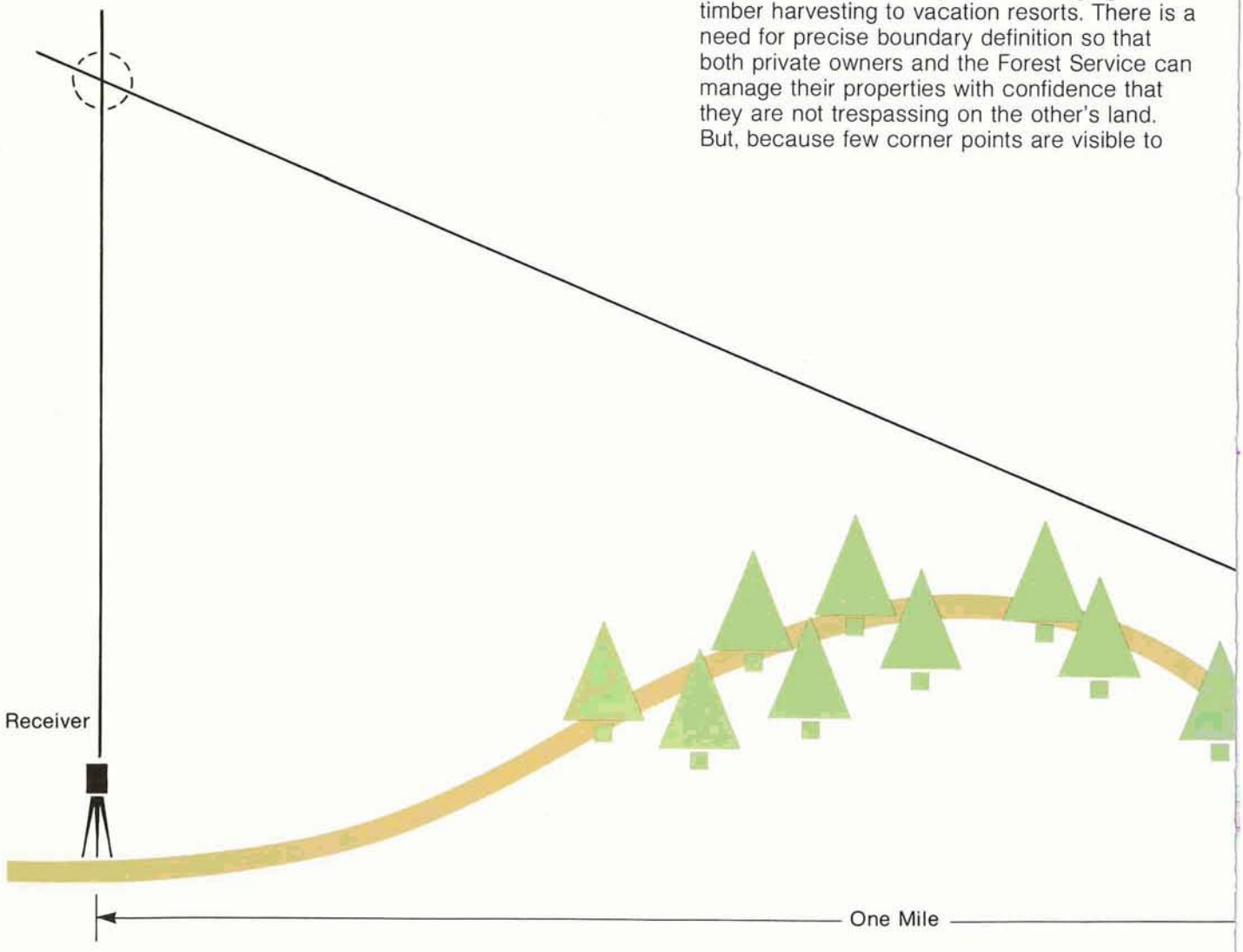
Laser Surveying NASA technology has produced a laser-aided system for surveying land boundaries in difficult terrain. It does the job more accurately than conventional methods, takes only one-third the time normally required, and is considerably less expensive.

In surveying to mark property boundaries, the objective is to establish an accurate heading between two "corner" points. This is conventionally accomplished by erecting a "range pole" at one point and sighting it from the other point through an instrument called a theodolite. But how do you take a heading between two points which are not visible to each other, for instance, when tall trees, hills or other obstacles obstruct the line of sight? That was the problem confronting the U.S. Department of Agriculture's Forest Service.

The Forest Service manages 187 million acres of land in 44 states and Puerto Rico. Unfortunately, National Forest System lands are not contiguous but intermingled in complex patterns with privately-owned land. In recent years much of the private land has been undergoing development for purposes ranging from timber harvesting to vacation resorts. There is a need for precise boundary definition so that both private owners and the Forest Service can manage their properties with confidence that they are not trespassing on the other's land. But, because few corner points are visible to



each other, the surveying task posed monumental problems and the Forest Service was faced with a rapidly growing backlog of unposted boundary lines.

The Forest Service considered ways of sighting over obstructions. The practical limit for extending the height of the range pole was six or eight feet. Tethering a balloon over a corner marker was feasible, but wind effect makes the balloon an inaccurate aiming point. Building towers is too costly and time consuming. Use of helicopters is also very expensive and not sufficiently accurate. So the Forest Service took the problem to NASA's Goddard Space Flight Center. Goddard undertook the assignment and came up with an answer: a laser system, diagrammed in the drawing below, which enables sighting between two points not intervisible with accuracy greater than conventional techniques.

The system, commercially produced by RCA's Automated Systems Division, Burlington, Massachusetts, is called the "laser range pole." It consists of two elements, a laser transmitter and a receiver/theodolite, which weigh a combined 58 pounds and can be backpacked into rugged country. The tripod-mounted transmitter pictured on the opposite page sends a vertical column of light straight upward from a corner marker. Although the laser beam is invisible to the human eye, it can be picked up by electronic eyes in the receiver/theodolite, stationed at another corner marker a mile or more away. The theodolite operator (right photo) makes fine adjustments to his sighting equipment until an indicator light tells him his optical sight is correctly aligned with the laser beam. This establishes a precise heading between the two boundary markers, allowing crews to set stakes along the heading by conventional line of sight methods.

The Forest Service is using three laser range poles, two of them improved, second-generation systems which far exceed the original range specification of one mile; they are effective over distances of two and a half miles in daytime and five miles at night. The Department of the Interior's Bureau of Land Management has purchased four of the improved laser devices from RCA, to be used principally for surveying oil-shale land boundaries. The system has a number of surveying applications beyond boundary marking. Goddard Space Flight Center, under contract with the Department of Agriculture, is redesigning the equipment to make it less expensive for broader use.

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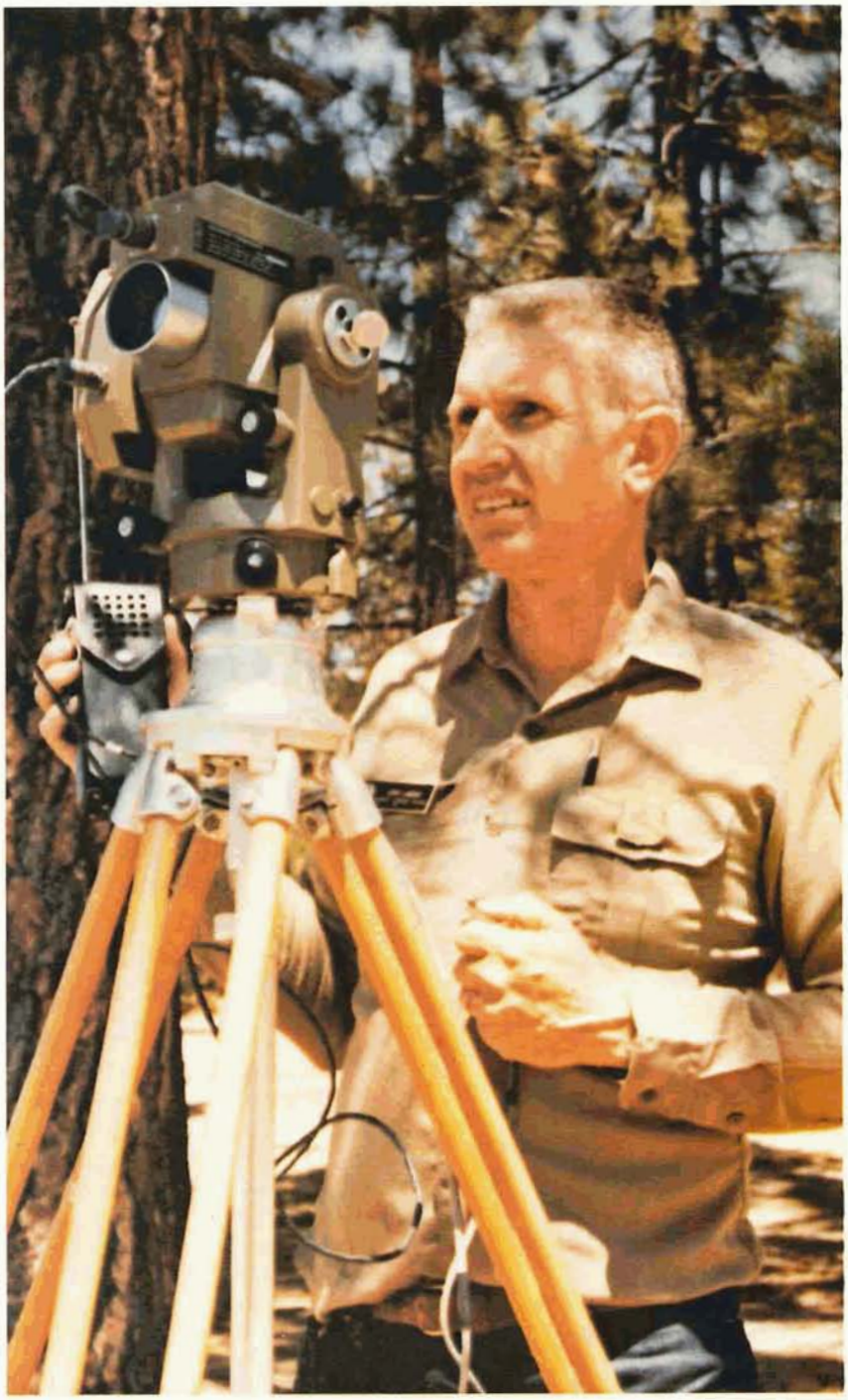

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