UK COOPERATIVE EXTENSION SERVICE
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Elements of PRECISION AGRICULTURE

Lightbar Guidance Aids

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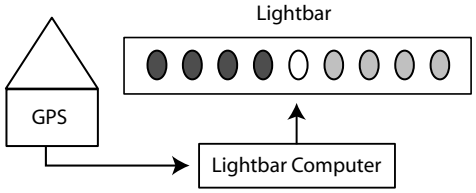
GPS (Global Positioning System) and other electronic technologies have facilitated many innovations in agricultural field machinery. One of these innovations is the development of GPS-based guidance aids commonly referred to as "lightbars." The primary function of a lightbar is to show a driver how to steer the machine along accurate parallel passes or swaths across a field. This publication gives information about different system configurations and how they work.



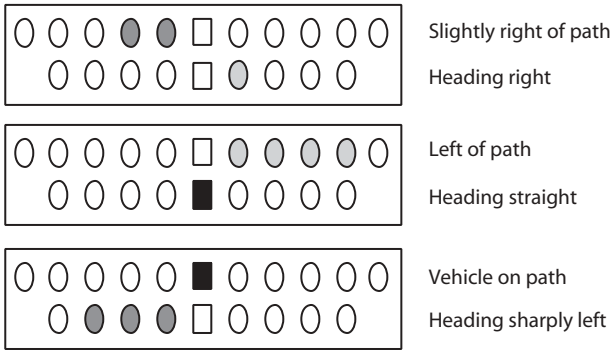
Lightbar System Components

Most lightbar systems include a Differential GPS (DGPS) receiver and antenna, some kind of computer or microprocessor, and a lightbar or graphics display. In some lightbar systems, these components are separate physical units connected by electronic cables; in other systems, several components are combined into one box.

To operate a lightbar system, the driver first steers the vehicle along the first pass through a field and selects an A-B line by pressing a button or switch at each end of the pass. The lightbar computer records the GPS position at each of these points. The driver also enters the machine width along with other basic setup information into the computer. The computer then determines the location of each subsequent parallel pass across the field. The driver must perform the headland turns and position the vehicle relatively close to the next swath. The computer compares the current vehicle position indicated by the GPS receiver to the desired path. This error is displayed on the lightbar so that the driver knows which way to steer the vehicle to keep it on the desired path.

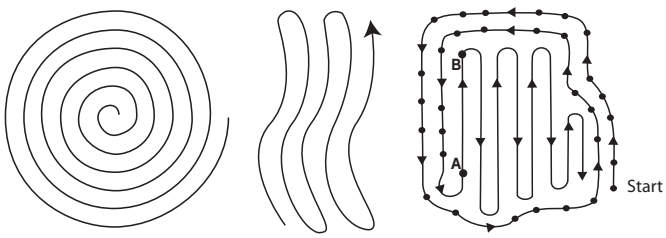
The simplest lightbar displays are made up of a single horizontal row of lights. The center light, which is sometimes a different color or shape than the other lights, indicates that the vehicle is right on the desired path. As the vehicle deviates from that path, the lights to one side of the center light will be successively turned on. On most systems, the lights indicate which way to steer the vehicle; i.e., as the vehicle drifts right, the lights will move left telling the driver to steer left to correct. More lights generally indicate a larger deviation from the desired path. The driver's goal is to keep the lights in the center.

There are many variations in lightbar displays. Some lightbars have two horizontal rows of lights. One row of lights indicates the offset error or deviation from the path while the other row indicates whether the vehicle is heading toward or away from the desired path. The purpose of the additional heading indication is to help drivers better anticipate how to steer the vehicle. Other manufacturers use graphical LCD displays on lightbar systems. Graphical displays show a two-dimensional rendering of the vehicle and/or path. The driver keeps the vehicle image or path in the center of the screen. Still other manufacturers provide audible signals or beeps to indicate which direction the driver should steer the vehicle.



Sample Lightbar Indications

The earliest lightbars were only capable of creating straight parallel swaths. Some more modern systems have the capability to guide along curved paths. Various field patterns are accommodated including contour strips, irregularly shaped fields, and circular patterns for center-pivot irrigated fields.



Sample Field Patterns

Benefits of Lightbars

The primary advantage of using a lightbar is a reduction in application errors (overlaps and skips). Most operators, in typical field operations, tend to overlap subsequent passes to avoid the more noticeable effects of a skip. Recent studies have shown that most drivers who use foam markers with chemical application equipment will overlap about 5% of the machine width on each pass. Lightbars can help reduce overlap to less than 3% without increasing skipped areas. This could translate into a reduction in chemical use of as much as 2%.

Lightbars can also improve machine operation in poor visibility. For example, early or late in the day when sun glare can make it difficult to see foam markers or fencerow references, a lightbar is easily visible, thus making it possible to guide more accurately. Also, some cover crops can make it difficult to see foam or mechanical marks.

Most lightbars are designed to be placed in the peripheral vision of the driver, usually just above the steering wheel or on the forward hood. As such, the driver does not have to focus as much attention on the display as he or she does with external indicators such as fencerow references or foam markers. This means that the driver experiences much less fatigue. Additionally, it is easier for the driver to monitor other machine functions and displays.

Another advantage of lightbars is record keeping. Many lightbar systems will record the path of the machine through the field, and some will even record whether or not the machine was applying. These data can be a valuable record of exactly where inputs were applied and the time of application.

In short, lightbars are a new, relatively simple technology that can bring many advantages to farm operations. A companion factsheet *Implementing Precision Agriculture: Choosing the Right Lightbar* (PA-4) gives more information about how to choose the right lightbar for a particular operation.

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