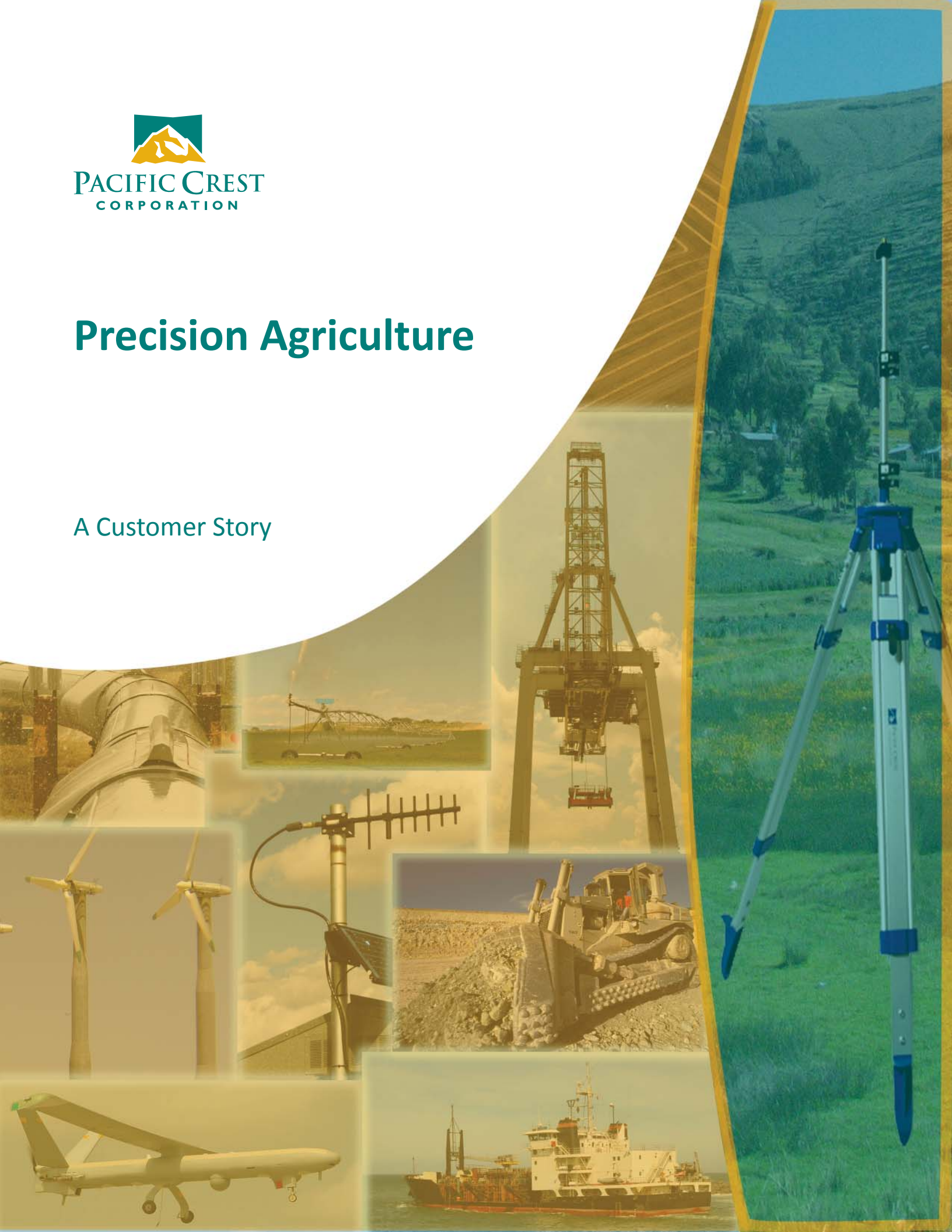
PACIFIC CREST
CORPORATION

Precision Agriculture

A Customer Story



Precision Agriculture

Introduction

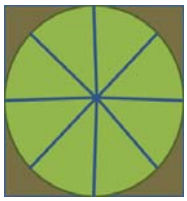
When flying over rural areas, particularly in the American Midwest, it is common to see row after row of immense green circles that sometimes touch but never overlap. These giant disks demark areas where agricultural land not blessed with abundant rainfall is made productive by pivot irrigation systems.

Traditional sprinkler systems consist of pipes and sprinkler heads that traverse from one end of a field to the other and spray water in rectangular patterns. They can either be set up and moved by hand or put atop "lateral move" systems – pipes on motorized wheels that automate the distribution of water at a pre-set pace. The mobile pipes are attached by hoses to a series of stationary source pipes dug into one edge of the field. This requires both a lot of source pipes and a lot of manual tending.

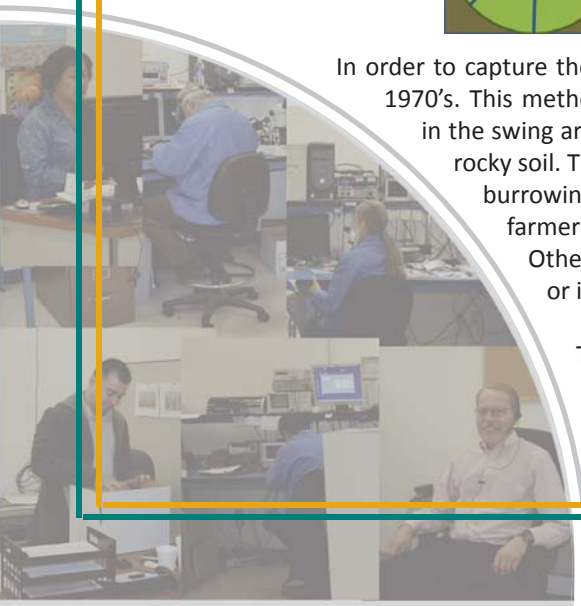
A pivot irrigation system attaches the same pipes and motorized wheels to a single, central source pipe. The motorized wheels spin around the central "pivot" and sprays water in a circular pattern which is seen from the sky as a green zone in an otherwise arid, brown landscape. A pivot system can be programmed to require essentially no human intervention. Even though it is attached to a single source pipe, the pivot can irrigate one hundred sixty acres or more. The only problem with this method comes from the fact that land is sold, plowed, seeded, and sprayed with chemicals in squares or rectangles, not circles. Large amounts of money can be wasted if the irrigation pattern doesn't match the seed and chemical application pattern. When a square field lies inside an irrigated circle, water is wasted because it is sprayed on unseeded ground.

Square or rectangular field using center pivot system.

When the irrigated circle lies inside the square field, seed and chemicals are wasted in the corners of the field that do not receive any irrigation.



Traditional center pivot system in a standard square field.



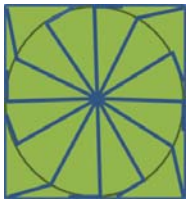
In order to capture the corners in a field, a swing arm was added to the existing center pivot system in the 1970's. This method used an electromagnetically charged cable buried in the ground that gave sensors in the swing arm a path to follow. Digging and laying the cable was expensive and also very difficult in rocky soil. Thousands of feet of cable are required for just a single large field. In addition, plows and burrowing animals could break the cable – and buried cable is expensive to repair. And when the farmer needs to change the water pattern, the entire cable must be dug up and repositioned. Other methods were devised to power the swing arm, but they, too, proved to be expensive or inefficient or both.

The agricultural market looked at early GPS systems, but the pivot calculations were too inaccurate to effectively pinpoint the location of the arm – not to mention the systems

were incredibly expensive. Since those early systems, GPS technology has made giant strides in accuracy and reliability while bringing down the cost considerably.

Reinke Manufacturing is one of the world's oldest and largest manufacturers of center pivot and lateral move irrigation systems. It was one of the first to adopt precision satellite guidance for its irrigation systems. Reinke Navigator offers a GPS guidance system for swing arm corner systems that eliminates the need for buried cable. This GPS system comprises a Pacific Crest radio (EDL II) that is mounted on the center pivot system with a Trimble BD960 GPS locator on the end tower. Data is transmitted that tracks the exact position of the end of the swing arm as the sprinkler pivots around the field, following the lines of land. The coordinates of the field are programmed into the GPS software. As the pivot arm moves around the center point, the swing arm is told how it needs to be oriented to irrigate the full extent of the farmer's field. If the field perimeters should change, new coordinates can easily be changed in the GPS software and the swing arms path is automatically adjusted. All this data is transmitted back to a central location, eliminating the need for the farmers to be out in the fields, making the adjustments to each piece of equipment.

Radio and GPS working together on Reinke systems provide a highly reliable, precise position where the swing arm is located at all times. Rocky soil and uneven terrain, once considered too difficult to cover, are easily turned into crop-producing acreage with the radio-GPS positioning system. This navigation system not only determines the location of the arm, but also controls the amount of water needed to run from the water source to the end of the arm, allowing for an even and consistent application. Money is saved by using no more water than is needed in each location. Pacific Crest's radio-GPS controlled corner swing arm allows 27% more land to be cultivated in a simple square field. With the average center pivot unit, an additional 45 acres that can be cultivated and maximum yields can be produced for each and every acre.



Swing arm built on center pivot system uses a radio and GPS to position the swing arm to fit the size and shape of the field.

This technology is currently available from Pacific Crest radios and Trimble's BD960 GNSS receiver module with programmable software. These components form the backbone of an exploding precision OEM agricultural market. Built on industry-leading technology with Trimble's centimeter-level positioning and Pacific Crest's rugged RTK radios, the radio-GPS combination will continue to drive next-generation agriculture.

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