Path planning and route optimization can appear to be an incremental improvement on traditional in-field practices. Traditionally, growers have used mechanical means and years of practice to minimize overlap and other field inefficiencies. Over time the use of marker arms on planters and foam markers on applicators were replaced with autosteer and continued advancements in guidance systems.

Path planning and optimization is deeper and more important than simply an incremental improvement. At its core, the in-field farm operations are the execution layer associated with detailed and intentional crop planning. Path planning and optimization is how a grower takes the sea of information, considerations and advice and distills it down to take the actions necessary to produce a crop providing the maximum return.

Growers have not had the tools required to assess the economic impact of the movement of their machinery with regards to field efficiency and sustainability. There became a clear need for an easily-adoptable interface, designed to allow the grower to take a granular view of their field movements, allowing for complete optimization.
WHAT IS LAUNCH PAD?

Launch Pad is a web-based interactive geospatial application developed to help the growers optimize the movement of their agriculture machinery. Users have the ability to tweak critical, field- and equipment-specific parameters to create a route plan, based on proprietary First Pass optimization algorithms, that minimizes economic and environmental costs while maximizing field efficiency. The application offers a variety of cutting-edge, cloud-native capabilities to help growers create and visualize optimized path plans for every field operation in a growing season.

Launch Pad also leverages recent advancements in automation and big data analytics to enriched incomplete and disparate past as-applied machine paths and reveal actionable intelligence. The automated workflows in the application enables the customers to export path plans directly to equipment through integrations with OEM platform APIs.

The various features of Launch Pad demonstrate a clear ROI and value proposition that is intuitive - creating an optimized path plan based on user inputs and geospatial characteristics of the field to increase the economic gain per acre farmed. This web application integrates complex computational structures in an accessible way to drive adoption. The grower now has the power to incorporate all of these various considerations and data points and then utilize the power of First Pass to extract the value of this information in how a grower implements their decisions.
Path planning

**Tweak input parameters.** Select a specific boundary associated with the field, enter the equipment swath or track width related to a field operation, and change the number of passes around the outside of the field and each in-field obstacle.

**Visualize optimized path plans.** Use sliders to change track direction (heading) and visualize the optimal path plan for each angle. See the impact each path plan has on economic factors like distance traveled and number of tracks.

**Compare path plans.** After choosing an optimal path plan, compare that against past as-applied data and previous field routes. See the savings (in both distance and number of tracks) of using First Pass when compared against previously used paths.
**KEY FEATURES**

**Growing Season Analysis**

*Evaluate dependencies.* Evaluate the impact of optimizing for seeding operations across your other in-season operations like application and harvest. Curious about how optimizing for harvest efficiency will impact seeding paths? Adjust the anchor operation and re-run the scenario before ever entering the field.

*Layering path plans.* Use sliders to view all path plans in a single map layer and highlight the changes between multiple plans at different swath or track widths by adjusting the transparency of each operation relative to the others. This could also be used as an analysis tool to select the appropriate swath or track width for a field operation to minimize soil compaction by keeping all field operations aligned to the same track.

*Modify path plans.* In the same user interface, re-apply parameters including selection of field boundary, equipment swath or track width, and number of headland passes to refine path plans.
KEY FEATURES

Bulk Operations

Multi-field optimization. Select a combination, or all fields in an organization, add the required field operations (seeding, application, or harvest) and generate optimal path plans concurrently.

Processing notifications. Analysis of a large selection of fields and operations can be compute-intensive. This can be set to run independently while other analysis is conducted, sending an email notification when complete.

Push guidance to OEM platform. After reviewing the path plans, the users can select multiple fields and push their respective path plans to the OEM platform. For select OEM brands, the path plans can be also exported in other formats.
IN-FIELD EFFICIENCIES CREATE VALUE BEYOND THE GROWER

In-field operations are akin to the delivery service that delivers your packages from Amazon. The timely delivery of an undamaged internet purchase ensures a positive consumer experience whereas a broken set of dishes or crushed box of laundry detergent is seen by the consumer as a failure of Amazon, not a failure of the delivery service.

Pulling together and making sense of the advice of your agronomist to top-dress fertilize or apply fungicide based on weather forecasts and patterns, satellite imagery, market prices and trends, established yield goals and available moisture, input prices and availability, and cash flow constraints is a complex exercise. That decision to apply fungicide or additional nutrients is made to drive the desired outcome. When that decision is made, the implementation of that decision (being the in-field application), becomes a matter of execution. As with the poor delivery service impacting the desired outcome of new dishes from Amazon, too much product being applied due to unnecessary overlaps, increased crop damage from unnecessary wheel damage, and being unable to cover all of the desired fields during the application window all result in the desired outcome not being achieved due to execution issues. Proper execution of in-field operations underpins the sustainability, both economic and agronomic, of the entire crop production system the same way that delivery services underpin Amazon’s online marketplace business.
Recently there has been a lot of discussion regarding outcome based pricing models from input providers. Both Bayer and BASF have announced plans to pursue and pilot such models whereby a result, such as a yield target, is agreed upon and contracted. If the outcome is exceeded, the input provider is paid a percentage of the upside and provides a rebate in the event the outcome isn't achieved. This results in the “productization” of the outcome and a sharing of risk/reward between the grower and the input provider.

To deliver this “product” the input provider employs a suite of tools, technology and advice including data interpretation and analysis, agronomic advice, satellite imagery, risk mitigation tools, variable rate application mapping, seed genetics and crop protection chemistry, and so on. Similar to the purchase of the item from Amazon, the execution on the prescribed actions to deliver the “product” of the agreed upon outcome is as important in achieving the outcome as the advice itself. The best genetics and leading chemistry being utilized through an optimized variable rate prescription from the most accurate yield maps aren’t enough to drive the intended outcome. Without proper planning and execution of the operational aspects to put the perfect crop plan into action at the right time across the entire area, the desired outcome won’t be achieved or the inputs required to generate the outcome will be unnecessarily increased. Both of these effects result in a lower margin to the input provider and a lower satisfaction rate among the customer base. Proper delivery in the field of the outcome based product is a key ingredient to the success of the new Outcome Based Pricing business model. This analogy holds true for other bundled or grouped offerings by input providers to the end-grower customer, whether it be Outcome Based Pricing or full season scouting, agronomic recommendations and custom application based on trust and experience.

This is why the Verge family of products provides immense value to the grower, and can serve as a valuable tool for any group moving towards a variety of different pricing and product models. First Pass provides the most efficient path plans to increase planting, application and harvest efficiency resulting in less overlap, reduced errors, reduced tracks, and increased area covered. Launch Pad allows growers to simulate, visualize and modify these optimized path plans across all of their fields for an entire season while also comparing against the operations of a past season. Launch Pad and First Pass together allow a grower to reduce their crop inputs, labor costs and soil impacts while maximizing their machinery productivity during crucial timing windows.
We are in an age in agriculture where there is an abundance of information available from a seemingly unlimited number of sources. Our understanding of plant and soil interactions have continued to evolve and improve. Understanding the impact of chemical residues on resistance, crop rotations on disease cycles, nutrient availability on crop yield, plant density on yield, or erosion on surface water and environmental contamination have each led to improvements on how our food is produced. Improving practices have allowed growers to constantly improve the sustainability of crop production, both economically and environmentally. Launch Pad provides the power to incorporate all of these various considerations and data points, while utilizing the power of First Pass to extract the value of this information to allow the grower to better implement their decisions.

Organizations looking to move into various non-traditional pricing models, such as bundled offerings or outcome based pricing, gain a distinct advantage when partnering with Verge. Not only do they have the ability to gain access, and spread awareness of cutting edge optimization technologies, but it also allows for an early-adopter relationship entrenched at the forefront of the optimized farming frontier.