The size of machines used for agricultural field operations has increased steadily over the past few decades in order to reduce labor costs and allow the grower to efficiently manage larger plots of land. While these massive machines are built with modern technology, they come with the adverse side effect of damaging the soil structure - impacting the soil’s ability to hold water, nutrients, and air necessary to support crop life. A large number of agricultural fields around the world also have complex field shapes, multiple obstacle areas, and irregular terrain with steep slopes with some of these features like terraces and drainage developed previously around older equipment parameters. A combination of all of these factors make it very difficult for growers to intuitively decide on a track direction and orientation for the machines that will result in minimizing both economic (excess input usage, distance traveled, non-working time in field, and overlap area) and environmental (excess input usage, GHG emissions, soil compaction, and erosion) costs.

Farm operators have predominantly adopted auto-steering and high precision guidance systems to follow parallel straight or curved paths that provide near-complete field coverage. But this does not account for any operational optimization by considering irregularities of field boundaries and topography features. A non-optimal starting point and track direction can have an adverse impact on total distance traveled, the number of turns, and overlap area for each field operation. Extra passes taken on the field lead to an increase in fuel consumption and input costs such as seed, chemical, and fertilizer while also reducing the total area able to be covered in a day.

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 an interactive web-based geospatial application developed to help growers optimize the movement of their 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. It 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 enrich incomplete and previous machine paths, revealing actionable intelligence. The automated workflows in the application enables the grower to easily export path plans directly to their equipment through integrations with OEM platform APIs.

Launch Pad’s features show a clear return on investment and value proposition that is intuitive to the grower, creating an optimized path plan based on user inputs and geospatial characteristics of the field, increasing the economic gain per acre farmed. The application integrates complex computational structures in an accessible way to drive adoption.
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.
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 our practices have allowed growers to incrementally and constantly improve the sustainability of crop production, both economically and environmentally. Launch Pad provides a grower 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.

Path planning and optimization is deeper and more important than simply an incremental improvement. At its core, the in-field operations of your farm 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.

Verge is looking to the horizon in today’s farming landscape in an effort to continually find new ways to utilize data to improve crop production margins. Through in-depth analysis, in-field trials, an ever-growing knowledge base, and stakeholder collaboration, Verge products are designed to maximize every single in-field operation, saving the grower time and money without sacrificing the land.