THE CASE FOR CONTINUOUS SUPPLY CHAIN VISIBILITY INDOORS AND OUT

Track Goods Seamlessly In Facilities
And To Their Destination With RTLS

AiRISTA
Location. Insight. Visibility.

INTRODUCTION

DATA SILOS CREATE SUPPLY CHAIN INEFFICIENCY

Supply chain managers operate in a world of data silos. To help improve responsiveness and even proactive intervention to disruptions, supply chains need to track goods between indoors and outdoors seamlessly. Creating a unified view of goods both inside facilities as well as in transit gives supply chain managers the tools to anticipate and react in the moment to disruptions.

STRAINS ON SUPPLY CHAINS INCREASE

Opportunities for supply chain disruptions are increasing. Consider the last several years. We experienced a global pandemic, saw a surge in demand for digital products, semiconductor inventories were drained, a shortage of truck drivers left ports clogged, and now the war in Ukraine, a spike in energy prices, extreme weather events, emerging geopolitical alliances, and new targeted tariffs.

SEAMLESS TRACKING INDOORS AND OUTDOORS

When disruptions occur, supply chain managers are hamstrung by islands of data and applications that are not coordinated. Warehouse Management Systems focus on products under the warehouse roof; inventory management, order management, warehouse optimization, and labor management. Once goods leave the warehouse and are enroute, management is turned over to logistics platforms for load planning, route planning, carrier management, and payment/audit.

In short, a supply chain is broken if there is not continuous visibility as goods move indoors and out.

Real Time Insights for Efficient Operations

Connecting silos with location insights is low hanging fruit

Disruptions to supply will have ripple effects both up and down the supply chain. Finished goods pile up in inventory, freight gets diverted on its way to depots or delayed as it arrives at transit hubs. The result limits access for businesses to receive materials and replenish their stock. An Accenture survey of 1,200 executives estimated they missed out on revenue growth opportunities totaling $1.6T due to disruption in engineering, supply, production and operations.[1] To manage interruptions in real time requires a unified view of goods across the chain. At the heart of the challenge is visibility to location of goods in the moment regardless of whether they are indoors or in transit.

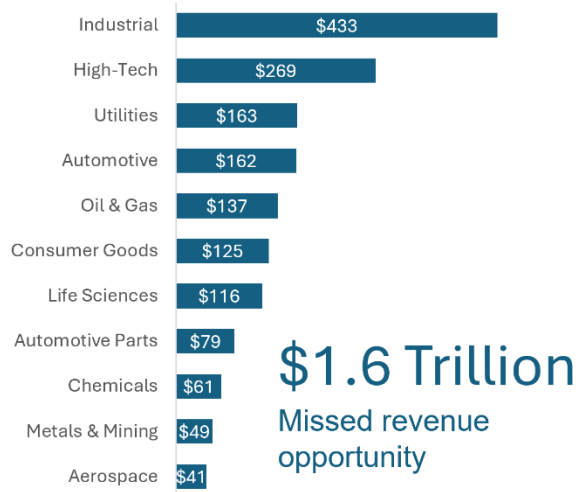| Industry	Value ($B)
Industrial	$433
High-Tech	$269
Utilities	$163
Automotive	$162
Oil & Gas	$137
Consumer Goods	$125
Life Sciences	$116
Automotive Parts	$79
Chemicals	$61
Metals & Mining	$49
Aerospace	$41

$1.6 Trillion
Missed revenue opportunity

Fig. 1 Survey respondents missed out on revenue growth opportunities of between 7.4%-11.0% due to disruption in their engineering, supply, production and operations ($B).

To create supply chain agility, vendors are encouraged to engage with multiple logistics providers to create reconfigurable supply chains. This two-edged sword introduces new challenges as information must be shared among more parties. Integrations are time consuming, costly, and may expose your operations to potential cyber threats.

Enter the role of a an RTLS platform. With the right RLS platform, steering information between vendors and applications is simplified, events are captured in real time, and recovery strategies are kicked off. When considering RTLS vendors, your first priority should be the software platform and its ability to address not just the needs of the enterprise but the entire supply chain.

Benefits of continuous visibility to goods both indoors and outdoors

Providing real-time visibility data and predictive insights to teams across your supply chain network can lead to significant cost reductions across critical areas. By having access to accurate and timely information, teams can make more informed decisions, reducing inefficiencies and waste. This enhanced visibility allows for better inventory management, optimized transportation routes, and improved scheduling. As a result, companies can achieve lower operational costs, minimize delays, and enhance overall supply chain performance.

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[1] "Resiliency in the Making", Accenture, 2023

Right-size your inventory

Visibility in the supply chain gives operators a comprehensive understanding of inventory availability both in transit and across different facilities. This ensures there is sufficient stock to fulfill customer orders and adapt to changes in demand without overstocking on safety inventory. Traditional forecasting models often rely on fixed sourcing locations and lead times, but real-time visibility allows supply chain managers to see actual quantities and transit times using historical and predictive data. This accurate information enables teams to update master data to reflect true transit times, reducing inventory carrying costs and achieving significant savings at scale.

Moreover, integrating real-time visibility into order systems lets customers see which locations have a specific SKU available. This capability allows teams to use alternative sourcing locations or excess stock in other markets, avoiding the need to purchase additional materials. Since most companies maintain about 30 days of finished goods ready to ship, these savings can accumulate quickly. Comprehensive insights into actual versus estimated unit counts eliminate the reliance on inflated estimates, freeing up working capital for other uses.

The average level of inventory accuracy among US retailers is a modest 63%, resulting in bloated safety stocks or inventory stock outs.

Eliminate stockouts

Each potential sale represents a chance to either strengthen or damage your customer relationships. Long product lead times and uncertain delivery ETAs can hinder your ability to maximize sales of seasonal items, coordinate promotional efforts, and make reliable commitments to customers. Attempting to offset disruptions with expedited delivery reduces margins and revenue.

40%
Increase of product order-to-delivery lead times reported in the last 2 years

By having a clear view of the entire supply chain and using SKU and order-level details from your real-time visibility platform, you can gain control over your inventory. Sharing data across transportation, warehouse, and sales departments provides a single source of truth, allowing you to plan based on actual lead times and inventory levels, rather than relying on assumptions.

Facility operations

At the facility level, supply chain visibility can lead to cost savings through more efficient use of capacity and staff time, in addition to avoiding fines and fees. When visibility is provided across your supply chain, the benefits increase significantly. Knowing the arrival times of inbound trucks and contents transforms warehouse efficiency. Loading dock staff can now strategically stage orders, ensuring seamless operations when trucks arrive. At the drop-off point, managers can effectively coordinate unloading activities, reducing downtime and boosting productivity.

Integrating a yard management system with RTLS visibility optimizes yard task management, enhancing productivity for gates, spotters, warehouses, and carriers. By automatically tracking each inbound order, you can alert your team to any exceptions that could jeopardize the schedule, allowing yard teams to quickly locate the correct freight for incoming trucks. Once a shipment arrives, integration with your yard management solution can assign tasks to dock workers, track the location of goods to storage, and monitor completion time to ensure a smooth workflow.

Proactively manage exceptions

Effectively managing exceptions not only enhances customer satisfaction and boosts revenue potential but also saves thousands in on-time, in-full (OTIF) charges and missed appointment fines. To significantly impact financial outcomes, organizations need to predict delivery exceptions early, while there's still time to take corrective action and keep the shipment on track. Shippers and carriers with visibility into the entire shipment journey are better equipped to adjust transportation plans and mitigate the negative effects of exceptions.

"Transisiton to a federated implementation model to support the emergence of composite analytics platforms that are more resilient to turmoil."

- Gartner

When end-to-end visibility is combined with artificial intelligence, exceptions can be anticipated in advance, enabling shippers or carriers to prevent these issues before they arise. Supply chain visibility provides teams with timely, accurate data to make quick, informed decisions during disruptions. With SKU-level visibility, proactive alerts, and the most precise predictive ETAs, operating teams can adjust shipping plans or appointment times to avoid OTIF failures.

Collaborate with customers & suppliers

Advanced real-time visibility solutions enable you to view your supply chain in the context of purchase orders, rather than just tracking the location of inventory, containers, or trucks. Visibility can start as soon as an order is placed, eliminating the need for your partners to wait for a shipment number to begin tracking.

- By extending visibility to the earlier stages of the order lifecycle with supplier-managed inbound freight, you can reduce disputes, eliminate check-calls, and focus on strengthening supplier relationships with shared data and performance goals.

- Integration with an RTLS platform provides a unified platform that connects teams with real-time insights into the status of vendor-controlled freight, including alerts for at-risk shipments and recommended actions. Teams can rely on early exception notifications and accurate ETAs to make decisions that prevent shutdowns, stockouts, and the need for expedited shipping.

- When partners can effortlessly access shared, real-time insights and foresee potential disruptions, the entire supply chain ecosystem is revolutionized. No longer must we depend on assumptions, guesswork, or manual interventions.

- With a unified source of truth readily available, the ecosystem can dynamically respond to challenges and seize opportunities. Embracing the power of supply chain data and ecosystem collaboration is essential to shaping a future where progress surpasses tradition, and innovation leads the way to success.

The effects of RTLS insights to operational efficiency will increase even further with the synergy between AI and RTLS platforms. AI synergies will result in smarter, more responsive systems that enhance decision-making, increase efficiency, and drive innovation across various sectors. By applying AI to RTLS, organizations can harness real-time data to make more informed and timely decisions. This integration not only streamlines operations but also uncovers new opportunities for innovation and growth. Consequently, industries ranging from healthcare to manufacturing can experience significant advancements and improved outcomes through this powerful combination.

EXPLANATION OF TRACKING TECHNOLGY

Match your needs to right technology and price point

Bar Code Systems

Barcode scanners play a crucial role in streamlining operations and enhancing efficiency. These devices are used to quickly and accurately capture information encoded in barcodes affixed to products, pallets, or containers based on optical technology. Warehouse personnel use handheld or fixed-mount scanners to scan barcodes during receiving, inventory management, picking, packing, and shipping processes. By scanning barcodes, workers can instantly retrieve product details, update inventory records in real-time, track the movement of goods throughout the warehouse, and ensure accurate order fulfillment. But handheld scanners assume a level of human interaction, they require line of sight, and scanners generally can't track the real time location of tagged goods.

Unlike Active RTLS, bar codes and Passive RFID do not provide real time updates to the current location of goods.

Passive RFID

Passive RFID (Radio Frequency Identification) technology is utilized in warehouses to automate and enhance various logistics and inventory management processes. Small RFID tags with embedded circuitry are affixed to products or pallets. The circuitry contains a unique identifier that can be read wirelessly by RFID readers positioned strategically throughout the warehouse. Unlike barcode scanners, RFID does not require line-of-sight scanning, allowing for rapid and simultaneous reading of multiple tags within the reader's range. And because the tag harvests the energy of the RFID reader to reflect the signal back to the reader, no batteries are required. Passive RFID facilitates inventory tracking, enabling warehouse managers to monitor stock levels, and manage replenishment needs more effectively. Passive RFID also aids in automating receiving, sorting, and shipping processes, improving overall operational efficiency by minimizing manual handling and reducing errors associated with traditional barcode systems. But unlike active RTLS solutions, passive RFID solutions do not provide real time updates of the current location of goods

Active RTLS

As the name implies, active RTLS uses an internal battery to generate a periodic wireless signal. The wireless signal is detected by receivers in the area which relay the tag ID and its signal information to a software algorithm that calculates the current location. Unlike passive RFID, RTLS solutions provide a continuous accounting of tagged items including location.

LoRaWAN

LoRaWAN is one type of RTLS solution used primarily outdoors in laydown yards and trailer facilities. LoRaWAN benefits include long-range communication capabilities, and long battery life. However, it has drawbacks, such as limited bandwidth and location accuracy no better than 10 meters. Additionally, the deployment and maintenance of LoRaWAN overlay networks can be complex and costly.

Wi-Fi & BLE

Wi-Fi and Bluetooth® Low Energy (BLE) require less overlay infrastructure because it can often leverage the access points that are likely already deployed in the facility. With sufficient density of access points, 3 to 5 meters of accuracy are possible. Using advanced versions of these standards like BLE Angle of Arrival, submeter accuracy is possible with the addition of special antennas. This approaches the accuracy of UWB without the need for a significant overlay network. As the name implies, BLE is energy conserving helping to make batteries last years (dependent on the frequency of the tag's chirp rate). And BLE technology is riding down the consumerization curve reducing the cost of tags. This means more items can be tracked at lower costs using less infrastructure.

Ultra-wideband (UWB)

Ultra-Wideband (UWB) technology offers precise location tracking (10s of centimeters) and high data transfer rates, making it ideal for applications requiring accurate positioning, such as indoor navigation. In addition to x/y positions, UWB also provides location in the z or vertical direction for items on shelves for example. It operates with low power consumption and has strong resistance to interference, ensuring reliable performance in various environments. However, UWB has limited range and faces higher costs and complexity in deployment because it relies on an overlay network of transceivers, each of which require power.

> BLE standards adopt UWB techniques to get accuracy to less than 1 meter using low cost, power efficient BLE tags.

Cellular & GPS

Cellular and GPS technologies together provide location continuity once tagged items move from indoors to outdoors. A GPS receiver uses commercial satellites to triangulate a longitude/latitude to several meters of accuracy. The cellular radio provides the backhaul of the GPS coordinates. If GPS is not available (e.g. inside a metal trailer) the cellular radio can provide location to roughly 500 meters triangulating among cell towers.

Bring Indoor & Outdoor Tracking Together

Multiple use cases extend the value of your RTLS platform

When tracking indoors, a low cost BLE tag attached to goods can often be tracked using the existing wireless infrastructure. If the access points do not have a BLE radio, the wireless network can be augmented with devices like AiRISTA's BLE beacon, an AC powered beacon that acts as an anchor point as well as a bridge between the BLE and Wi-Fi environment. When submeter accuracy is required, devices like AiRISTA's BLE Angle of Arrival gateways are installed, and in some cases integrate directly to the access point over USB.

When goods transition outdoors, a single AiRISTA GPS/cellular gateway is attached to the trailer or container. Think of it as a traveling access point which detects the BLE tags onboard. The gateway uses its GPS/cellular radio to periodically check for geocoordinates which are relayed over a cellular connection. Because the gateway also acts as a BLE tag, the GPS/cellular gateway can track goods indoors, but the relative cost makes it practical for larger, more valuable items.
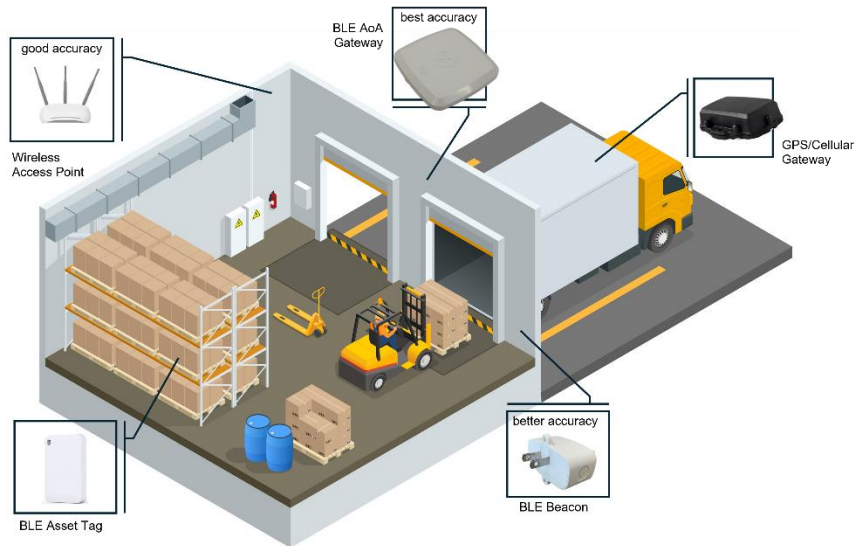
Stone Fabrication

Custom carriers are used to transport countertops which can be left at job sites or lost. Outdoor tracking with small detachable tags increases utilization and reduces expensive write offs.

Often overlooked when considering RTLS vendors is the importance of the RTLS software platform. An RTLS platform designed for the supply chain must seamlessly transition between indoor and outdoor maps. It should be ready to consume input from bar code and passive RFID systems. Alerts to exceptions like route deviation or theft should be simple for users to implement. It must easily integrate with other applications and be architected to leverage composite AI microservices. AiRISTA's sofia® RTLS software platform has been architected as microservices communicating via streaming data. Written in the language "go", it is machine learning ready and AI friendly. As an RTLS software platform, sofia is designed to carry customers into the IOT future.

Once the first use cases are deployed, additional use cases can be deployed quickly and cost effectively. With a variety of tags to choose from, a wide range of goods can be tracked. And as RTLS is rolled out to other facilities, the existing wireless infrastructure can be augmented as needed. The ability to easily add use cases brings even more value to your RTLS investment and the ROI expected by management. Below is a description of some of the potential use cases.

Liquid Container Transport

- Just as the GPS/cellular gateway accounts for tagged items in the trailer, it can also alert when goods go missing due to theft.
- Provide insight to the last known location of a trailer enroute or in a depot. The GPS/cellular gateway relays its GPS coordinates a couple times a day which preserves battery life. This provides a last-known location for trailers.
- By adding a BLE tag to the truck cab, the GPS/cellular gateway can detect which cab is associated with each trailer. This reduces confusion about loads and identifies trailers that are likely idle.

The ability to associate a specific cab with a trailer reduce accessorial charges, minimizes the cost of delivery exceptions, and improve OITF and reducing missed appointment fees.

Aerospace

Once prepreg stock is inventoried, it is pulled in FIFO fashion from large refrigerators. Spoilage can be expensive, but finding expired prepreg in completed assemblies is very expensive.

- Alert to deviations in vehicle routes using geofenced zones as boundaries. Zones should be easily defined by users by drawing boundary areas over the image of a map.
- Maintain records of historic paths and dwell times at various stops to comply with regulatory requirements.
- When items are offloaded and moved indoors, their dwell time can be recorded. This is helpful for adhering to a FIFO policy for pulling perishable stock like prepreg material.
- Like outdoors, geo-zones can be created indoors to alert to the movement of items into or out of bounded areas including exits and dock door

- Enhance dock efficiency and minimize detention with comprehensive inbound visibility. Real-time notifications and accurate ETA for incoming deliveries eliminate the need for staff to make status check calls, reducing wasted time.
- Transportation costs can accumulate rapidly. Mitigate these risks by reducing dwell time, optimizing labor planning, and preventing product loss in temperature-controlled shipments.
- Boost your on-time resupply rate and ensure full visibility with automated status notifications and live tracking dashboards.

Dock Management

To support just-in-time inventory management, auto manufacturer messages the receiving team to specific product arrivals. Empty parts carriers are located and staged for return to supplier.
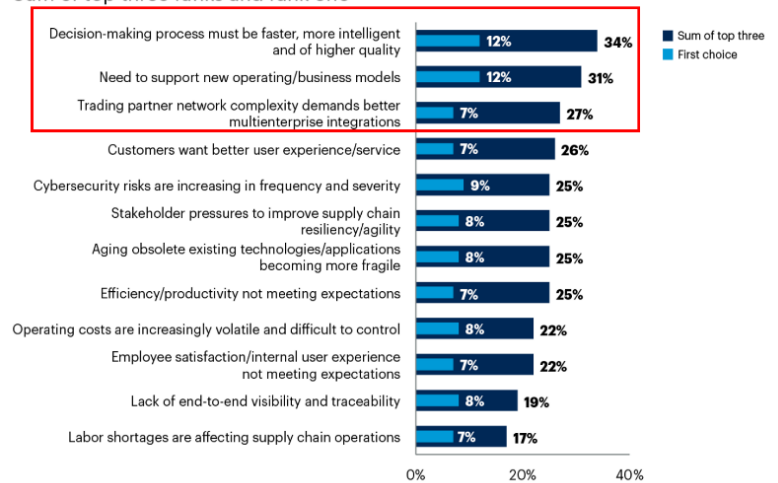
THE OPPORTUNITY FOR AI IN SUPPLY CHAINS

The real value of your RTLS investment is in the software platform

AI is revolutionizing decision-making across various industries by providing advanced data analysis, predictive modeling, and automation capabilities. In healthcare, AI aids in diagnosing diseases and personalizing treatment plans through analysis of medical data. In retail, AI optimizes inventory management, personalizes marketing, and improves customer experience with recommendation systems. AI is transforming supply chain management by enhancing demand forecasting through advanced data analytics, reducing inventory costs and minimizing stockouts. It optimizes logistics and route planning, improving delivery efficiency and reducing transportation costs. The technology investment priorities of supply chain managers parallel these benefits that AI delivers.

Factors Motivating Investments in Supply Chain Technology
Sum of top three ranks and rank one

Factor	First choice	Sum of top three
Decision-making process must be faster, more intelligent and of higher quality	12%	34%
Need to support new operating/business models	12%	31%
Trading partner network complexity demands better multienterprise integrations	7%	27%
Customers want better user experience/service	7%	26%
Cybersecurity risks are increasing in frequency and severity	9%	25%
Stakeholder pressures to improve supply chain resiliency/agility	8%	25%
Aging obsolete existing technologies/applications becoming more fragile	8%	25%
Efficiency/productivity not meeting expectations	7%	25%
Operating costs are increasingly volatile and difficult to control	8%	22%
Employee satisfaction/internal user experience not meeting expectations	7%	22%
Lack of end-to-end visibility and traceability	8%	19%
Labor shortages are affecting supply chain operations	7%	17%

n = 505, all respondents; excluding "don't know"

Q. Which of these are the top three most important factors motivating your organization to invest in supply chain technology areas over the next two years?
Source: 2023 Gartner Supply Chain Technology User Wants and Needs Survey
800687_C

Gartner

According to a Gartner survey[2], the top 3 motivations for investment in supply chain technology are, (1) faster/smarter decisions making, (2) support for new business models, and (3) better technology integration with supply chain partners.

To turn AI insights into business value requires the right software platform and the underlying architecture. As important as the hardware and tags are to RTLS, Gartner reminds us, "the value is in the RTLS software platform. Multitenant cloud solutions built on a composable microservices architecture that provide extensibility and continuous upgrades."[3] An advanced software platform must be extensible to integrate easily with other supply chain platforms. And to leverage the emergence of purpose-built AI engines, the platform must ingest AI analysis in real time, react and alert to queues, and distribute location insights as input to AI engine.

To be ready for the demands of an IoT world, a new platform architecture is needed.

AiRISTA's *sofia* platform is an example of a streaming, broker-based architecture based on microservices. Communication between sofia's microservices is based on streams rather than traditional ETL methods (extract, load, transform) for speed and scalability. Written in the language Golang, *sofia* is AI-friendly and machine learning ready. AiRISTA extends the *sofia* platform with Flow Studio, a low-code design environment. Flow Studio provides an intuitive drag & drop pallet where microservices are connected with logic elements. Once organized in the visual editor, the underlying code is compiled into an executable application, reducing the time and complexity of traditional software development. Through the Flow Studio pallet, AI modules can be inserted in the code flow (represented as individual microservices on the pallet) or integrate with external AI modules. The resulting application can act as an enterprise bus, automating decision making and steering activities among the ecosystem platforms.

Conclusion

As opportunities for disruptions increase, supply chain managers need tools that provide real time visibility to goods across the delivery chain. Leveraging the right RTLS platform can provide seamless insights to the inventory and location of goods both indoors and outdoors, eliminating walls between warehouse and logistics systems. With the right RTLS platform you can facilitate integration creating a seamless ecosystem of partners. And with an RTLS software platform ready for AI-enablement, you can make better supply chain decisions faster, helping you move from a reactive to a proactive supply chain.

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[2] "Technology Trends Transforming Warehousing – Part 1: Improving Upgrades", Gartner, April 2024

[3] "Critical capabilities for Warehouse Management Systems", Gartner, July 2023

ACCOLADES

AiRISTA is proud to be recognized by Gartner for being in the "Leaders" quadrant in 2022, 2023, and 2024.

The report is available on request.

PROJECT PROCESS

AiRISTA and our partners provide a consultative sales process to ensure success criteria are well understood and requirements will be met. The process includes the following major steps.

Discovery

Consult with you to understand your challenges and objectives

Design

Develop with you a recommended solution

SW Installation

Deploy an instance of Sofia - cloud or premises

Location Points

Use existing APs or deploy BLE gateways overlaid on maps

Integration

Third-party application intergration as necessary

Test/Training

Exercise system, review results, fine tune

Rollout

Assign and deploy tags to people and equipment

CONTACT US

Find out what AiRISTA can do for your organization by getting in touch for a consultation.

E: salesinfo@airista.com | P: 1-844-816-7127

airistaflow.com