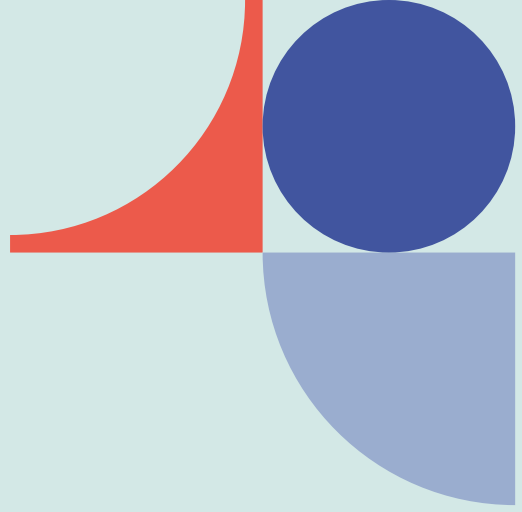


Warehouse Modernization: From Legacy Operations to Peak Performance

Re-platforming the distribution center
for omnichannel, same-day fulfillment.

 POV



Overview

Retail distribution is being reshaped by a structural shift that legacy warehouses were never designed to absorb. A single facility is now expected to serve two fundamentally different demand streams at once, replenishing stores in bulk while fulfilling individual customer orders as singles, against a backdrop of expanding product assortments, compressing delivery windows, and increasingly severe seasonal peaks. The economics of same-day delivery, the scarcity and cost of warehouse labor, and the growing burden of returns have pushed conventional, manually driven operations past their breaking point.

This paper sets out a point of view on warehouse modernization: the business forces that make it unavoidable, the operational failure points of legacy estates, the capabilities a modern fulfillment platform must provide, and a delivery blueprint for getting there. We argue that modernization is not simply a software upgrade but a re-platforming of the distribution center around a cloud-native warehouse management system, an intelligent optimization engine, and a deliberately tiered automation strategy that blends fully automated, semi-automated, and manual fulfillment by product and category.

Our point of view is grounded in delivery experience. Working alongside a leading North

American department-store retailer and the platform vendor, we implemented Manhattan Active® Warehouse Management at one of the largest and most automated fulfillment centers in the sector, a ~2.5 million square foot, \$640M+ facility integrated with goods-to-person and high-throughput automation. The program cut average order fulfillment from roughly 1.5-2 days to under a day, consolidated shipments to reduce cost and packaging, lifted inventory capacity and in-stock performance, and established a platform the retailer could extend across its other brands. Crucially, the implementation was validated against a full peak season, the only true test of a modernized warehouse.

A realistic modernization-and-implementation program of this scale runs to roughly 18 months for the first distribution center, because the solution must be hardened against peak volumes before it can be declared a success. Retailers, however, operate networks of warehouses and modernize them one at a time, so the first site becomes a reusable template that speeds each subsequent rollout. We also describe how we further compress timelines and de-risk delivery by applying AI across integration, customization, and quality assurance, and how the approach adapts to the reality that most programs are brownfield modernizations of live facilities, even though our reference engagement was a greenfield build.

The inflection point: Why legacy warehousing is breaking

The pressures below rarely arrive in isolation. They compound, and together they overwhelm warehouse designs and systems conceived for a slower, more predictable, store-centric era.

Omnichannel order divergence

A modern department-store DC fulfills two order types from the same inventory, with opposite physics. Store replenishment moves in bulk, at case/pack level, in predictable cadences, optimized for full pallets and trailers. Customer e-commerce orders move as singles or small multiples, high in volume, low in lines, unpredictable in timing, and intolerant of delay.

SKU and product-mix proliferation

Assortment growth places sustained stress on both inbound and outbound operations. More SKUs mean more receiving variety, more put-away decisions, more pick faces to maintain, and more opportunities for error. Slow-moving long-tail items consume storage and handling capacity disproportionate to their throughput, while the operation must still turn fast-moving lines at speed.

The rise of same-day and next-day delivery

Customer expectations have collapsed acceptable delivery windows. Same-day and next-day fulfillment are shifting from premium differentiators to baseline expectations, leaving little slack between order capture and dispatch. Every internal process, including waving, picking, packing, and manifesting, must be faster and more tightly orchestrated, with far less tolerance for queueing.

Peak volatility

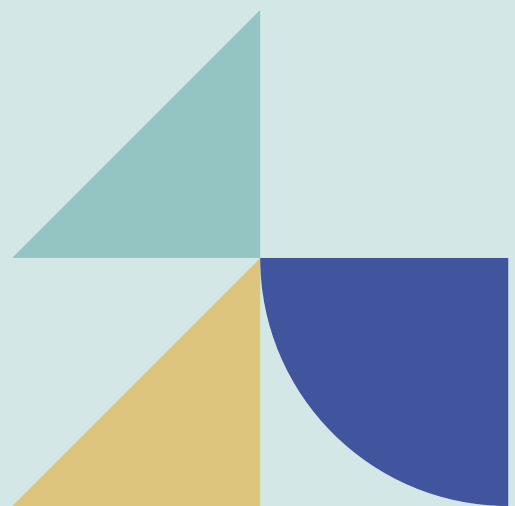
Retail demand is intensely seasonal. Peak events can drive volumes several times above the daily baseline, and a warehouse that performs adequately for ten months can fail catastrophically in the two that matter most commercially. Any modernization must therefore be designed, sized and proven for peak, not for the average day.

Returns and reverse logistics

For department stores in particular, returns are a defining operational load, not an afterthought. High return rates in apparel and similar categories mean inbound flows are not only supplier deliveries but a continuous stream of customer returns that must be inspected, dispositioned, restocked, or routed onward, all competing for the same labor, space, and systems as forward fulfillment.

Labor scarcity and cost

Warehouse labor is increasingly scarce, expensive, and hard to retain, especially at the elastic scale peak demand requires. This economic reality drives automation: not to remove people, but to raise the throughput and accuracy achievable per person and reduce dependence on volatile seasonal hiring.



Where legacy operations fail: The operational pain points

Inside the four walls, the market forces above surface as recurring, interconnected operational failures. Each erodes service, inflates cost, or both.

Inventory visibility and accuracy

Reliable fulfillment depends on knowing, in real time, exactly what is on hand and where. Legacy systems frequently rely on periodic updates and disconnected sub-systems, producing inventory records that drift from physical reality. Inaccuracy cascades into oversells, failed picks, expedited recovery shipments, and lost customer trust.

Inventory churn, slotting and location management

As assortments and velocities shift, the optimal physical placement of stock changes constantly. Without dynamic slotting and disciplined location management, fast-movers end up in inefficient locations, travel distances grow, and storage density falls. Static slotting that was correct at go-live silently decays into a daily productivity tax.

Pick-face replenishment and continuous monitoring

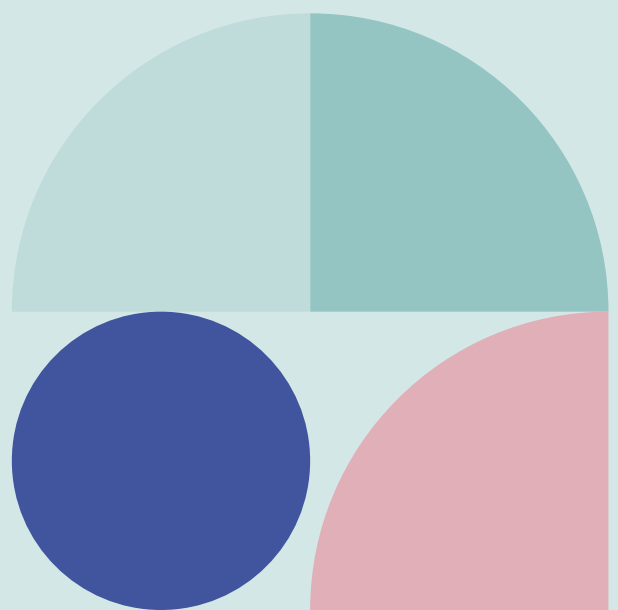
Forward pick locations must be replenished continuously to avoid stockouts at the face that stall picking. Doing this well requires constant monitoring of pick-face depletion and proactive, well-timed replenishment from reserve. Legacy operations often react too late, creating pick-path interruptions precisely when throughput pressure is highest.

Waving and picking at scale

As facilities grow to millions of square feet, the orchestration of work that decides how orders are grouped into waves, sequenced, batched, and released to pickers and automation becomes a decisive driver of performance. Poor wave management produces congestion, idle automation, uneven labor utilization, and missed cut-off times. At scale, picking is no longer a local task but a facility-wide optimization problem.

Throughput, accuracy, completeness, and on-time fulfillment

Ultimately, the operation is judged on outcomes: inbound and outbound throughput, order accuracy, order completeness, and adherence to promised timelines. Legacy estates struggle to improve any one of these without degrading another, pushing throughput at the expense of accuracy, or protecting accuracy by sacrificing speed. Modernization aims to move all of these measures together.



The capability gap: What modern warehousing demands

Reframing the pain points as required capabilities defines the target. A modern fulfillment platform must provide the following as an integrated whole, not as bolt-on point solutions.

An intelligent solver and optimizer

At the center of a modern warehouse is an optimization engine that continuously balances competing constraints: order priority and promised timelines, inventory availability and location, shipping and carrier cut-offs, wave composition, and labor and automation capacity. Decisions that humans cannot make fast enough or well enough at scale, such as which orders to release, in what sequence, from which stock, and to which resource, are computed dynamically and re-optimized as conditions change.

Elastic, high-performance compute

Solving these problems in real time, for very large order books, under peak load, demands significantly more computing capacity than legacy systems assume. A modern platform must be cloud-native and scale compute elastically with demand, so performance holds during peak, and the organization pays for capacity in proportion to need rather than provisioning permanently for the busiest hour of the year.

Mixed-mode fulfillment by product and category

No single fulfillment method suits every product. A modern warehouse must orchestrate fully automated flows (goods-to-person systems, robotics), semi-automated flows (assisted picking, conveyance) and manual flows in parallel, assigning each product or category to the mode where its size, value, velocity and handling characteristics make automation economically and operationally sensible. The platform must direct work seamlessly across all three.

Real-time data and control-tower visibility

Decision-making and exception handling depend on a single, real-time view of orders, inventory, labor, and automation. A control-tower capability that surfaces bottlenecks, at-risk orders, and capacity constraints as they emerge, not in a next-day report, is essential to running a large, fast facility with confidence.

Open integration

The warehouse does not operate in isolation. The platform must integrate cleanly with order management and distributed order management, ERP, transportation and parcel systems, store systems, and the materials-handling and robotics automation on the floor. Open, well-architected integration is what allows the warehouse to function as one orchestrated system rather than a set of disconnected islands.



The modernization blueprint

Closing the capability gap is a program, not a purchase. Our blueprint sequences the work so that risk is managed and the result is hardened for the conditions that matter.

Target operating model first

Modernization begins with process, not software. We define the target operating model across all demand streams, store replenishment, e-commerce singles and returns, including how work flows, where automation applies, and how labor is organized. Configuring a platform before agreeing the operating model automates yesterday's inefficiencies.

A cloud-native, microservices platform

We anchor modernization on a cloud-native, microservices-based warehouse management platform in our reference engagement, Manhattan Active® Warehouse Management. A version-less, continuously updated (evergreen) architecture removes the disruptive upgrade cycles of legacy WMS, scales elastically for peak, and provides the API surface required for open integration with enterprise systems and floor automation.

A deliberately tiered automation strategy

Automation is applied where it pays, not uniformly. We segment the assortment by velocity, value, and handling characteristics and match each segment to the appropriate fulfillment tier, fully automated, semi-automated, or manual. This protects the business case, avoids automating low-return flows, and keeps the operation resilient by retaining manual capacity where flexibility is needed.

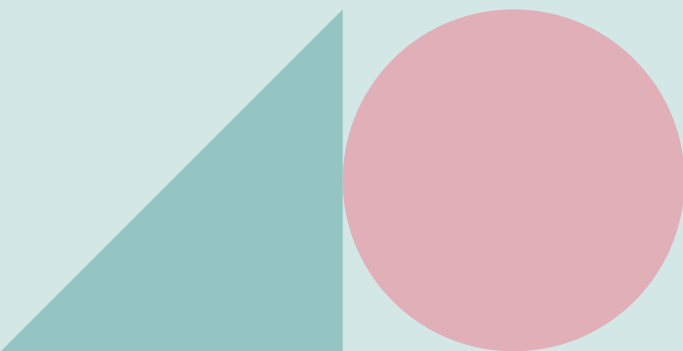
Designing for the multi-brand retailer

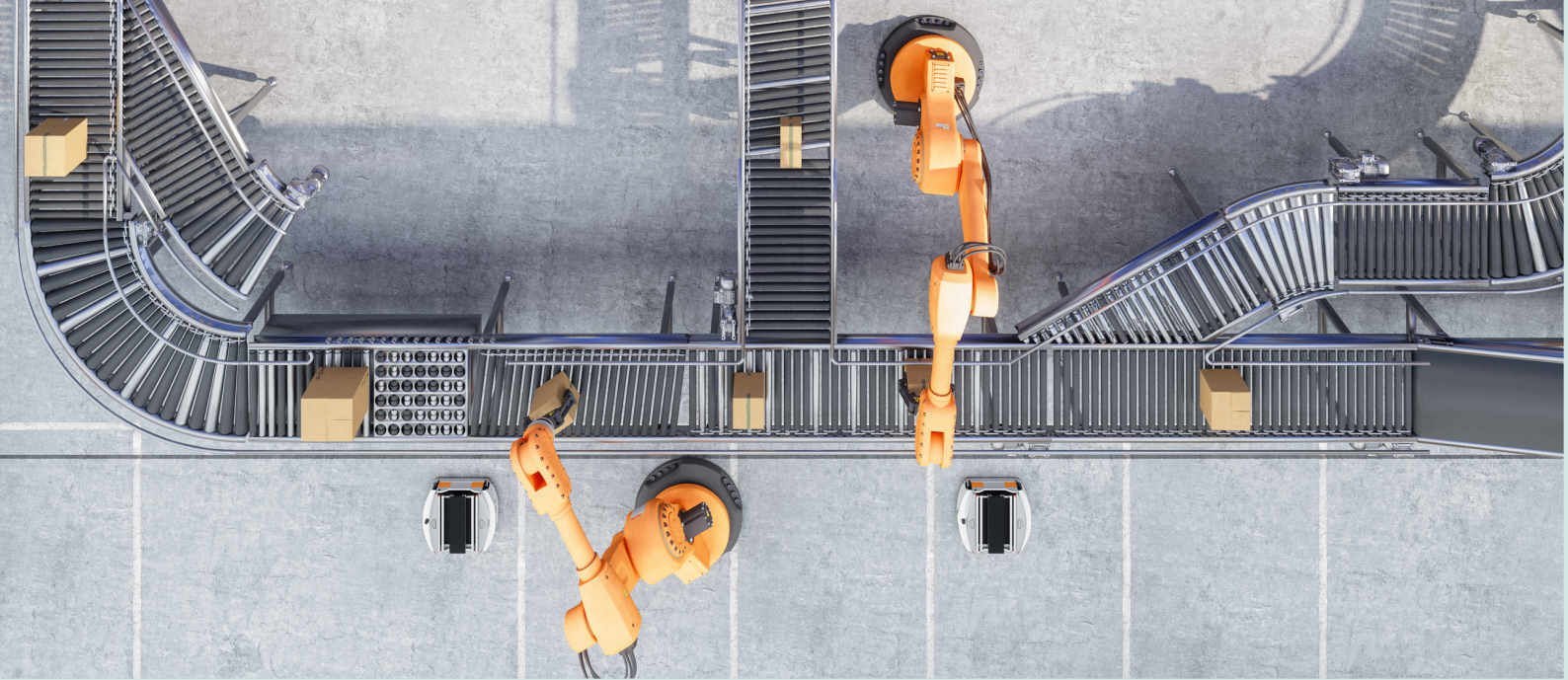
Many retailers operate a portfolio of brands and banners that share fulfillment infrastructure but differ in assortment, packaging, and service promise. The platform and operating model should be designed once as a configurable foundation that can be extended to additional brands without re-implementation, standardizing the core while allowing brand-specific configuration. In our reference engagement, the platform established for the flagship brand became the basis for extending fulfillment to the retailer's other brands, turning a single-site program into a reusable enterprise capability.

Rolling out across a multi-DC network

Retailers rarely operate a single warehouse; they run a network of distribution centers, and modernization proceeds one DC at a time. Each facility has its own nuances, including physical size and layout, geographic location, the markets it serves, the product mix it handles, its automation footprint, and its service obligations, so no two implementations are identical and each requires site-specific design and configuration.

What does carry across, however, is the bulk of the work. The first warehouse establishes a reusable template: the core platform configuration, integration patterns, test assets, deployment playbook, and operating procedures become the starting point for the next. Subsequent sites adapt this template to local nuances rather than building from scratch, so each rollout after the first is materially faster and lower-risk than the roughly 18 months the first DC required. Over a network, this template-driven approach turns a one-off program into a repeatable industrialized capability.





Greenfield and brownfield modernization

Two delivery contexts must be distinguished. A greenfield implementation stands up the platform in a brand-new facility with no live operation to disrupt, the cleaner scenario, allowing the system to be built, tested, and ramped without interrupting ongoing fulfillment. Our reference engagement was, advantageously, a greenfield build of a new facility.

In practice, most modernizations are brownfield: the platform must be implemented in a distribution center that is already operating and cannot stop shipping. This raises the stakes considerably; data migration, cutover, and fallback must be planned around live volumes, change must be sequenced to avoid disrupting daily fulfillment, and the team must protect service continuity throughout. The template-driven, AI-accelerated, peak-anchored approach described here applies to both contexts. Still, brownfield programs demand additional rigor in cutover planning, phased migration, and contingency, which should be reflected in both the timeline and the risk plan.

AI-accelerated implementation and rollout

Modernization programs are traditionally slow and labor-intensive in three areas: integration, customization, and quality assurance. We now apply AI across all three to compress the timeline and reduce delivery risk:

- Integration and customization: AI helps generate and adapt interface and configuration code, mapping data between the WMS and surrounding enterprise and automation systems, and accelerating the build of the tailored processes each retailer requires.
- Quality assurance, validation and verification: AI accelerates test design and execution and validates and verifies the build against the agreed solution design, systematically checking that the configured and customized behavior matches intended design and flagging divergence early, when it is cheapest to correct.

The effect is faster rollout with stronger design conformance, ensuring that the build is continuously checked against the solution design rather than only at late-stage testing, which is decisive when a fixed peak deadline cannot move.

The 18-month first site and faster thereafter

A modernization-and-implementation program of this scale typically spans around 18 months for the first distribution center, from initiation to a hardened go-live. This is not a function of slow execution but of a hard requirement: the solution must be built, integrated, tested, and then proven against a full peak cycle before it can be considered complete. The calendar is, therefore, anchored to the retail peak, with the program sequenced to deliver and stabilize ahead of it. For subsequent DCs in the network, the template established at the first site, combined with AI-accelerated integration, customization, and QA, compresses the timeline, so later rollouts complete faster while still being validated against peak.

Cutover, go-live, and hyper care

Cutover in a live, high-volume DC carries real operational risk and must be planned

meticulously, with data migration, fallback positions, and phased ramp-up rehearsed in advance. Go-live is followed by an intensive hypercare period in which the joint team closely monitors performance, tunes configuration, and resolves issues at speed. Peak readiness, not the go-live date, is the real measure of success.

Change management, workforce enablement, and the business case

Technology delivers value only when people operate it well. A structured change-management and training program prepares the workforce for new processes and new human-machine collaboration, and is essential to realizing the throughput gains the platform makes possible. Throughout, the program should be governed against a clear business case, such as total cost of ownership or return on investment, so that scope and automation decisions remain tied to measurable value.



Experience that shaped this point of view

This point of view is informed by a large-scale modernization we delivered for a leading North American department-store retailer. The program implemented a cloud-native warehouse management platform at one of the largest and most automated fulfillment centers in the sector, and serves here as an anonymized proof of the approach rather than as a named case study.

The facility: A new, ~2.5 million square foot fulfillment center representing a \$640M+ investment and among the largest and most automated in the retailer's network, integrating goods-to-person and high-throughput materials-handling automation with the warehouse management platform.

Platform and automation: Manhattan Active® Warehouse Management as the cloud-native, evergreen fulfillment platform, integrated with leading warehouse automation including goods-to-person storage and high-speed handling systems.

Our scope: Delivered jointly with the platform vendor and the retailer's technology team, our scope spanned solution configuration, customization to the retailer's specific warehouse processes, end-to-end quality assurance and go-live readiness, and the integrations linking the WMS to floor automation and enterprise systems.

The outcomes below were realized and, importantly, validated through live peak operation:

Outcome	What changed	Driver addressed
Faster fulfilment	Average order fulfillment reduced to under one day, from roughly 1.5-2 days previously.	Speed/same-day, throughput
Fewer shipments	Order consolidation reduced the number of packages, cutting shipping and packaging costs.	Cost, sustainability
Higher capacity	Greater inventory capacity and improved in-stock position to serve stores and customers.	Product mix, availability
Scalable platform	A configurable foundation, extended to the retailer's other brands without re-implementation.	Multi-brand scaling

From pain points to capabilities

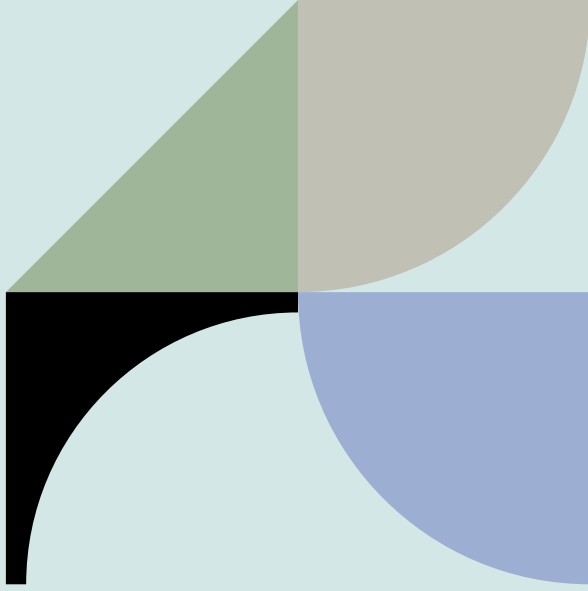
The engagement closed the specific gaps set out earlier: divergent store and customer workflows were orchestrated from one platform; real-time inventory and dynamic location management improved accuracy and density;

intelligent waving and an optimization engine managed picking across a vast footprint; and a tiered mix of automated, semi-automated and manual fulfillment was directed centrally, all sustained through peak.



Lessons learned and best practices

- Anchor the plan to peak. Treat the peak season as the immovable deadline and the true acceptance test. Build backward from it and protect stabilization time.
- Fix the operating model before configuring software. Early process design decisions prevent expensive rework and avoid automating inefficiency.
- Tier automation to the assortment. Apply automation where velocity, value, and handling justify it; retain manual flexibility deliberately, not by omission.
- Make inventory accuracy a first-class objective. Real-time, reconciled inventory underpins every downstream service and cost outcome.
- Use AI to validate against the design, continuously. Verifying the build against the solution design throughout, not only at final testing, compresses timelines and catches divergence when it is cheapest to fix.
- Rehearse cutover and resource hyper care. Plan migration and fallback in detail and staff an intensive post-go-live period to tune and stabilize.
- Invest in people. Change management and training convert platform capability into realized throughput and accuracy.
- Design once for many brands. Build a configurable core so the investment extends across the portfolio rather than being rebuilt site by site.
- Template the first DC for the network. Capture configuration, integrations, test assets, and playbooks at the first site so each subsequent warehouse is faster and lower-risk while still tailoring to its size, location, and product mix.
- Respect brownfield realities. Most sites are modernized live; plan migration, cutover, and fallback around continuous operation, and reflect that added rigor in the timeline and risk plan.



Conclusion and the road ahead

Warehouse modernization is no longer optional for retailers facing omnichannel divergence, assortment growth, compressed delivery promises, and severe peaks. The destination is a re-platformed distribution center built on a cloud-native warehouse management system, driven by an intelligent optimizer, and served by a deliberately tiered automation strategy that is proven, above all, against peak.

The road ahead extends this foundation in three directions. First, scaling the platform across a retailer's full warehouse network and brand portfolio, rolling out site by site from a proven template, to turn a single modernization into an

enterprise capability. Second, deepening AI and optimization maturity, both in running the warehouse and in delivering and evolving it faster and more reliably. Third, advancing sustainability: order consolidation and fewer, fuller shipments reduce packaging and transport emissions, making efficiency and environmental responsibility mutually reinforcing.

With the right sequencing, platform, and AI-accelerated execution, warehouse modernization pays back in faster, more accurate, lower-cost fulfillment that holds up when it matters most at peak.



zensar
An  **RPG** Company

At Zensar, we're 'experience-led everything.' We are committed to conceptualizing, designing, engineering, marketing, and managing digital solutions and experiences for over 145 leading enterprises. Using our 3Es of experience, engineering, and engagement, we harness the power of technology, creativity, and insight to deliver impact.

Part of the \$4.8 billion RPG Group, we are headquartered in Pune, India. Our 10,000+ employees work across 30+ locations worldwide, including Milpitas, Seattle, Princeton, Cape Town, London, Zurich, Singapore, and Mexico City.

For more information, please contact: info@zensar.com | www.zensar.com