

FROM VISIBILITY TO RESILIENCE

The Future of Reefer Logistics

How visibility, digital intelligence and connected operations are helping reefer supply chains navigate disruption and strengthen operational confidence.



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Executive Summary

Through ongoing engagement with exporters, importers, and cold chain stakeholders worldwide, Ocean Network Express (ONE) has observed a common shift across refrigerated supply chains. Today, customers expect more than cargo tracking—they need timely information that helps them respond confidently when transportation conditions change.

In this volatile operating environment, the ability to build reliability, adaptability and resilience has become a strategic priority for companies managing temperature-sensitive supply chains. As disruptions become more frequent and interconnected, success depends on the ability to anticipate risks, adapt quickly and maintain confidence from origin to destination.

For shippers, the challenge is not simply transporting cargo from one location to another. It is maintaining oversight throughout transit so that they can stay informed, respond proactively, minimize disruption, and make timely operational decisions when conditions change.

As refrigerated supply chains become more interconnected, visibility is evolving from a useful tracking capability into an important component of modern cold chain management. Access to timely shipment information is becoming a critical enabler for these capabilities that can help stakeholders better understand cargo status, improve operational responsiveness and support more informed decision-making across the supply chain.

This report explores the growing complexity of cold chain transportation, visibility gaps that continue to challenge traditional reefer operations, and how connected visibility is helping shippers strengthen oversight across the cargo journey. It also examines evolving industry requirements, emerging digital trends, and real-world operational examples that demonstrate how greater transparency can strengthen refrigerated supply chains.



The Growing Complexity of Refrigerated Supply Chains

Refrigerated supply chains play a critical role in supporting the global movement of fresh produce, seafood, pharmaceuticals, and other temperature-sensitive cargo. As global demand continues to grow, the cold chain logistics market is projected to expand alongside with a

CAGR of 6.38%, from USD 366.13 billion in 2025 to USD 638.96 billion by 2034,

reflecting the increasing importance of reliable refrigerated transportation.

However, market growth tells only part of the story. Today's cold chain operates against a backdrop of shifting trade patterns, supply chain disruption, digital transformation, evolving regulations, and sustainability priorities. Together, these forces are reshaping how refrigerated cargo is planned, transported, and managed—while placing greater emphasis on access to timely, reliable shipment information.

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Across our customer conversations, one common theme continues to emerge—the need for greater transparency throughout the cargo journey. Whether shipping fresh produce, seafood or pharmaceutical cargo, customers want access to timely information that helps them better understand shipment status, respond to disruptions and make informed decisions with confidence.”



Mike Hanson
Senior Vice President,
Global Key Account Sales,
Global Sales & Customer Service
Management,
Ocean Network Express

An Unpredictable Operating Environment

Many of these shipments travel across multiple countries and transportation modes before reaching their final destination. A shipment of cherries harvested in Chile, for example, may be transported from the orchard to a packing facility, moved to a port for export, shipped across the Pacific Ocean, transferred through terminal operations upon arrival and transported inland before eventually reaching supermarket shelves in Asia, often several weeks after harvest. Throughout this journey, cargo passes through multiple logistics providers, transportation modes and operational handovers, creating numerous points where disruptions can affect shipment schedules, product quality and customer commitments.

Maintaining the appropriate transportation environment remains fundamental to reefer logistics. However, success also depends on how effectively organizations manage the growing complexity surrounding the movement of refrigerated cargo.

Supply chain volatility remains one of the most immediate challenges facing reefer logistics. Throughout 2025 and into 2026, congestion at major transshipment hubs across Asia and Northern Europe, together with ongoing adjustments to global shipping networks, has demonstrated how quickly disruptions can ripple across supply chains. Extended vessel waiting times, longer dwell periods and schedule changes have created uncertainty for refrigerated cargo shippers who rely on timely information to support inventory planning, downstream distribution and customer commitments. At the same time, more frequent extreme weather events created additional uncertainty into transportation planning.



Beyond operational disruptions, geopolitical developments and regulatory requirements continue to influence global trade and supply chain planning. Changes in trade policies, customs requirements and compliance expectations require organizations to continually reassess their logistics strategies while balancing long-term planning with the flexibility to adapt to changing market conditions, regulatory environments and emerging operational risks.

Meanwhile, digital transformation is accelerating across the logistics industry. Artificial intelligence, predictive analytics, automation and connected supply chain platforms are changing how refrigerated cargo is managed. Rather than relying solely on historical reporting, organizations are beginning to use digital technologies to anticipate potential issues, improve planning accuracy and coordinate activities across multiple stakeholders. As these capabilities mature, their effectiveness will depend on the quality and timeliness of the shipment data that supports them, making reliable information a critical foundation for future digital supply chain capabilities.

Alongside these developments, sustainability and waste reduction have become strategic priorities across the cold chain. Organizations continue to explore opportunities to reduce food loss, improve transportation efficiency and optimize resource utilization while maintaining product quality.

According to the Food and Agriculture Organization (FAO),

13.2% of food produced globally is lost between harvest and retail, while food loss and waste together account for an estimated 8–10% of global greenhouse gas emissions.

Although these developments are reshaping refrigerated logistics in different ways, they point to a common operational challenge—managing greater complexity across the supply chain. As cargo moves through multiple providers, transportation modes and information sources, maintaining a clear, consistent view of shipment status becomes essential for effective coordination. Understanding where these information gaps exist and the impact they have on day-to-day operations is the next step in building a more connected cold chain.

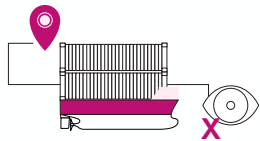


Visibility Gaps in Traditional Reefer Logistics

Despite advances in supply chain digitalization, many reefer shipments are still managed through a combination of manual reporting, fragmented systems and stakeholder updates. As a result, access to shipment information may be limited or delayed during transit.

When disruptions occur, stakeholders often rely on multiple communication channels to gather information and assess the situation. This process can slow communication, complicate coordination and reduce visibility across the shipment lifecycle, particularly for cargo involving multiple handovers or inland transportation segments.

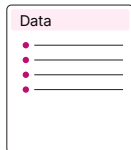
Common challenges include:



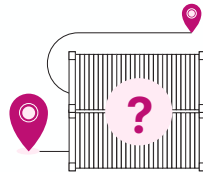
Limited visibility into cargo location, condition during transit, across inland and multimodal transportation



Delayed awareness of disruptions or operational issues



Siloed information across different stakeholders and systems



Difficulty coordinating activities across transportation providers



From Monitoring to Actionable Operational Intelligence

As supply chains become more data-driven, customer expectations for visibility are changing. Shippers now require more than basic location tracking, seeking shipment information that helps them understand cargo status, identify potential risks and support operational decision-making.

However, visibility is not simply about collecting data. The value of these data points lies not in the volume of information collected, but in how effectively they are brought together and presented. Centralized dashboards, automated alerts and intuitive reporting tools enable supply chain teams to identify shipment exceptions earlier, coordinate more effectively across stakeholders and maintain greater continuity throughout transportation.

Examples of visibility information may include:

Shipment location

Supply/Return air

Humidity levels

Ambient temperature

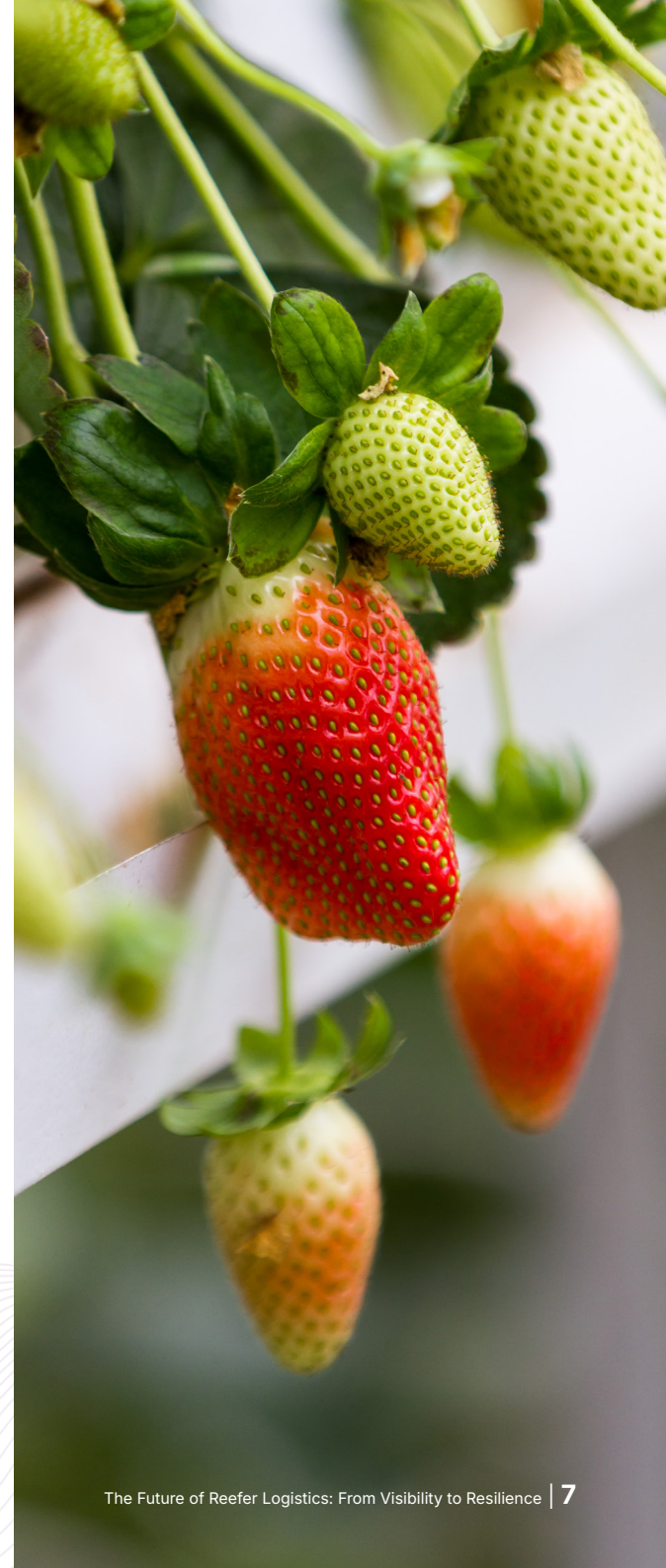
Reefer power status

O₂/CO₂ (Control atmosphere) / USDA* probes (Cold treatment)

*United States Department of Agriculture

Historical shipment reporting

Visibility delivers the greatest value when shipment information can be translated into timely coordination across the supply chain.



Supporting Modern Reefer Operations

Digital technologies are changing not only how refrigerated cargo is transported, but also how shipment information is collected, shared and applied across the supply chain. As a result, modern visibility solutions are expected to support data-driven shipment planning, provide near real-time access to operational information and integrate seamlessly across supply chain ecosystems.

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The future of supply chains will be shaped not only by the movement of cargo, but also by the quality of information that accompanies it. Recognizing this shift, Ocean Network Express continues to invest in digitalization and advanced digital tools that help customers gain greater transparency, improve operational confidence and navigate an increasingly dynamic supply chain environment.”



Takeshi Uechi
Senior Vice President,
Strategic Yield Management,
Ocean Network Express

Organizations are now seeking greater mobility and responsiveness through dashboards that make shipment information accessible across teams and locations. Artificial intelligence and predictive analytics are also beginning to influence how visibility data is used. Rather than simply understanding what has happened, organizations are exploring ways to identify emerging risks, anticipate disruptions and support more proactive decision-making. As these technologies continue to mature, access to reliable shipment data will remain a critical foundation for future digital supply chain capabilities.

Industry organizations and policymakers recognize digitalization as an important enabler of supply chain resilience and efficiency. According to the Organisation for Economic Co-operation and Development (OECD), digital technologies are helping organizations improve information sharing, coordination and visibility across supply chains.

Similarly, the World Economic Forum has highlighted the growing role of digital tools, data transparency and technology-enabled decision-making in helping supply chains navigate disruption and improve operational resilience.

As digital capabilities continue to mature, shipment information is becoming more than a record of past events. It is evolving into a strategic resource that helps organizations coordinate activities, anticipate potential issues and manage refrigerated cargo with greater confidence.

Industry-Specific Operational Priorities

While connected shipment information is valuable across the refrigerated supply chains as a whole, their practical application varies depending on the cargo being transported. Different commodities face distinct operational priorities, commercial risks and handling requirements, influencing how shipment information is used across the cold chain. Understanding these differences is essential to managing refrigerated cargo effectively. From preserving the freshness of premium produce to maintaining compliance for pharmaceutical shipments, access to timely shipment information enables supply chain teams to adapt their operations to the specific requirements of each commodity.



Fresh Produce and Horticulture

Fresh produce shipments—including fruits, vegetables, flowers and ornamental plants—are highly sensitive to transit times and changes in transportation conditions. Different commodities may require specific carriage conditions to help preserve freshness, maintain shelf life and minimize quality deterioration during transit. Some fresh produce exports are also subject to country-specific cold treatment protocols, requiring precise temperature control and continuous monitoring of pulp temperatures throughout transportation to support import compliance because most fresh produce has a limited market window, early awareness of shipment delays or operational disruptions can support delivery planning, customer communication and downstream distribution decision.



Seafood

Seafood is among the most perishable refrigerated cargoes and often travels long distances from harvesting or processing locations to international markets. Maintaining consistent transportation conditions is essential for preserving freshness, product quality and export value. Timely operational information can help stakeholders respond more effectively to delays, strengthen quality assurance and provide greater confidence throughout the supply chain.



Protein

Chilled and frozen meat and poultry shipments require consistent transportation conditions to help maintain food safety, product integrity and compliance with importing country requirements. Given the complexity of international protein supply chains, maintaining awareness of shipment progress can help organizations better coordinate logistics activities, manage operational risks and maintain continuity throughout the cold chain.



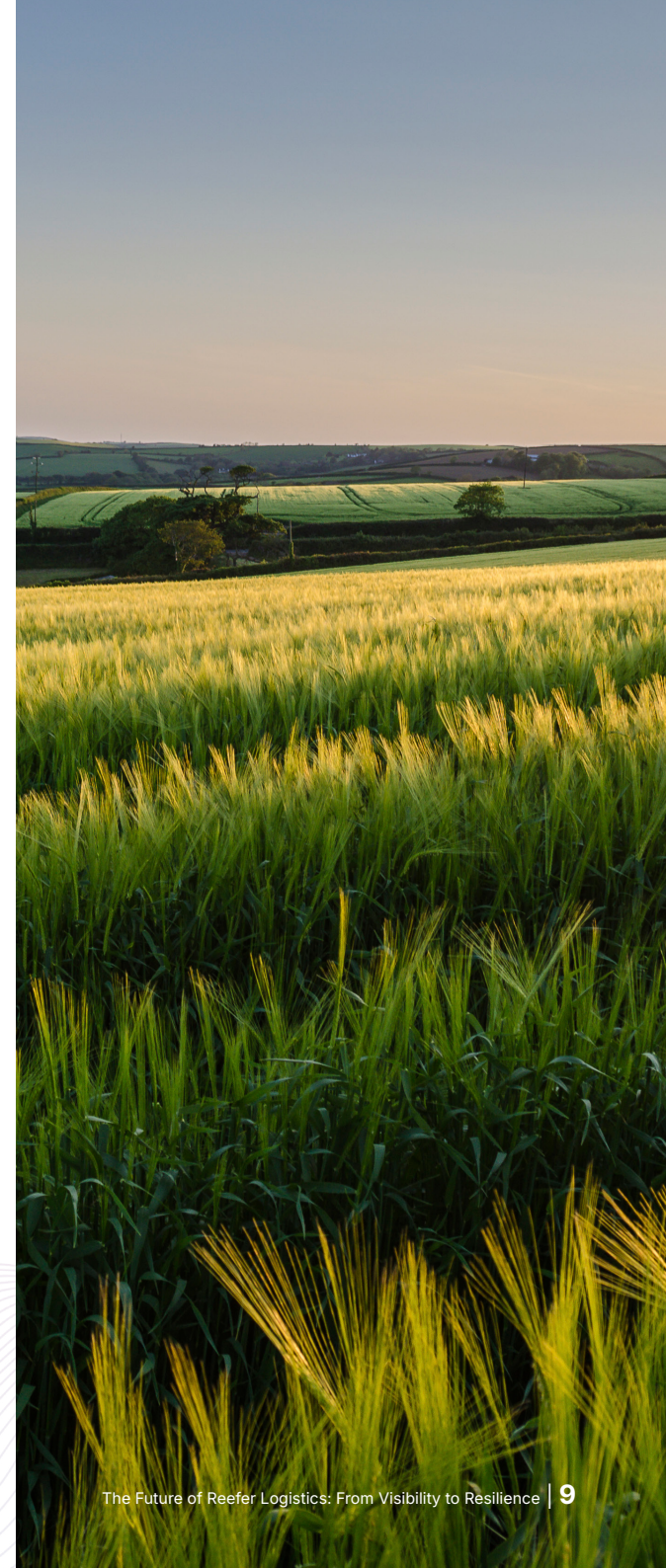
Pharmaceuticals and Healthcare

Pharmaceutical and healthcare cargo, including vaccines, biologics, clinical trial materials and temperature-sensitive medicines, requires carefully controlled transportation conditions to help preserve product efficacy and ensure patient safety.

Unlike many other refrigerated cargoes, pharmaceutical shipments are also subject to stringent regulatory and quality requirements. The World Health Organization's Good Distribution Practices (GDP) guidelines emphasize appropriate temperature control, documentation, traceability and risk management throughout the distribution process to safeguard product quality.

For pharmaceutical manufacturers and logistics providers, shipment visibility extends beyond location tracking to include access to temperature records and transportation data. This information helps facilitate documentation, improve communication across supply chain partners, and support the traceability expected under GDP.

As global pharmaceutical supply chains continue to expand, shippers are placing greater emphasis on transparency across both ocean and inland transportation. Reliable shipment information helps improve coordination, manage exceptions and maintain the high standards of quality expected throughout pharmaceutical distribution.



Case Studies

Based on Ocean Network Express operational projects and shipments conducted in 2025 and 2026

New Ocean Freight Solution for Kenyan Flowers

Traditionally, Kenyan flower exports to Japan have relied heavily on air freight to preserve freshness and product quality. In 2026, Ocean Network Express (ONE) supported the transportation of Kenyan flowers to Tokyo using Controlled Atmosphere (CA) reefer containers, providing an alternative to traditional air freight for this highly perishable cargo.

By carefully regulating oxygen and carbon dioxide levels inside the reefer container, Controlled Atmosphere technology helped slow the flowers' natural ageing process while maintaining product quality throughout the voyage. In addition to preserving cargo integrity, the shift from air to ocean transportation also contributed to significantly lower transport-related carbon emissions.

The project demonstrates how specialized reefer technologies can broaden transportation options for highly perishable cargo while supporting both operational and sustainability objectives.

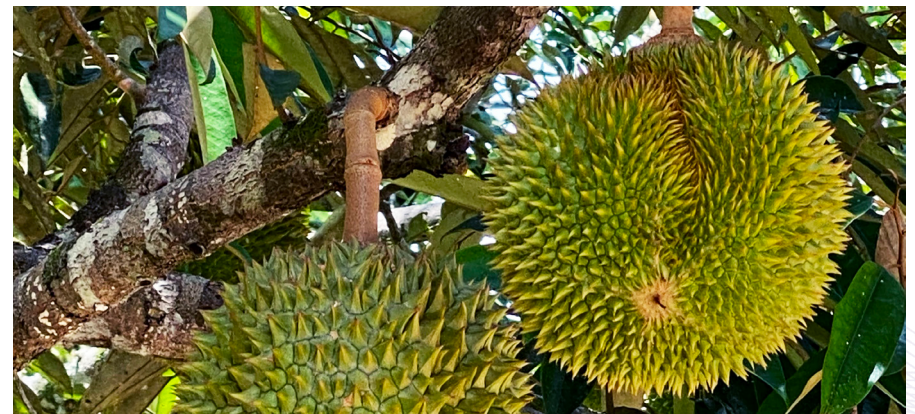


Seasonal Malaysian Durian Exports

Durians are one of Malaysia's most important agricultural exports. Their highly perishable nature requires carefully controlled transportation conditions to help preserve freshness and product quality throughout the journey.

In a recent shipment, Ocean Network Express (ONE) transported Malaysian durians to regional markets including China, Indonesia, and Thailand using specialized reefer containers supported by CONTAINER+. The refrigerated containers were maintained at 10°C, while CONTAINER+ provided near real-time visibility into shipment conditions, including temperature, humidity, and reefer power status through hourly updates on a centralized digital dashboard.

The shipment was supported by ONE's dedicated reefer specialists, providing continuous operational support throughout transportation. The successful delivery demonstrated how connected shipment visibility can give customers greater confidence through timely access to shipment information and key transportation conditions.



Pakistan's Seafood Export Supply Chain

Pakistan is known for its abundant marine resources, supplying a wide range of frozen and chilled seafood to international markets throughout much of the year. Given the highly perishable nature of seafood, maintaining stable transportation conditions is essential to preserving product quality and supporting export reliability.

Ocean Network Express (ONE) transported these seafood exports in reefer containers equipped with advanced temperature and humidity controls and high-performance insulation to help maintain stable transportation conditions from origin to destination. The shipments were carried via ONE's Thailand–Pakistan (TIP) and China–Pakistan (NPI) service routes, connecting seafood exporters with key markets across Asia..

The project highlighted how specialized refrigerated transportation, supported by dedicated regional connectivity and reefer expertise, can help seafood exporters maintain product quality while connecting them with key regional markets.



Intermodal Reefer Solution for Pharmaceutical Exports

Temperature-sensitive pharmaceutical products require carefully controlled transportation conditions and strict handling protocols throughout the supply chain. Before implementing a new intermodal ocean–rail transportation solution linking Hyderabad with global export markets, a pharmaceutical exporter sought assurance that shipment conditions could be continuously monitored while meeting its established Quality Assurance (QA) requirements.

To support the evaluation, Ocean Network Express (ONE) collaborated closely with the customer's Quality Assurance (QA) team by providing a reefer container equipped with CONTAINER+ for validation prior to commercial deployment. The trial enabled the customer to evaluate CONTAINER+'s ability to provide near real-time shipment information and monitor key shipment conditions across both the inland rail and ocean journey.

Following a successful validation, the customer approved the intermodal transportation solution and adopted CONTAINER+ for its Trans-Pacific pharmaceutical export shipments. The project demonstrates how connected shipment visibility can help build confidence in intermodal cold chain transportation while supporting customers' quality assurance processes, and has since supported more than 100 reefer container shipments.



Enabling Greater Shipment Oversight Through Digital Solutions

As refrigerated supply chains continue to evolve, digital visibility platforms are playing a more prominent role in helping organizations manage temperature-sensitive cargo. By bringing shipment information together into a centralized interface, these platforms improve information sharing, reduce reliance on manual updates and provide a more consistent view of refrigerated shipments across ocean and inland transportation.

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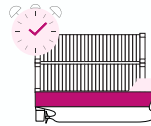
Historically, shipment visibility was often viewed as a supplementary capability. Today, it is becoming a core expectation as refrigerated supply chains grow more interconnected and stakeholders seek greater certainty in a dynamic operating environment. Visibility will continue to play an important role in helping organizations strengthen operational oversight and supply chain resilience.”



Matty van der Waal
Deputy General Manager,
Global Reefer and Special Cargo,
Strategic Yield Management
Ocean Network Express

As digital adoption continues across the logistics industry, solutions such as CONTAINER+ reflect a broader shift toward more connected, data-enabled refrigerated supply chains. Rather than replacing operational expertise, they complement it by making critical shipment information more accessible to the teams responsible for planning, customer communication and cargo management.

CONTAINER+ Key Features



Near real-time condition data through a single dashboard



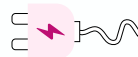
Location visibility across sea and land transportation



Supply/return air monitoring



Ambient temperature & humidity monitoring



Reefer power status visibility

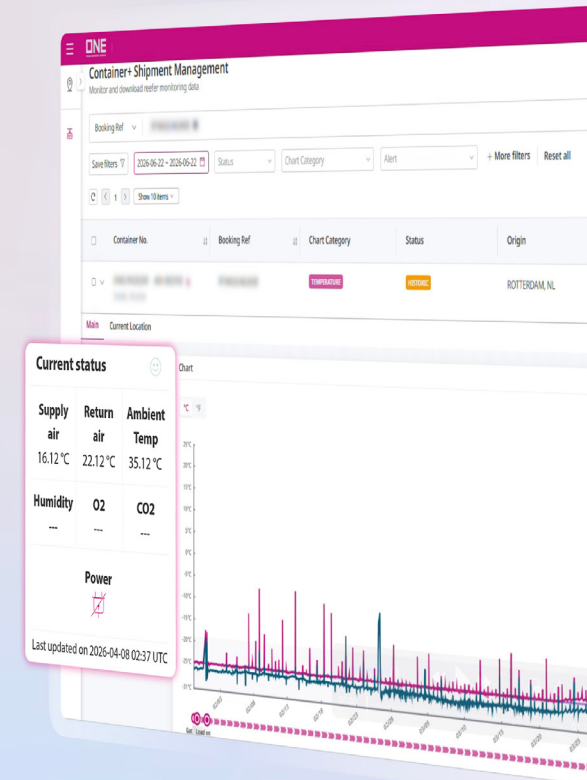


Historical shipment data



Advanced probes

CONTAINER+
by ONE



Accelerating to the Future

Refrigerated supply chains are becoming more interconnected, increasing the importance of timely, reliable information across every stage of transportation. As cargo moves through multiple partners, trade lanes and transport modes, organizations are placing greater emphasis on information that supports coordination, continuity and operational visibility.

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As supply chains face disruption more frequently than ever, visibility has become a cornerstone of resilient cold chain logistics. Our commitment as **Your Number ONE Shipping Partner** is to combine our global network, operational expertise and digital innovation to deliver the visibility and insights needed to help protect cargo quality and strengthen your supply chain performance.



Rupesh Jain

Vice President,
Global Sales & Customer
Service Management,
Ocean Network Express

For decades, refrigerated logistics has focused on preserving cargo conditions throughout transportation.

Organizations now face a broader challenge ensuring that accurate shipment information flows seamlessly across the supply chain. Today, the value of shipment visibility extends beyond tracking cargo location. Organizations are using connected shipment information to strengthen collaboration, improve operational planning and respond more effectively when conditions change.

This shift is reflected across the broader logistics industry. The OECD's Supply Chain Resilience Review highlights that future supply chain performance will depend on stronger digital capabilities, information sharing and organizational agility. Similarly, the World Economic Forum identifies artificial intelligence, connected technologies and data transparency as key enablers of more adaptive and collaborative supply chains.

Against this backdrop, solutions such as CONTAINER+ reflect the continued evolution of refrigerated cargo transportation. By providing customers with near real-time access to shipment information through a centralized digital platform, CONTAINER+ helps improve transparency, strengthen coordination and make more informed operational decisions throughout the cargo journey.

The future of reefer logistics will be shaped not only by how efficiently cargo moves, but by how effectively information moves with it.



Explore the Future of Reefer Logistics with ONE

Ocean Network Express (ONE) combines specialized refrigerated transportation, operational expertise and connected digital solutions to help customers navigate the evolving demands of temperature-sensitive logistics with greater confidence.

Connect with your local Ocean Network Express representative to explore how our refrigerated transportation solutions and digital capabilities, including CONTAINER+, can help enhance shipment visibility, strengthen operational confidence and strengthen cold chain resilience.

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This report draws on industry research, international guidance and Ocean Network Express operational expertise to examine the evolving role of connected shipment visibility in refrigerated supply chains.

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