

Industry Overview

Transportation

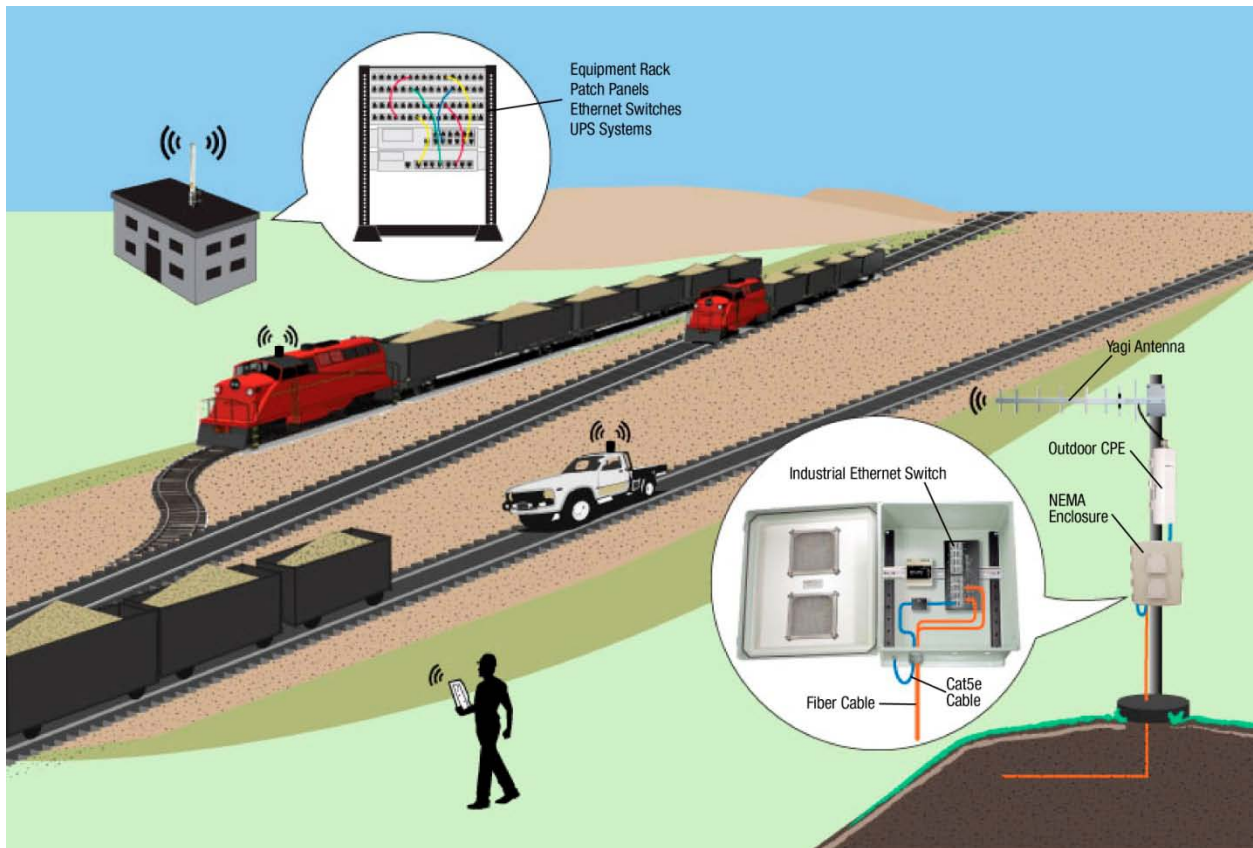


Rail

L-com provides rugged wired and wireless communications solutions to address rail applications including in-car communications, car to car communications, wayside monitoring, as well as rail yard communications and asset management applications. Our industrial rated copper and fiber cable assemblies as well as connectors, adapters, Industrial Ethernet switches and equipment enclosures provide the building blocks for critical wired rail infrastructure networks. L-com's wireless product portfolio addresses myriad rail applications including support for wireless rail security networks as well as wireless control, tracking and monitoring systems. L-com currently serves the leading commuter and freight rail companies in the US and Canada with our wired and wireless networking solutions reducing operating costs and improving overall service.

Rail Yard Communications

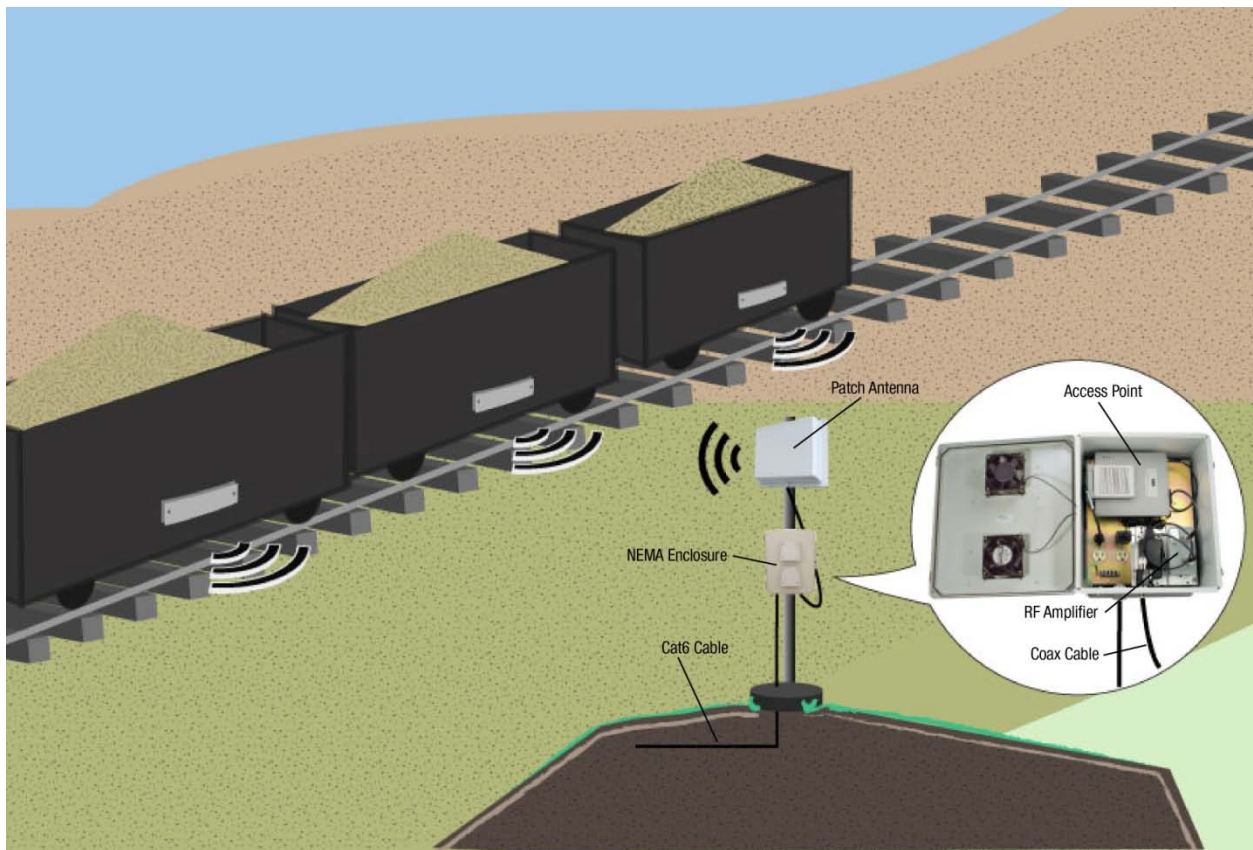
In the rail yard network example below, the main control building is connected via direct burial fiber optic cabling to an Industrial Ethernet switch housed in L-com's weatherproof NEMA enclosure and then connects to the L-com wireless CPE via outdoor rated Cat5e cabling to provide wireless connectivity to maintenance vehicles, ground personnel and engines. By utilizing L-com's wired and wireless products, comprehensive communication throughout the rail yard is realized providing real time data collection, security, monitoring and control.



Railroad Asset Management

Managing rail assets can be labor intensive and costly. Traditionally the manual scanning of cars and other assets was done by railroad employees who walked from car to car recording asset tags and other information. Human error would sometimes cause missed logs and inaccuracies in addition to the many man hours to perform these tasks. With the advent of RFID technology, modernized rail yard operations now employ electronic asset management systems where cars pass scanning equipment which records all asset information completely and accurately and sends the data via wired or wireless networks to a central control office where assets can be managed and monitored in real time.

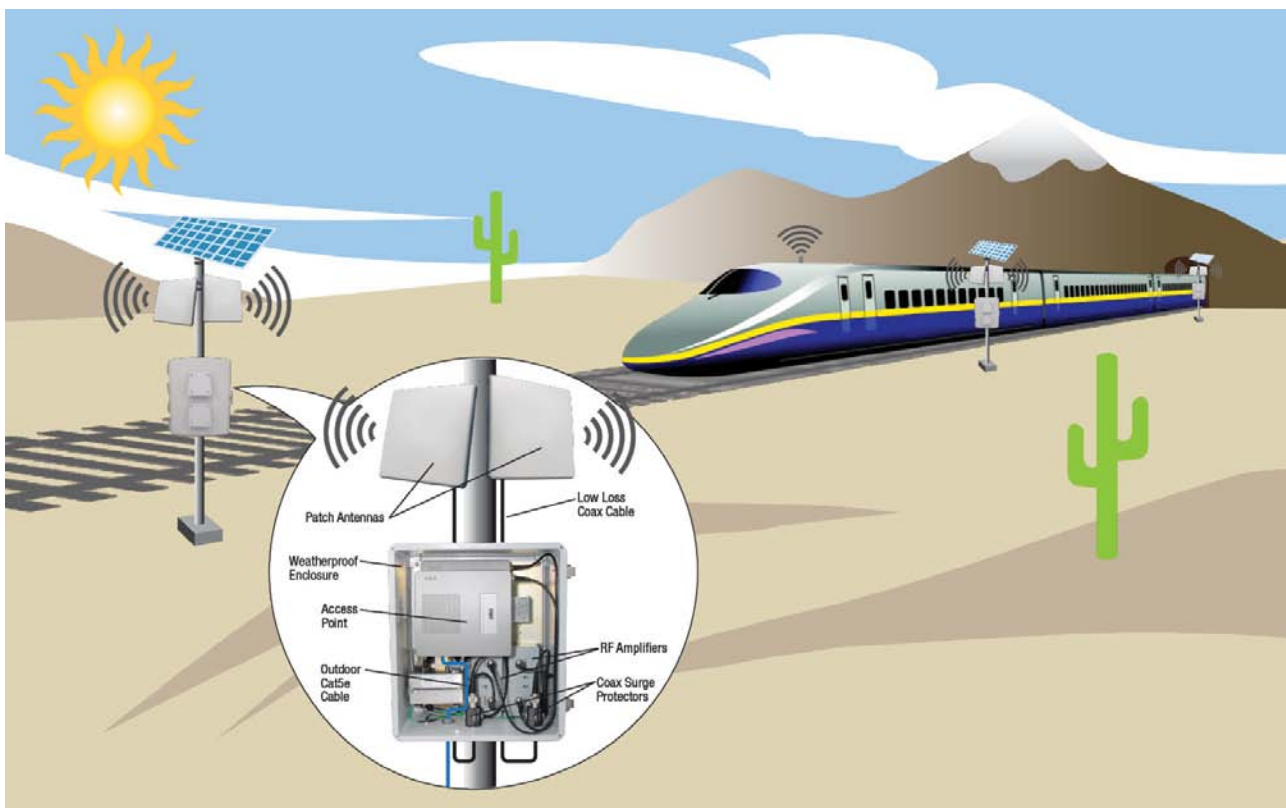
L-com provides the network cabling, antennas, weatherproof equipment enclosures and RF amplifiers for rail yard asset management systems. In the diagram below, the directional patch antenna records information from RFID tags as the cars pass and sends the data along to the central control station via direct burial Category 6 cabling. Other systems employ an entirely wireless solution for sending information back to central control with a combination of directional and Omni directional antennas in a point-to-multi point wireless network.



Wayside Monitoring

Wayside monitoring applications record real time data such as train speed, time of train pass through, track integrity, and other critical pieces of information to enable safety alerts and provide real time scheduling information.

Below, L-com's weatherproof NEMA enclosure houses a wireless access point, RF amplifiers and coaxial lightning protectors which provide a connection to various sensors including hot box detection sensors, derailment detection sensors as well as over loading and unbalanced load sensors. Other train information is captured via RFID tags on the train which record its speed, location etc. L-com's directional HyperLink® patch antennas send the data back to the central control office via a wireless link.



Roadway

L-com's communication and networking solutions for roadway, tunnel and intelligent traffic management systems include IP67/68 rated cables and connectors for harsh outdoor use, NEMA rated UL listed equipment enclosures for wired and wireless devices, as well as an extensive selection of antennas, Bandpass filters and RF amplifiers for wireless monitoring and control of highway and tunnel systems. Additionally L-com offers industrial Ethernet switches and media converters built for extreme environments found in outdoor, roadway applications.

Tunnel Communications and Monitoring

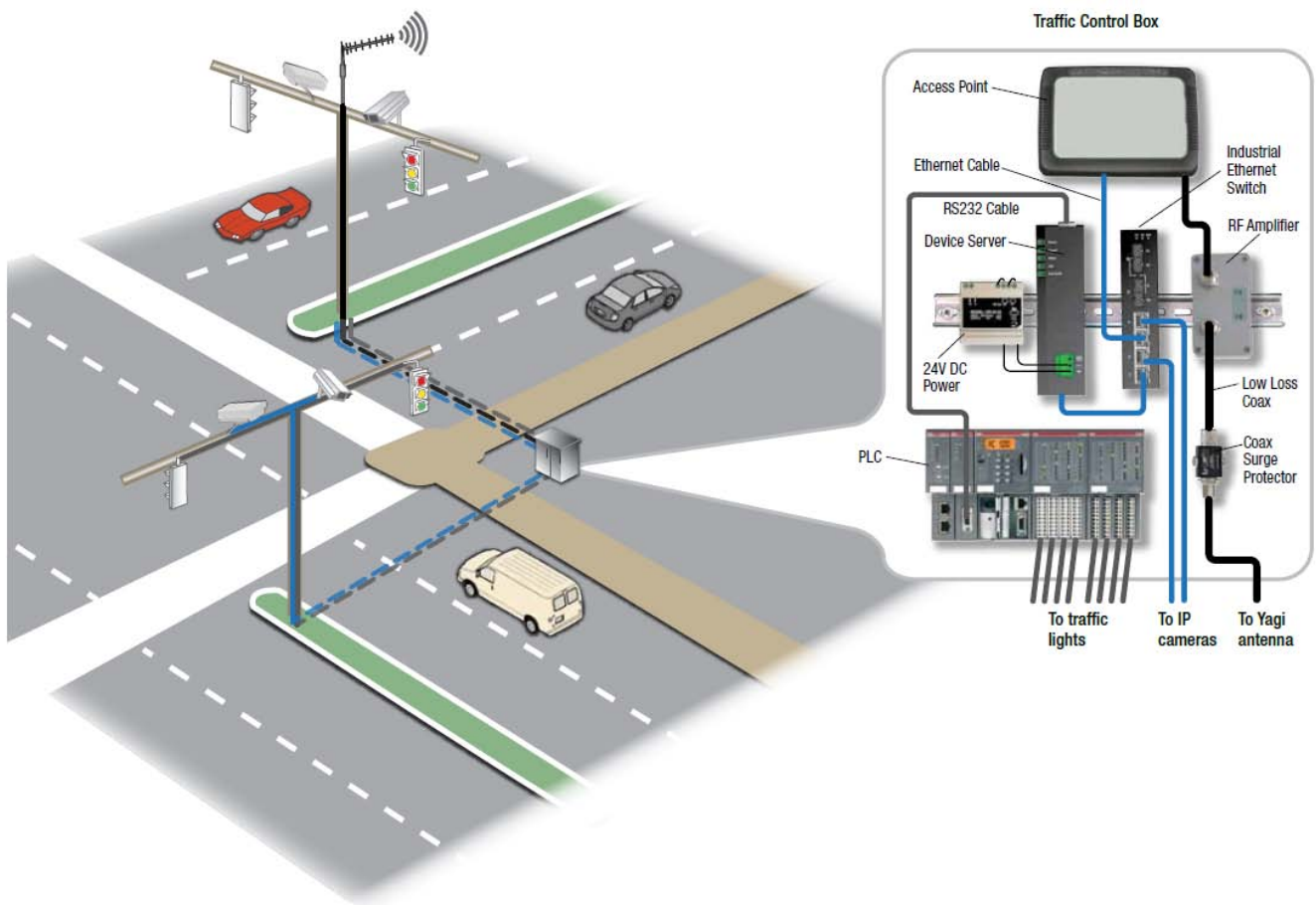
In the tunnel communications network shown below L-com's broadband DAS antennas provide cellular and Wi-Fi service in the tunnel while IP cameras connected to shielded industrial Ethernet cabling collapse via fiber cabling back to the tunnel control center providing real time surveillance and monitoring. RS232 enabled environmental sensors connect via data cabling to Ethernet device servers collapsing back to the tunnel control center via fiber optic cabling. All cable assemblies utilize Low Smoke Zero Halogen (LSZH) jackets for protecting lives and valuable communications equipment in the event of a tunnel fire. Digital signs in the tunnel are connected to shielded Ethernet cabling and are terminated to L-com's IES series Industrial Ethernet Switches housed in the NEMA enclosures.



Intelligent Transportation Systems (ITS)

L-com's wired and wireless product solutions support advanced Intelligent Transportation Systems (ITS) for roadway traffic signaling and vehicle and pedestrian safety systems. By utilizing a combination of wired and wireless technology traffic flow can be optimized to avoid congestion and bottle necks. Additionally by utilizing IP cameras and traffic sensors roadway security and safety can be enhanced providing real time monitoring and control.

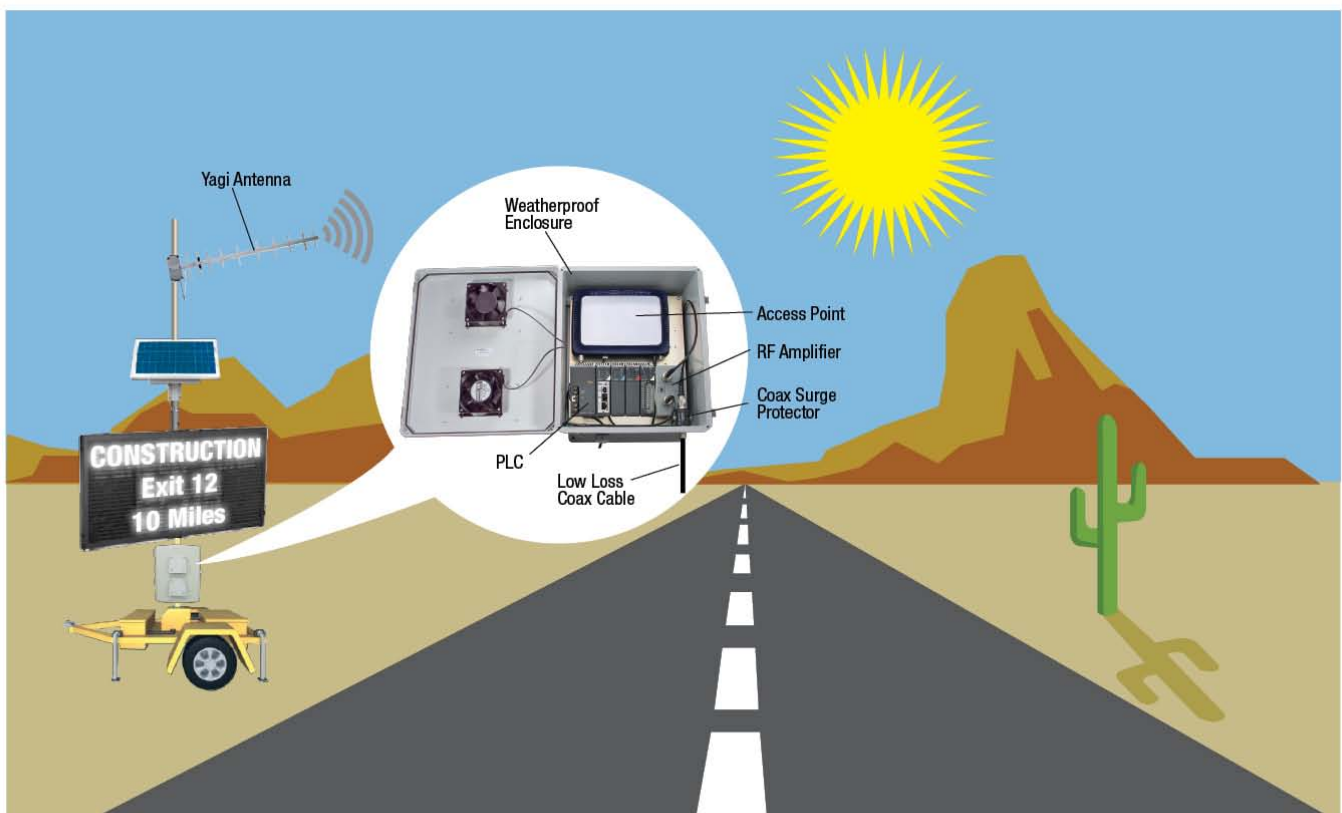
In the application diagram below, IP cameras are connected to L-com's industrial Ethernet switch via rugged outdoor rated Category 6 cabling. RS232 enabled traffic lights and sensors are connected to the traffic light control PLC housed in the roadside control box, via shielded data cabling collapsing to an Ethernet Device Server then to L-com's IES Series Industrial Ethernet switch. The system also employs wireless connectivity via L-com's HyperLink® Yagi antenna which sends traffic data and video to the central traffic management center.



Roadside Digital Signage

The use of dynamic, real time digital messaging along roadways, in tunnels and on bridges can save lives and make travel more efficient by displaying weather updates, upcoming road conditions, traffic alerts and alternate route information. Other applications for roadside digital signage include variable speed limit displays that can vary depending on traffic volume and weather conditions.

In the diagram below L-com's HyperLink® Yagi antenna receives wireless communications from a central control office to change the messaging on the sign. The Yagi antenna is connected via low loss coaxial cabling to the coax surge protector housed in L-com's weatherproof enclosure. The enclosure houses an RF amplifier, access point and Programmable Logic Controller (PLC) which controls the sign messaging.



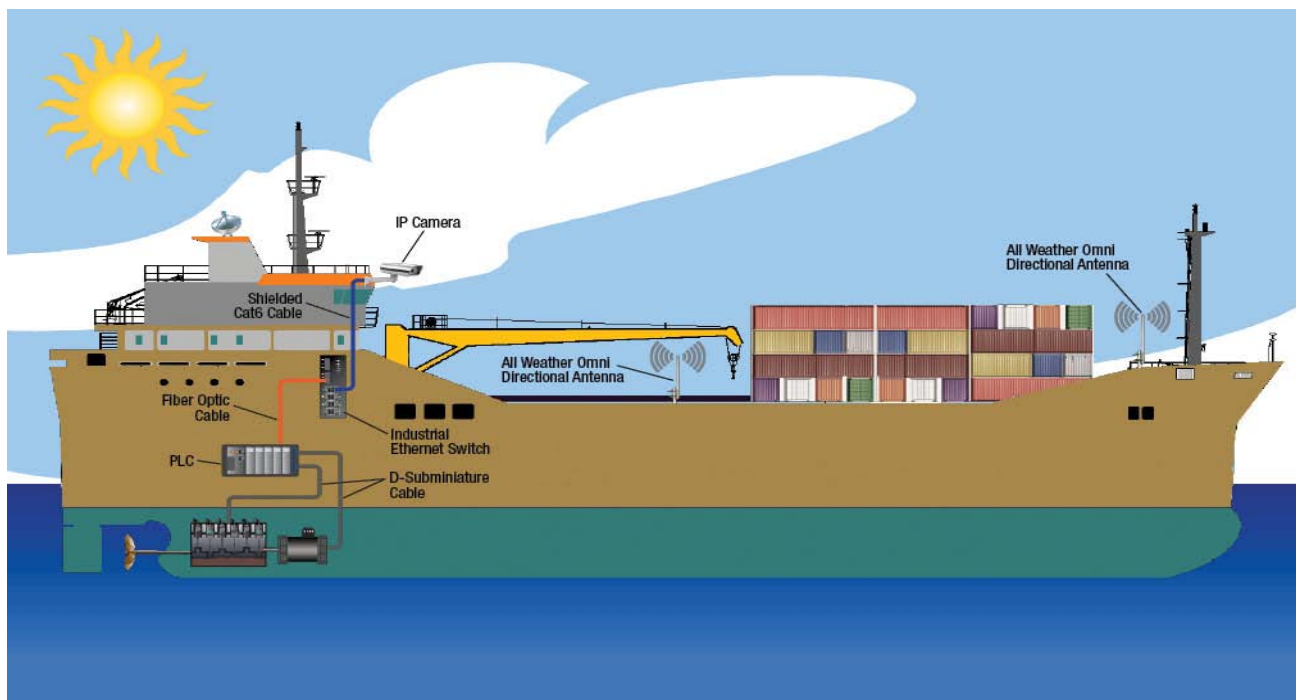
Maritime

L-com supports shipboard communications systems as well as seaport crane and ground personnel communications with its rugged fiber, copper and comprehensive wireless communications systems. Ranging from IP67/68 rated cable assemblies and connectors to weatherproof enclosures as well as Omni directional and directional antennas, L-com provides a complete wired and wireless network solution for the marine transportation and Intermodal freight industries.

Shipboard Communications and Control

Many shipboard communications and surveillance systems now employ Ethernet technology which provides redundancy, low latency and real time control of navigation and propulsion systems. By coupling wired and wireless Ethernet communications, an entire ship can be controlled via a central management station using Simple Network Management Protocol (SNMP) to monitor and manage all aspects of onboard communication and control.

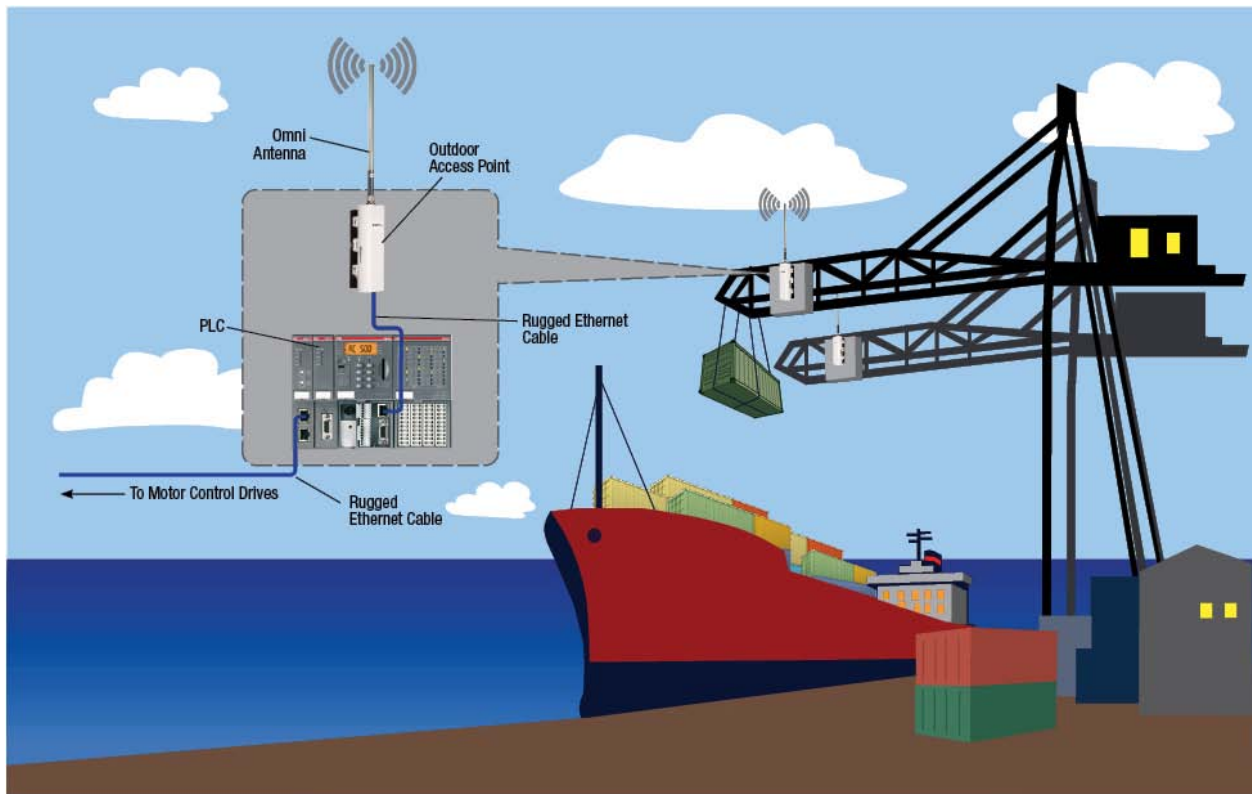
In the application diagram below IP surveillance cameras located throughout the ship are connected via shielded Category 6 cabling connecting back to L-com's Industrial Ethernet Switches housed in the main control cabinet. Fiber cabling is used to connect propulsion and steering systems to a Programmable Logic Controller (PLC). Additionally L-com's weatherproof Omni directional HyperLink® brand antennas are used to provide the crew with wireless communication access for tasks such as RFID asset tag management for cargo containers and for accessing voice and data communications.



Crane Communications

Many modern seaport terminals utilize automated crane systems for loading and unloading cargo ships. These automated systems can save Intermodal freight companies millions of dollars a year in labor, maintenance and repair costs. The cranes are controlled by computers housed in a secure locations and are often connected via Ethernet networks. L-com offers wired and wireless connectivity solutions for automated crane applications saving freight operators time and money.

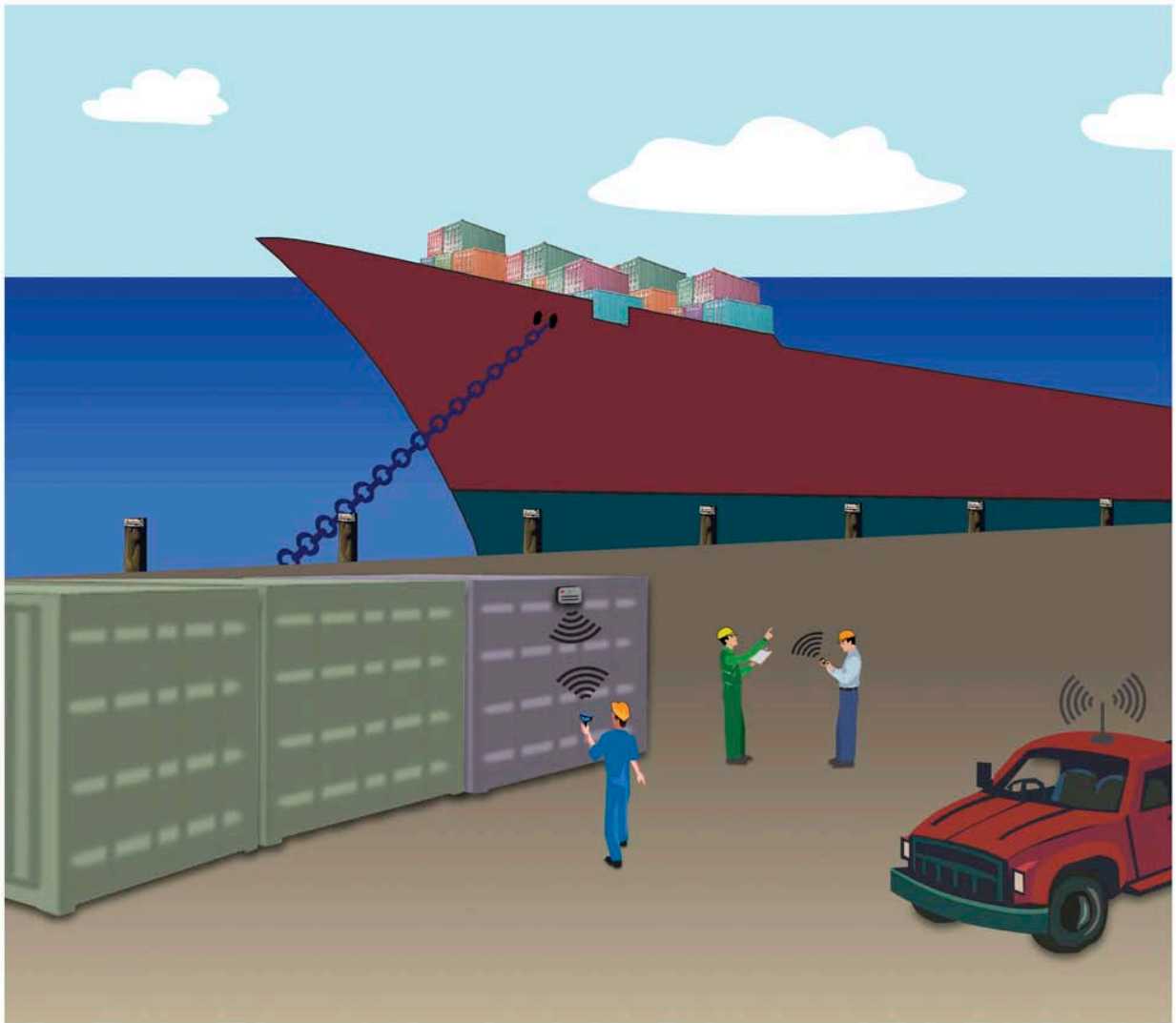
In the diagram below L-com's outdoor wireless CPE's provide a link between the cranes motor control, stability and alignment systems to the crane operator and central control building. By utilizing wireless connectivity system costs are reduced by not having to run cables. The CPE connects via L-com's Industrial Ethernet cable to a PLC that controls the motor drives located on the quay crane. L-com's HyperLink® brand Omni antennas provide seamless 360° wireless coverage. Alternative crane control networks utilize hi-flex category 5e/6 Ethernet cabling as well as fiber optic cabling to connect the cranes drive and control systems to the network.



Dockside Personnel/Vehicles

For tracking assets, personnel and ground support vehicles, L-com offers a complete suite of wired and wireless connectivity products to fit every application. Our HyperLink® brand antennas provide support for Intermodal container RFID tracking systems as well as broadband cellular and Wi-Fi communication between ground crews and vehicles.

In the application example below ground support vehicles utilize L-com's mobile mount Omni directional antennas to communicate with the main operations center and other ground personnel. Using ISM band frequencies for communication eliminates the need for traditional radio communications saving money and adding a level of security. RFID tags on the containers are scanned then uploaded to the operations center using L-com's wireless antennas, Bandpass filters and RF amplifiers which are housed in our weatherproof NEMA rated equipment enclosures. By using handheld wireless tablets and computers, dock personnel can more efficiently process container information accurately and in real time.



L-com, a global leader in the manufacture of wired and wireless connectivity products, offers a wide range of solutions and unmatched customer service for the electronics and data communications industries. The company's product portfolio includes cable assemblies, connectors, adapters, computer networking components, and custom products, as well as their HyperLink® line of wireless products which include Antennas, RF Amplifiers, Coaxial lightning and surge protectors, and NEMA rated enclosures.

L-com's HyperLink® wireless products are designed for WiFi, WiMAX, SCADA, 802.11a/b/g/n, RFID and Bluetooth applications. Trusted for over 30 years, L-com, which is headquartered in North Andover, MA, is ISO 9001: 2008 certified and many of its products are UL® recognized. www.l-com.com

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