

4. Cargo airline, Cargo sampling, Cargo scanning and delivery.

4.1 Cargo airlines (or airfreight carriers, and derivatives of these names)

are airlines dedicated to the transport of cargo. Some cargo airlines are divisions or subsidiaries of larger passenger airlines.

4.1.1 Logistics

Air transport is a vital component of many international logistics networks, essential to managing and controlling the flow of goods, energy, information and other resources like products, services, and people, from the source of production to the marketplace. It is difficult or nearly impossible to accomplish any international trading, global export/import processes, international repositioning of raw materials/products and manufacturing without a professional logistical support. It involves the integration of information, transportation, inventory, warehousing, material handling, and packaging. The operating responsibility of logistics is the geographical repositioning of raw materials, work in process, and finished inventories where required at the lowest cost possible.

4.1.2 Aircraft used

Larger cargo airlines tend to use new or recently built aircraft to carry their freight, but many use older aircraft, like the Boeing 707, Boeing 727, Douglas DC-8, DC-10, MD-11, Boeing 747, and the Ilyushin Il-76. Examples of the 60-year-old Douglas DC-3 are still flying around the world carrying cargo (as well as passengers). Short range turboprop airliners such as the An-12, An-26, Fokker Friendship, and British Aerospace ATP are now being modified to accept standard air freight pallets to extend their working lives. This normally involves the replacement of glazed windows with opaque panels, the strengthening of the cabin floor and insertion of a broad top-hinged door in one side of the fuselage.

Antonov An-225 Mriya and Antonov An-124 are the worlds' largest aircraft, used for transporting large shipments and oversized cargos.

Usage of large military airplanes for commercial purposes, pioneered by Ukraine's Antonov Airlines in the 1990s, has allowed new types of cargo in aerial transportation.

In the past, some cargo airlines would carry a few passengers from time to time on flights, and UPS Airlines once unsuccessfully tried a passenger charter airline

division. However, cargo planes in the United States are strictly forbidden from carrying non-employee passengers.

4.2 Cargo sampling

Cargo sampling is the taking and retaining of true representative samples of commodity products, usually to facilitate payment to a shipper for cargo leaving its port of loading.

Samples may be taken from all points in the supply chain, from warehouses, terminals, barges, ships, pipelines or service stations.

Accurately taken and labeled samples with an unequivocal chain of custody are essential to all operations. Effective and consistent cargo sampling requires a specialized staff of trained individuals who are responsible for taking such samples and transporting them to the corresponding testing laboratories.

4.3 Cargo scanning

Cargo scanning or non-intrusive inspection (NII) refers to non-destructive methods of inspecting and identifying goods in transportation systems. It is often used for scanning of intermodal freight shipping containers. In the US it is spearheaded by the Department of Homeland Security and its Container Security Initiative (CSI) trying to achieve one hundred percent cargo scanning by 2012 as required by the US Congress and recommended by the 9/11 Commission. In the US the main purpose of scanning is to detect special nuclear materials (SNMs), with the added bonus of detecting other types of suspicious cargo. In other countries the emphasis is on manifest verification, tariff collection and the identification of contraband. At February 2009, approximately 80% of US incoming containers are scanned. In order to bring that number to 100% researchers are evaluating numerous technologies, described in the following sections.

4.3.1 Radiography

Gamma-ray radiography

Gamma-ray radiography systems capable of scanning trucks usually use cobalt-60 or caesium-137 as a radioactive source and a vertical tower of gamma detectors. This gamma camera is able to produce one column of an image. The horizontal dimension of the image is produced by moving either the truck or the scanning hardware. The cobalt-60 units use gamma photons with a mean energy 1.25 MeV, which can penetrate up to 15–18 cm of steel. The systems provide good quality images which

can be used for identifying cargo and comparing it with the manifest, in an attempt to detect anomalies. It can also identify high-density regions too thick to penetrate, which would be the most likely to hide nuclear threats.

X-ray radiography

X-ray radiography is similar to Gamma-ray radiography but instead of using a radioactive source, it uses a high-energy Bremsstrahlung spectrum with energy in the 5-10 MeV range created by a linear particle accelerator (LINAC). Such X-ray systems can penetrate up to 30–40 cm of steel in vehicles moving with velocities up to 13 km/h. They provide higher penetration but also cost more to buy and operate. They are more suitable for the detection of special nuclear materials than gamma-ray systems. They also deliver about 1000 times higher dose of radiation to potential stowaways.

Dual-energy X-ray radiography

Dual-energy X-ray radiography

Backscatter X-ray radiography

Backscatter X-ray radiography

Muon radiography

Muon radiography.

4.3.2 Neutron activation systems

Examples of neutron activation systems include: Pulsed Fast Neutron Analysis (PFNA) and Thermal Neutron Activation (TNA) – which detect gamma-rays created when neutrons interact with matter.

Passive radiation detectors

Gamma radiation detectors

Radiological materials emit gamma photons, which gamma radiation detectors, also called Radiation Portal Monitors (RPM), are good at detecting. Systems currently used in US ports (and steel mills) use several (usually 4) large PVT panels as scintillators and can be used on vehicles moving up to 16 km/h.

on energy of detected photons, and as a result, they were criticized for their inability to distinguish gammas originating from nuclear sources from gammas originating

from a large variety of benign cargo types that naturally emit radioactivity, including bananas, cat litter, granite, porcelain, stoneware, etc. Those Naturally Occurring Radioactive Materials, called NORMs account for 99% of nuisance alarms. Some radiation, like in the case of large loads of bananas is due to potassium and its rarely occurring (0.0117%) radioactive isotope potassium-40, other is due to radium or uranium that occur naturally in earth and rock, and cargo types made out of them, like cat litter or porcelain.

Radiation originating from earth is also a major contributor to background radiation.

Another limitation of gamma radiation detectors is that gamma photons can be easily suppressed by high-density shields made from lead or steel, preventing detection of nuclear sources. Those types of shields do not stop fission neutrons produced by plutonium sources, however. As a result radiation detectors usually combine gamma and neutron detectors, making shielding only effective for certain uranium sources.

Neutron radiation detectors

Fissile materials emit neutrons. Some nuclear materials, such as the weapons usable Plutonium-239, emit large quantities of neutrons, making neutron detection a useful tool to search for such contraband. Radiation Portal Monitors often use Helium-3 based detectors to search for neutron signatures. However, a global supply shortage of He-3 [20] has led to the search for other technologies for neutron detection.

4.4 Delivery (commerce)

Delivery is the process of transporting goods from a source location to a predefined destination. There are different delivery types. Cargo (physical goods) are primarily delivered via roads and railroads on land, shipping lanes on the sea and airline networks in the air. Certain specialized goods may be delivered via other networks, such as pipelines for liquid goods, power grids for electrical power and computer networks such as the Internet or broadcast networks for electronic information.

The general process of delivering goods is known as distribution. The study of effective processes for delivery and disposition of goods and personnel is called logistics. Firms that specialize in delivering commercial goods from point of production or storage to point of sale are generally known as distributors, while those that specialize in the delivery of goods to the consumer are known as delivery services. Postal, courier, and relocation services also deliver goods for commercial and private interests.

4.4.1 Consumer goods delivery

A Dairy Crest Smiths Elizabethan electric Milk float for use of delivering fresh milk to people's doorsteps.

Most consumer goods are delivered from a point of production (factory or farm) through one or more points of storage (warehouses) to a point of sale (retail store), where the consumer buys the good and is responsible for its transportation to point of consumption. There are many variations on this model for specific types of goods and modes of sale. Products sold via catalogue or the Internet may be delivered directly from the manufacturer or warehouse to the consumer's home, or to an automated delivery booth. Small manufacturers may deliver their products directly to retail stores without warehousing. Some manufacturers maintain factory outlets which serve as both warehouse and retail store, selling products directly to consumers at wholesale prices (although many retail stores falsely advertise as factory outlets). Building, construction, landscaping and like materials are generally delivered to the consumer by a contractor as part of another service. Some highly perishable or hazardous goods, such as radioisotopes used in medical imaging, are delivered directly from manufacturer to consumer. Home delivery is often available for fast food and other convenience products, e.g. pizza delivery. Sometimes home delivery of supermarket goods is possible. A milk float is a small battery electric vehicle (BEV), specifically designed for the delivery of fresh milk. A new form of delivery is emerging on the horizon of the internet age: Delivery by the crowd e.g. crowd delivery. In this concept an individual not necessarily contracted by the vendor performs the delivery of goods to the destination.

4.4.2 Delivery vehicles

The consumer demand for Supermarkets to deliver to their door created the need for a mixed temperature controlled vehicle on 3.5T chassis. These vehicle bodies were initially built with the traditional GRP sandwich panels but as more damage resistant lightweight materials with better insulation properties have become available companies have been developing Advanced Home Delivery Vehicles. The 2012 Commercial Vehicle Show in the UK saw the new JDC PolyBilt design, one of the latest of these "Plastic" bodies that can also be recycled at the end of its service life unlike the traditional GRP which ends up as landfill.

Vehicles are often specialized to deliver different types of goods. On land, semi-trailers are outfitted with various trailers such as box trailers, flatbeds, car carriers, tanks and other specialized trailers, while railroad trains include similarly specialized cars. Armored cars, dump trucks and concrete mixers are examples of vehicles specialized for delivery of specific types of goods. On the sea, merchant ships come in various forms, such as cargo ships, oil tankers and fishing boats. Freight aircraft are used to deliver cargo.

Often, passenger vehicles are used for delivery of goods. These include buses, vans, pick-ups, cars (e.g., for mail or pizza delivery), motorcycles and bicycles (e.g., for newspaper delivery). A significant amount of freight is carried in the cargo holds of passenger ships and aircraft. Everyday travelers, known as a casual courier, can also be used to deliver goods.

Delivery to remote, primitive or inhospitable areas may be accomplished using small aircraft, snowmobiles, horse-drawn vehicles, dog sleds, pack animals, on foot, or by a variety of other transport methods.

4.4.3 Periodic deliveries

Some products are delivered to consumers on a periodic schedule. Historically, home delivery of many goods was much more common in urban centres of the developed world. At the beginning of the 20th century, perishable farm items such as milk, eggs and ice, were delivered weekly or even daily to customers by local farms. Milkmen delivered milk and other farm produce. With the advent of home refrigeration and better distribution methods, these products are today largely delivered through the same retail distribution systems as other food products. icemen delivered ice for iceboxes until the popularization of home refrigerator rendered them obsolete in most places. Similarly, laundry was once picked up and washed at a commercial laundry before being delivered to middle-class homes until the appearance of the washing machine and dryer (the lower classes washed their own and the upper classes had live-in servants). Likewise deliveries of coal and wood for home heating were more common until they were replaced in many areas by natural gas, oil, or electric heating. Some products, most notably home heating oil, are still delivered periodically.

Milk delivery continued until the mid-twentieth century across North America. For example, the last milk delivery by horse-and-wagon in Edmonton was in 1961. Milkman jokes continue in circulation long after. Related lines of Jeannie C. Riley's 1968 hit song Harper Valley PTA say: There's old Bobby Taylor sitting there,

and seven times he's asked me for a date, And Mrs. Taylor sure seems to use a lot of ice whenever he's away.