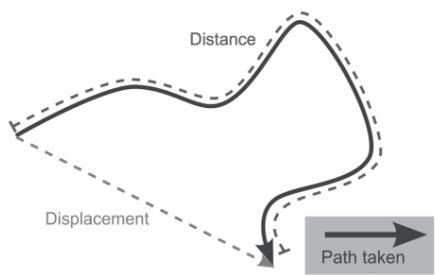


Hateruma	05
Island	05
Tourism	06
Airport	08
Runway	12
Distance	14
Direction	14
Navigation	14
Boat	18
Ship	19
Shipping	23
Transport	23
Cargo	27
Intermodal Containers	28
Dangerous Goods	30
Packaging and Labeling	32
Shrink Wrap	35
Boxes	35
Letterbox	37
Rural Delivery Service	38
Post Office	39
Passport	39
Travel Documents	44
Freedom of Movement	45
Trespass	46
Intangible Property	48
Intellectual Property	48
Copyright	49
Public Domain	51



In February of 2005 I traveled to Hateruma, the southern-most inhabited island of Japan. Located in the Yaeyama Archipelago in the Okinawa Prefecture, the island sits between the East China Sea and the Phillipine Sea, closer to Taiwan than Japan's main islands. Standing on the island's southern side, which I did, one can look out at sea from the bottom of Japan.

There are two distances: one is the distance of displacement between Los Angeles and Hateruma. The other is the length of a travel's journey. The second involves time, various kinds of vehicles, boats, airplanes, bicycles, waiting, customs forms, looking out windows, sleeping, walking. The itinerary of this distance was as follows: a flight from LAX to Narita Airport, then a flight from Haneda Airport to Naha in Okinawa. From there, a 14-hour ship to the island of Ishigaki, making a brief stop at the island of Miyako. From Ishigaki, a small ferry to Hateruma, and a bicycle to the southern side of the island.

On the following page is a photograph of the sea from the southern side of the island. I made it from as far as I could reach standing on the island's coastal rocks. According to the meta-data of this photograph's file (the camera is set to Pacific Standard Time), the picture was taken on: 23:42, 23 February 2005. I uploaded it later to Wikipedia and inserted it into the Hateruma page (and thereby licensing it into the public domain), hoping the view would circulate openly outside of my control.

This book documents another kind of itinerary and movement. It is a movement that navigates through information via connections. Here the connection is the link that leads to another URL. It is like a doorway that leads to a connecting place. A list of interconnecting links that documents one's movement through information can be seen as a defined itinerary. The itinerary printed here, from Hateruma to Public Domain (all within Wikipedia), is defined by the following: Hateruma, Island, Tourism, Airport, Runway, Distance, Direction, Navigation, Boat, Ship, Shipping, Transport, Cargo, Containers, Dangerous Goods, Packaging and Labeling, Shrink Wrap, Boxes, Letterbox, Rural Delivery Service, Post Office, Passport, Travel Documents, Freedom of Movement, Trespass, Intangible Property, Intellectual Property, Copyright, Public Domain.

This itinerary is also indicative of a moment in time. In an environment of continuously changing information, at any moment these connections can be broken, and new ones can emerge. Thus, this list of links points to the time when the flow of connections were intact (which they could very well still be). An analogous example of this breaking, again paralleling the two forms of movement (my travel to the island, and trail from the island to the public domain through information), is as follows. I recently tried to re-trace my exact movement to Hateruma by looking up the different routes I had taken. I came across a dead URL of the company whose ship I had traveled on from Naha to Ishigaki (<http://www.arimuraline.co.jp>). The ship had stopped service in 2008. This specific connection between Naha and Ishigaki had become part of the past.

—David Horvitz









Monument at the southernmost point of Japan open to the public

1

## HATERUMA

Hateruma (波照間島; Hateruma-jima; Yaeyama: Hatirōma Okinawan: Hatiruma) is an island in the Yaeyama District of Okinawa Prefecture, Japan. Part of the town Taketomi, it is the southern-most inhabited island in Japan at 24°2'25" north latitude, 123°47'16" east longitude. Hateruma, composed of corals, which has 12.7 km<sup>2</sup> of area and approximate 600 inhabitants.

The primary products of the island include sugarcane, refined sugar, and Awamori, a highly-prized type of the alcoholic beverage awamori. Its southern location makes it one of the few places in Japan where the Southern Cross can be observed.

Hateruma Airport serves the island.

2

## ISLAND

An island or isle is any piece of sub-continental land that is surrounded by water. Very small islands such as emergent land features on atolls can be called islets, cays or keys. An island in a river or lake may be called an eyot. A grouping of geographically or geologically related islands is called an archipelago.

An island may still be described as such despite the presence of a land bridge, for example Singapore and its causeway, or the various Dutch delta islands, such as IJsselmonde. Some places may even retain "island" in their names for historical reasons after being connected to a larger landmass by a wide land bridge, such as Coney Island.

There are two main types of islands: continental islands and oceanic islands. There are also artificial islands. There is no standard of size which distinguishes islands from islets and continents.

### Etymology

The word island comes from Old English *igland* (from 'ig', similarly meaning 'island' when used independently, and -land carrying its contemporary meaning). However, the spelling of the word was modified in the 15th century by association with the etymologically unrelated Old French loanword *isle*, which

itself comes from the Latin word *insula*. Old English 'ig' is actually a cognate of Latin *aqua* (water).

### Types of island

#### Continental islands

Continental islands are bodies of land that lie on the continental shelf of a continent. Examples include Greenland and Sable Island off North America; Barbados and Trinidad off South America; Great Britain, Ireland and Sicily off Europe; Sumatra, Borneo and Java off Asia; and New Guinea, Tasmania and Kangaroo Island off Australia.

A special type of continental island is the microcontinental island, which results when a continent is rifted. Examples



Cies Islands in Galicia



Pokonji Dol, a small Croatian island in the Adriatic Sea

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are Madagascar and Socotra off Africa; New Zealand; New Caledonia; the Kerguelen Islands; and some of the Seychelles.

Another subtype is an island or bar formed by deposition of tiny rocks where a water current loses some of its carrying capacity. An example is barrier islands, which are accumulations of sand deposited by sea currents on the continental shelf. Another example is islands in river deltas or in large rivers. While some are transitory and may disappear if the volume or speed of the current changes, others are stable and long-lived. Islets are very small islands.

#### Oceanic islands

Oceanic islands are ones that do not sit on continental shelves. The vast majority are volcanic in origin. The few oceanic islands that are not volcanic are tectonic in origin and arise where plate movements have lifted up the deep ocean floor to above the surface. Examples of this include Saint Peter and Paul Rocks in the Atlantic Ocean and Macquarie Island in the Pacific.

One type of volcanic oceanic island is found in a volcanic island arc. These islands arise from volcanoes where the subduction of one plate under another is occurring. Examples include the Mariana Islands, the Aleutian Islands and most of Tonga in the Pacific Ocean. Some of the Lesser Antilles and the South Sandwich Islands are the only Atlantic Ocean examples.

Atlantic is the island of Surtsey, which was formed in 1963.

An atoll is an island formed from a coral reef that has grown on an eroded and submerged volcanic island. The reef rises to the surface of the water and forms a new island. Atolls are typically ring-shaped with a central lagoon. Examples include the Maldives in the Indian Ocean and Line Islands in the Pacific.

#### Tropical islands

There are approximately 45,000 tropical islands on Earth. Among coral tropic islands for example are Maldives, Tonga, Nauru and Polynesia. Granite islands include Seychelles and Tioman. The socio-economic diversity of these regions ranges from the Stone Age societies in the interior of Madagascar, Borneo or Papua New Guinea to the high-tech lifestyles of the city-islands of Singapore and Hong Kong. The international tourism is a significant factor in the local economy of Seychelles, Sri Lanka, Mauritius, Réunion, Hawaii or Maldives.

#### Desert islands

A desert island is an island with no people. Typically, a desert island is denoted as such because it exists in a state of being deserted, or abandoned. Note that an arid desert climate is not typically implied; one dictionary uses the phrase ‘desert



Tourists enjoying cocktails during a beach vacation

Another type of volcanic oceanic island occurs where an oceanic rift reaches the surface. There are two examples: Iceland, which is the world’s second largest volcanic island, and Jan Mayen — both are in the Atlantic.

A third type of volcanic oceanic island is formed over volcanic hotspots. A hotspot is more or less stationary relative to the moving tectonic plate above it, so a chain of islands results as the plate drifts. Over long periods of time, this type of island is eventually “drowned” by isostatic adjustment and eroded, becoming a seamount. Plate movement across a hotspot produces a line of islands oriented in the direction of the plate movement. An example is the Hawaiian Islands, from Hawaii to Kure, which then extends beneath the sea surface in a more northerly direction as the Emperor Seamounts. Another chain with similar orientation is the Tuamotu Archipelago; its older, northerly trend is the Line Islands. The southernmost chain is the Austral Islands, with its northerly trending part the atolls in the nation of Tuvalu. Tristan da Cunha is an example of a hotspot volcano in the Atlantic Ocean. Another hot spot in the

island’ to illustrate the use of ‘desert’ as an adjective meaning “desolate and sparsely occupied or unoccupied”. According to another, “A desert island is a small tropical island, where nobody lives or an undiscovered island.”

## TOURISM

Tourism is travel for recreational, leisure or business purposes. The World Tourism Organization defines tourists as people who “travel to and stay in places outside their usual environment for more than twenty-four (24) hours and not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited.” Tourism has become a popular global leisure activity. In 2008, there were over 922 million international tourist arrivals, with a growth of 1.9% as compared to 2007.

International tourism receipts grew to US\$944 billion (euro 642 billion) in 2008, corresponding to an increase in real terms of 1.8%.

As a result of the late-2000s recession, international travel demand suffered a strong slowdown beginning in June 2008, with growth in international tourism arrivals worldwide falling to 2% during the boreal summer months. This negative trend intensified during 2009, exacerbated in some countries due to the outbreak of the H1N1 influenza virus, resulting in a worldwide decline of 4% in 2009 to 880 million international tourists arrivals, and an estimated 6% decline in international tourism receipts.

Tourism is vital for many countries, such as Egypt, Greece, Lebanon, Spain and Thailand, and many island nations, such as The Bahamas, Fiji, Maldives, and the Seychelles, due to the large intake of money for businesses with their goods and services and the opportunity for employment in the service industries associated with tourism. These service industries include transportation services, such as airlines, cruise ships and taxicabs, hospitality services, such as accommodations, including hotels and resorts, and entertainment venues, such as amusement parks, casinos, shopping malls, music venues and theatres.

### Definition

Theobald (1994) suggested that “etymologically, the word tour is derived from the Latin, ‘tornare’ and the Greek, ‘tornos’, meaning ‘a lathe or circle; the movement around a central point or axis’. This meaning changed in modern English to represent ‘one’s turn’. The suffix –ism is defined as ‘an action or process; typical behavior or quality’, while the suffix, –ist denotes ‘one that performs a given action’. When the word tour and the suffixes –ism and –ist are combined, they suggest the action of movement around a circle. One can argue that a circle represents a starting point, which ultimately returns back to its beginning. Therefore, like a circle, a tour represents a journey in that it is a round-trip, i.e., the act of leaving and then returning to the original starting point, and therefore, one who takes such a journey can be called a tourist.”

In 1941, Hunziker and Krapf defined tourism as people who travel “the sum of the phenomena and relationships arising from the travel and stay of non-residents, insofar as they do not lead to permanent residence and are not connected with any earning activity.” In 1976, the Tourism Society of England’s definition was: “Tourism is the temporary, short-term movement of people to destination outside the places where they normally live and work and their activities during the stay at each destination. It includes movements for all purposes.” In 1981, the International Association of Scientific Experts in Tourism defined tourism in terms of particular activities selected by choice and undertaken outside the home.

In 1994, the United Nations classified three forms of tourism in its Recommendations on Tourism Statistics:

- Domestic tourism, involving residents of the given country traveling only within this country.
- Inbound tourism, involving non-residents traveling in the given country.
- Outbound tourism, involving residents traveling in another country.

### History

Wealthy people have always travelled to distant parts of the world, to see great buildings, works of art, learn new languages, experience new cultures and to taste different cuisines. Long ago, at the time of the Roman Republic, places such

as Baiae were popular coastal resorts for the rich. The word tourism was used by 1811 and tourist by 1840. In 1936, the League of Nations defined foreign tourist as “someone traveling abroad for at least twenty-four hours”. Its successor, the United Nations, amended this definition in 1945, by including a maximum stay of six months.

#### Leisure travel

Leisure travel was associated with the Industrial Revolution in the United Kingdom – the first European country to promote leisure time to the increasing industrial population. Initially, this applied to the owners of the machinery of production, the economic oligarchy, the factory owners and the traders. These comprised the new middle class. Cox & Kings was the first official travel company to be formed in 1758.

The British origin of this new industry is reflected in many place names. In Nice, France, one of the first and best-established holiday resorts on the French Riviera, the long esplanade along the seafront is known to this day as the Promenade des Anglais; in many other historic resorts in continental Europe, old, well-established palace hotels have names like the Hotel Bristol, the Hotel Carlton or the Hotel Majestic – reflecting the dominance of English customers.

Many leisure-oriented tourists travel to the tropics, both in the summer and winter. Places of such nature often visited are: Mexico, Bali in Indonesia, Brazil, Cuba, the Dominican Republic, Malaysia, the various Polynesian tropical islands, Queensland in Australia, Thailand, and Florida and Hawaii in the United States.

#### Winter tourism

Major ski resorts are located in the various European countries (e.g. Austria, Bulgaria, Czech Republic, France, Germany, Iceland, Italy, Norway, Poland, Sweden, Slovenia, Spain, Switzerland), Canada, the United States, New Zealand, Japan, South Korea, Chile and Argentina.

#### Mass tourism

Mass tourism could only have developed with the improvements in technology, allowing the transport of large numbers of people in a short space of time to places of leisure interest, so that greater numbers of people could begin to enjoy the benefits of leisure time.

In the United States, the first seaside resorts in the European style were at Atlantic City, New Jersey and Long Island, New York.

In Continental Europe, early resorts included: Ostend, popularized by the people of Brussels; Boulogne-sur-Mer (Pas-de-Calais) and Deauville (Calvados) for the Parisians; and Heiligendamm, founded in 1793, as the first seaside resort on the Baltic Sea.

### Recent developments

There has been an upmarket trend in the tourism over the last few decades, especially in Europe, where international travel for short breaks is common. Tourists have high levels of disposable income, considerable leisure time, are well educated, and have sophisticated tastes. There is now a demand for a better quality products, which has resulted in a fragmenting of the mass market for beach vacations; people want more specialised versions, quieter resorts, family-oriented holidays or niche market-targeted destination hotels.

The developments in technology and transport infrastructure, such as jumbo jets, low-cost airlines and more accessible airports have made many types of tourism more affordable. WHO estimates that up to 500,000 people are on planes at any time. There have also been changes in lifestyle, such as retiree-age people who sustain year round tourism. This is facilitated by internet sales of tourism products. Some sites have now started to offer dynamic packaging, in which an inclusive price is quoted for a tailor-made package requested by the customer upon impulse.

## AIRPORT

There have been a few setbacks in tourism, such as the September 11 attacks and terrorist threats to tourist destinations, such as in Bali and several European cities. Also, on December 26, 2004, a tsunami, caused by the 2004 Indian Ocean earthquake, hit the Asian countries on the Indian Ocean, including the Maldives. Thousands of lives were lost and many tourists died. This, together with the vast clean-up operation in place, has stopped or severely hampered tourism to the area.

The terms tourism and travel are sometimes used interchangeably. In this context, travel has a similar definition to tourism, but implies a more purposeful journey. The terms tourism and tourist are sometimes used pejoratively, to imply a shallow interest in the cultures or locations visited by tourists.

**Human right**

On the 15th of April 2010, European Commissioner Antonio Tajani attracted attention and criticism after the British newspaper, *The Sunday Times*, reported he had unveiled a plan declaring tourism as a human right. According to the article, pensioners, youths and those too poor to afford it should have

An airport is a location where aircraft such as fixed-wing aircraft, helicopters, and blimps takeoff and land. Aircraft may be stored or maintained at an airport. An airport consists of at least one surface such as a runway for a plane to takeoff and land, a helipad, or water for takeoffs and landings, and often includes buildings such as control towers, hangars and terminal buildings.

Larger airports may have fixed base operator services, seaplane docks and ramps, air traffic control, passenger facilities such as restaurants and lounges, and emergency services. A military airport is known as an airbase or air station. The terms aerodrome, airdrome, airfield, and airstrip may also be used to refer to airports, and the terms heliport, seaplane base, and STOLport refer to airports dedicated exclusively to helicopters, seaplanes, or short take-off and landing aircraft. In some jurisdictions, the term airport is used when the facility is licensed as such by the relevant government organization



The apron from the top floor observation room, Halifax International Airport, Canada

their travel subsidised by the taxpayer. Tajani's program will be piloted until 2013 and then put into full operation. In introducing his plan, Tajani stated, "Travelling for tourism today is a right. The way we spend our holidays is a formidable indicator of our quality of life." His spokesman added, "Why should someone from the Mediterranean not be able to travel to Edinburgh in summer for a breath of cool, fresh air; why should someone from Edinburgh not be able to travel to Greece in winter?"

EurActiv, an independent media portal, criticized the article by *The Sunday Times* as an example of misleading information about the EU to appear in the British press and then picked up by other Anglo-Saxon media and blogs, and Wikipedia. EurActiv stated that "the article on *The Sunday Times* never quotes the commissioner as having made such a statement. Nevertheless, it pursues the argument under the headline "Brussels decrees holidays as a human right," underlining the alleged "hundreds of millions of pounds" that pursuing the idea would cost taxpayers." Wikipedia was criticized by EurActiv regarding the difficulty that Commissioner Tajani's team had with changing the wrong information on the encyclopedia, and echoed European Commission spokesperson Pia Ahrenkilde Hansen's statement that "ethics in digital communications is definitely a subject which deserves to be addressed."

(e.g. the U.S. Federal Aviation Administration (FAA), Transport Canada). Elsewhere the distinction is one of general appearance. Other jurisdictions define an airport as having the customs offices etc. expected of a port, though the more general term is airport of entry.

**Infrastructure**

Smaller or less-developed airports — which represent the vast majority — often have a single runway shorter than 1,000 m (3,300 ft). Larger airports for airline flights generally have paved runways 2,000 m (6,600 ft) or longer. Many small airports have dirt, grass, or gravel runways, rather than asphalt or concrete.

In the United States, the minimum dimensions for dry, hard landing fields are defined by the FAR Landing And Takeoff Field Lengths. These include considerations for safety margins during landing and takeoff. Heavier aircraft require longer runways.

The longest public-use runway in the world is at Qamdo Bangda Airport in China. It has a length of 5,500 m (18,045 ft). The world's widest paved runway is at Ulyanovsk Vostochny Airport in Russia and is 105 m (344 ft) wide.

As of 2009, the CIA stated that there were approximately 44,000 "... airports or airfields recognizable from the air." around the world, including 15,095 in the US, the US having the most in the world.

## Airport ownership and operation

Most of the world's airports are owned by local, regional, or national government bodies who then lease the airport to private corporations who oversee the airport's operation. For example, BAA Limited (BAA) operates seven of the commercial airports in the United Kingdom, as well as several other airports outside of the UK. Germany's Frankfurt Airport is managed by the quasi-private firm Fraport. While in India GMR Group operates, through joint ventures, Indira Gandhi International Airport and Hyderabad International Airport. Bangalore and Mumbai airports are controlled by GVK Group. Rest of Indian airports are managed by Airport Authority of India, AAI.

In the United States and Canada, commercial airports are generally operated directly by government entities or government-created airport authorities (also known as port authorities).

Many US airports still lease part or all of their facilities to outside firms, who operate functions such as retail management and parking. In the US, all commercial airport runways are certified by the FAA under the Code of Federal Regulations Title 14 Part 139, "Certification of Commercial Service Airports" but maintained by the local airport under the regulatory authority of the FAA.

Despite the reluctance to privatize airports in the US (despite the FAA sponsoring a privatization program since 1996), the government-owned, contractor-operated (GOCO) arrangement is the standard for the operation of commercial airports in the rest of the world.

## Airport Structures

Airports are divided into landside and airside areas. Landside areas include parking lots, public transportation train stations, tank farms and access roads. Airside areas include all areas accessible to aircraft, including runways, taxiways, ramps and tank farms. Access from landside areas to airside areas is tightly controlled at most airports. Passengers on commercial flights access airside areas through terminals, where they can purchase tickets, clear security, check or claim luggage and board aircraft through gates. The waiting areas which provide passenger access to aircraft are typically called concourses, although this term is often used interchangeably with terminal.

The area where aircraft park next to a terminal to load passengers and baggage is known as a ramp (or "the tarmac"). Parking areas for aircraft away from terminals are called aprons.

Airports can be towered or non-towered, depending on air traffic density and available funds. Due to their high capacity and busy airspace, many international airports have air traffic control located on site.

Airports with international flights have customs and immigration facilities. However, as some countries have agreements that allow travel between them without customs and immigrations, such facilities are not a definitive need for an international airport. International flights often require a higher level of physical security, although in recent years, many countries have adopted the same level of security for international and domestic travel.

Some airport structures include on-site hotels built within or attached to a terminal building. Airport hotels have grown popular due to their convenience for transient passengers and easy accessibility to the airport terminal. Many airport hotels also have agreements with airlines to provide overnight lodging for displaced passengers.

"Floating airports" are being designed which could be located out at sea and which would use designs such as pneumatic stabilized platform technology.

## Shops and food services

The prices charged for food are generally higher than prices found outside the airport. However, some airports now regulate

food costs to keep them comparable to "street prices". This term is misleading as prices often match the manufacturer's suggested retail price (MSRP) but are almost never discounted.

Some airport restaurants offer regional cuisine specialties for those in transit so that they may sample local food or culture without leaving the airport.



Airport Traffic sign



Baggage is scanned using X-ray machines, passengers walk through metal detectors



A sign in the Vancouver airport pointing to the direction of the American part of the airport. In the Vancouver Airport, depending on the flight, travelers can cross the Canadian-American border inside the airport before flying to the United States.

## Premium and VIP services

Airports may also contain premium and VIP services. The premium and VIP services may include express check-in, dedicated check-in counters, separate departures and/or arrivals lounge, priority boarding, separate air bridges, and priority baggage handling.

These services are usually reserved for First and Business class passengers, premium frequent flyers, and members of the airline's clubs. Premium services may sometimes be open to passengers who are members of a different airline's frequent flyer program. This can sometimes be part of a reciprocal deal, as when multiple airlines are part of the same alliance, or as a ploy to attract premium customers away from rival airlines.

Sometimes these premium services will be offered to a non-premium passenger if the airline has made a mistake in handling of the passenger, such as unreasonable delays or mishandling of checked baggage.

Airline lounges frequently offer free or reduced cost food, as well as alcoholic and non-alcoholic beverages. Lounges themselves typically have seating, showers, quiet areas, televisions, computer, wi-fi and Internet access, and power outlets that passengers may use for their electronic equipment. Some airline lounges employ baristas, bartenders and gourmet chefs.

Airlines sometimes operate multiple lounges within the one airport terminal allowing ultra premium customers, such as first class customers, additional services, which are not available to other premium customers. Multiple lounges may also prevent overcrowding of the lounge facilities.

### **Cargo and freight services**

In addition to people, airports move cargo around the clock. Cargo airlines often have their own on-site and adjacent infrastructure to transfer parcels between ground and air. Cargo Terminal Facilities International airports need areas where export cargo has to be stored after customs clearance and prior to loading on the aircraft. Similarly import cargo that is offloaded needs to be in bond before the consignee decides to take delivery. Areas have to be kept aside for examination of export and import cargo by the airport authorities. Designated areas or sheds may be given to airlines or freight forward ring agencies. Every cargo terminal has a landside and an airside. The landside is where the exporters and importers through either their agents or by themselves deliver or collect shipments while the airside is where loads are moved to or from the aircraft. In addition cargo terminals are divided into distinct areas - export, import and interline or transshipment

### **Airport access**

Many large airports are located near railway trunk routes for seamless connection of multimodal transport, for instance Frankfurt Airport, Amsterdam Airport Schiphol, London Heathrow Airport, London Gatwick Airport and London Stansted Airport. It is also common to connect an airport and a city with rapid transit, light rail lines or other non-road public transport systems, for instance the AirTrain JFK at John F. Kennedy International Airport in New York and the Silver Line T at Boston's Logan International Airport by the Massachusetts Bay Transportation Authority (MBTA). Such a connection lowers risk of missed flights due to traffic congestion. Large airports usually have access also through expressways from which motor vehicles enter either the departure loop or the arrival loop.

### **Internal transport**

The distances passengers need to move within a large airport can be substantial. It is common for airports to provide moving walkways and buses. The Hartsfield–Jackson Atlanta International Airport has a tram that takes people through the concourses and baggage claim. Major airports with more than one terminal offer inter-terminal transportation, such as Mexico City International Airport, where the domestic building of Terminal 1 is connected by Aerotrén to Terminal 2, on the other side of the airport.

### **Airport designation and naming**

Airports are uniquely represented by their International Air Transport Association airport code and ICAO airport code. An International Air Transport Association (IATA) airport code is often an abbreviation of the airport's common name, particularly older ones, such as PHL for Philadelphia International Airport. An airport sometimes retains its previous IATA code when its name, or even when its location is changed. Beirut Rafic Hariri International Airport in Beirut retains the IATA code BEY, from its former name of Beirut International Airport (BEY is from its French name, Aéroport International de Beyrouth). Hong Kong International Airport retained both its

name and its IATA code when moved from Kai Tak to Chek Lap Kok in 1998.

The name of the airport itself can be its location, such as San Francisco International Airport. It can be named after some public figure, commonly a politician, e.g. Paris-Charles de Gaulle Airport, or a person associated with the region it serves or prominent figures in aviation history, such as Norman Y. Mineta San Jose International Airport, Will Rogers World Airport, Liverpool John Lennon Airport, Rio de Janeiro-Galeão International Airport, Tehran Imam Khomeini International Airport, or more recently, Belfast City Airport was renamed George Best Belfast City Airport in memory of the football star born in Northern Ireland.

Some airports have unofficial names, possibly so widely circulated that its official name is little used or even known.

Airport names may include the word "International", reflecting their ability to handle international aviation traffic, although the airport may not actually operate any such flights; an example is Texel International Airport. Some airports with international immigration facilities may also choose to drop the word from their airport names (e.g. Perth Airport, Singapore Changi Airport).

### **Airport security**

Airport security normally requires baggage checks, metal screenings of individual persons, and rules against any object that could be used as a weapon. Since the September 11, 2001 attacks, airport security has been dramatically increased.

### **Airport operations**

#### **Air traffic control**

The majority of the world's airports are non-towered, with no air traffic control presence. However, at particularly busy airports, or airports with other special requirements, there is an air traffic control (ATC) system whereby controllers (usually ground-based) direct aircraft movements via radio or other communications links. This coordinated oversight facilitates safety and speed in complex operations where traffic moves in all three dimensions. Air traffic control responsibilities at airports are usually divided into at least two main areas: ground and tower, though a single controller may work both stations. The busiest airports also have clearance delivery, apron control, and other specialized ATC stations.

Ground Control is responsible for directing all ground traffic in designated "movement areas", except the traffic on runways. This includes planes, baggage trains, snowplows, grass cutters, fuel trucks, and a wide array of other vehicles. Ground Control will instruct these vehicles on which taxiways to use, which runway they will use (in the case of planes), where they will park, and when it is safe to cross runways. When a plane is ready to takeoff it will stop short of the runway, at which point it will be turned over to Tower Control. After a plane has landed, it will depart the runway and be returned to Ground Control.

Tower Control controls aircraft on the runway and in the controlled airspace immediately surrounding the airport. Tower controllers may use radar to locate an aircraft's position in three-dimensional space, or they may rely on pilot position reports and visual observation. They coordinate the sequencing of aircraft in the traffic pattern and direct aircraft on how to safely join and leave the circuit. Aircraft which are only passing through the airspace must also contact Tower Control in order to be sure that they remain clear of other traffic.

#### **Traffic pattern**

All airports use a traffic pattern (often called a traffic circuit outside the U.S.) to assure smooth traffic flow between departing and arriving aircraft. Generally, this pattern is a circuit consisting of five "legs" that form a rectangle (two legs and the runway form one side, with the remaining legs forming three more sides). Each leg is named (see diagram), and ATC directs

pilots on how to join and leave the circuit. Traffic patterns are flown at one specific altitude, usually 800 or 1,000 ft (244 or 305 m) above ground level (AGL). Standard traffic patterns are left-handed, meaning all turns are made to the left. Right-handed patterns do exist, usually because of obstacles such as a mountain, or to reduce noise for local residents. The predetermined circuit helps traffic flow smoothly because all pilots know what to expect, and helps reduce the chance of a mid-air collision.

At extremely large airports, a circuit is in place but not usually used. Rather, aircraft (usually only commercial with long routes) request approach clearance while they are still hours away from the airport, often before they even takeoff from their departure point. Large airports have a frequency called Clearance Delivery which is used by departing aircraft specifically for this purpose. This then allows airplanes to take the most direct approach path to the runway and land without worrying about interference from other aircraft. While this system keeps the airspace free and is simpler for pilots, it requires detailed knowledge of how aircraft are planning to use the airport ahead of time and is therefore only possible with large commercial airliners on pre-scheduled flights. The system has recently become so advanced that controllers can predict whether an aircraft will be delayed on landing before it even takes off; that aircraft can then be delayed on the ground, rather than wasting expensive fuel waiting in the air.

### Navigational aids

There are a number of aids available to pilots, though not all airports are equipped with them. A Visual Approach Slope Indicator (VASI) helps pilots fly the approach for landing. Some airports are equipped with a VHF omnidirectional range (VOR) to help pilots find the direction to the airport. VORs are often accompanied by a distance measuring equipment (DME) to



Runway at Gibraltar Airport

determine the distance to the VOR. VORs are also located off airports, where they serve to provide airways for aircraft to navigate upon. In poor weather, pilots will use an instrument landing system (ILS) to find the runway and fly the correct approach, even if they cannot see the ground. The number of instrument approaches based on the use of the Global Positioning System (GPS) is rapidly increasing and may eventually be the primary means for instrument landings.

Larger airports sometimes offer precision approach radar (PAR), but these systems are more common at military air bases than civilian airports. The aircraft's horizontal and vertical movement is tracked via radar, and the controller tells the pilot his position relative to the approach slope. Once the pilots can see the runway lights, they may continue with a visual landing.

### Guidance signs

Airport guidance signs provide direction and information to taxiing aircraft and airport vehicles. Smaller airports may have few or no signs, relying instead on airport diagrams and charts. There are two classes of signage at airports, with several types of each:

#### Operational guidance signs

Location signs – yellow on black background. Identifies the runway or taxiway currently on or entering.

Direction/Runway Exit signs – black on yellow. Identifies the intersecting taxiways the aircraft is approaching, with an arrow indicating the direction to turn.

Other – many airports use conventional traffic signs such as stop and yield signs throughout the airport.

#### Mandatory instruction signs

Mandatory instruction signs are white on red. They show entrances to runways or critical areas. Vehicles and aircraft are required to stop at these signs until the control tower gives clearance to proceed.

Runway signs – White text on a red background. These signs simply identify a runway intersection ahead.

Frequency Change signs – Usually a stop sign and an instruction to change to another frequency. These signs are used at airports with different areas of ground control.

Holding Position signs – A single solid yellow bar across a taxiway indicates a position where ground control may require a stop. If two solid yellow bars and two dashed yellow bars are encountered, this indicates a holding position for a runway intersection ahead; runway holding lines must never be crossed without permission. At some airports, a line of red lights across a taxiway is used during low visibility operations to indicate holding positions. An “interrupted ladder” type marking with an “ILS” sign in white on red indicates a holding position before an ILS critical area.

### Lighting

Many airports have lighting that help guide planes using the runways and taxiways at night or in rain or fog.

On runways, green lights indicate the beginning of the

runway for landing, while red lights indicate the end of the runway. Runway edge lighting consists of white lights spaced out on both sides of the runway, indicating the edge. Some airports have more complicated lighting on the runways including lights that run down the centerline of the runway and lights that help indicate the approach (an Approach Lighting System, or ALS). Low-traffic airports may use Pilot Controlled Lighting to save electricity and staffing costs.

Along taxiways, blue lights indicate the taxiway's edge, and some airports have embedded green lights that indicate the centerline.

#### Obstruction Lighting

- Used to mark hazards
- Gives pilots a visual aid (usually creates a lane)
- Meant to be visible to pilots and not a disturbance to people on ground

#### Weather observations

Weather observations at the airport are crucial to safe takeoffs and landings. In the US and Canada, the vast majority of airports, large and small, will either have some form of automated airport weather station, whether an AWOS, ASOS, or AWSS, a human observer or a combination of the two. These weather observations, predominantly in the METAR format, are available over the radio, through Automatic Terminal Information Service (ATIS), via the ATC or the Flight Service Station.

Planes take-off and land into the wind in order to achieve maximum performance. Because pilots need instantaneous information during landing, a windsock is also kept in view of the runway.

#### Airstrip

An airstrip or airfield is a kind of airport that consists only of a runway with perhaps fueling equipment. They are generally in remote locations. Many airstrips (now mostly abandoned) were built on the hundreds of islands in the Pacific Ocean during World War II. Sometimes a few airstrips become full fledged airbases as strategic or economic importance of a region increases over time.

## 5

### RUNWAY

A runway (RWY) is a strip of land at an airport on which aircraft can take off and land and forms part of the maneuvering area. Runways may be a man-made surface (often asphalt, concrete, or a mixture of both) or a natural surface (grass, dirt, gravel, ice, or salt).

By extension, the term has also come to mean any long, flat, straight area, such as that used in fashion shows.

#### Orientation and dimensions

Runways are named by a number between 01 and 36, which is generally one tenth of the magnetic azimuth of the runway's heading: a runway numbered 09 points east (90°), runway 18 is south (180°), runway 27 points west (270°) and runway 36 points to the north (360° rather than 0°). However, runways in North America that lie within the Northern Domestic Airspace are numbered relative to true north because proximity to the magnetic North Pole makes the magnetic declination large. A runway can normally be used in both directions, and is named for each direction separately: e.g., "runway 33" in one direction is "runway 15" when used in the other. The two numbers always differ by 18 (= 180°).

If there is more than one runway pointing in the same direction (parallel runways), each runway is identified by

appending Left (L), Center (C) and Right (R) to the number — for example, Runways One Five Left (15L), One Five Center (15C), and One Five Right (15R). Runway Zero Three Left (03L) becomes Runway Two One Right (21R) when used in the opposite direction (derived from adding 18 to the original number for the 180 degrees when approaching from the opposite direction).

At large airports with more than three parallel runways (for example, at Los Angeles, Detroit Metropolitan Wayne County, Hartsfield-Jackson Atlanta, Denver, and Dallas-Fort Worth), some runway identifiers are shifted by 10 degrees to avoid the ambiguity that would result with more than three parallel runways. For example, in Los Angeles, this system results in Runways 6L, 6R, 7L, and 7R, even though all four runways are exactly parallel (approximately 69 degrees). At Dallas-Fort Worth, there are five parallel runways, named 17L, 17C, 17R, 18L, and 18R, all oriented at a heading of 175.4 degrees.

Runway designations change over time because the magnetic poles slowly drift on the Earth's surface and the magnetic bearing will change. Depending on the airport location and how much drift takes place, it may be necessary over time to change the runway designation. As runways are designated with headings rounded to the nearest 10 degrees, this will affect some runways more than others. For example, if the magnetic heading of a runway is 233 degrees, it would be designated Runway 23. If the magnetic heading changed downwards by 5 degrees to 228, the Runway would still be Runway 23. If on the other hand the original magnetic heading was 226 (Runway 23), and the heading decreased by only 2 degrees to 224, the runway should become Runway 22. Because the drift itself is quite slow, runway designation changes are uncommon, and not welcomed, as they require an accompanying change in aeronautical charts and descriptive documents. When runway designations do change, especially at major airports, it is often changed overnight as taxiway signs need to be changed and the huge numbers at each end of the runway need to be repainted to the new runway designators. In July 2009 for example, London Stansted Airport in the United Kingdom changed its runway designations from 05/23 to 04/22 overnight.

Runway dimensions vary from as small as 245 m (804 ft) long and 8 m (26 ft) wide in smaller general aviation airports, to 5,500 m (18,045 ft) long and 80 m (262 ft) wide at large international airports built to accommodate the largest jets, to the huge 11,917 m (39,098 ft) x 274 m (899 ft) lake bed runway 17/35 at Edwards Air Force Base in California - a landing site for the Space Shuttle.



#### Runway lighting

##### History

The first runway lighting appeared in 1930 at Cleveland Municipal Airport (now known as Cleveland Hopkins International Airport) in Cleveland, Ohio. A line of lights on an airfield or elsewhere to guide aircraft in taking off or coming in to land or an illuminated runway is sometimes also known as a flare path.

### Technical specifications

Runway lighting is used at airports which allow night landings. Seen from the air, runway lights form an outline of the runway. A particular runway may have some or all of the following.

**Runway End Identification Lights (REIL)** – unidirectional (facing approach direction) or omnidirectional pair of synchronized flashing lights installed at the runway threshold, one on each side.

**Runway end lights** – a pair of four lights on each side of the runway on precision instrument runways, these lights extend along the full width of the runway. These lights show green when viewed by approaching aircraft and red when seen from the runway.

**Runway edge lights** – white elevated lights that run the length of the runway on either side. On precision instrument runways, the edge-lighting becomes yellow in the last 2,000 ft (610 m) of the runway. Taxiways are differentiated by being bordered by blue lights, or by having green centre lights, depending on the width of the taxiway, and the complexity of the taxi pattern.

**Runway Centerline Lighting System (RCLS)** – lights embedded into the surface of the runway at 50 ft (15 m) intervals along the runway centerline on some precision instrument runways. White except the last 3,000 ft (914 m), alternate white and red for next 2,000 ft (610 m) and red for last 1,000 ft (305 m).

**Touchdown Zone Lights (TDZL)** – rows of white light bars (with three in each row) on either side of the centerline over the first 3,000 ft (914 m) (or to the midpoint, whichever is less) of the runway.

**Taxiway Centerline Lead-Off Lights** – installed along lead-off markings, alternate green and yellow lights embedded into the runway pavement. It starts with green light about runway centerline to the position of first centerline light beyond holding position on taxiway.

**Taxiway Centerline Lead-On Lights** – installed the same way as taxiway centerline lead-off Lights.

**Land and Hold Short Lights** – a row of white pulsating lights installed across the runway to indicate hold short position on some runways which are facilitating land and hold short operations (LAHSO).

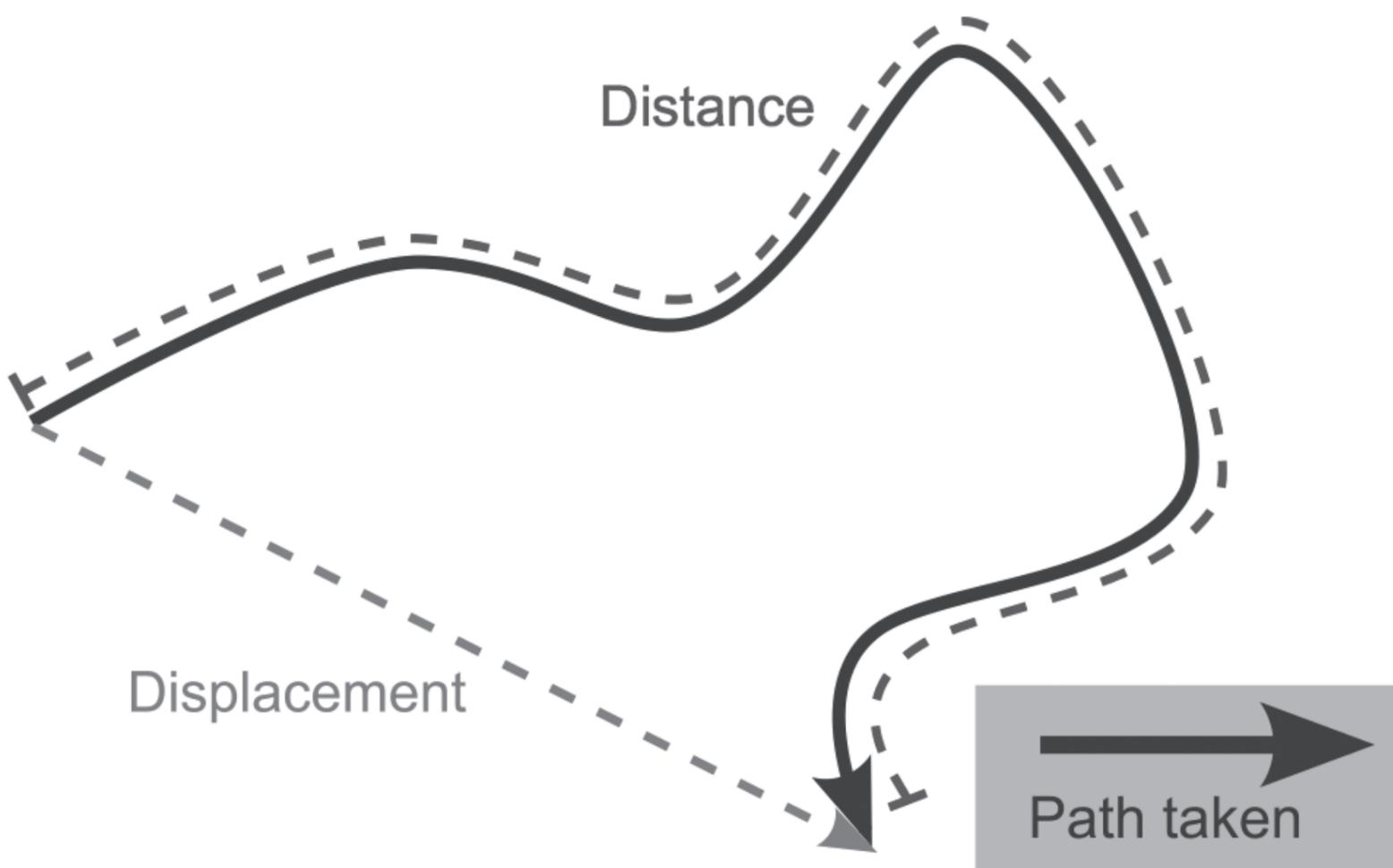
**Approach Lighting System (ALS)** – a lighting system installed on the approach end of an airport runway and consists of a series of lightbars, strobe lights, or a combination of the two that extends outward from the runway end.

According to Transport Canada's regulations, the runway-edge lighting must be visible for at least 2 mi (3 km). Additionally, a new system of advisory lighting, Runway Status Lights, is currently being tested in the United States.

The edge lights must be arranged such that:

- the minimum distance between lines is 75 ft (23 m), and maximum is 200 ft (61 m);
- the maximum distance between lights within each line is 200 ft (61 m);
- the minimum length of parallel lines is 1,400 ft (427 m);
- the minimum number of lights in the line is 8.

**Control of Lighting System** Typically the lights are controlled by a control tower, a Flight Service Station or another designated authority. Some airports/airfields (particularly uncontrolled ones) are equipped with Pilot Controlled Lighting, so that pilots can temporarily turn on the lights when the relevant authority is not available. This avoids the need for automatic systems or staff to turn the lights on at night or in other low visibility situations. This also avoids the cost of having the lighting system on for extended periods. Smaller airports may not have lighted runways or runway markings. Particularly at private airfields for light planes, there may be nothing more than a windsock beside a landing strip.



Distance along a path compared with displacement

**DISTANCE**

Distance is a numerical description of how far apart objects are. In physics or everyday discussion, distance may refer to a physical length, or an estimation based on other criteria (e.g. “two counties over”). In mathematics, a distance function or metric is a generalization of the concept of physical distance. A metric is a function that behaves according to a specific set of rules, and provides a concrete way of describing what it means for elements of some space to be “close to” or “far away from” each other.

In most cases, “distance from A to B” is interchangeable with “distance between B and A”.

**Distances between sets and between a point and a set**

Various distance definitions are possible between objects. For example, between celestial bodies one should not confuse the surface-to-surface distance and the center-to-center distance. If the former is much less than the latter, as for a LEO, the first tends to be quoted (altitude), otherwise, e.g. for the Earth-Moon distance, the latter.

There are two common definitions for the distance between two non-empty subsets of a given set:

One version of distance between two non-empty sets is the infimum of the distances between any two of their respective points, which is the every-day meaning of the word. This is a symmetric premetric. On a collection of sets of which some touch or overlap each other, it is not “separating”, because the distance between two different but touching or overlapping sets is zero. Also it is not hemimetric, i.e., the triangle inequality does not hold, except in special cases. Therefore only in special cases this distance makes a collection of sets a metric space.

The Hausdorff distance is the larger of two values, one being the supremum, for a point ranging over one set, of the infimum, for a second point ranging over the other set, of the distance between the points, and the other value being likewise defined but with the roles of the two sets swapped. This distance makes the set of non-empty compact subsets of a metric space itself a metric space.

The distance between a point and a set is the infimum of the distances between the point and those in the set. This corresponds to the distance, according to the first-mentioned definition above of the distance between sets, from the set containing only this point to the other set.

In terms of this, the definition of the Hausdorff distance can be simplified: it is the larger of two values, one being the supremum, for a point ranging over one set, of the distance between the point and the set, and the other value being likewise defined but with the roles of the two sets swapped.

**Distance versus directed distance and displacement**

The distance covered by a vehicle (for example as recorded by an odometer), person, animal, or object along a curved path from a point A to a point B should be distinguished from the straight line distance from A to B. For example whatever the distance covered during a round trip from A to B and back to A, the displacement is zero as start and end points coincide. In general the straight line distance does not equal distance travelled, except for journeys in a straight line.

Cruising sailor navigating.

The shape of each panel of this road sign, and the broken lines at the ends, represents an arrow; a space-consuming central bar of the arrow sign is dispensed with.

**DIRECTION**

Direction is the information contained in the relative position of one point with respect to another point without the distance information. Directions may be either relative to some indicated reference (the violins in a full orchestra are typically seated



to the left of the conductor), or absolute according to some previously agreed upon frame of reference (New York City lies due west of Madrid). Direction is often indicated manually by an extended index finger or written as an arrow. On a vertically oriented sign representing a horizontal plane, such as a road sign, “forward” is usually indicated by an upward arrow. Mathematically, direction may be uniquely specified by a unit vector in a given basis, or equivalently by the angles made by the most direct path with respect to a specified set of axes.



See also

- Cardinal direction
- Compass
- Navigation
- Radio direction finder
- Relative direction
- Affine space

**NAVIGATION**

Navigation is the process of reading, and controlling the movement of a craft or vehicle from one place to another. It is also

the term of art used for the specialized knowledge used by navigators to perform navigation tasks. The word navigate is derived from the Latin “navigate”, which is the command “sail”. More literally however, the word “Navi” in Sanskrit means ‘boat’ and “Gathi” means ‘direction’. All navigational techniques involve locating the navigator’s position compared to known locations or patterns.

#### History

In the European medieval period, navigation was considered part of the set of seven mechanical arts.

#### Basic concepts

The latitude of a place on the Earth’s surface is the angular distance north or south of the equator. Latitude is usually expressed in degrees (marked with °) ranging from 0° at the Equator to 90° at the North and South poles. The latitude of the North Pole is 90° N, and the latitude of the South Pole is 90° S. Historically, mariners calculated latitude in the Northern Hemisphere by sighting the North Star Polaris with a sextant and sight reduction tables to take out error for height of eye and atmospheric refraction. Generally, the height of Polaris in degrees of arc above the horizon is the latitude of the observer.

#### Longitude

Similar to latitude, the longitude of a place on the Earth’s surface is the angular distance east or west of the prime meridian or Greenwich meridian. Longitude is usually expressed in degrees (marked with °) ranging from 0° at the Greenwich meridian to 180° east and west. Sydney, Australia, for example, has a longitude of about 151° east. New York City has a longitude of about 74° west. For most of history, mariners struggled to determine precise longitude. The problem was solved with the invention of the marine chronometer. Longitude can be calculated if the precise time of a sighting is known.

#### Modern technique

Most modern navigation relies primarily on positions determined electronically by receivers collecting information from satellites. Most other modern techniques rely on crossing lines of position or LOP. A line of position can refer to two different things: a line on a chart and a line between the observer and an object in real life. A bearing is a measure of the direction to an object. If the navigator measures the direction in real life, the angle can then be drawn on a nautical chart and the navigator will be on that line on the chart.

In addition to bearings, navigators also often measure distances to objects. On the chart, a distance produces a circle or arc of position. Circles, arcs, and hyperbolae of positions are often referred to as lines of position.

If the navigator draws two lines of position, and they intersect he must be at that position. A fix is the intersection of two or more LOPs.

If only one line of position is available, this may be evaluated against the dead reckoning position to establish an estimated position.

Lines (or circles) of position can be derived from a variety of sources:

- celestial observation (a short segment of the circle of equal altitude, but generally represented as a line),
- terrestrial range (natural or man made) when two charted points are observed to be in line with each other,
- compass bearing to a charted object,
- radar range to a charted object,
- on certain coastlines, a depth sounding from echo sounder or hand lead line.

There are some methods seldom used today such as “dipping a light” to calculate the geographic range from observer to lighthouse. Methods of navigation have changed through history. Each new method has enhanced the mariner’s ability to complete his voyage. One of the most important judgments the navigator must make is the best method to use. Some types of navigation are depicted in the table.

#### Dead reckoning

Dead reckoning is the process of estimating present position by projecting course and speed from a known past position. It is also used to predict a future position by projecting course and speed from a known present position. The DR position is only an approximate position because it does not allow for the effect of leeway, current, helmsman error, compass error, or any other external influences.

The navigator uses dead reckoning in many ways, such as:

- to determine sunrise and sunset,
- to predict landfall, sighting lights and arrival times,
- to evaluate the accuracy of electronic positioning information,
- to predict which celestial bodies will be available for future observation.

The most important use of dead reckoning is to project the position of the ship into the immediate future and avoid hazards to navigation.

The navigator carefully tends the DR plot, updating it when required, and uses it to evaluate external forces acting on the ship. The navigator also consults the DR plot to avoid navigation hazards. A fix taken at each DR position will reveal the effects of current, wind, and steering error, and allow the navigator to stay on track by correcting for them.

The use of DR when an Electronic Charts Display and Information System (ECDIS) is the primary plotting method will vary with the type of system. An ECDIS allows the display of the ship’s heading projected out to some future position as a function of time, the display of waypoint information, and progress toward each waypoint in turn.

Until ECDIS is proven to provide the level of safety and accuracy required, the use of a traditional DR plot on paper charts is a prudent backup, especially in restricted waters.

Before the development of the lunar distance method or the marine chronometer, dead reckoning was the primary method of determining longitude available to mariners such as Christopher Columbus and John Cabot on their trans-Atlantic voyages.

#### Piloting

Piloting (also called pilotage) involves navigating a vessel in restricted waters and fixing its position as precisely as possible at frequent intervals. More so than in other phases of navigation, proper preparation and attention to detail are important. Procedures vary from vessel to vessel, and between military, commercial, and private vessels.

A military navigation team will nearly always consist of several people. A military navigator might have bearing takers stationed at the gyro repeaters on the bridge wings for taking simultaneous bearings, while the civilian navigator must often take and plot them himself. While the military navigator will have a bearing book and someone to record entries for each fix, the civilian navigator will simply pilot the bearings on the chart as they are taken and not record them at all.

If the ship is equipped with an ECDIS, it is reasonable for the navigator to simply monitor the progress of the ship along the chosen track, visually ensuring that the ship is proceeding as desired, checking the compass, sounder and other indicators only occasionally. If a pilot is aboard, as is often the case in the most restricted of waters, his judgement

can generally be relied upon, further easing the workload. But should the ECDIS fail, the navigator will have to rely on his skill in the manual and time-tested procedures.

### **Celestial navigation**

Celestial navigation systems are based on observation of the positions of the Sun, Moon, Planets and navigational stars. Such systems are in use as well for terrestrial navigating as for interstellar navigating. By knowing which point on the rotating earth a celestial object is above and measuring its height above the observer's horizon, the navigator can determine his distance from that subpoint. A Nautical almanac and a chronometer are used to compute the subpoint on earth a celestial body is over, and a sextant is used to measure the body's angular height above the horizon. That height can then be used to compute distance from the subpoint to create a circular line of position. A navigator shoots a number of stars in succession to give a series of overlapping lines of position. Where they intersect is the celestial fix. The moon and sun may also be used. The sun can also be used by itself to shoot a succession of lines of position (best done around local noon) to determine a position.

### **Marine chronometer**

In order to accurately measure longitude, the precise time of a sextant sighting (down to the second, if possible) must be recorded. Each second of error is equivalent to 15 seconds of longitude error, which at the equator is a position error of .29 mile, about the accuracy limit of manual celestial navigation.

The spring-driven marine chronometer is a precision timepiece used aboard ship to provide accurate time for celestial observations. A chronometer differs from a spring-driven watch principally in that it contains a variable lever device to maintain even pressure on the mainspring, and a special balance designed to compensate for temperature variations. A spring-driven chronometer is set approximately to Greenwich mean time (GMT) and is not reset until the instrument is overhauled and cleaned, usually at three-year intervals. The difference between GMT and chronometer time is carefully determined and applied as a correction to all chronometer readings. Spring-driven chronometers must be wound at about the same time each day.

Quartz crystal marine chronometers have replaced spring-driven chronometers aboard many ships because of their greater accuracy. They are maintained on GMT directly from radio time signals. This eliminates chronometer error and watch error corrections. Should the second hand be in error by a readable amount, it can be reset electrically.

The basic element for time generation is a quartz crystal oscillator. The quartz crystal is temperature compensated and is hermetically sealed in an evacuated envelope. A calibrated adjustment capability is provided to adjust for the aging of the crystal.

The chronometer is designed to operate for a minimum of 1 year on a single set of batteries. Observations may be timed and ship's clocks set with a comparing watch, which is set to chronometer time and taken to the bridge wing for recording sight times. In practice, a wrist watch coordinated to the nearest second with the chronometer will be adequate.

A stop watch, either spring wound or digital, may also be used for celestial observations. In this case, the watch is started at a known GMT by chronometer, and the elapsed time of each sight added to this to obtain GMT of the sight.

All chronometers and watches should be checked regularly with a radio time signal. Times and frequencies of radio time signals are listed in publications such as Radio Navigational Aids.

### **The marine sextant**

The second critical component of celestial navigation is to measure the angle formed at the observer's eye between the

celestial body and the sensible horizon. The sextant, an optical instrument, is used to perform this function. The sextant consists of two primary assemblies. The frame is a rigid triangular structure with a pivot at the top and a graduated segment of a circle, referred to as the "arc", at the bottom. The second component is the index arm, which is attached to the pivot at the top of the frame. At the bottom is an endless vernier which clamps into teeth on the bottom of the "arc". The optical system consists of two mirrors and, generally, a low power telescope. One mirror, referred to as the "index mirror" is fixed to the top of the index arm, over the pivot. As the index arm is moved, this mirror rotates, and the graduated scale on the arc indicates the measured angle ("altitude").

The second mirror, referred to as the "horizon glass", is fixed to the front of the frame. One half of the horizon glass is silvered and the other half is clear. Light from the celestial body strikes the index mirror and is reflected to the silvered portion of the horizon glass, then back to the observer's eye through the telescope. The observer manipulates the index arm so the reflected image of the body in the horizon glass is just resting on the visual horizon, seen through the clear side of the horizon glass.

Adjustment of the sextant consists of checking and aligning all the optical elements to eliminate "index correction". Index correction should be checked, using the horizon or more preferably a star, each time the sextant is used. The practice of taking celestial observations from the deck of a rolling ship, often through cloud cover and with a hazy horizon, is by far the most challenging part of celestial navigation.

### **Radio navigation**

A radio direction finder or RDF is a device for finding the direction to a radio source. Due to radio's ability to travel very long distances "over the horizon", it makes a particularly good navigation system for ships and aircraft that might be flying at a distance from land.

RDFs work by rotating a directional antenna and listening for the direction in which the signal from a known station comes through most strongly. This sort of system was widely used in the 1930s and 1940s. RDF antennas are easy to spot on German World War II aircraft, as loops under the rear section of the fuselage, whereas most US aircraft enclosed the antenna in a small teardrop-shaped fairing.

In navigational applications, RDF signals are provided in the form of radio beacons, the radio version of a lighthouse. The signal is typically a simple AM broadcast of a morse code series of letters, which the RDF can tune in to see if the beacon is "on the air". Most modern detectors can also tune in any commercial radio stations, which is particularly useful due to their high power and location near major cities.

Decca, OMEGA, and LORAN-C are three similar hyperbolic navigation systems. Decca was a hyperbolic low frequency radio navigation system (also known as multilateration) that was first deployed during World War II when the Allied forces needed a system which could be used to achieve accurate landings. As was the case with Loran C, its primary use was for ship navigation in coastal waters. Fishing vessels were major post-war users, but it was also used on aircraft, including a very early (1949) application of moving-map displays. The system was deployed in the North Sea and was used by helicopters operating to oil platforms.

The OMEGA Navigation System was the first truly global radio navigation system for aircraft, operated by the United States in cooperation with six partner nations. OMEGA was developed by the United States Navy for military aviation users. It was approved for development in 1968 and promised a true worldwide oceanic coverage capability with only eight transmitters and the ability to achieve a four mile (6 km) accuracy when fixing a position. Initially, the system was to be used for navigating nuclear bombers across the North Pole to Russia. Later, it was found useful for submarines. Due to the success of the Global Positioning System the use of Omega declined during the 1990s, to a point where the cost of operating

Omega could no longer be justified. Omega was terminated on September 30, 1997 and all stations ceased operation.

LORAN is a terrestrial navigation system using low frequency radio transmitters that use the time interval between radio signals received from three or more stations to determine the position of a ship or aircraft. The current version of LORAN in common use is LORAN-C, which operates in the low frequency portion of the EM spectrum from 90 to 110 kHz. Many nations are users of the system, including the United States, Japan, and several European countries. Russia uses a nearly exact system in the same frequency range, called CHAYKA. LORAN use is in steep decline, with GPS being the primary replacement. However, there are attempts to enhance and re-popularize LORAN. LORAN signals are less susceptible to interference and can penetrate better into foliage and buildings than GPS signals.

### **Radar navigation**

When a vessel is within radar range of land or special radar aids to navigation, the navigator can take distances and angular bearings to charted objects and use these to establish arcs of position and lines of position on a chart. A fix consisting of only radar information is called a radar fix.

Types of radar fixes include “range and bearing to a single object,” “two or more bearings,” “tangent bearings,” and “two or more ranges.”

Parallel indexing is a technique defined by William Burger in the 1957 book *The Radar Observer’s Handbook*. This technique involves creating a line on the screen that is parallel to the ship’s course, but offset to the left or right by some distance. This parallel line allows the navigator to maintain a given distance away from hazards.

Some techniques have been developed for special situations. One, known as the “contour method,” involves marking a transparent plastic template on the radar screen and moving it to the chart to fix a position.

Another special technique, known as the Franklin Continuous Radar Plot Technique, involves drawing the path a radar object should follow on the radar display if the ship stays on its planned course. During the transit, the navigator can check that the ship is on track by checking that the pip lies on the drawn line.

### **Satellite navigation**

Global Navigation Satellite System or GNSS is the term for satellite navigation systems that provide positioning with global coverage. A GNSS allow small electronic receivers to determine their location (longitude, latitude, and altitude) to within a few metres using time signals transmitted along a line of sight by radio from satellites. Receivers on the ground with a fixed position can also be used to calculate the precise time as a reference for scientific experiments.

As of 2010, the United States NAVSTAR Global Positioning System (GPS) is the only fully operational GNSS. The Russian GLONASS is a GNSS in the process of being restored to full operation. The European Union’s Galileo positioning system is a next generation GNSS in the initial deployment phase, scheduled to be operational by 2013. China has indicated it may expand its regional Beidou navigation system into a global system.

More than two dozen GPS satellites are in medium Earth orbit, transmitting signals allowing GPS receivers to determine the receiver’s location, speed and direction. Since the first experimental satellite was launched in 1978, GPS has become an indispensable aid to navigation around the world, and an important tool for map-making and land surveying. GPS also provides a precise time reference used in many applications including scientific study of earthquakes, and synchronization of telecommunications networks.

Developed by the United States Department of Defense, GPS is officially named NAVSTAR GPS (NAVigation

Satellite Timing And Ranging Global Positioning System).

The satellite constellation is managed by the United States Air Force 50th Space Wing. The cost of maintaining the system is approximately US\$750 million per year, including the replacement of aging satellites, and research and development. Despite this fact, GPS is free for civilian use as a public good.

### **Day’s work in navigation**

The Day’s work in navigation is a minimal set of tasks consistent with prudent navigation. The definition will vary on military and civilian vessels, and from ship to ship, but takes a form resembling:

1. Maintain continuous dead reckoning plot.
2. Take two or more star observations at morning twilight for a celestial fix. (prudent to observe 6 stars)
3. Morning sun observation. Can be taken on or near prime vertical for longitude, or at any time for a line of position.
4. Determine compass error by azimuth observation of the sun.
5. Computation of the interval to noon, watch time of local apparent noon, and constants for meridian or ex-meridian sights.
6. Noontime meridian or ex-meridian observation of the sun for noon latitude line. Running fix or cross with Venus line for noon fix.
7. Noontime determination the day’s run and day’s set and drift.
8. At least one afternoon sun line, in case the stars are not visible at twilight.
9. Determine compass error by azimuth observation of the sun.
10. Take two or more star observations at evening twilight for a celestial fix. (prudent to observe 6 stars)

### **Passage planning**

Passage planning or voyage planning is a procedure to develop a complete description of vessel’s voyage from start to finish. The plan includes leaving the dock and harbor area, the enroute portion of a voyage, approaching the destination, and mooring. According to international law, a vessel’s captain is legally responsible for passage planning, however on larger vessels, the task will be delegated to the ship’s navigator.

Studies show that human error is a factor in 80 percent of navigational accidents and that in many cases the human making the error had access to information that could have prevented the accident. The practice of voyage planning has evolved from penciling lines on nautical charts to a process of risk management.

Passage planning consists of three stages: appraisal, planning, execution, and monitoring, which are specified in International Maritime Organization Resolution A.893(21), *Guidelines For Voyage Planning*, and these guidelines are reflected in the local laws of IMO signatory countries (for example, Title 33 of the U.S. Code of Federal Regulations), and a number of professional books or publications. There are some fifty elements of a comprehensive passage plan depending on the size and type of vessel.

The appraisal stage deals with the collection of information relevant to the proposed voyage as well as ascertaining risks and assessing the key features of the voyage. In the next stage, the written plan is created. The third stage is the execution of the finalised voyage plan, taking into account any special circumstances which may arise such as changes in the weather, which may require the plan to be reviewed or altered. The final stage of passage planning consists of monitoring the vessel’s progress in relation to the plan and responding to deviations and unforeseen circumstances.

Aluminum flat-bottomed boats ashore for storage.



## BOAT

A boat is a watercraft of modest size designed to float or plane, to provide passage across water. Usually this water will be inland (lakes) or in protected coastal areas. However, boats such as the whaleboat were designed to be operated from a ship in an offshore environment. In naval terms, a boat is something small enough to be carried aboard another vessel (a ship). Strictly speaking and uniquely a submarine is a boat as defined by the Royal Navy. Some boats too large for the naval definition include the Great Lakes freighter, riverboat, narrowboat and ferryboat.

### History

Boats have served as short distance transportation since early times. Circumstantial evidence, such as the early settlement of Australia over 40,000 years ago, suggests that boats have been used since very ancient times. The earliest boats have been predicted to be logboats. The oldest boats to be found by archaeological excavation are logboats from around 7,000-10,000 years ago. The oldest recovered boat in the world is the canoe of Pesse; it is a dugout or hollowed tree trunk from a *Pinus sylvestris*. According to C14 dating analysis it was constructed somewhere between 8200 and 7600 B.C. This canoe is exhibited in the Drents Museum in Assen, Netherlands; other very old dugout boats have been recovered. A 7,000 year-old seagoing boat made from reeds and tar has been found in Kuwait.

Boats were used between 4000BCE-3001BCE in Sumer, ancient Egypt and in the Indian Ocean.

Boats played a very important part in the commerce between the Indus Valley Civilization and Mesopotamia. Evidence of varying models of boats has also been discovered in various Indus Valley sites.

The accounts of historians Herodotus, Pliny the Elder, and Strabo suggest that boats were being used for commerce and traveling.

### Types

Boats can be categorized into three types:

- unpowered or human-powered boats (Unpowered boats include rafts and floats meant for one-way downstream travel. Human-powered boats include canoes, kayaks, gondolas and boats propelled by poles like a punt.)
- sailing boats (Sailing boats are boats which are propelled solely by means of sails.)
- motorboats (Motorboats are boats which are propelled by mechanical means, such as engines.)

### Parts and terminology

Several key components make up the main structure of most boats. The hull is the main structural component of the boat which actually provides buoyancy for the boat. The roughly horizontal, but chambered structures spanning the hull of the boat are referred to as the deck. In a ship there are often several decks, but a boat is unlikely to have more than one, if any at all. Above the deck are the superstructures. The underside of a deck is the deck head.

An enclosed space on a boat is referred to as a cabin. Several structures make up a cabin: the similar but usually lighter structure which spans a raised cabin is a coach-roof. The “floor” of a cabin is properly known as the sole, but is more likely to be called the floor (a floor is properly, a structural member which ties a frame to the keelson and keel). The vertical surfaces dividing the internal space are bulkheads.

The keel is a lengthwise structural member to which the frames are fixed (sometimes referred to as a backbone).

The front (or forward end) of a boat is called the bow. Boats of earlier times often featured a figurehead protruding from the front of the bows. The rear (or aft end) of the boat is called the stern. The right side (facing forward) is starboard and the left side is port.

The most common means are:

- human power (rowing, paddling, setting pole etc.)
- wind power (sailing)
- Motor powered screws
- Inboard
  - + internal combustion (gasoline, diesel, heavy fuel oil)
  - + steam (coal, fuel oil)
  - + nuclear (for submarines and large naval ships)
- Inboard/Outboard
  - + gasoline
  - + diesel
- Outboard
  - + electric
    - o paddle wheel
    - o Water Jet (Personal water craft, Jetboat)
    - o Air Fans (Hovercraft, Air boat)

**SHIP**

A ship is a large vessel that floats on water. Ships are generally distinguished from boats based on size and cargo or passenger capacity. Ships may be found on lakes, seas, and rivers and they allow for a variety of activities, such as the transport of people or goods, fishing, entertainment, public safety, and warfare. Historically, a ship referred to a vessel with sails rigged in a specific manner.

Ships and boats have developed alongside mankind. In major wars, and in day to day life, they have become an integral part of modern commercial and military systems. Fishing boats are used by millions of fishermen throughout the world. Military forces operate highly sophisticated vessels to transport and support forces ashore. Commercial vessels, nearly 35,000 in number, carried 7.4 billion tons of cargo in 2007.

These vessels were also key in history's great explorations and scientific and technological development. Navigators such as Zheng He spread such inventions as the compass and



Ship graveyard in France

**Track-driven propulsion**

An early uncommon means of boat propulsion was referred to as the water caterpillar which is similar in construction to paddles on a conveyor belt and preceded the development of tracked vehicles such as military tanks and earth moving equipment. A series of paddles on chains moved along the bottom of the boat to propel it over the water.

The first water caterpillar was developed by Desblancs in 1782 and propelled by a steam engine. In the United States the first water caterpillar was patented in 1839 by William Leavenworth of New York.

**Buoyancy**

A floating boat displaces its weight in water. The material of the boat hull may be denser than water, but if this is the case then it forms only the outer layer. If the boat floats, the mass of the boat (plus contents) as a whole divided by the volume below the waterline is equal to the density of water (1 kg/l). If weight is added to the boat, the volume below the waterline will increase to keep the weight balance equal, and so the boat sinks a little to compensate.

gunpowder. Ships have been used for such purposes as colonization and the slave trade, and have served scientific, cultural, and humanitarian needs. New crops that had come from the Americas via the European seafarers in the 16th century significantly contributed to the world's population growth.

As Thor Heyerdahl demonstrated with his tiny craft the Kon-Tiki, it is possible to navigate long distances upon a simple log raft. From Mesolithic canoes to today's powerful nuclear-powered aircraft carriers, ships tell the history of human technological development.

**Nomenclature**

Ships can usually be distinguished from boats based on size and the ship's ability to operate independently for extended periods. A commonly used rule of thumb is that if one vessel can carry another, the larger of the two is a ship. As dinghies are common on sailing yachts as small as 35 feet (10.67 m), this rule of thumb is not foolproof. In a more technical and now rare sense, the term ship refers to a sailing ship with at least 3 square-rigged masts and a full bowsprit, with lesser ships described by their sailplan (e.g. barque, brigantine, etc.).

A number of large vessels are traditionally referred to as boats. Submarines are a prime example. Other types of large

vessels which are traditionally called boats are the Great Lakes freighter, the riverboat, and the ferryboat. Though large enough to carry their own boats and heavy cargoes, these vessels are designed for operation on inland or protected coastal waters.

### Types of ships

Ships are difficult to classify, mainly because there are so many criteria to base classification on. One classification is based on propulsion; with ships categorised as either a sailing ship a Steamship or a motorship. Sailing ships are ships which are propelled solely by means of sails. Steamships are ships which are propelled by steam engines. Motorships are ships which use internal combustion engines as a means to propel themselves. Motorships include ships that propel itself through the use of both sail and mechanical means.

Other classification systems exist that use criteria such as:

- The number of hulls, giving categories like monohull, catamaran, trimaran.
- The shape and size, giving categories like dinghy, keel boat, and icebreaker.
- The building materials used, giving steel, aluminum, wood, fiberglass, and plastic.
- The type of propulsion system used, giving human-propelled, mechanical, and sails.
- The epoch in which the vessel was used, triremes of Ancient Greece, men of war in the 18th century.
- The geographic origin of the vessel, many vessels are associated with a particular region, such as the pinnacle of Northern Europe, the gondolas of Venice, and the junks of China.
- The manufacturer, series, or class.

Another way to categorize ships and boats is based on their use, as described by Paulet and Presles. This system includes military ships, commercial vessels, fishing boats, pleasure craft and competitive boats. In this section, ships are classified using the first four of those categories, and adding a section for lake and river boats, and one for vessels which fall outside these

categories.

### Commercial vessels

Commercial vessels or merchant ships can be divided into three broad categories: cargo ships, passenger ships, and special-purpose ships. Cargo ships transport dry and liquid cargo. Dry cargo can be transported in bulk by bulk carriers, packed directly onto a general cargo ship in break-bulk, packed in inter-modal containers as aboard a container ship, or driven aboard as in roll-on roll-off ships. Liquid cargo is generally carried in bulk aboard tankers, such as oil tankers, chemical tankers and LNG tankers, although smaller shipments may be carried on container ships in tank containers.

Passenger ships range in size from small river ferries to giant cruise ships. This type of vessel includes ferries, which move passengers and vehicles on short trips; ocean liners, which carry passengers on one-way trips; and cruise ships, which typically transport passengers on round-trip voyages promoting leisure activities aboard and in the ports they visit.

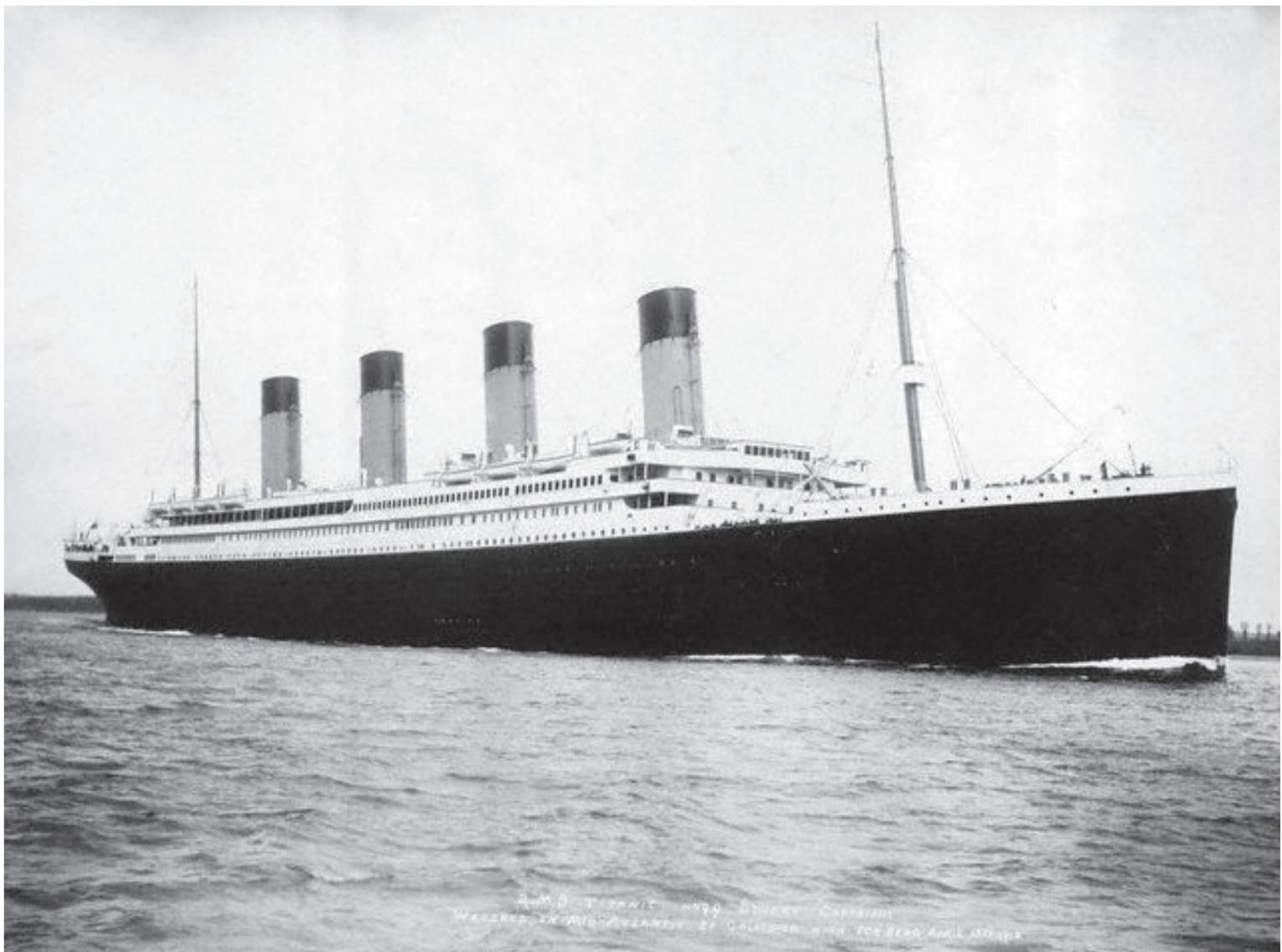
Special-purpose vessels are not used for transport but are designed to perform other specific tasks. Examples include tugboats, pilot boats, rescue boats, cable ships, research vessels, survey vessels, and ice breakers.

Most commercial vessels have full hull-forms to maximize cargo capacity. Hulls are usually made of steel, although aluminum can be used on faster craft, and fiberglass on the smallest service vessels. Commercial vessels generally have a crew headed by a captain, with deck officers and marine engineers on larger vessels. Special-purpose vessels often have specialized crew if necessary, for example scientists aboard research vessels. Commercial vessels are typically powered by a single propeller driven by a diesel engine. Vessels which operate at the higher end of the speed spectrum may use pump-jet engines or sometimes gas turbine engines.

### Naval vessels

There are many types of naval vessels currently and through history. Modern naval vessels can be broken down into three categories: warships, submarines, and support and auxiliary vessels.

Modern warships are generally divided into seven main categories, which are: aircraft carriers, cruisers, destroyers,



RMS Titanic departs from Southampton. Her sinking would tighten safety regulations

frigates, corvettes, submarines and amphibious assault ships. Battleships encompass an eighth category, but are not in current service with any navy in the world.

Most military submarines are either attack submarines or ballistic missile submarines. Until the end of World War II, the primary role of the diesel/electric submarine was anti-ship warfare, inserting and removing covert agents and military forces, and intelligence-gathering. With the development of the homing torpedo, better sonar systems, and nuclear propulsion, submarines also became able to effectively hunt each other. The development of submarine-launched nuclear missiles and submarine-launched cruise missiles gave submarines a substantial and long-ranged ability to attack both land and sea targets with a variety of weapons ranging from cluster bombs to nuclear weapons.

Most navies also include many types of support and auxiliary vessels, such as minesweepers, patrol boats, offshore patrol vessels, replenishment ships, and hospital ships which are designated medical treatment facilities.

Combat vessels like cruisers and destroyers usually have fine hulls to maximize speed and maneuverability. They also usually have advanced electronics and communication systems, as well as weapons.

#### Fishing vessels

Fishing vessels are a subset of commercial vessels, but generally small in size and often subject to different regulations and classification. They can be categorized by several criteria: architecture, the type of fish they catch, the fishing method used, geographical origin, and technical features such as rigging. As of 2004, the world's fishing fleet consisted of some 4 million vessels. Of these, 1.3 million were decked vessels with enclosed areas and the rest were open vessels. Most decked vessels were mechanized, but two-thirds of the open vessels were traditional craft propelled by sails and oars. More than 60% of all existing large fishing vessels were built in Japan, Peru, the Russian Federation, Spain or the United States of America.

Fishing boats are generally small, often little more than 30 meters (98 ft) but up to 100 metres (330 ft) for a large tuna or whaling ship. Aboard a fish processing vessel, the catch can be made ready for market and sold more quickly once the ship makes port. Special purpose vessels have special gear. For example, trawlers have winches and arms, stern-trawlers have a rear ramp, and tuna seiners have skiffs.

In 2004, 85,800,000 tonnes of fish were caught in the marine capture fishery. Anchoveta represented the largest single catch at 10,700,000 tonnes. That year, the top ten marine capture species also included Alaska pollock, Blue whiting, Skipjack tuna, Atlantic herring, Chub mackerel, Japanese anchovy, Chilean jack mackerel, Largehead hairtail, and Yellowfin tuna. Other species including salmon, shrimp, lobster, clams, squid and crab, are also commercially fished.

Modern commercial fishermen use many methods. One is fishing by nets, such as purse seine, beach seine, lift nets, gillnets, or entangling nets. Another is trawling, including bottom trawl. Hooks and lines are used in methods like long-line fishing and hand-line fishing). Another method is the use of fishing trap.

#### Inland and coastal boats

Many types of boats and ships are designed for inland and coastal waterways. These are the vessels that trade upon the lakes, rivers and canals.

Barges are a prime example of inland vessels. Flat-bottomed boats built to transport heavy goods, most barges are not self-propelled and need to be moved by tugboats towing or towboats pushing them. Barges towed along canals by draft animals on an adjacent towpath contended with the railway in the early industrial revolution but were out competed in the carriage of high value items because of the higher speed, falling costs, and route flexibility of rail transport.

Riverboats and inland ferries are specially designed to carry passengers, cargo, or both in the challenging river

environment. Rivers present special hazards to vessels. They usually have varying water flows that alternately lead to high speed water flows or protruding rock hazards. Changing siltation patterns may cause the sudden appearance of shoal waters, and often floating or sunken logs and trees (called snags) can endanger the hulls and propulsion of riverboats. Riverboats are generally of shallow draft, being broad of beam and rather square in plan, with a low freeboard and high topsides. Riverboats can survive with this type of configuration as they do not have to withstand the high winds or large waves that are seen on large lakes, seas, or oceans.

Lake freighters, also called lakers, are cargo vessels that ply the Great Lakes. The most well-known is the SS Edmund Fitzgerald, the latest major vessel to be wrecked on the Lakes. These vessels are traditionally called boats, not ships. Visiting ocean-going vessels are called "salties." Because of their additional beam, very large salties are never seen inland of the Saint Lawrence Seaway. Because the smallest of the Soo Locks is larger than any Seaway lock, salties that can pass through the Seaway may travel anywhere in the Great Lakes. Because of their deeper draft, salties may accept partial loads on the Great Lakes, "topping off" when they have exited the Seaway. Similarly, the largest lakers are confined to the Upper Lakes (Superior, Michigan, Huron, Erie) because they are too large to use the Seaway locks, beginning at the Welland Canal that bypasses the Niagara River.

Since the freshwater lakes are less corrosive to ships than the salt water of the oceans, lakers tend to last much longer than ocean freighters. Lakers older than 50 years are not unusual, and as of 2005, all were over 20 years of age.

The St. Mary's Challenger, built in 1906 as the William P Snyder, is the oldest laker still working on the Lakes. Similarly, the E.M. Ford, built in 1898 as the Presque Isle, was sailing the lakes 98 years later in 1996. As of 2007 the Ford was still afloat as a stationary transfer vessel at a riverside cement silo in Saginaw, Michigan.

## Lifecycle

A ship will pass through several stages during its career. The first is usually an initial contract to build the ship, the details of which can vary widely based on relationships between the shipowners, operators, designers and the shipyard. Then, the design phase carried out by a naval architect. Then the ship is constructed in a shipyard. After construction, the vessel is launched and goes into service. Ships end their careers in a number of ways, ranging from shipwrecks to service as a museum ship to the scrapyard.

### Design

A vessel's design starts with a specification, which a naval architect uses to create a project outline, assess required dimensions, and create a basic layout of spaces and a rough displacement. After this initial rough draft, the architect can create an initial hull design, a general profile and an initial overview of the ship's propulsion. At this stage, the designer can iterate on the ship's design, adding detail and refining the design at each stage.

The designer will typically produce an overall plan, a general specification describing the peculiarities of the vessel, and construction blueprints to be used at the building site. Designs for larger or more complex vessels may also include sail plans, electrical schematics, and plumbing and ventilation plans.

As environmental laws are strictening, ship designers need to create their design in such a way that the ship -when it nears its end-of-term- can be disassembled or disposed easily and that waste is reduced to a minimum.

### Construction

Ship construction takes place in a shipyard, and can last from a few months for a unit produced in series, to several years to reconstruct a wooden boat like the frigate Hermione, to more

than 10 years for an aircraft carrier. Hull materials and vessel size play a large part in determining the method of construction. The hull of a mass-produced fiberglass sailboat is constructed from a mold, while the steel hull of a cargo ship is made from large sections welded together as they are built.

Generally, construction starts with the hull, and on vessels over about 30 meters (98 ft), by the laying of the keel. This is done in a drydock or on land. Once the hull is assembled and painted, it is launched. The last stages, such as raising the superstructure and adding equipment and accommodation, can be done after the vessel is afloat.

Once completed, the vessel is delivered to the customer. Ship launching is often a ceremony of some significance, and is usually when the vessel is formally named. A typical small rowboat can cost under US\$100, \$1,000 for a small speedboat, tens of thousands of dollars for a cruising sailboat, and about \$2,000,000 for a Vendée Globe class sailboat. A 25 meters (82 ft) trawler may cost \$2.5 million, and a 1,000-person-capacity high-speed passenger ferry can cost in the neighborhood of \$50 million. A ship's cost partly depends on its complexity: a small, general cargo ship will cost \$20 million, a Panamax-sized bulk carrier around \$35 million, a supertanker around \$105 million and a large LNG carrier nearly \$200 million. The most expensive ships generally are so because of the cost of embedded electronics: a Seawolf class submarine costs around \$2 billion, and an aircraft carrier goes for about \$3.5 billion.

#### Repair and conversion

Ships undergo nearly constant maintenance during their career, whether they be underway, pierside, or in some cases, in periods of reduced operating status between charters or shipping seasons.

Most ships, however, require trips to special facilities such as a drydock at regular intervals. Tasks often done at drydock include removing biological growths on the hull, sandblasting and repainting the hull, and replacing sacrificial anodes used to protect submerged equipment from corrosion. Major repairs to the propulsion and steering systems as well as major electrical systems are also often performed at dry dock.

Vessels that sustain major damage at sea may be repaired at a facility equipped for major repairs, such as a shipyard. Ships may also be converted for a new purpose: oil tankers are often converted into floating production storage and offloading units.

#### End of service

Most ocean-going cargo ships have a life expectancy of between 20 and 30 years. A sailboat made of plywood or fiberglass can last between 30 and 40 years. Solid wooden ships can last much longer but require regular maintenance. Carefully maintained steel-hulled yachts can have a lifespan of over 100 years.

As ships age, forces such as corrosion, osmosis, and rotting compromise hull strength, and a vessel becomes too dangerous to sail. At this point, it can be scuttled at sea or scrapped by shipbreakers. Ships can also be used as museum ships, or expended to construct breakwaters or artificial reefs.

Many ships do not make it to the scrapyards, and are lost in fires, collisions, grounding, or sinking at sea. There are more than 3 million shipwrecks on the ocean floor, the United Nations estimates. The Allies lost some 5,150 ships during World War II.

### Ship pollution

Ship pollution is the pollution of air and water by shipping. It is a problem that has been accelerating as trade has become increasingly globalized, posing an increasing threat to the world's oceans and waterways as globalization continues. It is expected that, "...shipping traffic to and from the USA is projected to double by 2020." Because of increased traffic in ocean ports, pollution from ships also directly affects coastal areas. The pollution produced affects biodiversity, climate, food, and human health. However, the degree to which humans are polluting and how it affects the world is highly debated and has been a

hot international topic for the past 30 years.

#### Oil spills

The Exxon Valdez spilled 10,800,000 US gallons (8,993,000 imp gal; 40,880,000 L) of oil into Alaska's Prince William Sound.

Oil spills have devastating effects on the environment. Crude oil contains polycyclic aromatic hydrocarbons (PAHs) which are very difficult to clean up, and last for years in the sediment and marine environment. Marine species constantly exposed to PAHs can exhibit developmental problems, susceptibility to disease, and abnormal reproductive cycles.

By the sheer amount of oil carried, modern oil tankers must be considered something of a threat to the environment. An oil tanker can carry 2 million barrels (318,000 m<sup>3</sup>) of crude oil, or 84,000,000 US gallons (69,940,000 imp gal; 318,000,000 L). This is more than six times the amount spilled in the widely known Exxon Valdez incident. In this spill, the ship ran aground and dumped 10,800,000 US gallons (8,993,000 imp gal; 40,880,000 L) of oil into the ocean in March 1989. Despite efforts of scientists, managers, and volunteers, over 400,000 seabirds, about 1,000 sea otters, and immense numbers of fish were killed.

The International Tanker Owners Pollution Federation has researched 9,351 accidental spills since 1974. According to this study, most spills result from routine operations such as loading cargo, discharging cargo, and taking on fuel oil. 91% of the operational oil spills were small, resulting in less than 7 tons per spill. Spills resulting from accidents like collisions, groundings, hull failures, and explosions are much larger, with 84% of these involving losses of over 700 tons.

Following the Exxon Valdez spill, the United States passed the Oil Pollution Act of 1990 (OPA-90), which included a stipulation that all tankers entering its waters be double-hulled by 2015. Following the sinkings of the Erika (1999) and Prestige (2002), the European Union passed its own stringent anti-pollution packages (known as Erika I, II, and III), which require all tankers entering its waters to be double-hulled by 2010. The Erika packages are controversial because they introduced the new legal concept of "serious negligence".

#### Ballast water

When a large vessel such as a container ship or an oil tanker unloads cargo, seawater is pumped into other compartments in the hull to help stabilize and balance the ship. During loading, this ballast water is pumped out from these compartments.

One of the problems with ballast water transfer is the transport of harmful organisms. Meinesz believes that one of the worst cases of a single invasive species causing harm to an ecosystem can be attributed to a seemingly harmless jellyfish. *Mnemiopsis leidyi*, a species of comb jellyfish that inhabits estuaries from the United States to the Valdés peninsula in Argentina along the Atlantic coast, has caused notable damage in the Black Sea. It was first introduced in 1982, and thought to have been transported to the Black Sea in a ship's ballast water. The population of the jellyfish shot up exponentially and, by 1988, it was wreaking havoc upon the local fishing industry. "The anchovy catch fell from 204,000 tonnes in 1984 to 200 tonnes in 1993; sprat from 24,600 tonnes in 1984 to 12,000 tonnes in 1993; horse mackerel from 4,000 tonnes in 1984 to zero in 1993." Now that the jellyfish have exhausted the zooplankton, including fish larvae, their numbers have fallen dramatically, yet they continue to maintain a stranglehold on the ecosystem. Recently the jellyfish have been discovered in the Caspian Sea. Invasive species can take over once occupied areas, facilitate the spread of new diseases, introduce new genetic material, alter landscapes and jeopardize the ability of native species to obtain food. "On land and in the sea, invasive species are responsible for about 137 billion dollars in lost revenue and management costs in the U.S. each year."

Ballast and bilge discharge from ships can also spread human pathogens and other harmful diseases and toxins potentially causing health issues for humans and marine life alike.

Discharges into coastal waters, along with other sources of marine pollution, have the potential to be toxic to marine plants, animals, and microorganisms, causing alterations such as changes in growth, disruption of hormone cycles, birth defects, suppression of the immune system, and disorders resulting in cancer, tumors, and genetic abnormalities or even death.

#### Exhaust emissions

Exhaust emissions from ships are considered to be a significant source of air pollution. "Seagoing vessels are responsible for an estimated 14 percent of emissions of nitrogen from fossil fuels and 16 percent of the emissions of sulfur from petroleum uses into the atmosphere." In Europe ships make up a large percentage of the sulfur introduced to the air, "...as much sulfur as all the cars, lorries and factories in Europe put together." "By 2010, up to 40% of air pollution over land could come from ships." Sulfur in the air creates acid rain which damages crops and buildings. When inhaled sulfur is known to cause respiratory problems and increase the risk of a heart attack.



#### Ship breaking

Ship breaking or ship demolition is a type of ship disposal involving the breaking up of ships for scrap recycling, with the hulls being discarded in ship graveyards. Most ships have a lifespan of a few decades before there is so much wear that refitting and repair becomes uneconomical. Ship breaking allows materials from the ship, especially steel, to be reused.

In addition to steel and other useful materials, however, ships (particularly older vessels) can contain many substances that are banned or considered dangerous in developed countries. Asbestos and polychlorinated biphenyls (PCBs) are typical examples. Asbestos was used heavily in ship construction until it was finally banned in most of the developed world in the mid 1980s. Currently, the costs associated with removing asbestos, along with the potentially expensive insurance and health risks, have meant that ship-breaking in most developed countries is no longer economically viable. Removing the metal for scrap can potentially cost more than the scrap value of the metal itself. In the developing world, however, shipyards can operate without the risk of personal injury lawsuits or workers' health claims, meaning many of these shipyards may operate with high health risks. Protective equipment is sometimes absent or inadequate. Dangerous vapors and fumes from burning materials can be inhaled, and dusty asbestos-laden areas around such breakdown locations are commonplace.

Aside from the health of the yard workers, in recent years, ship breaking has also become an issue of major environmental concern. Many developing nations, in which ship breaking yards are located, have lax or no environmental law, enabling large quantities of highly toxic materials to escape into the environment and causing serious health problems among ship breakers, the local population and wildlife. Environmental campaign groups such as Greenpeace have made the issue a high priority for their campaigns.

11

## SHIPPING

Shipping has multiple meanings. It can be a physical process of transporting goods and cargo, by land, air, and sea. It also can describe the movement of objects by ship.

Land or "ground" shipping can be by train or by truck.

In air and sea shipments, ground transportation is often still required to take the product from its origin to the airport or seaport and then to its destination. Ground transportation is typically more affordable than air shipments, but more expensive than shipping by sea.

Shipment of freight by trucks, directly from the shipper to the destination, is known as a door to door shipment. Vans and trucks make deliveries to sea ports and air ports where freight is moved in bulk.

Much shipping is done aboard actual ships. An individual nation's fleet and the people that crew it are referred to its merchant navy or merchant marine. Merchant shipping is essential to the world economy, carrying 90% of international trade with 50,000 merchant ships worldwide. The term shipping in this context originated from the shipping trade of wind power ships, and has come to refer to the delivery of cargo and parcels of any size above the common mail of letters and postcards.

12

## TRANSPORT

Transport or transportation is the movement of people and goods from one location to another. Modes of transport include air, rail, road, water, cable, pipeline, and space. The field can be divided into infrastructure, vehicles, and operations.

Transport infrastructure consists of the fixed installations necessary for transport, and may be roads, railways, airways, waterways, canals and pipelines, and terminals such as airports, railway stations, bus stations, warehouses, trucking terminals, refueling depots (including fueling docks and fuel stations), and seaports. Terminals may be used both for interchange of passengers and cargo and for maintenance.

Vehicles traveling on these networks may include automobiles, bicycles, buses, trains, trucks, people, helicopters, and aircraft. Operations deal with the way the vehicles are operated, and the procedures set for this purpose including financing, legalities and policies. In the transport industry, operations and ownership of infrastructure can be either public or private, depending on the country and mode.

Passenger transport may be public, where operators provide scheduled services, or private. Freight transport has become focused on containerization, although bulk transport is used for large volumes of durable items. Transport plays an important part in economic growth and globalization, but most types cause air pollution and use large amounts of land. While it is heavily subsidized by governments, good planning of transport is essential to make traffic flow, and restrain urban sprawl.

#### Mode

A mode of transport is a solution that makes use of a particular type of vehicle, infrastructure and operation. The transport of a person or of cargo may involve one mode or several modes, with the latter case being called intermodal or multimodal transport. Each mode has its advantages and disadvantages, and will be chosen for a trip on the basis of cost, capability, route, and speed.

Harbour cranes unload cargo from a container ship at the Jawaharlal Nehru Port, Navi Mumbai, India.

People walking in front of the bulk carrier BW Fjord



Human-powered transport remains common in developing countries



### Human-powered

Human powered transport is the transport of people and/or goods using human muscle-power, in the form of walking, running and swimming. Modern technology has allowed machines to enhance human-power. Human-powered transport remains popular for reasons of cost-saving, leisure, physical exercise and environmentalism. Human-powered transport is sometimes the only type available, especially in underdeveloped or inaccessible regions. It is considered an ideal form of sustainable transportation.

Although humans are able to walk without infrastructure, the transport can be enhanced through the use of roads, especially when enforcing the human power with vehicles, such as bicycles and inline skates. Human-powered vehicles have also been developed for difficult environments, such as snow and water, by watercraft rowing and skiing; even the air can be entered with human-powered aircraft.

### Animal-powered

Animal-powered transport is the use of working animals for the movement of people and goods. Humans may ride some of the animals directly, use them as pack animals for carrying goods, or harness them, alone or in teams, to pull sleds or wheeled vehicles. Animals are superior to people in their speed, endurance and carrying capacity; prior to the Industrial Revolution they were used for all land transport impracticable for people, and they remain an important mode of transport in less developed areas of the world.

landing on ice, snow and calm water.

The aircraft is the second fastest method of transport, after the rocket. Commercial jets can reach up to 875 kilometres per hour (544 mph), single-engine aircraft 175 kilometres per hour (109 mph). Aviation is able to quickly transport people and limited amounts of cargo over longer distances, but incur high costs and energy use; for short distances or in inaccessible places helicopters can be used. WHO estimates that up to 500,000 people are on planes at any time.

### Rail

Rail transport is where a train runs along a set of two parallel steel rails, known as a railway or railroad. The rails are anchored perpendicular to ties (or sleepers) of timber, concrete or steel, to maintain a consistent distance apart, or gauge. The rails and perpendicular beams are placed on a foundation made of concrete, or compressed earth and gravel in a bed of ballast. Alternative methods include monorail and maglev.

A train consists of one or more connected vehicles that run on the rails. Propulsion is commonly provided by a locomotive, that hauls a series of unpowered cars, that can carry passengers or freight. The locomotive can be powered by steam, diesel or by electricity supplied by trackside systems. Alternatively, some or all the cars can be powered, known as a multiple unit. Also, a train can be powered by horses, cables, gravity, pneumatics and gas turbines. Railed vehicles move with much less friction than rubber tires on paved roads, making trains more energy efficient, though not as efficient as ships.



A local transit bus operated by ACTION in Canberra, Australia

### Air

A fixed-wing aircraft, commonly called airplane, is a heavier-than-air craft where movement of the air in relation to the wings is used to generate lift. The term is used to distinguish from rotary-wing aircraft, where the movement of the lift surfaces relative to the air generates lift. A gyroplane is both fixed-wing and rotary-wing. Fixed-wing aircraft range from small trainers and recreational aircraft to large airliners and military cargo aircraft.

Two things necessary for aircraft are air flow over the wings for lift and an area for landing. The majority of aircraft also need an airport with the infrastructure to receive maintenance, restocking, refueling and for the loading and unloading of crew, cargo and passengers. While the vast majority of aircraft land and take off on land, some are capable of take off and

Intercity trains are long-haul services connecting cities; modern high-speed rail is capable of speeds up to 350 km/h (220 mph), but this requires specially built track. Regional and commuter trains feed cities from suburbs and surrounding areas, while intra-urban transport is performed by high-capacity tramways and rapid transits, often making up the backbone of a city's public transport. Freight trains traditionally used box cars, requiring manual loading and unloading of the cargo. Since the 1960s, container trains have become the dominant solution for general freight, while large quantities of bulk are transported by dedicated trains.

### Road

A road is an identifiable route, way or path between two or more places. Roads are typically smoothed, paved, or otherwise

prepared to allow easy travel; though they need not be, and historically many roads were simply recognizable routes without any formal construction or maintenance. In urban areas, roads may pass through a city or village and be named as streets, serving a dual function as urban space easement and route.

The most common road vehicle is the automobile; a wheeled passenger vehicle that carries its own motor. Other users of roads include buses, trucks, motorcycles, bicycles and pedestrians. As of 2002, there were 590 million automobiles worldwide.

Automobiles offer high flexibility and with low capacity, but are deemed with high energy and area use, and the main source of noise and air pollution in cities; buses allow for more efficient travel at the cost of reduced flexibility. Road transport by truck is often the initial and final stage of freight transport.

#### Water

Water transport is the process of transport a watercraft, such as a barge, boat, ship or sailboat, makes over a body of water, such as a sea, ocean, lake, canal or river. The need for buoyancy unites watercraft, and makes the hull a dominant aspect of its construction, maintenance and appearance.

In the 1800s the first steam ships were developed, using a steam engine to drive a paddle wheel or propeller to move the ship. The steam was produced using wood or coal. Now most ships have an engine using a slightly refined type of petroleum called bunker fuel. Some ships, such as submarines, use nuclear power to produce the steam. Recreational or educational craft still use wind power, while some smaller craft use internal combustion engines to drive one or more propellers, or in the case of jet boats, an inboard water jet. In shallow draft areas, hovercraft are propelled by large pusher-prop fans.

Although slow, modern sea transport is a highly effective method of transporting large quantities of non-perishable goods. Commercial vessels, nearly 35,000 in number, carried 7.4 billion tons of cargo in 2007. Transport by water is significantly less costly than air transport for trans-continental shipping; short sea shipping and ferries remain viable in coastal areas.

#### Other

Pipeline transport sends goods through a pipe, most commonly liquid and gases are sent, but pneumatic tubes can also send solid capsules using compressed air. For liquids/gases, any chemically stable liquid or gas can be sent through a pipeline. Short-distance systems exist for sewage, slurry, water and beer, while long-distance networks are used for petroleum and natural gas.

Cable transport is a broad mode where vehicles are pulled by cables instead of an internal power source. It is most commonly used at steep gradient. Typical solutions include aerial tramway, elevators, escalator and ski lifts; some of these are also categorized as conveyor transport.

Spaceflight is transport out of Earth's atmosphere into outer space by means of a spacecraft. While large amounts of research have gone into technology, it is rarely used except to put satellites into orbit, and conduct scientific experiments. However, man has landed on the moon, and probes have been sent to all the planets of the Solar System.

Suborbital spaceflight is the fastest of the existing and planned transport systems from a place on Earth to a distant other place on Earth. Faster transport could be achieved through part of a Low Earth orbit, or following that trajectory even faster using the propulsion of the rocket to steer it.

### Function

Relocation of travelers and cargo are the most common uses of transport. However, other uses exist, such as the strategic and tactical relocation of armed forces during warfare, or the civilian mobility construction or emergency equipment.

#### Passenger

Passenger transport, or travel, is divided into public and private transport. Public is scheduled services on fixed routes, while

private is vehicles that provide ad hoc services at the riders desire. The latter offers better flexibility, but has lower capacity, and a higher environmental impact. Travel may be as part of daily commuting, for business, leisure or migration.

Short-haul transport is dominated by the automobile and mass transit. The latter consists of buses in rural and small cities, supplemented with commuter rail, trams and rapid transit in larger cities. Long-haul transport involves the use of the automobile, trains, coaches and aircraft, the last of which have become predominantly used for the longest, including intercontinental, travel. Intermodal passenger transport is where a journey is performed through the use of several modes of transport; since all human transport normally starts and ends with walking, all passenger transport can be considered intermodal. Public transport may also involve the intermediate change of vehicle, within or across modes, at a transport hub, such as a bus or railway station.

Taxis and Buses can be found on both ends of Public Transport spectrum, whereas Buses remain the cheaper mode of transport but are not necessarily flexible, and Taxis being very flexible but more expensive. In the middle is Demand responsive transport offering flexibility whilst remaining affordable.

International travel may be restricted for some individuals due to legislation and visa requirements.

#### Freight

Freight transport, or shipping, is a key in the value chain in manufacturing. With increased specialization and globalization, production is being located further away from consumption, rapidly increasing the demand for transport. While all modes of transport are used for cargo transport, there is high differentiation between the nature of the cargo transport, in which mode is chosen. Logistics refers to the entire process of transferring products from producer to consumer, including storage, transport, transshipment, warehousing, material-handling and packaging, with associated exchange of information. Incoterm deals with the handling of payment and responsibility of risk during transport.

Containerization, with the standardization of ISO containers on all vehicles and at all ports, has revolutionized international and domestic trade, offering huge reduction in transshipment costs. Traditionally, all cargo had to be manually loaded and unloaded into the haul of any ship or car; containerization allows for automated handling and transfer between modes, and the standardized sizes allow for gains in economy of scale in vehicle operation. This has been one of the key driving factors in international trade and globalization since the 1950s.

Bulk transport is common with cargo that can be handled roughly without deterioration; typical examples are ore, coal, cereals and petroleum. Because of the uniformity of the product, mechanical handling can allow enormous quantities to be handled quickly and efficiently. The low value of the cargo combined with high volume also means that economies of scale become essential in transport, and gigantic ships and whole trains are commonly used to transport bulk. Liquid products with sufficient volume may also be transported by pipeline.

Air freight has become more common for products of high value; while less than one percent of world transport by volume is by airline, it amounts to forty percent of the value. Time has become especially important in regards to principles such as postponement and just-in-time within the value chain, resulting in a high willingness to pay for quick delivery of key components or items of high value-to-weight ratio. In addition to mail, common items sent by air include electronics and fashion clothing.

### History

Humans' first means of transport were walking and swimming. The domestication of animals introduces a new way to lay the burden of transport on more powerful creatures, allowing heavier loads to be hauled, or humans to ride the animals for higher speed and duration. Inventions such as the wheel and

## CARGO

sled helped make animal transport more efficient through the introduction of vehicles. Also water transport, including rowed and sailed vessels, dates back to time immemorial, and was the only efficient way to transport large quantities or over large distances prior to the Industrial Revolution.

The first forms of road transport were horses, oxen or even humans carrying goods over dirt tracks that often followed game trails. Paved roads were built by many early civilizations, including Mesopotamia and the Indus Valley Civilization. The Persian and Roman empires built stone-paved roads to allow armies to travel quickly. Deep roadbeds of crushed stone underneath ensured that the roads kept dry. The medieval Caliphate later built tar-paved roads.



The first watercraft were canoes cut out from tree trunks. Early water transport was accomplished with ships that were either rowed or used the wind for propulsion, or a combination of the two. The importance of water has led to most cities, that grew up as sites for trading, being located on rivers or at sea, often at the intersection of two bodies of water. Until the Industrial Revolution, transport remained slow and costly, and production and consumption were located as close to each other as feasible.

The Industrial Revolution in the 19th century saw a number of inventions fundamentally change transport. With telegraphy, communication became instant and independent of transport. The invention of the steam engine, closely followed by its application in rail transport, made land transport independent of human or animal muscles. Both speed and capacity increased rapidly, allowing specialization through manufacturing being located independent of natural resources. The 19th century also saw the development of the steam ship, that sped up global transport.

The development of the combustion engine and the automobile at the turn into the 20th century, road transport became more viable, allowing the introduction of mechanical private transport. The first highways were constructed during the 19th century with macadam. Later, tarmac and concrete became the dominant paving material. In 1903, the first controllable airplane was invented, and after World War I, it became a fast way to transport people and express goods over long distances.

After World War II, the automobile and airlines took higher shares of transport, reducing rail and water to freight and short-haul passenger. Spaceflight was launched in the 1950s, with rapid growth until the 1970s, when interest dwindled. In the 1950s, the introduction of containerization gave massive efficiency gains in freight transport, permitting globalization. International air travel became much more accessible in the 1960s, with the commercialization of the jet engine. Along with the growth in automobiles and motorways, this introduced a decline for rail and water transport. After the introduction of the Shinkansen in 1964, high-speed rail in Asia and Europe started taking passengers on long-haul routes from airlines.

Cargo (or freight) is goods or produce transported, generally for commercial gain, by ship, aircraft, train, van or truck. In modern times, containers are used in most intermodal long-haul cargo transport.

## Transportation types

## Marine

There is a wide range of marine cargo handled at seaport terminals.

— Automobiles are handled at many ports and are usually carried on specialized roll-on/roll-off ships.

— Break bulk cargo is typically material stacked on wooden pallets and lifted into and out of the hold of a vessel by cranes on the dock or aboard the ship itself. The volume of break bulk cargo has declined dramatically worldwide as containerization has grown. A safe and secure way to secure break bulk and freight in containers is by using Dunnage Bags.

— Bulk cargo, such as salt, oil, tallow, and Scrap metal, is usually defined as commodities that are neither on pallets nor in containers. Bulk cargoes are not handled as individual pieces, the way heavy-lift and project cargoes are. Alumina, grain, gypsum, logs and wood chips, for instance, are bulk cargoes.

— Containers are the largest and fastest growing cargo category at most ports worldwide. Containerized cargo includes everything from auto parts, machinery and manufacturing components to shoes and toys to frozen meat and seafood.



— Project cargo and the heavy lift cargo include items like manufacturing equipment, air conditioners, factory components, generators, wind turbines, military equipment, and almost any other oversized or overweight cargo which is too big or too heavy to fit into a container.

## Air

Air cargo, commonly known as air freight, is collected by firms from shippers and delivered to customers. Aircrafts were first used for carrying mail as cargo in 1911. Eventually manufacturers started designing aircrafts for other types of freight as well.

There are many commercial aircrafts suitable for carrying cargo such as the Boeing 747 and the bigger An-124, which was purposely built for easy conversion into a cargo aircraft. Such large aircraft employ quick-loading containers known as Unit Load Devices (ULDs), much like containerized cargo

Cargolux Boeing 747-400F with the nose loading door open

A picture of a P&amp;O Nedlloyd inter-modal freight well car at Banbury station in the year 2001

ships. The ULDs are located in front section of the aircraft.

Most nations own and utilize large numbers of cargo aircraft such as the C-17 Globemaster III for airlift logistic needs.

**Train**

Trains are capable of transporting large numbers of containers that come from shipping ports. Trains are also used for the transportation of steel, wood and coal. They are used because they can carry a large amount and generally have a direct route to the destination. Under the right circumstances, freight transport by rail is more economic and energy efficient than by road, especially when carried in bulk or over long distances.

The main disadvantage of rail freight is its lack of flexibility. For this reason, rail has lost much of the freight business to road transport. Rail freight is often subject to transshipment costs, since it must be transferred from one mode of transportation to another. Practices such as containerization aim at minimizing these costs.

a customs agency, to the handling of cargo to minimize risks of terrorism and other crime. Of particular concern is cargo entering through a country's borders.

The United States has been one of the leaders in securing cargo. They see cargo as a concern to United States national security. After the terrorist attacks of September 11th, the security of this magnitude of cargo has become highlighted on the over 6 million cargo containers enter the United States ports each year. The latest US Government response to this threat is the CSI: Container Security Initiative. CSI is a program intended to help increase security for containerized cargo shipped to the United States from around the world.

**INTERMODAL CONTAINER**

A "40-foot" (12.19 m) long shipping container. Each of the eight corners has a simple "twislock" fitting for stacking, locking and craning



Many governments are currently trying to encourage shippers to use trains more often because of the environmental benefits.

**Road**

Many firms, like Parcelforce or FedEx, transport all types of cargo by road. Delivering everything from letters to houses to cargo containers, these firms offer fast, sometimes same-day, delivery.

A good example of road cargo is food, as supermarkets require deliveries every day to keep their shelves stocked with goods. Retailers of all kinds rely upon delivery trucks, be they full size semi trucks or smaller delivery vans.

**Security concerns**

Governments are very concerned with the shipment of cargo, as it may bring security risks to a country. Therefore, many governments have enacted rules and regulations, administered by

An intermodal container or freight container (commonly shipping container or conex box, a shorthand of the Army term CONtainer EXpress) is a reusable transport and storage unit for moving products and raw materials between locations or countries; the terms container or box may be used on their own within the context of shipping. Containers manufactured to ISO specifications may be referred to as ISO containers and the term high-cube container is used for units that are taller than normal. There are approximately seventeen million intermodal containers in the world and a large proportion of the world's long distance freight generated by international trade is transported inside shipping containers (as opposed to break bulk cargo).

The containerization system developed from a design of an 8-foot (2.438 m) cube units used by the United States' military and later standardised by extension to 10-foot (3.05 m), 20-foot (6.1 m), and 40-foot (12.19 m) lengths. Longer, higher and wider variants are now in general use in various places.

Container variants are available for many different cargo types. Non-container methods of transport include bulk cargo,

break bulk cargo and tankers/oil tankers used for liquids. For air freight the alternative and lighter IATA-defined Unit Load Device is used.

## Description

A typical container has doors fitted at one end, and is constructed of corrugated weathering steel. Containers were originally 8 feet (2.44 m) wide by 8 feet (2.44 m) high, and either a nominal 20 feet (6.1 m) or 40 feet (12.19 m) long. They could be stacked up to seven units high. At each of the eight corners are castings with openings for twistlock fasteners.

Taller units have been introduced, including 'hi-cube' or 'high-cube' units at 9 feet 6 inches (2.9 m) and 10 feet 6 inches (3.2 m) high.

The United States often uses longer units at 48 ft (14.63 m) and 53 ft (16.15 m). Some rare European containers are often about 2 inches (5 cm) wider at 2.5 m (8 ft 2.4 in) to accommodate Euro-pallets. Australian RACE containers are also slightly wider to accommodate Australia Standard Pallets.

Swap body units use many of the same mounting fixings as Intermodal containers, but have folding legs under their frame so that they can be moved between trucks without using a crane. They are generally lighter in weight.

Each container is allocated a standardized ISO 6346 reporting mark (ownership code), four characters long ending in either U, J or Z, followed by six numbers and a check digit.

Container capacity is often expressed in twenty-foot equivalent units (TEU, or sometimes teu). An equivalent unit is a measure of containerized cargo capacity equal to one standard 20 ft (length) × 8 ft (width) container. As this is an approximate measure, the height of the box is not considered; for example, the 9 ft 6 in (2.9 m) high cube and the 4-foot-3-inch (1.3 m) half height 20-foot (6.1 m) containers are also called one TEU. Similarly, the 45 ft (13.72 m) containers are also commonly designated as two TEU, although they are 45 and not 40 feet (12.19 m) long. Two TEU are equivalent to one forty-foot equivalent unit (FEU).

## Types

Variations on the standard container exist for use with different cargoes including Refrigerated container units for perishable goods, tanks in a frame for bulk liquids, open top units for top loading and collapsible versions. Containerised coal carriers, and 'bin-liners' (containers designed for the efficient road/rail transportation of rubbish from cities to recycling and dump sites) are used in Europe.

Container types:

- Collapsible ISO
- Flushfolding flat-rack containers for heavy and bulky semi-finished goods, out of gauge cargo
- Gas bottle
- Generator
- General purpose dry van for boxes, cartons, cases, sacks, bales, pallets, drums in standard, high or half height
- High cube palletwide containers for europallet compatibility
- Insulated shipping container
- Refrigerated containers for perishable goods
- Open top bulkainers for bulk minerals, heavy machinery
- Open side for loading oversize pallet
- Platform or bolster for barrels and drums, crates, cable drums, out of gauge cargo, machinery, and processed timber
- Rolling floor for difficult to handle cargo
- Swapbody
- Tank containers for bulk liquids and dangerous goods

- Ventilated containers for organic products requiring ventilation

## Handling and transport

Containers can be transported by container ship, semi-trailer truck and freight trains as part of a single journey without unpacking and they are transferred between modes by container cranes at container terminals. Units can be secured during handling and in transit using "twistlock" points located at each corner of the container. Every container has a unique BIC code painted on the outside for identification and tracking, and is capable of carrying up to 20–25 tonnes. Costs for transport are calculated in twenty-foot equivalent units (TEU).

### Rail

When carried by rail, containers may be carried on flatcars or well cars. The latter are specially designed for container transport, and can accommodate double-stacked containers. However the loading gauge of a rail system may restrict the modes and types of container shipment. The smaller loading gauges often found in European railroads will only accommodate single-stacked containers. In some countries, such as the United Kingdom, there are sections of the rail network which high-cube containers cannot pass through, or can pass through only on well cars. On the other hand, Indian Railways runs double-stacked containers on flatcars under 25 kV overhead electrical wires. In order to do this, the wire must be at least 7.45 metres (24 ft 5 in) above the track, but IR is able to do so because of its large loading gauge and the extra stability provided by its 1,676 mm (5 ft 6 in) broad gauge track. China Railways also runs double-stacked containers under overhead wires, but must use well cars to do so since the wires are only 6.6 metres (21 ft 8 in) above the track and 1,435 mm (4 ft 8 1/2 in) (standard gauge) does not provide adequate stability to run double-stacked containers on flat cars .

## History

The United States Department of Defense produced specifications for standard containers for military use of 8-foot (2.44 m) by 8-foot (2.44 m) square cross section in units of 10-foot (3.05 m) long in the 1950s. The International Organization for Standardization (ISO) issued standards based upon the US Department of Defense standards between 1968 and 1970, ensuring interchangeability between different modes of transportation worldwide. and they subsequently also became known as ISO containers for this reason.

The modern intermodal container was pioneered by Malcolm McLean. A global system of intermodal freight transport has developed around these standard containers and new container sizes have been developed to suit different purposes. Since November 2007 48 ft (14.63 m) and 53 ft (16.15 m) containers are used also for international ocean shipments. As of April 2008 the only marine company who offer such containers is APL: However, APL containers have slightly different sizes and weights than standard 48 ft (14.63 m) and 53 ft (16.15 m) containers (that are used in the US by rail and truck services)

15

## DANGEROUS GOODS

Dangerous goods, also called hazardous materials or HazMat, are solids, liquids, or gases that can harm people, other living organisms, property, or the environment. They are often subject to chemical regulations. "HazMat teams" are personnel specially trained to handle dangerous goods. Dangerous goods include materials that are radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, biohazardous, toxic,

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pathogenic, or allergenic. Also included are physical conditions such as compressed gases and liquids or hot materials, including all goods containing such materials or chemicals, or may have other characteristics that render them hazardous in specific circumstances.

Dangerous goods are often indicated by diamond-shaped signage. The colours of each diamond in a way has reference to its hazard ie: Flammable = red, Explosive = orange, because mixing red (flammable) with yellow (oxidising agent) creates orange. Non Flammable Non Toxic Gas = green, due to all compressed air vessels being this colour in France after World War II. France is where the diamond system of HazMat identification originated.



Mitigating the risks associated with hazardous materials may require the application of safety precautions during their transport, use, storage and disposal. Most countries regulate hazardous materials by law, and they are subject to several international treaties as well. Even so, different countries may use different class diamonds for the same product. For example, in Australia, Anhydrous Ammonia UN 1005 is classified as 2.3 (Toxic Gas) with sub risk 8 (Corrosive), where as in the U.S. it is only classified as 2.2 (Non Flammable Gas).

People who handle dangerous goods will often wear protective equipment, and metropolitan fire departments often have a response team specifically trained to deal with accidents and spills. Persons who may come into contact with dangerous goods as part of their work are also often subject to monitoring

or health surveillance to ensure that their exposure does not exceed occupational exposure limits.

Laws and regulations on the use and handling of hazardous materials may differ depending on the activity and status of the material. For example, one set of requirements may apply to their use in the workplace while a different set of requirements may apply to spill response, sale for consumer use, or transportation. Most countries regulate some aspect of hazardous materials.

The most widely applied regulatory scheme is that for the transportation of dangerous goods. The United Nations Economic and Social Council issues the UN Recommendations on the Transport of Dangerous Goods, which form the basis for most regional and national regulatory schemes. For instance, the International Civil Aviation Organization has developed regulations for air transport of hazardous materials that are based upon the UN Model but modified to accommodate unique aspects of air transport. Individual airline and governmental requirements are incorporated with this by the International Air Transport Association to produce the widely used IATA Dangerous Goods Regulations. Similarly, the International Maritime Organization has developed the International Maritime Dangerous Goods Code ("IMDG Code", part of the International Convention for the Safety of Life at Sea) for transportation on the high seas, and the Intergovernmental Organisation for International Carriage by Rail has developed the Regulations concerning the International Carriage of Dangerous Goods by Rail ("RID", part of the Convention concerning International Carriage by Rail). Many individual nations have also structured their dangerous goods transportation regulations to harmonize with the UN Model in organization as well as in specific requirements.

The Globally Harmonized System of Classification and Labeling of Chemicals or GHS is an internationally agreed upon system set to replace the various different classification and labeling standards used in different countries. The GHS will use consistent criteria for classification and labeling on a global level.

Dangerous goods are divided into classes on the basis of the specific chemical characteristics producing the risk.

Note: The graphics and text in this article representing the dangerous goods safety marks are derived from the United Nations-based system of identifying dangerous goods. Not all countries use precisely the same graphics (label, placard and/or text information) in their national regulations. Some use graphic symbols, but without English wording or with similar wording in their national language. Refer to the Dangerous Goods Transportation Regulations of the country of interest.

### Australia

Australia uses the standard international UN numbers with a few slightly different signs on the back, front and sides of vehicles carrying hazardous substances. The country uses the same "Hazchem" code system as the UK to provide advisory information to emergency services personnel in the event of an emergency.

### Canada

Transportation of dangerous goods (hazardous materials) in Canada by road is normally a provincial jurisdiction. The federal government has jurisdiction over air, most marine, and most rail transport. The federal government acting centrally created the federal transportation of dangerous goods act and regulations, which provinces adopted in whole or in part via provincial transportation of dangerous goods legislation. The result is that all provinces use the federal regulations as their standard within their province; some small variances can exist because of provincial legislation. Creation of the federal regulations was coordinated by Transport Canada. Hazard classifications are based upon the UN Model.

Outside of federal facilities, labour standards are generally under the jurisdiction of individual provinces and territories. However, communication about hazardous materials in



An Emergency Medical Technician team training as rescue (grey suits) and decontamination (green suits) responders to hazardous material and toxic contamination situations.

the workplace has been standardized across the country through Health Canada's Workplace Hazardous Materials Information System (WHMIS).

### Europe

The European Union has passed numerous directives and regulations to avoid the dissemination and restrict the usage of hazardous substances, important ones being the Restriction of Hazardous Substances Directive and the REACH regulation. There are also long-standing European treaties such as ADR and RID that regulate the transportation of hazardous materials by road, rail, river and inland waterways, following the guide of the UN Model Regulation.

European law distinguishes clearly between the law of dangerous goods and the law of hazardous materials. The first refers primarily to the transport of the respective goods including the interim storage, if caused by the transport. The latter describes the requirements of storage (including warehousing) and usage of hazardous materials. This distinction is important, because different directives and orders of European law are applied.

### United Kingdom

The United Kingdom (and Australia, Malaysia, and New Zealand) use the Hazchem warning plate system which carries information on how an emergency service should deal with an incident. The Dangerous Goods Emergency Action Code (EAC) List lists dangerous goods; it is reviewed every two years and is an essential compliance document for all emergency services, local government and for those who may control the planning for, and prevention of, emergencies involving dangerous goods. A PDF version of the 2009 list may be downloaded from the National Chemical Emergency Centre (NCEC) website, or it may be purchased from TSO directly (ISBN 9780113413263).

### United States

Due to the increase in the perceived threat of terrorism in the early 21st century, particularly after the September 11, 2001 attacks, funding for greater HAZMAT-handling capabilities was increased throughout the United States, recognizing that flammable, poisonous, explosive, or radioactive substances in particular could be used for terrorist attacks.

The United States Department of Transportation (DOT) regulates hazmat transportation within the territory of the US. The regulations are in 49 FR (Title 49 of the Code of Federal Regulations).

The U.S. Occupational Safety and Health Administration (OSHA) regulates the handling of hazardous materials in the workplace as well as response to hazardous-materials-related incidents, most notably through HAZWOPER (Hazardous Waste Operations and Emergency Response) regulations found at 29 FR 1910.120.

In 1984 the agencies OSHA, EPA, USCG, NIOSH jointly published the first Hazardous Waste Operations and Emergency Response Guidance Manual which is available on the Worldwide Web, and can be purchased from the US Government Printing Office, Pub. 85-115.

The Environmental Protection Agency (EPA) regulates hazardous materials as they may impact the community and environment, including specific regulations for environmental cleanup and for handling and disposal of waste hazardous materials.

The Consumer Product Safety Commission regulates hazardous materials that may be used in products sold for household and other consumer uses.

### Transport documents

One of the transport regulations is that, as an assistance during emergency situations, written instructions how to deal in such need to be carried and easily accessible in the driver's cabin. A license or permit card for hazmat training must be presented when requested by officials.

16

## PACKAGING AND LABELING

Packaging is the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of design, evaluation, and production of packages. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells. In many countries it is fully integrated into government, business, institutional, industrial, and personal use.

Package labelling (en-GB) or labeling (en-US) is any written, electronic, or graphic communications on the packaging or on a separate but associated label.



— Marketing - The packaging and labels can be used by marketers to encourage potential buyers to purchase the product. Package graphic design and physical design have been important and constantly evolving phenomenon for several decades. Marketing communications and graphic design are applied to the surface of the package and (in many cases) the point of sale display.

— Security - Packaging can play an important role in reducing the security risks of shipment. Packages can be made with improved tamper resistance to deter tampering and also can have tamper-evident features to help indicate tampering. Packages can be engineered to help reduce the risks of package pilferage: Some package constructions are more resistant to pilferage and some have pilfer indicating seals. Packages may include authentication seals and use security printing to help indicate that the package and contents are not counterfeit. Packages also can include anti-theft devices, such as dye-packs, RFID tags, or electronic article surveillance tags that can be activated or detected by devices at exit points and require specialized tools to deactivate. Using packaging in this way is a means of loss prevention.

— Convenience - Packages can have features that add convenience in distribution, handling, stacking, display, sale, opening, reclosing, use, dispensing, and reuse.

— Portion control - Single serving or single dosage packaging has a precise amount of contents to control usage. Bulk commodities (such as salt) can be divided into packages that are a more suitable size for individual households. It is also aids the control of inventory: selling sealed one-liter-bottles of milk, rather than having people bring their own bottles to fill themselves.

## Packaging types

Packaging may be looked at as being of several different types. For example a transport package or distribution package can be the shipping container used to ship, store, and handle the product or inner packages. Some identify a consumer package as one which is directed toward a consumer or household.

Packaging may be described in relation to the type of product being packaged: medical device packaging, bulk chemical packaging, over-the-counter drug packaging, retail food packaging, military materiel packaging, pharmaceutical packaging, etc.

It is sometimes convenient to categorize packages by layer or function: “primary”, “secondary”, etc.

— Primary packaging is the material that first envelops the product and holds it. This usually is the smallest unit of distribution or use and is the package which is in direct contact with the contents.

— Secondary packaging is outside the primary packaging, perhaps used to group primary packages together.

— Tertiary packaging is used for bulk handling, warehouse storage and transport shipping. The most common form is a palletized unit load that packs tightly into containers.

These broad categories can be somewhat arbitrary. For example, depending on the use, a shrink wrap can be primary packaging when applied directly to the product, secondary packaging when combining smaller packages, and tertiary packaging on some distribution packs.



Tablets in a blister pack, which was itself packaged in a folding carton made of paperboard.

## Symbols used on packages and labels

Many types of symbols for package labeling are nationally and internationally standardized. For consumer packaging, symbols exist for product certifications, trademarks, proof of purchase, etc. Some requirements and symbols exist to communicate aspects of consumer use and safety. Examples of environmental and recycling symbols include the recycling symbol, the resin identification code and the “Green Dot”.

Bar codes, Universal Product Codes, and RFID labels are common to allow automated information management in logistics and retailing. Country of Origin Labeling is often used.

## Shipping container labeling

Technologies related to shipping containers are identification codes, bar codes, and electronic data interchange (EDI). These three core technologies serve to enable the business functions in the process of shipping containers throughout the distribution channel. Each has an essential function: identification codes either relate product information or serve as keys to other data, bar codes allow for the automated input of identification codes and other data, and EDI moves data between trading partners within the distribution channel.

Elements of these core technologies include UPC and EAN item identification codes, the SCC-14 (UPC shipping container code), the SSCC-18 (Serial Shipping Container Codes), Interleaved 2-of-5 and UCC/EAN-128 (newly designated GS1-128) bar code symbologies, and ANSI ASC X12 and UN/EDIFACT EDI standards.

Small parcel carriers often have their own formats. For example, United Parcel Service has a MaxiCode 2-D code for parcel tracking.

RFID labels for shipping containers are also increasing in usage. A Wal-Mart division, Sam’s Club, has also moved in this direction and is putting pressure on its suppliers for compliance.

Shipments of hazardous materials or dangerous goods have special information and symbols (labels, placards, etc.) as required by UN, country, and specific carrier requirements.

## Package development considerations

Package design and development are often thought of as an integral part of the new product development process.

Alternatively, development of a package (or component) can be a separate process, but must be linked closely with the product to be packaged. Package design starts with the identification of all the requirements: structural design, marketing, shelf life, quality assurance, logistics, legal, regulatory, graphic design, end-use, environmental, etc. The design criteria, performance (specified by package testing), completion time targets, resources, and cost constraints need to be established and agreed upon.

An example of how package design is affected by other factors is the relationship to logistics. When the distribution system includes individual shipments by a small parcel carrier, the sortation, handling, and mixed stacking make severe demands on the strength and protective ability of the transport package. If the logistics system consists of uniform palletized unit loads, the structural design of the package can be designed to those specific needs: vertical stacking, perhaps for a longer time frame. A package designed for one mode of shipment may not be suited for another.

With some types of products, the design process involves detailed regulatory requirements for the package. For example with packaging foods, any package components that may contact the food are food contact materials. Toxicologists and food scientists need to verify that the packaging materials are allowed by applicable regulations. Packaging engineers need to verify that the completed package will keep the product safe for its intended shelf life with normal usage. Packaging processes, labeling, distribution, and sale need to be validated to comply with regulations and have the well being of the consumer in mind.

## Packaging machines

A choice of packaging machinery includes: technical capabilities, labor requirements, worker safety, maintainability, serviceability, reliability, ability to integrate into the packaging line, capital cost, floorspace, flexibility (change-over, materials, etc.), energy usage, quality of outgoing packages, qualifications (for food, pharmaceuticals, etc.), throughput, efficiency, productivity, ergonomics, return on investment, etc.

Packaging machines may be of the following general types:

- Accumulating and Collating Machines
- Blister packs, skin packs and Vacuum Packaging Machines
- Bottle caps equipment, Over-Capping, Lidding, Closing, Seaming and Sealing Machines
- Box, Case and Tray Forming, Packing, Unpacking, Closing and Sealing Machines
- Cartoning machines
- Cleaning, Sterilizing, Cooling and Drying Machines
- Coding, Printing, Marking, Stamping, and Imprinting Machines
- Converting Machines
- Conveyor belts, Accumulating and Related Machines
- Feeding, Orienting, Placing and Related Machines
- Filling Machines: Handling dry, powered, solid, liquid, gas, or viscous products
- Inspecting, Detecting and Check weigher Machines



Shrink wrapped helicopters

Sometimes the objectives of package development seem contradictory. For example, regulations for an over-the-counter drug might require the package to be tamper-evident and child resistant: These intentionally make the package difficult to open. The intended consumer, however, might be handicapped or elderly and be unable to readily open the package. Meeting all goals is a challenge.

Package design may take place within a company or with various degrees of external packaging engineering: independent contractors, consultants, vendor evaluations, independent laboratories, contract packagers, total outsourcing, etc. Some sort of formal Project planning and Project management methodology is required for all but the simplest package design and development programs. An effective quality management system and Verification and Validation protocols are mandatory for some types of packaging and recommended for all.

- Label dispenser
- Orienting, Unscrambling Machines
- Package Filling and Closing Machines
- Palletizing, Depalletizing, Unit load assembly
- Product Identification: labeling, marking, etc.
- Wrapping machines: Shrink wrap, Banding
- Form, Fill and Seal Machines
- Other speciality machinery: slitters, perforating, laser cutters, parts attachment, etc.
- Process Machinery (Product Preparation): Chopper, Crusher, Cutter, Molder, Peeler, etc.
- Process Machinery (Special Product): Coating, Enrobing, Seasoning
- Process Machinery (Product Cooking, Heating, and Cooling): Aseptic

**SHRINK WRAP**

Shrink wrap, also shrinkwrap or shrink film, is a material made up of polymer plastic film. When heat is applied to this material it shrinks tightly over whatever it is covering. Heat can be applied with a hand held heat gun (electric or gas) or the product and film can pass through a heat tunnel on a conveyor.

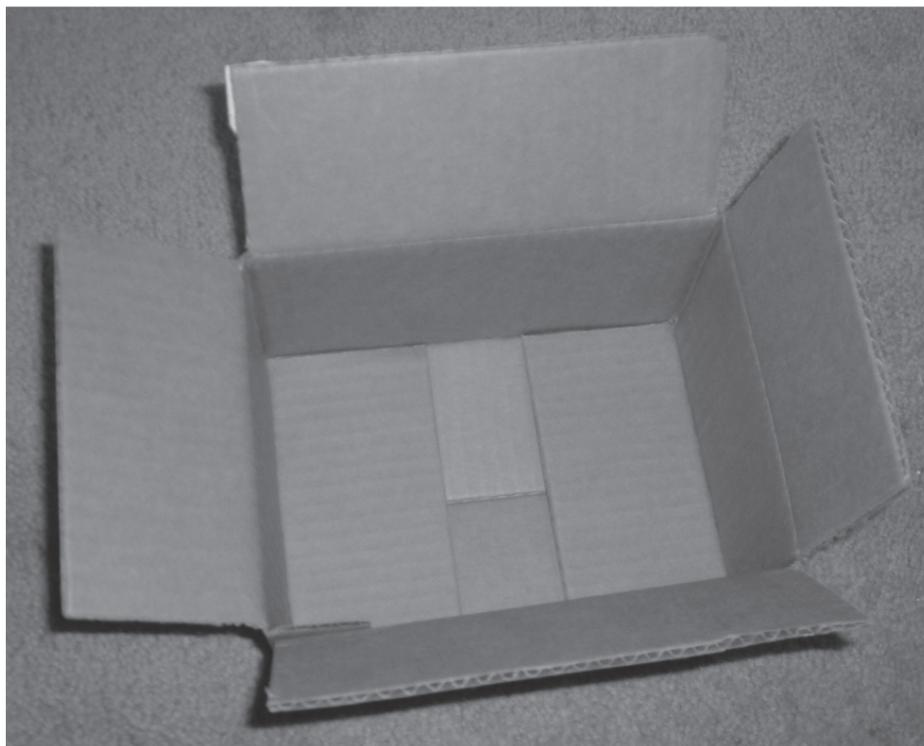
Shrink wrap is commonly used as an overwrap on many types of packaging, including cartons, boxes, beverage cans and pallet loads. A variety of products may be enclosed in shrink wrap to stabilize the products, unitize them, keep them clean, add a degree of tamper resistance, etc. It can be the primary covering for some foods such as cheese and meats. It is also used to cover boats after manufacture and for winter storage. Heat-shrink tubing is used to seal electric wiring.

Shrink bands are applied over parts of packages for tamper resistance or labels. It can also combine two packages or parts.

**Use**

Shrink wrap is applied over or around the intended item, often by automated equipment. It is then sent through a heat tunnel or oven for shrinking. Heat guns are also used for large items.

Shrink wrap can be supplied in several forms. Flat roll-stock can be wrapped around a product but centerfolded film is by far the most popular, supplied on a roll the plastic is folded in half: product is placed in the center portion, the remaining three edges are sealed to form a bag, and the package then heated which causes the bag to shrink and conform to the prod-



An empty box made of corrugated fiberboard

uct placed in the bag. Less popular are the pre-formed Shrink bags plastic bags with one end open: the product is placed in the bag, sealed, and sent for heat shrinking.

Shrink wrap can be used to wrap buildings. It is far superior to blue tarps for wrapping roofs after hurricanes, earthquakes, tornadoes and other disasters. Shrink wrap can be used for environmental containments to facilitate safe removal of asbestos, lead and other hazards.

Shrink wrap is sometimes used to wrap up books, especially adult-oriented ones and certain comics and manga, mainly to prevent them from being read by minors.

Software on carriers such as CDs or DVDs are often sold in boxes that are packaged in shrink wrap. The licenses of such software are typically put inside the boxes, making it impossible to read them before purchasing. This has raised questions about the validity of such shrink wrap licenses.

**BOX**

Box (plural boxes) describes a variety of containers and receptacles for permanent use as storage, or for temporary use often for transporting contents. The word derives from the Greek πύξος (puxos), “box, boxwood”.

Boxes may be made of durable material such as wood or metal, or of corrugated fiberboard, paperboard, or other non-durable materials. The size may vary from very small (e.g., a matchbox) to the size of a large appliance. A corrugated box is a very common shipping container. When no specific shape is described, a box of rectangular cross-section with all sides flat may be expected, but a box may have a horizontal cross section that is square, elongated, round or oval; sloped or domed top surfaces, or non-vertical sides.

A decorative box may be opened by raising, pulling, sliding or removing the lid, which may be hinged and/or fastened by a catch, clasp, lock, or adhesive tape.

A common storage box usually has the shape of a cuboid or right rectangular prism, although boxes of almost any shape may be used.

**Packaging boxes**

Several types of boxes are used in packaging and storage.

- A corrugated box is a shipping container made of corrugated fiberboard. These are most commonly used to transport and warehouse products during distribution.

- A folding carton (sometimes called a box) is fabricated from paperboard. The paperboard is printed (if necessary), die-cut and scored to form a blank. These are transported and stored flat, and erected at the point of filling. These are used to package a wide range of consumer goods.
- A “set up” box (or rigid paperboard box) is made of a non-bending grade of paperboard. Unlike folding cartons, these are assembled at the point of manufacture and transported already “set-up”. Set-up boxes are more expensive than folding boxes and are typically used for high value items such as cosmetics and gift boxes.
- A wooden box is heavy duty shipping container made of wood. See also crate.

- A bulk box is a large box often used in industrial environments. It is sized to fit well on a pallet.

Depending on locale and specific usage, the terms carton and box are sometimes used interchangeably.

#### Wooden wine box

Wooden wine boxes, also known as wooden wine crates are used to ship and store expensive wines in transit. Most wineries that use wooden boxes engrave their logo and designs on the front panel. These panels are usually highly detailed and used by wine collectors as decoration pieces for their bars or wine cellars. A typical wooden wine box holds either six or twelve 750 ml bottles.

Some people use boxes for shelter, for example to keep warm or dry. Homeless people sometimes use flattened boxes as a substitute for blankets. Other types of box use include:

- Police box, a booth for use by police in 20th century Britain.
- Signal box, a building by a railway to coordinate and control railway signals.
- Penalty box, a booth used in sports where a player sits to serve the time of a given penalty.
- Telephone box, or telephone booth, containing a public telephone.



A corrugated box

### Permanent boxes

Numerous types of boxes are used in permanent installations. Permanent boxes may include the following:

Compartments:

- Mailbox
- Luxury box
- Safe or “strong box”
- Humidor

### Decorative boxes

#### Jewelry box

A jewelry (AmE) or jewellery (BrE) box, is a receptacle for trinkets, not only jewels. It may take a very modest form, covered in leather and lined with satin, or it may be larger.

#### Gift box

Gifts are stored in boxes wrapped in decorative wrapping paper. Gift boxes are usually for containing birthday or Christmas gifts.

### Equipment boxes

- Toolbox (or tool box), used in various trades.
- Fuse box, holds electrical circuit breaker switches.
- Set-top box, a device used to decode and display TV signals.
- Black box (transportation), a durable data-recording device found in some vehicles, used to assist in the investigation of an accident.

### Shelters or booths

### Postal service

— Post box (British English and others, also written postbox), or mailbox (North American English and others) is a physical box used to collect mail that is to be sent to a destination. Varieties of post boxes for outgoing mail include:

- Lamp box
- Ludlow wall box
- Pillar box
- Wall box

— Post office box, (often abbreviated P.O. box or PO box), a uniquely-addressable lockable box located in a post office station.

— Post box, can refer to a letter box for incoming mail

### Other boxes

- Ballot box, a box in which votes (ballot papers) are deposited during voting.
- Black box, something for which the internal operation is not described but its function is.
- Box, informal reference to large box-shaped parts of a computer, such as the base unit or tower case of a personal computer.
- Coach Box or the driver’s seat on a carriage coach.
- Dispatch box, (or despatch box), a box for holding official papers and transporting them.
- Glory box or Hope Chest, a box or chest containing items typically stored by unmarried young women in anticipation of married life.

- Lunch box, or “lunch pail” or “lunch kit”, a rigid container used for carrying food. Can also be decorative.
- Mitre box, a woodworking tool used to guide a hand saw to make precise mitre cuts in a board.
- Nest box, a substitute for a hole in a tree for birds to make a nest in.
- Pandora’s box, in Greek mythology, a box containing the evils of mankind and also hope.
- Check box, on paper, normally to check off as opinion or option.

19

## LETTER BOX

A letter box, letterbox, letter plate, letter hole, mail slot, or mailbox is a receptacle for receiving incoming mail at a private residence or business. For the opposite purpose of collating outgoing mail, a post box is generally used instead.

Letterboxes or mailboxes consist of four primary designs:

- a slot in a wall or door through which mail is delivered
- a box attached directly to the house
- a box mounted at or near the street
- a centralised unit consisting of many individual mailboxes for an entire building or neighbourhood

### History

#### Europe

Private letterboxes or mail slots did not become popular in most of Europe until the mid to late 19th century, although they were used in Paris, France from the late 18th century.

In 1849, the British Post Office first encouraged people to install letterboxes to facilitate the delivery of mail. Before then, letterboxes of a similar design had been installed in the doors and walls of post offices for people to drop off outgoing

mail. An example of such a wall box (originally installed in the wall of the Wakefield Post Office) is dated 1809 and believed to be the oldest example in Britain.

#### North America

In the late 18th century, a mailbox was set up at the current location of Boxtree Rd. and Lewis Rd in East Quogue, NY. It is the oldest recorded mailbox in the U.S..

In 1863, with the creation of Free City Delivery, U.S. postal carriers began delivering mail to home addresses. During the nineteenth and early 20th centuries, mailmen knocked on the door and waited patiently for someone to answer. Efficiency experts estimated that each mailman lost 1.5 hours each day just waiting for patrons to come to the door. Slowly, homeowners and businesses began to install mail slots (letterboxes) to receive mail when they were either not at home or unable to answer the door.

To reduce the time required for the mail carrier to complete delivery when the front door is some distance from the street, it was proposed that individual residential or commercial mailboxes be mounted curbside on suitable posts or other supports, particularly in rural areas. In the U.S.A, curbside mailboxes were originally seen as a method of solving the problem of delivering mail with limited numbers of mail carriers using horse-drawn wagons (and later, motor vehicles) to many widely-scattered rural customers. Before the introduction



A suburban curbside letterbox.



An attached or wall-mount letterbox, with a hook underneath for newspapers. This mailbox is located in Calgary, Canada.

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of rural free delivery (RFD) by the U.S. Post Office in 1896, and in Canada in 1908, many rural residents either had no access to public mail delivery, or had to pick up their mail at a post office located many miles from their homes. Consequently, curbside mailboxes did not become popular in North America until free home mail delivery was an established service. Even then, farmers and rural homeowners at first resisted the purchase of dedicated mailboxes, often using empty bushel baskets, tins, and wooden boxes in which to collect their mail. Not until 1923 did the U.S. Post Office finally mandate that every household have a mailbox or mail slot in order to receive home delivery of mail.

Curbside 'full-service' mailboxes were soon fitted with a signal flag or semaphore arm - usually red or fluorescent orange. Originally, this flag was raised not only by the resident of the property to notify the postman of outgoing mail, but also by the postman to inform the recipient that incoming mail had been delivered - a convenience to all during periods of inclement weather.

In 1915, the familiar U.S. curbside mailbox with its curved, tunnel-shape top (to prevent water and snow collection), latching door, and movable signal flag was designed by U.S. Post Office employee Roy J. Joroleman.

Joroleman's design, approved by the U.S. Postmaster General, was eventually released free of charge by the Post Office for inexpensive duplication by mailbox manufacturers; it has been the top-selling U.S. curbside mailbox ever since, and was also used by some rural residents in Canada before most rural door-to-door mail delivery was discontinued in that country. The Joroleman mailbox has been both exalted as a supreme manifestation of American functionalist industrial design, and excoriated by others as a 'Quonset hut on a stick'.

In order to promote uniformity, as well as the convenient and rapid delivery of the mail, the United States Post Office Department, (later the United States Postal Service, or USPS) retained the authority to approve the size and other characteristics of all mail receptacles, whether mailboxes or mail slots, for use in delivery of the U.S. mails, and issued specifications for curbside mailbox construction for use by manufacturers. Approved mailboxes from the latter are always stamped U.S. Mail and Approved by the Postmaster General. These standards have resulted in inevitable limitations on product diversity and design, though new materials, shapes, and features have appeared in recent years.

Since 1971, steady increases in postal service costs have motivated the USPS to insist on either curbside or centralized mail delivery for new suburban neighborhoods and developments. The USPS usually makes curbside deliveries to one side of the road only, often requiring elderly or disabled people to cross hazardous busy roads to collect their mail. A 1995 cost delivery study published in a USPS Operations handbook listed per-address annual delivery costs as: Door-to-door, \$243; Curbside, \$154; Cluster Box (centralized mail delivery), \$106.

A number of designs of mail slots have been patented, particularly in the United States.

### Recent developments

In 2001, the USPS first approved designs for locking curbside mailboxes to stem a rise in mail and identity theft. With these secure designs, the incoming mail is placed into a slot or hopper by the mail carrier, where it drops into a secure locked compartment for retrieval by the homeowner (who retains the only key or combination to the lock). Because of the increased risk of vandalism to curbside mailboxes, various vandal-resistant boxes made of resilient plastics or heavy-gauge steel or aluminum plate have also entered the market.

A property containing several homes, apartments, condominiums, or businesses may utilize a community mail station (NDCBU, or Neighborhood Delivery Collection Box Unit), commonly known as a cluster mailbox. These units have multiple compartments for the centralized delivery of mail to

the residents of a building or an entire neighborhood, instead of door-to-door or curbside delivery. A parcel locker for receipt of packages and a separate compartment for outgoing mail are usually built into the station. The mail carrier will have a key to a large door on one side that reaches all the compartments, and the residents or tenants will each have a key to the door into their individual compartment on the other side. Recently, the USPS and Canada Post have engendered controversy by aggressively promoting community mail stations or cluster box installations in new suburban developments and some urban and rural areas as well.

KopparStaden AB, a housing cooperative in Falun, Sweden, has begun to install centralized mail stations with individual letterboxes using electronically-operated doors in its buildings.

### Standards

The European standard for letter boxes, EN 13724:2002 "Postal services - Apertures of private letter boxes and letter plates - Requirements and test methods", replaces earlier national standards such as BS 2911:1974 "Specification for letter plates" or DIN 32617. It specifies among other things:

- that envelope size C4 (229 mm × 324 mm) must be deliverable without bending or damage;
- that the internal volume must be able to hold at least a 40 mm high bundle of C4 envelopes;
- an aperture width of either 230–280 mm (> C4 width) or 325–400 mm (> C4 height);
- an aperture height of 30–35 mm;
- a mounting height of between 0.7 and 1.7 m for the aperture;
- and various privacy, theft-protection, rain protection, vandalism resistance and corrosion-resistance test requirements.

In the U.S.A., the USPS also has established postal delivery guidelines for its various residential and business customers, including mailbox size, location, and identification requirements.

## RURAL DELIVERY SERVICE

Rural delivery service refers to the delivery of mail in what are traditionally considered rural areas. In the United States, rural letter carriers began service with the introduction of Rural Free Delivery in 1891.

Much support for the introduction of a nationwide rural mail delivery service came from the The National Grange of the Order of Patrons of Husbandry, the nation's oldest agricultural organization. Formerly, residents of rural areas had to either travel to a distant post office to pick up their mail, or else pay for delivery by a private carrier. Postmaster General John Wanamaker was ardently in favor of Rural Free Delivery (RFD), as it was originally called, along with many thousands of Americans living in rural communities who wanted to send and receive mail inexpensively. However, the adoption of a nationwide RFD system had many opponents. Some were simply opposed to the cost of the service. Private express carriers thought inexpensive rural mail delivery would eliminate their business, and many town merchants worried the service would reduce farm families' weekly visits to town to obtain goods and merchandise. The Post Office Department first experimented with the idea of rural mail delivery on October 1, 1891 to determine the viability of RFD. They began with five routes covering ten miles, 33 years after free delivery in cities had begun. The first routes to receive RFD during its experimental phase were in

Jefferson County, West Virginia, near Charles Town, Halltown, and Uvilla.

After five years of controversy, RFD finally became an official service in 1896 under President Grover Cleveland. That year, 82 rural routes were put into operation. A massive undertaking, nationwide RFD service took several years to implement, and remains the “biggest and most expensive endeavor” ever instituted by the U.S. postal service.

The service has grown steadily. By 1901, the mileage had increased to over 100,000; the cost was \$1,750,321 and over 37,000 carriers were employed. In 1910 the mileage was 993,068; cost \$36,915,000; carriers 40,997. In 1913 came the introduction of parcel post delivery, which caused another boom in rural deliveries. Parcel post service allowed the distribution of national newspapers and magazines, and was responsible for millions of dollars of sales in mail-order merchandise to customers in rural areas. In 1930 there were 43,278 rural routes serving about 6,875,321 families—that is about 25,471,735 persons. The cost was \$106,338,341. In 1916, the Rural Post “Good” Roads Act authorized federal funds for rural post roads.

Today, as in years past, the rural delivery service uses a network of rural routes traveled by carriers to deliver and pick up mail to and from roadside mailboxes. Formerly, an address for mail to a rural delivery address included both the rural route number and the box number, for example “RR 5, Box 10.” With the creation of the 911 emergency system, it became necessary to discontinue the old rural route numbers in favor of house numbers and street names as used on city routes. This change enabled emergency services to more quickly locate a rural residence.

21

## POST OFFICE

A post office is a facility authorised by a postal system for the posting, receipt, sorting, handling, transmission or delivery of mail.

Post offices offer mail-related services such as post office boxes, postage and packaging supplies. In addition, some post offices offer non-postal services such as passport applications and other government forms, car tax purchase, money orders, and banking services.

Post offices had a main customer service and point of sale area and many offices were directly assigned to Postal code, ZIP code.



The back rooms of a post office are where mail is processed for delivery. Large open spaces for sorting mail were sometimes known as a sorting hall or postal hall. Mail may also be processed in other post offices that are not open to the general public. Over time, sophisticated mail sorting and delivery

equipment has been developed, including Mail Rail.

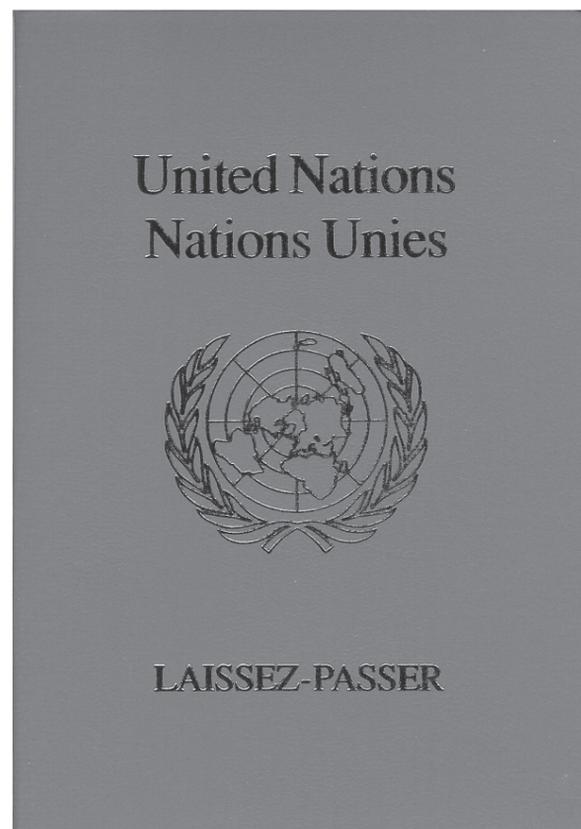
In Commonwealth countries, many of the larger post office buildings in capital cities used the official title of General Post Office. In parts of Europe, special Postal censorship offices were known as Cabinet noir. During wartime, Post Office Rifles were often sent from post offices into battle to deliver messages.

After the turn of the century, dedicated mail exchange facilities became common and postal services colocated customer services with businesses such as newsagents or stations in order to increase convenience for customers and cut costs. As a result, many purpose built post offices became redundant and either fell into misuse or were adaptively reused with whilst retaining the title prefixed by Old or Former for historical and heritage reasons.

22

## PASSPORT

A passport is a document, issued by a national government, which certifies, for the purpose of international travel, the identity and nationality of its holder. The elements of identity are name, date of birth, sex, and place of birth. Most often, nationality and citizenship are congruent.



A passport does not of itself entitle the passport holder entry into another country, nor to consular protection while abroad or any other privileges. It does, however, normally entitle the passport holder to return to the country that issued the passport. Rights to consular protection arise from international agreements, and the right to return arises from the laws of the issuing country. A passport does not represent the right or the place of residence of the passport holder in the country that issued the passport.

### History

One of the earliest known reference to what served the major role of a passport is found in the Hebrew Bible. In Nehemiah 2:7-9, attributed to the time of the Persian Empire in about 450 BC, it is said that Nehemiah, an official serving King Artaxerxes I of Persia, asked leave to travel to Judea, and the king granted leave and gave him a letter “to the governors beyond the river” requesting safe passage for him as he travelled through their lands.

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The United Nations Laissez-Passer is issued to officials of the United Nations

Automatic sorters inside a major postal facility.



In the medieval Islamic Caliphate, a form of passport was used in the form of a *bara'a*, a receipt for taxes paid. Only citizens who paid their *zakah* (for Muslims) or *jizya* (for *Dhimmis*) taxes were permitted to travel to different regions of the Caliphate, thus the *bara'a* receipt was a “traveller’s basic passport.”

It is considered unlikely that the term “passport” is derived from sea ports, but rather from a medieval document required to pass through the gate (“*porte*”) of a city wall. In medieval Europe, such documents were issued to travellers by local authorities, and generally contained a list of towns and cities into which a document holder was permitted to pass. On the whole, documents were not required for travel to sea ports, which were considered open trading points, but documents were required to travel inland from sea ports.

King Henry V of England is credited with having invented what some consider the first true passport, notwithstanding the earlier examples cited, as a means of helping his subjects prove who they were in foreign lands.

The rapid expansion of rail travel in Europe from the mid-nineteenth century led to a breakdown of the European passport system of the early part of the nineteenth century. The speed of trains, as well as the numbers of passengers that crossed many borders, made enforcement of passport laws difficult. The general reaction was the relaxation of passport requirements. In the later part of the nineteenth century and up to World War I, passports were not required, on the whole, for travel within Europe, and crossing a border was straightforward. Consequently, comparatively few people had passports. The Ottoman Empire and the Russian Empire maintained passport requirements for international travel, in addition to an internal-passport system to control travel within their borders.

Early passports included a description of the passport holder. Photographs began to be attached to passports in the early decades of the twentieth century, when photography became widespread.

During World War I, European governments introduced border passport requirements for security reasons (to keep out spies) and to control the emigration of citizens with useful skills, retaining potential manpower. These controls remained in place after the war, and became standard procedure, though not without controversy. British tourists of the 1920s complained, especially about attached photographs and physical descriptions, which they considered led to a “nasty dehumanisation”.

In 1920, the League of Nations held a conference on passports and through tickets. Passport guidelines and a general booklet design resulted from the conference, which was followed up by conferences in 1926 and 1927.

The United Nations held a travel conference in 1963, but passport guidelines did not result from it. Passport standardisation came about in 1980, under the auspices of the International Civil Aviation Organisation (ICAO).

## Types

A rough standardization exists in types of passports throughout the world, although passport types, number of pages and definitions can vary by country.

### Full passports

— Ordinary passport, [Tourist passport, Regular passport, Passport]

Issued to citizens and generally the most-issued type of passport. Sometimes it is possible to have children registered within the ordinary passport of the parent, rendering the passport functionally equal to a family passport.

— Official passport [Service passport]

Issued to government employees for work-related travel, and to accompanying dependents.

— Diplomatic passport

Issued to diplomats for work-related travel, and to accompanying dependents. Although most diplomats with diplomatic immunity carry diplomatic passports, having a diplomatic passport is not the equivalent of having diplomatic immunity. A grant of diplomatic status, a privilege of which is diplomatic immunity, has to come from the government of the country in relation to which diplomatic status is claimed. Also, having a diplomatic passport does not mean visa-free travel. A holder of a diplomatic passport usually has to obtain a diplomatic visa, even if a holder of an ordinary passport may enter a country visa-free or may obtain a visa on arrival.

In exceptional circumstances, a diplomatic passport is given to a foreign citizen with no passport of his own, such as an exiled VIP who lives, by invitation, in a foreign country.

— Emergency passport [Temporary passport]

Issued to persons whose passports were lost or stolen, and who do not have time to obtain replacement passports. Sometimes *laissez-passer* are used for this purpose.

— Collective passport

Issued to defined groups for travel together to particular destinations, such as a group of school children on a school trip to a specified country.

— Family passport

Issued to family members—father, mother, son, daughter. There is one passport holder. The passport holder may travel alone or with one or more other family members. A family member who is not the passport holder cannot use the passport for travel unless accompanied by the passport holder.

### Travel documents in passport-booklet form

— *Laissez-passer*

It is issued by national governments as an emergency passport, or for travel on humanitarian grounds. *Laissez-passer* are also issued by international organisations (most notably, the U.N.) to their officers and employees for official travel.

— Certificate of identity, [Alien’s passport]

A document issued under certain circumstances -such as statelessness- to non-citizen residents. An example of this is the “Nansen passport”. Sometimes alien’s passports are issued as internal passport to non-residents.

— Refugee travel document

Document issued to a refugee by the state in which she or he normally resides allowing him or her to travel outside that state and to return there. Refugees are unlikely to be able to obtain passports from their state of nationality (from which they have sought asylum) and therefore need travel documents so that they might engage in international travel.

— Internal passport

Issued by some countries a identity document to keep of migration within a country. Examples are the internal passport of Russia, or the *hukou* residence-registration system in mainland China, both dating back to imperial times.

— Camouflage and Fantasy Passport

A Camouflage passport is a document that appears to be a regular passport but is actually in the name of a country that no longer exists, never existed, or the previous name a country that has changed its name. Companies that sell camouflage passports make the rather dubious claim that in the event of a hijacking they could be shown to terrorists to aid escape. There is no known instance of this happening. Because a camouflage passport is not issued in the name of a real country, it is not a counterfeit and is not illegal per se to have. However attempting to use it to actually enter a country would be illegal in most jurisdictions.

— A fantasy passport is likewise a document not issued by a recognized government and invalid for legitimate travel. Fantasy passports are distinguished from camouflage passports in that they are issued by an actual, existent group, organization, or tribe. In some cases the goal of the fantasy passport is to make a political statement or to denote membership in the organization. In other cases they are issued more or less as a joke or for novelty souvenir purposes, such as those sold as “Conch Republic” passports.

### **International Civil Aviation Organization Standards**

The International Civil Aviation Organization (ICAO) issues passport standards which are treated as recommendations to national governments.

#### — Standard passport format

The standard passport format includes the name of the issuing country on a passport cover, a national symbol, a description of the document (e.g., passport, official passport, diplomatic passport), and -if the passport is biometric- the biometric passport symbol. Inside, there is a title page, also naming the country. This is followed by a data page, on which there is information about the bearer and the issuing authority, although passports of some European Union member states provide that information on the inside back cover. There are blank pages available for foreign countries to affix visas, and to stamp for entries and exit. Passports have numerical or alphanumerical designators (“serial number”) assigned by the issuing authority.

#### — Machine-readable passport standards

Standards for machine-readable passports have also been issued by the ICAO, with an area set aside where most of the information written as text is also printed in a manner suitable for optical character recognition.

#### — e-Passport standards

To conform with ICAO standards, a biometric passport has an embedded contactless smart card, which contains data about the passport holder, a photograph in digital format, and data about the passport itself. Many countries now issue biometric passports. The objectives for the biometric passports are to speed up clearance through immigration and the prevention of identity fraud. These reasons are disputed by privacy advocates.

### **Passport message**

A passport contains a message, usually near the front of a passport, requesting that the bearer of the passport be allowed to pass freely, and further requests that, in the event of need, the bearer be granted assistance. The message is sometimes made in the name of the government or the head of state, notionally by the foreign minister or another representative of the government, often on behalf of the head of state. The message may be written in more than one language, depending on the language policies of the issuing authority. For example, the English passport message in a Philippine passport is:

The Government of the Republic of the Philippines requests all concerned authorities to permit the bearer, a citizen of the Philippines, to pass safely and freely and in case of need to give him/her all lawful aid and protection.

Other examples: United Kingdom; United States. However, such a message is not always present, for instance not in Norwegian passports.

### **Limitations on passport use**

Most countries accept passports of other countries as valid for international travel and valid for entry. There are exceptions, such as when a country does not recognise the passport-issuing

country as a sovereign state. Likewise, the passport-issuing country may also stamp restrictions on the passports of its citizens not to go to certain countries due to poor or non-existent foreign relations, or security or health risks.

### **Asia**

#### China and Taiwan

The People’s Republic of China (PRC) and the Republic of China (ROC) do not recognise each other as sovereign states. They both claim themselves as the only legal government representing the whole China.

Consistent with the 1992 Consensus, the PRC and ROC legally consider both citizens in mainland China and Taiwan as their own citizens, but residing in different areas of the same country. Neither the PRC nor the ROC accepts passports issued by the other as entry documents.

Citizens in Taiwan use identity documents issued by PRC public-security authorities to enter mainland China. Citizens in mainland China entering Taiwan must also use identity documents issued by the ROC authority, and have their mainland documents surrendered. The identity documents cannot be used for international travel, and an endorsement must be obtained separately to enable travel.

The ROC used to require its citizens who intended travel to mainland China to obtain official approval for the travel, and prescribed an administrative fine of NT\$20,000 to NT\$100,000 for those who did not. However, the fine was often unenforceable because such travel was untraceable by examination of travel documents, except if an ROC citizen lost his ROC passport while on the mainland, and, so, had to report the loss. The official-approval requirement was abolished, except in relation to ROC officials, of whom applications are required.

#### Hong Kong and Macau

Hong Kong and Macau, special administrative regions of the People’s Republic of China, are each empowered by the Central People’s Government under their respective Basic Laws to issue passports. A Hong Kong Special Administrative Region passport states that the holder is a Chinese national with the right of abode in Hong Kong. Similarly, a Macao Special Administrative Region passport states that the bearer is a Chinese national with the right of abode in Macau.

Hong Kong and Macau each maintains border controls at all points of entry, including at the border with mainland China. Travel to and from mainland China as well as between the SARs is known as “interregional travel” and not considered as international travel. Permanent residents of the SARs can use their identity cards to travel between the SARs.

The Public Security Bureau of Guangdong, the province adjacent to Hong Kong and Macau, issues a permit, dubbed the Home Return Permit, to Chinese citizens domiciled in Hong Kong and Macau, to allow them to enter and exit the mainland. The Hong Kong Special Administrative Region passport and the Macao Special Administrative Region passport are for purposes of international travel rather than interregional travel within the PRC; a proposal that the Hong Kong Special Administrative Region passport should supplant this permit was dismissed.

Many Chinese citizens who have the right of abode in Hong Kong hold British National (Overseas) passports or British Citizen passports issued under the British Nationality Selection Scheme effected by the United Kingdom in the 1990s. The PRC, for its part, considers such Chinese citizens domiciled in Hong Kong to be solely PRC citizens. The PRC does not recognise those BN(O) passports, and does not recognise the attendant United Kingdom nationality of each, inasmuch as PRC law does not permit dual nationality. Chinese citizens domiciled in Hong Kong who hold those BN(O) and BC passports use a Home Return Permit to enter mainland China as those who do not. It is impermissible under Chinese law to renounce PRC nationality on the basis of holding a form of British nationality obtained in HK.

A Chinese citizen who has the right of abode in Hong Kong may not use a BN(O) passport or an HKSAR passport in its own right for entering Taiwan. They must be used in conjunction with the Exit & Entry Permit issued by the ROC. In contrast, a British Citizen passport obtained in Hong Kong by a Chinese citizen (or a person of Chinese descent) domiciled in Hong Kong may be used in its own right to enter Taiwan. A person with the right of abode in Hong Kong, a Hong Kong resident who holds a [Document of Identity for Visa Purposes], a person who has the right to land, a person who is on unconditional stay in Hong Kong, and a non-permanent resident who has a notification label, may use his smart ID card for immigration purposes, that is, to enter and exit Hong Kong. A smart ID card may not be used by a person who is under eleven years old, other than at the Lo Wu crossing.

Mainland China residents visiting Hong Kong or Macau are required to hold a Exit-entry Permit for Travelling to and from Hong Kong and Macau (往来港澳通行或双程) issued by mainland authorities, along with an endorsement (注), also issued by mainland authorities, on the Exit-entry Permit which needs to be applied each time (similar to a visa) when visiting the SARs. Mainland residents settling in Hong Kong and or Macau (subjecting to a daily quota) are issued One-way Permit (前往港澳通行或程). Mainland residents transiting Hong Kong or Macau to or from third countries may enter Hong Kong or Macau for 7 days using a Chinese passport.

ROC citizens who travel to Hong Kong apply for entry permits and collect them at airline counters. Repeat travellers satisfying certain conditions may apply online up to twice a month, but it is proposed that such restrictions may be relaxed.

#### Israel

In Israel's first years, Israeli passports bore the stamp "not valid for Germany", as in the aftermath of the Holocaust it was considered improper for Israelis to visit Germany on any but official state business (for which the government issued special passports to "authorized personnel"). With the gradual normalization of Germany-Israel relations this limitation was removed from Israeli passports.

Some Muslim and African countries do not permit entry to people using an Israeli passport. In addition, Iran, Kuwait, Lebanon, Libya, Saudi Arabia, Sudan, Syria and Yemen go further and do not allow entry to people with evidence of travel to Israel, or whose passports have a used or an unused Israeli visa.

To circumvent this travel restriction, Israel did not require visitors to have passports stamped with Israeli visas or with Israeli entry and exit stamps. The procedure made it impossible to tell if a traveller had entered Israel. However, since September 2006, Israeli immigration officials will rarely agree not to stamp passports. The countries which do not allow entry to people with evidence of travel to Israel are aware of the entry and exit stamps stamped in passports by Egypt and Jordan at their respective land borders with Israel. Non-allowing countries prohibit entry based on the presence of a tell-tale Egyptian or Jordanian stamp. A traveller, for example, would be denied entry based on the presence of an Egyptian stamp, in his passport, which indicates that he crossed into or out of Egypt at Taba on the Egyptian-Israeli border.

Furthermore, under Israeli law, Lebanon, Syria, Saudi Arabia, Iraq, and Yemen are classified as "enemy countries" and an Israeli citizen may not visit them without a special permit issued by the Israeli minister of the Interior. An Israeli who visits these countries, whether using an Israeli passport or not, may be prosecuted when returning to Israel. This list was set in 1954, and Egypt and Jordan were taken off the list when they signed a peace treaty with Israel.

#### Pakistan

Initially on Pakistani passport there was a printed list of countries which can be visited. But nowadays there was a statement printed on Pakistani passports that they are valid for all countries except Israel. Furthermore on page 2 of machine readable passports the religion of passport holder is mentioned.

#### Philippines

Since 2004, the Philippine Department of Foreign Affairs deemed that bearers of its passports can't travel to Iraq due to the security threats in that country. As such, Philippine passports issued from that time are stamped "Not valid for travel to Iraq".

#### South Korea

From South Korea's viewpoint, travel from the section of the Korean peninsula under South Korean administration directly to the section of the Korean peninsula under North Korean administration is not international travel. South Korea claims by its constitution the whole Korean peninsula as its territory. However, for security reasons, any South Korean who is willing to travel to the tourist area in the North has to carry their passport.

#### Europe

##### Austria

After the fall of the Habsburg monarchy in 1918 and the establishment of the Austrian Republic, members of the former Imperial Family were exiled and forbidden to enter Austrian territory. Nevertheless, they remained Austrian citizens entitled to bear an Austrian passport. Such passports were unique in bearing the stamp stating that "this passport is valid for all countries except for Austria". The Habsburgs' exile was eventually overturned by the European Court of Human Rights and these special type of passport along with it.

##### Northern Cyprus and Republic of Cyprus

The Turkish Republic of Northern Cyprus (TRNC) issues passports, but only Turkey recognises its statehood. TRNC passports are not accepted for entry into the Republic of Cyprus via airports or sea ports, but are accepted at the designated green line crossing points. However, all Turkish Cypriots are entitled by law to the issue of a Republic of Cyprus EU passport, since the opening of the borders between the two republics, Cypriot and EU citizens can travel freely to the divided sides.

The United Kingdom, United States of America, Pakistan, Azerbaijan and Syria currently officially accept TRNC passports with the relevant visas.

Until 2003, Turkey did not accept passports issued by the Republic of Cyprus, because the Turkish Republic of Northern Cyprus does not recognize the Republic of Cyprus. Presently, Turkey accepts Greek Cypriot passports, but does not stamp them. Rather, Turkish immigration officials stamp a separate visa issued by Turkey.

The Republic of Turkey issues Turkish Republic of Northern Cyprus citizens with Turkish passports upon request to ease the travel restrictions which the TRNC passport imposes. The Republic of Cyprus, however, does not accept Turkish (Republic of Turkey) issued passports in any circumstances.

The Republic of Cyprus refuses entry to holders of Yugoslav passports which bear a renewal stamp with "Macedonia".

##### Spain and Gibraltar

Spain does not accept United Kingdom passports issued in Gibraltar, on the ground that the Government of Gibraltar is not a competent authority for issuing UK passports. Consequently, some Gibraltarians were refused entry to Spain. The word "Gibraltar" now appears beneath the words "United Kingdom of Great Britain and Northern Ireland" on passport covers, which is the usual format for passports of British overseas territories.

#### North America

##### United States

U.S. Department of the Treasury regulations require that persons subject to U.S. jurisdiction be licensed in order to engage in any travel-related transactions pursuant to travel to, from, and within Cuba. Transactions related to tourist travel are not licensable. This restriction includes tourist travel to Cuba from

or through a third country such as Mexico or Canada.

Some passports are issued for military dependents to travel to and from a foreign destination with a restriction stamp stating that the passport is only valid for official travel purposes. Further, said passports are valid only for five years from date of issue as opposed to ten years for adults.

**Oceania**

**Tonga**

Some countries decline to accept Tongan Protected Person passports, though they accept Tongan citizen passports. Tongan Protected Person passports are sold by the Government of Tonga to anyone who is not a Tongan national. A holder of a Tongan Protected Person passport is forbidden to enter or settle in Tonga. Generally, those holders are refugees, stateless persons, and individuals who for political reasons do not have access to any other passport-issuing authority.

**South America**

**Brazil**

Some countries do not maintain diplomatic relations with Brazil; therefore, Diplomatic, Official and Work Passports are not accepted and visas are only granted to tourist or business visitors, under Brazilian “laissez-passer”. The countries included in this group are: Bhutan, Central African Republic and Taiwan.

**Immigration stamps in passports**

For immigration control, immigration officials of many countries stamp passports with entry and exit stamps. A stamp can serve different purposes. In the United Kingdom, an immigration stamp in a passport includes the formal leave to enter granted to a person subject to entry control. Otherwise, a stamp activates or acknowledges the continuing leave conferred in the passport bearer’s entry clearance.

Under the Schengen system, a foreign passport is stamped with a date stamp which does not indicate any duration of stay. This stamp is taken to mean that the person is deemed to have permission to remain either for three months or for the period shown on his visa (whichever is shorter).

Member states of the European Union are not permitted to place a stamp in the passport of a person who is not subject to immigration control, such as a national of that country, a national of another EU member state or a non-EU national family member of an EU national who is seeking entry in conformity with EU Directive 2004/38/EC. Stamping is prohibited because a passport stamp is imposition of a control that the person is not subject to. This concept is not applicable in countries outside the EU, where a stamp in a passport may simply acknowledge the entry or exit of a person.

Countries have different styles of stamps for entries and exits, to make it easy to identify the movements of persons. The shape of the stamp and the colour of the ink may also provide information about movements (whether departure or arrival). In Hong Kong, prior to and immediately after the 1997 transfer of sovereignty, entry and exit stamps were identical at all ports of entry, but colours differed. Airport stamps used black ink, land stamps used red ink, and sea stamps used purple ink. In Macau, under Portuguese administration, the same colour of ink was used for all stamps. The stamps had slightly-different borders to indicate entry and exit by air, land, or sea. In several countries the stamps or its colour are different if the person arrived in a car as opposed to bus/boat/train/air passenger. Countries can vary the shape of their stamps to indicate the length of stay like Singapore where a perfectly rectangular stamp indicates a 14-day stay, rounded rectangular stamp indicates a 30-day stay or a hexagonal stamp indicates a 90-day stay.

Immigration stamps are a useful reminder of travels. Some travellers “collect” immigration stamps in passports, and

will choose to enter or exit countries via different means (for example, land, sea or air) in order to have different stamps in their passports.

Visas often take the form of a stamp, although many countries now use adhesive stickers that incorporate security features to prevent forgery.

**TRAVEL DOCUMENT**

A travel document is an identity document issued by a government or international treaty organization to facilitate the movement of individuals or small groups of persons across international boundaries. Travel documents usually assure other governments that the bearer may return to the issuing country, and are often issued in booklet form to allow other governments to place visas as well as entry and exit stamps into them. The most common travel document is a passport, which usually identifies the bearer as a citizen of the issuing country. However, the term is sometimes used only for those documents which do not bear proof of nationality, such as the Refugee Travel Document.



**Passport**

In general, a passport is a travel document that also serves as proof of citizenship from the issuing country. Although generally accepted by the majority of countries in the world, some issuing countries expressly exclude the validity of passports from nations that are not recognized by their governments.

**Laissez-Passer/Emergency passports**

A laissez-passer (from the French let pass) is a travel document issued by a national government or certain international organizations, such as the United Nations, European Union and the International Committee of the Red Cross (ICRC). A laissez-passer is often for one-way travel to the issuing country for humanitarian reasons only. Some national governments issue laissez-passers to their own nationals as emergency passports.

Others issue them to people who are stateless, or who are unable to obtain a passport from their own government, or whose government is not recognized by the issuing country.

Historically, laissez-passers were commonly issued during wartime and at other periods, literally acting as a pass to allow travel to specific areas, or out of war zones or countries for various officials, diplomatic agents, other representatives or citizens of third countries. In these contexts, a laissez-passer would frequently include quite specific and limited freedom of movement. The form and issuing authority would be more or less standardized, depending on the circumstances.

An example is when in the early 1950s, the Iraqi government granted permission to its 120 thousand Jewish citizens to leave (Operation Ezra and Nehemiah), conditional on their renouncement of their citizenship and leaving behind all their properties and assets. The travel document that was issued was the laissez-passer, since an Iraqi passport was no longer possible.

## UN travel documents

The United Nations (and the International Labour Organization) issue a laissez-passer to officials and members of the UN and other specialized agencies as well as to several international organizations. The laissez-passer is also issued to their families for official use. The United Nations Laissez-Passer is similar to a passport, and is generally recognized worldwide, although some countries will not accept the document as sufficient to gain entry. It does not generally confer diplomatic immunity, but may confer limited immunities and privileges.

Between 2000 and 2010, the United Nations Interim Administration Mission in Kosovo (UNMIK) issued travel documents to residents of Kosovo as they were often not able to obtain a passport through other channels.

## Aliens and refugees

- Refugee travel document (formally: 1951 Convention travel document) are passport-like booklets issued by national governments to refugees under the 1951 Convention Relating to the Status of Refugees.
- 1954 Convention travel documents are similar documents issued to stateless persons under the 1954 Convention Relating to the Status of Stateless Persons. The document is the successor of the (now defunct) League of Nations' Nansen passport.
- Alien's passports and certificates of identity are passport-like booklets issued by national governments to resident foreigners, other than those issued under the 1951 and 1954 conventions mentioned above. However, some governments issue certificates of identity to their own nationals as emergency passports.

## Other documents as travel documents

### National Identity Card

Identity cards are generally issued as a means of identification within a country, but can often also be used as a travel document. For example, complying National Identity Cards of the European Union can be used unrestricted in more than 20 countries. Also the U.S. passport card can be regarded an identity card fit for international travel.

### Driver's licence

Driver's licenses are generally not considered travel documents, since they bear no information on nationality and conditions which would lead to refusal of a travel document have generally not been tested. However, in several provinces of Canada and U.S. states, nationals/citizens can -upon payment of an extra

fee and additional information regarding- receive an Enhanced Drivers License which enables border crossing between Canada and the U.S. by land.

### De facto travel documents

De facto travel documents are documents which in practice will be sufficient to cross borders legally, but with no legal status as a travel document. Within the Border Controls in the Common Travel Area, travel between Ireland, the United Kingdom, the British Crown Dependencies, Isle of Man and Channel Islands, no travel documents is required by British or Irish citizens. As this requirement does not hold for others, these citizens have to establish the presumption of having this nationality, which requires in practice some form of identification. The documents used for this purpose (most notably: driver's license) are thus de facto travel documents.

## FREEDOM OF MOVEMENT

Freedom of movement, mobility rights or the right to travel is a human rights concept that the constitutions of numerous states respect. It asserts that a citizen of a state, in which that citizen is present has the liberty to travel, reside in, and/or work in any part of the state where one pleases within the limits of respect for the liberty and rights of others, and to leave that state and return at any time. Some immigrants' rights advocates assert that human beings have a fundamental human right to mobility not only within a state but between states.

### Common limitations

Nevertheless, restrictions on international freedom of movement (immigration or emigration) are commonplace. Within countries, freedom of movement is often more limited for minors, and penal law can modify this right as it applies to persons charged with or convicted of crimes (for instance, parole, probation, registration). In some countries, freedom of movement has historically been limited for women, and for members of disfavored racial and social groups. Circumstances, both legal and practical, may operate to limit this freedom. For example, a nation that is generally permissive with respect to travel may restrict that right during time of war. In some instances, the laws of a nation may assert a guarantee of this right, but lawless conditions may make unfettered movement impossible. In other instances, a nation whose written laws codify such rights may fail to actually provide them. Other common political-legal restrictions on freedom of movement are:

- national and regional official minimum wage tariff barriers to labour market entry (free movement or migration of workers);
- official identity cards (internal passports, citizenship licenses) that must be carried and produced on demand;
- obligations on persons to register change of address or partner with the state authorities;
- protectionist local-regional barriers to housebuilding and therefore settlement in particular districts;
- road toll barriers to the free movement of persons by motor cars.

### Philosophical grounds for a right to move

Scholars have attempted to base a universal "right to move" on several philosophical grounds, including the idea of a common ownership of the earth, a natural right of movement existing prior to the advent of nation states, an ethics of cosmopolitanism, and utilitarian notions of the benefits of immigration to both receiving countries and immigrants.



**Freedom of movement between private parties**  
 Freedom of movement is not construed as a right to permit an individual to enter private property of another. Such an unauthorized entry constitutes a trespass, often punishable as a tort or a crime, for which the private landowner can summon public officials to remove a trespasser from the landowner's property. In some jurisdictions, questions have arisen as to the extent to which a private owner of land can exclude certain persons from land used for public purposes, such as a shopping mall or a park. There is also a rule of law that a landowner whose property is completely boxed in by that of other private landowners shall have the right to cross private land if that is necessary to reach a public thoroughfare. The concept is also used as the basis for enacting laws to prevent alternate use of streets, roads and right-of-ways from blocking or restricting freedom of movement such as block parties and playing basketball. There is a converse duty for a private person not to impede the free movement of another. Where a person prevents another from freely leaving an area, either by physically imprisoning them or by threats, that person may be subject to a lawsuit for false imprisonment, and to criminal charges for kidnapping.

a showing of damages. Simply the "intermeddling with or use of...the personal property" of another gives cause of action for trespass. Since *CompuServe Inc. v. Cyber Promotions*, various courts have applied the principles of trespass to chattel to resolve cases involving unsolicited bulk e-mail and unauthorized server usage.

Trespass to land, the form of trespass most associated with the term trespass, refers to the "wrongful interference with one's possessory rights in [real] property." Generally, it is not necessary to prove harm to a possessor's legally protected interest; liability for unintentional trespass varies by jurisdiction. "[A]t common law, every unauthorized entry upon the soil of another was a trespasser", however, under the tort scheme established by the Restatement of Torts, liability for unintentional intrusions arises only under circumstances evincing negligence or where the intrusion involved a highly dangerous activity.

### Trespass to the person

There are three types of trespass, the first of which is trespass to the person. Whether intent is a necessary element of trespass to the person varies by jurisdiction. Under English decision, *Letang v Cooper*, intent is required to sustain a trespass to the person cause of action; in the absence of intent, negligence is the appropriate tort. In other jurisdictions, gross negligence is sufficient to sustain a trespass to the person, such as when a defendant negligently operates an automobile and strikes the plaintiff with great force. "Intent is to be presumed from the act itself." Generally, trespass to the person consists of three torts: assault, battery, and false imprisonment.

### Trespass to Chattels

Trespass to chattels, also known as trespass to goods or trespass to personal property, is defined as "an intentional interference with the possession of personal property...proximately caus[ing] injury." While originally a remedy for the asportation of personal property, the tort grew to incorporate any interference with the personal property of another. In some jurisdictions, such as the United Kingdom, trespass to chattels has been codified to clearly define the scope of the remedy; in most jurisdictions, trespass to chattel remains a purely common law remedy, the scope of which varies by jurisdiction.

## TRESPASS

Trespass is an area of tort law broadly divided into three groups: trespass to the person, trespass to chattels and trespass to land.

Trespass to the person, historically involved six separate trespasses: threats, assault, battery, wounding, mayhem, and maiming. Through the evolution of the common law in various jurisdictions, and the codification of common law torts, most jurisdictions now broadly recognize three trespasses to the person: assault, which is "any act of such a nature as to excite an apprehension of battery"; battery, "any intentional and unpermitted contact with the plaintiff's person or anything attached to it and practically identified with it"; and false imprisonment, the "unlaw[ful] obstruct[ion] or depriv[ation] of freedom from restraint of movement."

Trespass to chattels, also known as trespass to goods or trespass to personal property, is defined as "an intentional interference with the possession of personal property...proximately caus[ing] injury." Trespass to chattel, does not require

Generally, trespass to chattels possesses three elements:

1. Lack of consent. The interference with the property must be non-consensual. A claim does not lie if, in acquiring the property, the purchaser consents contractually to certain access by the seller. “[A]ny use exceeding the consent” authorized by the contract, should it cause harm, gives rise to a cause for action.
2. Actual harm. The interference with the property must result in actual harm. The threshold for actual harm varies by jurisdiction. In California, for instance, an electronic message may constitute a trespass if the message interferes with the functioning of the computer hardware, but the plaintiff must prove that this interference caused actual hardware damage or actual impaired functioning.
3. Intentionality. The interference must be intentional. What constitutes intention varies by jurisdiction, however, the Restatement (Second) of Torts indicates that “intention is present when an act is done for the purpose of using or otherwise intermeddling with a chattel or with knowledge that such an intermeddling will, to a substantial certainty, result from the act” and continues, “[i]t is not necessary that the actor should know or have reason to know that such intermeddling is a violation of the possessory rights of another.”

Remedies for trespass to chattel include damages, liability for conversion, and injunction, depending on the nature of the interference.

#### Traditional Applications

Trespass to chattels typically applies to tangible property and allows owners of such property to seek relief when a third party intentionally interferes or intermeddles in the owner’s possession of his personal property. “Interference” is often interpreted as the “taking” or “destroying” of goods, but can be as minor as “touching” or “moving” them in the right circumstances. In *Kirk v Gregory*, the defendant moved jewelry from one room to another, where it was stolen. The deceased owner’s executor successfully sued her for trespass to chattel. Furthermore, personal property, as traditionally construed, includes living objects, except where property interests are restricted by law. Thus animals are personal property, but organs are not.

#### Modern Applications

In recent years, trespass to chattels has been expanded in the United States to cover intangible property, including combating the proliferation of unsolicited bulk email as well as virtual property interests in online worlds. In the late 1990s, American courts enlarged trespass to chattels, first to include the unauthorized use of long distance telephone lines, and later to include unsolicited bulk email. In 1998, a federal court in Virginia held that the owner of a marketing company committed trespass to chattels against an Internet service provider’s computer network by sending 60 million unauthorized email advertisements after being notified that the spam was unauthorized. In *America Online, Inc. v. LCGM, Inc.*, AOL successfully sued a pornographic website for spamming AOL customers and forging the AOL domain name to trick customers. By the new millennium, trespass to chattel expanded beyond bulk email. In *eBay v. Bidder’s Edge*, a California court ruled that Bidder’s Edge’s use of a web crawler to cull auction information from eBay’s website constituted trespass to chattel and further, that a plaintiff in such a suit need not prove that the interference was substantial. A number of similar cases followed until, in *Intel v. Hamidi*, the Supreme Court of California held that a plaintiff must demonstrate either actual interference with the physical functionality of the computer system or the likelihood that such interference would occur in the future. The *Hamidi* decision quickly found acceptance at both the federal and state level.

To date, no United States court has identified property rights in items acquired in virtual worlds; heretofore, virtual world providers have relied on end-user license agreements to govern user behavior. Nevertheless, as virtual worlds grow, incidents of property interference, a form of “griefing”, may make trespass to chattel an attractive remedy for deleted, stolen, or corrupted virtual property.

#### Trespass to land

Trespass to land involves the “wrongful interference with one’s possessory rights in [real] property.” It is not necessary to prove that harm was suffered to bring a claim, and is instead actionable per se. While most trespasses to land are intentional, British courts have held liability holds for trespass committed negligently. Similarly, some American courts will only find liability for unintentional intrusions where such intrusions arise under circumstances evincing negligence or involve a highly dangerous activity. Exceptions exist for entering land adjoining a road unintentionally (such as in a car accident), as in *River Wear Commissioners v Adamson*.

##### Subsoil and Airspace

Aside from the surface, land includes the subsoil, airspace and anything permanently attached to the land, such as houses.

##### Subsoil

William Blackstone’s *Commentaries on the Laws of England* articulated the common law principle *cuius est solum eius est usque ad coelum et ad inferos*, translating from Latin as “for whoever owns the soil, it is theirs up to Heaven and down to Hell.” In modern times, courts have limited the right of absolute dominion over the subsurface. For instance, drilling a directional well that bottoms out beneath another’s property to access oil and gas reserves is trespass, but a subsurface invasion by hydraulic fracturing is not. Where mineral rights are severed from surface ownership, it is trespass to use another’s surface to assist in mining the minerals beneath that individual’s property, but, where an emergency responder accesses the subsurface following a blowout and fire, no trespass lies. Even the possible subsurface migration of toxic waste stored underground is not trespass, except where the plaintiff can demonstrate that the actions “actually interfere with the [owner’s] reasonable and foreseeable use of the subsurface[,]” or, in some jurisdictions, that the subsurface trespasser knows with “substantial certainty” that the toxic liquids will migrate to the neighboring land.

##### Airspace

The rights of landowners over airspace are quite limited; in *United States v. Causby et ux.*, Justice Douglas reasoned that, should it find in the plaintiff/respondent’s favor and accept the “ancient doctrine that at common law ownership of land extend[s] to the periphery of the universe — *Cujus est solum ejus est usque ad coelum*[,]” “every transcontinental flight would subject the operator to countless trespass suits.” Additionally, the Air Commerce Act of 1926 gave the United States government “exclusive sovereignty of airspace of the United States.” Thirty one years later, in *Bernstein v Skyviews & General Ltd*, an English court reached a similar conclusion, finding an action for trespass failed because the violation of airspace took place several hundred meters above the land: “[i]f the latin [sic] maxim were applied literally it would lead to the absurdity of trespass being committed every time a satellite passed over a suburban garden.” Parliament subsequently reinforced *Bernstein* in the Civil Aviation Act 1982, providing that it is not trespass if the aircraft is flying at a reasonable height. Objects hovering above a person’s property, though attached to the ground, may constitute trespass. An overhanging crane can constitute trespass, as in *Woolerton v Costain*, as can an 8 foot advertising sign, as in *Kelsen v Imperial Tobacco Co*. However, should the overhang fail to generate actual harm, the court may deny a plaintiff equitable relief despite the technical trespass.

## INTANGIBLE PROPERTY

Intangible property, also known as incorporeal property, describes something which a person or corporation can have ownership of and can transfer ownership of to another person or corporation, but has no physical substance. It generally refers to statutory creations such as copyright, trademarks, or patents. It excludes tangible property like real property (land, buildings and fixtures) and personal property (ships, automobiles, tools, etc.). In some jurisdictions intangible property are referred to as choses in action. Intangible property is used in distinction to tangible property. It is useful to note that there are two forms of intangible property - legal intangible property (which is discussed here) and competitive intangible property (which is the source from which legal intangible property is created but cannot be owned, extinguished, or transferred). Competitive intangible property disobeys the intellectual property test of voluntary extinguishment and therefore results in the sources that create intellectual property (knowledge in its source form, collaboration, process-engagement, etc) escaping quantification.

Generally, ownership of intangible property gives the owner a set of legally enforceable rights over reproduction of personal property containing certain content. For example, a copyright owner can control the reproduction of the work forming the copyright. However, the intangible property forms a set of rights separate from the tangible property that carries the rights. For example, the owner of a copyright can control the printing of books containing the content, but the book itself is personal property which can be bought and sold without concern over the rights of the copyright holder.

In English law and other Commonwealth legal systems, intangible property is traditionally divided in pure intangibles (such as debts, intellectual property rights and goodwill) and documentary intangibles, which obtain their character through the medium of a document (such as a bill of lading, promissory note or bill of exchange). The recent rise of electronic documents has blurred the distinction between pure intangibles and documentary intangibles.

See also

Industrial property  
Intellectual property  
Important Intangible Cultural Properties

## INTELLECTUAL PROPERTY

Intellectual property (IP) is a term referring to a number of distinct types of creations of the mind for which property rights are recognised—and the corresponding fields of law. Under intellectual property law, owners are granted certain exclusive rights to a variety of intangible assets, such as musical, literary, and artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Common types of intellectual property include copyrights, trademarks, patents, industrial design rights and trade secrets in some jurisdictions.

Although many of the legal principles governing intellectual property have evolved over centuries, it was not until the 19th century that the term intellectual property began to be used, and not until the late 20th century that it became commonplace in the United States. The British Statute of Anne 1710 and the Statute of Monopolies 1623 are now seen as the

origin of copyright and patent law respectively.

### History

Modern usage of the term intellectual property goes back at least as far as 1888 with the founding in Bern of the Swiss Federal Office for Intellectual Property (the Bureau fédéral de la propriété intellectuelle). When the administrative secretariats established by the Paris Convention (1883) and the Berne Convention (1886) merged in 1893, they also located in Berne, and also adopted the term intellectual property in their new combined title, the United International Bureaux for the Protection of Intellectual Property. The organisation subsequently relocated to Geneva in 1960, and was succeeded in 1967 with the establishment of the World Intellectual Property Organization (WIPO) by treaty as an agency of the United Nations. According to Lemley, it was only at this point that the term really began to be used in the United States (which had not been a party to the Berne Convention), and it did not enter popular usage until passage of the Bayh-Dole Act in 1980.

“The history of patents does not begin with inventions, but rather with royal grants by Queen Elizabeth I (1558-1603) for monopoly privileges... Approximately 200 years after the end of Elizabeth’s reign, however, a patent represents a legal [right] obtained by an inventor providing for exclusive control over the production and sale of his mechanical or scientific invention... [demonstrating] the evolution of patents from royal prerogative to common-law doctrine.”

In an 1818 collection of his writings, the French liberal theorist, Benjamin Constant, argued against the recently introduced idea of “property which has been called intellectual.” The term intellectual property can be found used in an October 1845 Massachusetts Circuit Court ruling in the patent case *Davoll et al. v. Brown.*, in which Justice Charles L. Woodbury wrote that “only in this way can we protect intellectual property, the labors of the mind, productions and interests are as much a man’s own...as the wheat he cultivates, or the flocks he rears.” (1 Woodb. & M. 53, 3 West.L.J. 151, 7 F.Cas. 197, No. 3662, 2 Robb.Pat.Cas. 303, Merw.Pat.Inv. 414). The statement that “discoveries are...property” goes back earlier. Section 1 of the French law of 1791 stated, “All new discoveries are the property of the author; to assure the inventor the property and temporary enjoyment of his discovery, there shall be delivered to him a patent for five, ten or fifteen years.” In Europe, French author A. Nion mentioned *propriété intellectuelle* in his *Droits civils des auteurs, artistes et inventeurs*, published in 1846.

The concept’s origins can potentially be traced back further. Jewish law includes several considerations whose effects are similar to those of modern intellectual property laws, though the notion of intellectual creations as property does not seem to exist – notably the principle of *Hasagat Ge’vul* (unfair encroachment) was used to justify limited-term publisher (but not author) copyright in the 16th century. The Talmud contains the prohibitions against certain mental crimes (further elaborated in the *Shulchan Aruch*), notably *Geneivat da’at*, literally “mind theft”), which some have interpreted as prohibiting theft of ideas, though the doctrine is principally concerned with fraud and deception, not property.

### Objectives

#### Financial incentive

These exclusive rights allow owners of intellectual property to benefit from the property they have created, providing a financial incentive for the creation of and investment in intellectual property, and, in case of patents, pay associated research and development costs. Some commentators, such as David Levine and Michele Boldrin, dispute this justification.

#### Economic growth

The existence of IP laws is credited with significant contributions toward economic growth. Economists estimate that two-thirds of the value of large businesses in the U.S. can be traced to intangible assets. “IP-intensive industries” are estimated to generate 72 percent more value added (price minus material cost) per employee than “non-IP-intensive industries”.

A joint research project of the WIPO and the United Nations University measuring the impact of IP systems on six Asian countries found “a positive correlation between the strengthening of the IP system and subsequent economic growth.” Other models would not expect that this correlation necessarily mean causation, such as the Nash equilibrium, which predicts they patent holders will prefer operating in countries with strong IP laws. In some of the cases, as was shown for Taiwan after the 1986 reform, the economic growth that comes with a stronger IP system might be due to an increase in stock capital from direct foreign investment.

## Economics

Intellectual property rights are the recognition of a property in an individual creation. Intellectual property rights are usually limited to non-rival goods, that is, goods which can be used or enjoyed by many people simultaneously—the use by one person does not exclude use by another. This is compared to rival goods, such as clothing, which may only be used by one person at a time. For example, any number of people may make use of a mathematical formula simultaneously. Some objections to the term intellectual property are based on the argument that property can only properly be applied to rival goods (or that one cannot own “property” of this sort).

Since a non-rival good may be simultaneously used (copied, for example) by many people (produced with minimal marginal cost), monopolies over distribution and use of works are meant to give producers incentive to create further works. The establishment of intellectual property rights, therefore, represents a trade-off, to balance the interest of society in the creation of non-rival goods (by encouraging their production) with the problems of monopoly power. Since the trade-off and the relevant benefits and costs to society will depend on many factors that may be specific to each product and society, the optimum period of time during which the temporary monopoly rights should exist is unclear.

According to economist George Reisman, patents do not constitute monopolies. “[Patents] reserve markets, or parts of markets, to the exclusive possession of the owners of the patents, ..., and they do so by means of the use of physical force inasmuch as it is against the law to infringe on these rights. None of these constitutes monopoly, however, because none of them is supported by the initiation of physical force... The fact that the government is ready to use force to protect patents ... is fully as proper as that it stands ready to use force to protect [for example] farmers and businessmen in the ownership of their physical products, and to come to their rescue when they are set upon by trespassers or attacked by robbers.”

## Criticism

### The term itself

Richard Stallman argues that, although the term intellectual property is in wide use, it should be rejected altogether, because it “systematically distorts and confuses these issues, and its use was and is promoted by those who gain from this confusion.” He claims that the term “operates as a catch-all to lump together disparate laws [which] originated separately, evolved differently, cover different activities, have different rules, and raise different public policy issues.” Stallman advocates referring to copyrights, patents and trademarks in the singular and warns against abstracting disparate laws into a collective term.

### The laws

Some critics of intellectual property, such as those in the free culture movement, point at intellectual monopolies as harming

health, preventing progress, and benefiting concentrated interests to the detriment of the masses, and argue that the public interest is harmed by ever expansive monopolies in the form of copyright extensions, software patents and business method patents.

There is also criticism because strict intellectual property rights can inhibit the flow of innovations to poor nations. Developing countries have benefitted from the spread of developed country technologies, such as the internet, mobile phone, vaccines, and high-yielding grains. Many intellectual property rights, such as patent laws, arguably go too far in protecting those who produce innovations at the expense of those who use them. The Commitment to Development Index measures donor government policies and ranks them on the “friendliness” of their intellectual property rights to the developing world.

Some libertarian critics of intellectual property have argued that allowing property rights in ideas and information creates artificial scarcity and infringes on the right to own tangible property. Stephan Kinsella uses the following scenario to argue this point:

[I]magine the time when men lived in caves. One bright guy—let’s call him Galt-Magnon—decides to build a log cabin on an open field, near his crops. To be sure, this is a good idea, and others notice it. They naturally imitate Galt-Magnon, and they start building their own cabins. But the first man to invent a house, according to IP advocates, would have a right to prevent others from building houses on their own land, with their own logs, or to charge them a fee if they do build houses. It is plain that the innovator in these examples becomes a partial owner of the tangible property (e.g., land and logs) of others, due not to first occupation and use of that property (for it is already owned), but due to his coming up with an idea. Clearly, this rule flies in the face of the first-user homesteading rule, arbitrarily and groundlessly overriding the very homesteading rule that is at the foundation of all property rights.

Other criticism of intellectual property law concerns the tendency of the protections of intellectual property to expand, both in duration and in scope. The trend has been toward longer copyright protection (raising fears that it may some day be eternal. In addition, the developers and controllers of items of intellectual property have sought to bring more items under the protection. Patents have been granted for living organisms, and colors have been trademarked. Because they are systems of government-granted monopolies copyrights, patents, and trademarks are called intellectual monopoly privileges, (IMP) a topic on which several academics, including Birgitte Andersen and Thomas Alured Faunce have written.

Copyright is a set of exclusive rights granted to the author or creator of an original work, including the right to copy, distribute and adapt the work. Copyright does not protect ideas, only their expression or fixation. In most jurisdictions copyright arises upon fixation and does not need to be registered. Copyright owners have the exclusive statutory right to exercise control over copying and other exploitation of the works for a specific period of time, after which the work is said to enter the public domain. Uses which are covered under limitations and exceptions to copyright, such as fair use, do not require permission from the copyright owner. All other uses require permission and copyright owners can license or permanently transfer or assign their exclusive rights to others.



Initially copyright law only applied to the copying of books. Over time other uses such as translations and derivative works were made subject to copyright and copyright now covers a wide range of works, including maps, dramatic works, paintings, photographs, sound recordings, motion pictures and computer programs. The British Statute of Anne 1709, full title “An Act for the Encouragement of Learning, by vesting the Copies of Printed Books in the Authors or purchasers of such Copies, during the Times therein mentioned”, was the first copyright statute.

Today copyright laws have been standardized to some extent through international and regional agreements such as the Berne Convention and the European copyright directives. Although there are consistencies among nations’ copyright laws, each jurisdiction has separate and distinct laws and regulations about copyright. National copyright laws on licensing, transfer and assignment of copyright still vary greatly between countries and copyrighted works are licensed on territorial basis. Some jurisdictions also recognize moral rights of creators, such as the right to be credited for the work.

### Justification

The British Statute of Anne was the first act to directly protect the rights of authors. Under US copyright law, the justification appears in Article I, Section 8 Clause 8 of the Constitution, known as the Copyright Clause. It empowers the United States Congress “To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.”

According to the World Intellectual Property Organisation the purpose of copyright is twofold:

“To encourage a dynamic creative culture, while returning value to creators so that they can lead a dignified economic existence, and to provide widespread, affordable access to content for the public.”

### Copyright as property right

Copyright as a property law was initially conceived of as a “chose in action”, that is an intangible property, as opposed to tangible property. Tangible property is attached to the legal ownership of a physical item, hence the purchase of a book buys ownership of the book, but not the underlying copyright in the book’s content. The Statute of Anne specifically referred to copyright in terms of property, albeit limited in time. Many contemporaries did not believe that the statute was concerned

with property “in the strict sense of the word”. The question of whether copyright is property right dates back to the Battle of the Booksellers. In 1773 Lord Gardenston commented in *Hinton v. Donaldson* that “the ordinary subjects of property are well known, and easily conceived... But property, when applied to ideas, or literary and intellectual compositions, is perfectly new and surprising...” According to Patterson and Livingston there remains confusion about the nature of copyright ever since *Donaldson v Beckett*, a case heard in 1774 by the British House of Lords about whether copyright is the natural law right of the author or the statutory grant of a limited monopoly. One theory holds that copyright’s origin occurs at the creation of a work, the other that its origin exists only through the copyright statute.

Copyright law emerged in 18th Century Europe in relation to printed books and a new notion of authorship. In the European Renaissance and Neoclassical period the writer was regarded as an instrument, not as an independent creator. The writer was seen as using external sources to create a work of inspiration. In the 18th Century a changing concept of genius located the source of inspiration within the writer, whose special talents and giftedness was the basis for creating works of inspiration and uniqueness. The concept of the author as original creator and owner of their work emerged partly from the new concept of property rights and John Locke’s theory that individuals were “owners of themselves”. According to Locke individuals invested their labour into natural goods, and so creating property. Authors were argued to be the owners of their work because they had invested their labour in creating it.

It was in the 19th century that the term intellectual property began to be used as an umbrella term for patents, copyright and other laws. The expansion of copyright and copyright term are mirrored in the rhetoric that has been employed in referring to copyright. Courts, when strengthening copyright, have characterised it as a type of property. Companies have strongly emphasised copyright as property, with leaders in the music and movie industries seeking to “protect private property from being pillaged” and making forceful assertions that copyright is absolute property right. With reference to the expanding scope of copyright, one commentator noted that “We have gone from a regime where a tiny part of creative content was controlled to a regime where most of the most useful and valuable creative content is controlled for every significant use.” According to Graham Dutfield and Uma Suthersanen copyright is now a “class of intangible business assets”, mostly owned by companies who function as “investor, employer, distributor and marketer”. While copyright was conceived as personal property awarded to creators, creators now rarely own the rights in their works.

## Exclusive rights granted by copyright

Copyright is literally, the right to copy, though in legal terms “the right to control copying” is more accurate. Copyright are exclusive statutory rights to exercise control over copying and other exploitation of the works for a specific period of time. The copyright owner is given two sets of rights: an exclusive, positive right to copy and exploit the copyrighted work, or license others to do so, and a negative right to prevent anyone else from doing so without consent, with the possibility of legal remedies if they do.

Copyright initially only granted the exclusive right to copy a book, allowing anybody to use the book to, for example, make a translation, adaptation or public performance. At the time print on paper was the only format in which most text based copyrighted works were distributed. Therefore, while the language of book contracts was typically very broad, the only exclusive rights that had any significant economic value were rights to distribute the work in print. The exclusive rights granted by copyright law to copyright owners have been gradually expanded over time and now uses of the work such as dramatization, translations, and derivative works such as adaptations and transformations, fall within the scope of copyright. With a few exceptions, the exclusive rights granted by copyright are strictly territorial in scope, as they are granted by copyright laws in different countries. Bilateral and multilateral treaties establish minimum exclusive rights in member states, meaning that there is some uniformity across Berne Convention member states.

The print on paper format means that content is affixed onto paper and the content can't be easily or conveniently manipulated by the user. Duplication of printed works is time-consuming and generally produces a copy that is of lower quality. Developments in technology have created new formats, in addition to paper, and new means of distribution. Particularly digital formats distributed over computer networks have separated the content from its means of delivery. Users of content are now able to exercise many of the exclusive rights granted to copyright owners, such as reproduction, distribution and adaptation.

## Types of work subject to copyright

The types of work which are subject to copyright has been expanded over time. Initially only covering books, copyright law was revised in the 19th century to include maps, charts, engravings, prints, musical compositions, dramatic works, photographs, paintings, drawings and sculptures. In the 20th century copyright was expanded to cover motion pictures, computer programs, sound recordings, choreography and architectural works.

## Idea-expression divide

Copyright law is typically designed to protect the fixed expression or manifestation of an idea rather than the fundamental idea itself. Copyright does not protect ideas, only their expression and in the Anglo-American law tradition the idea-expression divide is a legal concept which explains the appropriate function of copyright laws.

## Limitations and exceptions

### Fair use and fair dealing

Copyright does not prohibit all copying or replication. In the United States, the fair use doctrine, codified by the Copyright Act of 1976 as 17 U.S.C. § 107, permits some copying and distribution without permission of the copyright holder or payment to same. The statute does not clearly define fair use, but instead gives four non-exclusive factors to consider in a fair use analysis. Those factors are:

1. the purpose and character of the use;
2. the nature of the copyrighted work;
3. the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and

4. the effect of the use upon the potential market for or value of the copyrighted work.

## Infringement

Copyright infringement, or copyright violation, is the unauthorized use of works covered by copyright law, in a way that violates one of the copyright owner's exclusive rights, such as the right to reproduce or perform the copyrighted work, or to make derivative works.

For electronic and audio-visual media under copyright, unauthorized reproduction and distribution is also commonly referred to as piracy. An early reference to piracy in the context of copyright infringement was made by Daniel Defoe in 1703 when he said of his novel *The True-Born Englishman* “Had I wrote it for the gain of the press, I should have been concerned at its being printed again and again by PIRATES, as they call them, and PARAGRAPHMEN: but if they do justice, and print it true, according to the copy, they are welcome to sell it for a penny, if they please: the pence, indeed, is the end of their works.”. The practice of labeling the act of infringement as “piracy” predates statutory copyright law. Prior to the Statute of Anne 1709, the Stationers' Company of London in 1557 received a Royal Charter giving the company a monopoly on publication and tasking it with enforcing the charter. Those who violated the charter were labeled pirates as early as 1603.

## Orphan works

An orphan work is a work under copyright protection whose copyright owner is difficult or impossible to contact. The creator may be unknown, or where the creator is known it is unknown who represents them.

39

## PUBLIC DOMAIN

Works are in the public domain if they are not covered by intellectual property rights at all, if the intellectual property rights have expired, and/or if the intellectual property rights are forfeited. Examples include the English language, the formulae of Newtonian physics, as well as the works of Shakespeare and the patents over powered flight.

In a general context public domain may refer to ideas, information and works that are “publicly available”, but in the context of intellectual property law, which includes copyright, patents and trademarks, public domain refers to works, ideas, and information which are intangible to private ownership and/or which are available for use by members of the public.

## Defining the public domain

The term public domain did not appear in early copyright law, which was first established in Britain with the Statute of Anne 1709. Though the concept did exist and 18th Century British and French jurists used terms such as *publici juris* or *propriété publique* to describe works that were not covered by copyright law. The phrase “fall in the public domain” can be traced to mid 19th Century France to describe the end of copyright term. The French poet Alfred de Vigny equated the expiration of copyright with a work falling “into the sink hole of the public domain” and if the public domain receives any attention from intellectual property lawyers it is still treated as little more than that which is left when intellectual property rights, such as copyright, patents and trademarks, expire or are abandoned. Copyright law was created by statute and all works created and published before copyright law was first established are in the public domain. In this historical context Paul Torremans describes copyright as a “little coral reef of private right jutting



up from the ocean of the public domain.” Because copyright law is different from country to country Pamela Samuelson has described the public domain as being “different sizes at different times in different countries”.

Definitions of the boundaries of the public domain in relation to copyright, or intellectual property more generally, regard the public domain as a negative space, that is, it consist of works that are no longer in copyright term or were never protected by copyright law. More subtle definitions of the public domain move beyond those works that no longer receive legal protection under intellectual property law and incorporates all aspects of works which are not covered by the intellectual property doctrine, such as insubstantial parts of a copyrighted work or the statutory defined permitted acts and exceptions to copyright. A less legalistic definition of the public domain comes from Lange, who focused on what the public domain should be: “it should be a place of sanctuary for individual creative expression, a sanctuary conferring affirmative protection against the forces of private appropriation that threatened such expression”. Patterson and Lindberg described the public domain not as a “territory”, but rather as a concept: “There are certain materials - the air we breathe, sunlight, rain, space, life, creations, thoughts, feelings, ideas, words, numbers - not subject to private ownership. The materials that compose our cultural heritage must be free for all to use no less than matter necessary for biological survival.” The term public domain may also be interchangeably used with other imprecise and/or undefined terms such as the “public sphere” or “commons”, including concepts such as “commons of the mind”, the “intellectual commons” and the “information commons”.

### Value of the public domains

In attempting to map the public domain Pamela Samuelson has identified eight “values” that can arise from information and works in the public domain, though not every idea or work that is in the public domain necessarily has a value. Possible values include:

- Building blocks for the creation of new knowledge, examples include data, facts, ideas, theories and scientific principle.
- Access to cultural heritage through information resources such as ancient Greek texts and Mozart’s symphonies.
- Promoting education, through the spread of information, ideas and scientific principles.
- Enabling follow-on innovation, through for example expired patents and copyright.
- Enabling low cost access to information without the need to locate the owner or negotiate rights clearance and pay royalties, through for example expired copyrighted works or patents, and non-original data compilation.
- Promoting public health and safety, through information and scientific principles.
- Promoting the democratic process and values, through news, laws, regulation and judicial opinion.

- Enabling competitive imitation, through for example expired patents and copyright, or publicly disclosed technologies that do not qualify for patent protection.

### The public domain and derivative works

Derivative works include translations, musical arrangements and dramatizations of a work, as well as other forms of transformation or adaptation. Copyrighted works may not be used for derivative works without permission from the copyright owner, while public domain works can be freely used for derivative works without permission. Artworks that are public domain may also be reproduced photographically or artistically or used as the basis of new, interpretive works Once works enter into the public domain, derivative works such as adaptations in book and film may increase noticeably, as happened with Frances Hodgson Burnett’s novel *The Secret Garden*, which became public domain in 1987. As of 1999, the plays of Shakespeare, all public domain, had been used in more than 420 feature-length films. In addition to straightforward adaptation, they have been used as the launching point for transformative retellings such as Tom Stoppard’s *Rosencrantz and Guildenstern Are Dead* and Troma Entertainment’s *Tromeo and Juliet*. Marcel Duchamp’s *L.H.O.O.Q.* is a derivative of Leonardo Da Vinci’s *Mona Lisa*, one of thousands of derivative works based on the public domain painting.

### The public domain, traditional knowledge and folklore

Traditional knowledge includes pre-existing, underlying traditional culture, or folklore, and literary and artistic works created by current generations of society which are based on or derived from pre-existing traditional culture or folklore. Traditional culture and folklore tends to be trans-generational, old and collectively “owned” by groups or communities. Often traditional culture and folklore is of anonymous origin and expressions of this pre-existing traditional culture is generally not protected by current intellectual property laws and is treated as being in the public domain. Copyright law, first established for books by the Statute of Anne 1709, is based on the concept of the individual author. In 18th century Europe, written culture was regarded as European, while oral culture was regarded as uncivilised and pre-modern. The concept of “folk-lore” was coined by William Thomas in 1846, describing “knowledge of the people”, and in the late 19th century the fairy tales told by people living in the countryside were collected and published. While orally transmitted fairy tales were not covered by copyright law, and hence in the public domain, 18th century copyright law did apply to written folklore, hence the Brothers Grimm and others who recorded oral folklore owned the copyright on their publications. In the 20th century, the concept of authorship was extended to recorded musical works as the phonograph allowed for the fixation of oral transmissions.

The view that folklore and traditional knowledge were in the public domain and free for anybody to use was challenged by the newly independent African and Asian nations of the 1960s, who came under pressure to comply with the 1886 Berne Convention for the Protection of Literary and Artistic Works. African countries regarded folklore to be part of the “cultural heritage of the African nations” and the Tunisian 1966 Copyright Act awarded copyright protection to folklore with the stated aim “to prevent folklore from falling into the hands of third parties who might wish to exploit them for commercial purposes”. At the 1967 Stockholm Conference to amend the Berne Convention, India raised broader questions of individual authorship, arguing that “...works of folklore might represent the creative efforts of a number of unidentified indigenous authors. They were therefore not only anonymous works in the sense of the... Berne Convention, but also joint works, since in nearly all cases they were unfixed and represented a constantly changing apttern produced by successive performers

and authors.” As African nations opposed the inclusion of folklore under the “anonymous works” category of the Berne Convention, the Australian delegates conceded that “The whole structure of the Convention was designed to protect the rights of identifiable authors. With a work of folklore there was no such author”. Eventually, folklore was not integrated into the Berne Convention and therefore its status is not regulated under international copyright law, though countries may cover it in national copyright law.

Contemporary literary and artistic works based upon, derived from or inspired by traditional culture or folklore may incorporate new elements or expressions. These works are generally protected under copyright law as they are regarded as sufficiently original to be “new” upon publication, and they have a living and identifiable creator, or creators. Such contemporary works may include a new interpretation, arrangement, adaptation or collection of pre-existing cultural heritage that is in the public domain. Traditional culture or folklore may also be “repackaged” in digital formats, or restoration and colorization. In the 19th century, the Brothers Grimm and Hans Christian Andersen, three of the most influential collectors of European folklore, published collections of folklore, edited and altered, based on existing folklore and fairy tales. As their works passed into the public domain Walt Disney adapted them into animated film, including *Snow White and the Seven Dwarfs* (1937), *Cinderella* (1950) and *The Little Mermaid* (1989). Disney also adapted folklore from other cultures, such as *Aladdin* (1992), and the Disney fairy tales are now often the only version known, with the older versions largely unknown.

### **The public domain and indigenous people**

The public domain, as defined in the context of intellectual property rights, is not a concept recognised by indigenous peoples. As much of traditional knowledge has never been protected under intellectual property rights, they can not be said to have entered any public domain. On this point the Tulalip Tribes of Washington, United States, has commented that “... open sharing does not automatically confer a right to use the knowledge (of indigenous people)... traditional cultural expressions are not in the public domain because indigenous peoples have failed to take the steps necessary to protect the knowledge in the Western intellectual property system, but form a failure of governments and citizens to recognise and respect the customary laws regulating their use”.

### **The public domain in the information society**

According to Bernt Hugenholtz and Lucie Guibault the public domain is under pressure from the “commodification of information” as items of information that previously had little or no economic value have acquired independent economic value in the information age, such as factual data, personal data, genetic information and pure ideas. The commodification of information is taking place through intellectual property law, contract law, as well as broadcasting and telecommunications law.

### **Perpetual copyright**

Some works may never fully lapse into the public domain. A perpetual crown copyright is held for the Authorized King James Version of the Bible in the UK. While the copyright of the play *Peter Pan*, or the *Boy Who Wouldn't Grow Up* by J. M. Barrie has expired in the United Kingdom, it was granted a special exception under the Copyright, Designs and Patents Act 1988 (Schedule 6) that requires royalties to be paid for performances within the UK, so long as Great Ormond Street Hospital (to whom Barrie gave the rights) continues to exist.

**/100**

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**David Horvitz**

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