Air transport is by far the most time efficient mode of transporting goods, and in humanitarian contexts is used both domestically and internationally. Unfortunately, along with the speed and efficiency of air transport comes significantly higher costs and far more restrictions and complexities on handling of goods. In emergencies, and especially natural disasters and conflict situations where road access is difficult, air transport is often the preferred alternative.

### Common Terms in Air Transport

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed wing</strong></td>
<td>The most common type of aircraft – any airborne vessel with wings that requires horizontal take-off and landing space.</td>
</tr>
<tr>
<td><strong>Rotor wing</strong></td>
<td>Helicopters of any configuration that have top mounted rotors to provide vertical lift, and have vertical take-off and landing capability.</td>
</tr>
<tr>
<td><strong>Civil Aviation Authority (CAA)</strong></td>
<td>Any authority that maintains legal jurisdiction over the airspace above any country. Aircraft operating within a country or flying over a country (overflight clearance) must make arrangements through CAAs, registering flight plans and obtaining proper clearances.</td>
</tr>
<tr>
<td><strong>International Aviation and Transportation Administration (IATA)</strong></td>
<td>An international governing body that sets safety regulations on commercial flight. Any aircraft commercially operating between two different countries that mutually recognise IATA standards is legally obliged to follow IATA regulations.</td>
</tr>
<tr>
<td><strong>International Civil Aviation organisation (ICAO)</strong></td>
<td>A specialised UN agency that supports the development of mutually recognised civil aviation standards among UN member states, including air safety regulations.</td>
</tr>
<tr>
<td><strong>Tech Stop</strong></td>
<td>Used to describe a situation when an aircraft must be on the ground for technical reasons. Usually tech stops refer to refuelling, but they can also be for unscheduled maintenance. Sometimes referred to as “going technical.”</td>
</tr>
<tr>
<td><strong>Domicile</strong></td>
<td>Where the “permanent” home of the aircraft is, usually where the aircraft is originally licensed, and near the owner and operator. Domicile location are also frequently where aircraft receive routine maintenance as well, but not always.</td>
</tr>
<tr>
<td><strong>Repositioning</strong></td>
<td>Moving an aircraft from one location to another location in anticipation of another future need.</td>
</tr>
<tr>
<td><strong>Ground Support Equipment (GSE)</strong></td>
<td>Any equipment involving the offloading or moving of cargo around an airport or landing strip, in lead up to loading or offloading cargo and people. GSE also includes catering, refuelling and power supply units. Ground handling crews can be employees of governments, or sub contracted service providers.</td>
</tr>
<tr>
<td><strong>Airside</strong></td>
<td>Any part of an airport beyond a secure checkpoint usually associated with loading/offloading, service operations and take off/landing. Airside operations occur within close proximity to working aircraft.</td>
</tr>
<tr>
<td><strong>Cube/Weigh Out</strong></td>
<td>The act of reaching the maximum limitations to a specific airframe, either by reaching its maximum volume (cube out) or its maximum weight (weigh out).</td>
</tr>
<tr>
<td><strong>Flight Hours</strong></td>
<td>Defined as the specified hours air craft, pilot or crew are allowed to operate for. Physical air craft may only be able to operate for a maximum number of hours in any week or month period, while pilots and crew can only operate for a maximum number of hours per day/week before mandated “crew rest.”</td>
</tr>
<tr>
<td><strong>Loading</strong></td>
<td>All the special considerations surrounding aircraft loading, such as loading specifications and safety concerns. Loading is overseen by a &quot;Loadmaster&quot; or other trained crew, who will ensure proper distribution of weight and balance of cargo, while also screening for prohibited or controlled items.</td>
</tr>
</tbody>
</table>
Air Transport Arrangements

The nature and type of the arrangements humanitarian agencies enter into for the movement of cargo by air will be largely informed by the volume of goods, type of goods and shipping/destination points. Most medium sized cargo loads (1-20 full pallets / 30 cubic meters) shipped internationally will generally not require a specialised flight, while a high volume of cargo (500+ full pallets / 700 cubic meters) might require obtaining a full plane. Conversely, extended, routine operation inside the borders of a country no matter how small might require long term leasing of an aircraft. For a general overview of airframe size relative to cargo capacity, reference the air cargo capacity table.

In almost all situations, different arrangements for air cargo transport will need to be arranged by forwarders, brokers, or other third-parties who have the ability to connect requestors to various available options. Regular movement of small cargo can be done through a typical freight forwarder, while specialised charters or leases may be done through specialised brokerages. Agencies acquiring these arrangements will need to go through their typical procurement process.

Typical air transport arrangements can look like:

**Regular scheduled** – Air carriers around the world develop regular routes between high volume or common destinations. Cargo travelling on regularly scheduled movement is similar to buying a seat on a regular passenger plane – it’s easy to identify space and move cargo because the movement is predictable and frequent. Cargo shipped along regularly scheduled routes can be moved as excess cargo in the hold of a commercial passenger plane, or transported using regularly scheduled cargo planes. Often, cargo moved along regularly scheduled routes will be broken up into multiple tranches and re-consolidated on the receiving end, a process that is enabled by the predictability of arriving flights. Regular movement by air is cheaper than organising special flights. Unfortunately, regularly scheduled flights will not deviate from their courses, and tend to only serve more developed markets.

**Charters** – Many forwarders and air carrier specialise in organising charter flights – flights specifically dedicated to the movement of one or a very few consignments. Charter flights are often extremely expensive, but have the advantage of being able to depart from a specified origin, arrive at a specified destination, and meet the size and airframe requirements of the proposed air movement. A properly arranged charter might be able to match the size of the aircraft to the requested cargo size saving on total costs, as well as identify special needs such as the overall operating environment or limitations on size of aircraft. Unfortunately, charting aircraft frequently means repositioning an aircraft from another area as the exact airframe may not be domiciled at the desired point of departure. This means that users of charter services usually have to pay for repositioning costs. As charters are basically only single aircraft, shippers run the risk of technical defaults holding up the entire process as well. Factors that influence the decision to charter and the nature of the aircraft chartered:

**Aircraft Leasing** – In situations where long term, well identified needs are in place, organisations may choose to lease aircraft. Aircraft can be leased for months or years at a time, and leased aircraft can be used on an ongoing basis for needs as they evolve. A “Dry Lease” is when an aircraft is made available to an agency without additional support of crew or maintenance, while a “Wet Lease” is a lease type that includes pilots, crew, and aircraft maintenance. Wet leases are more expensive, especially because flight and maintenance crews are paid at a commercial rate and because food and housing is usually part of the contact, but many agencies prefer wet leases due to the fact they take the complexity of aircraft management out of the hands of non-aviation experts.

**Other arrangements** – During times of emergency, air cargo may be transported through a variety ad-hoc or irregular means. This might include cargo movement on military air craft, in personally owned air craft, or agencies offering free space to each other. The process of utilising non-traditional air transport to move cargo can have varied procedures and tolerance thresholds. Irrespective of the movement type, users will have to respect CAA and national import regulations at all times.

Unique Components to Air Transport

Air transport has become so common in the modern world that shippers frequently take key important factors for granted, or overlook them when planning and utilizing aviation for cargo. Understanding some of these unique needs will help when planning large international shipments, but will also help understanding in-country and response specific aviation needs as well.

Aircraft Loading and Stowage

Aircraft have special terminology when it comes to loading. Cargo can be loaded into specially defined sections of an aircraft including:

- **Deck Cargo** – cargo loaded onto the main deck/body of an aircraft.
- **Belly Load** – cargo loaded onto the under deck/belly of an aircraft.
- **Nose Load** – cargo loaded into the front compartment of an aircraft.
- **Tail Load** – cargo loaded into the rear compartment/are past the real wheel based of an aircraft.

While loading and storing cargo onto an aircraft, there are some specific physical limitations to what and how items can be loaded.

**Cargo Hold** - The cargo hold - or sometimes just referred to as a "hold" - is any space on an aircraft where cargo is stored and transported, including any of compartments on an aircraft. Holds of each aircraft have specific dimensions, including height, depth, width, and shaped curvature of the airframe itself. These dimensions will limit what and how objects are loaded.
Doors are any/all points where cargo can enter or leave an aircraft. Door dimensions have maximum sizes specific to the aircraft, and ultimately limit what can be loaded. Even the hold is large enough to store a certain object, it may not be able to fit through the doors of the aircraft. Planners and loaders should understand this before trying to load an aircraft.

Load Balance - Cargo loaded onto a plane must be properly balanced. A balanced cargo load maximises safety and energy efficiency, while an unbalanced load can lead to serious safety risks.

At any time, when cargo is being loaded onto an aircraft, there will be an appointed loadmaster. A loadmaster may be a regular crew member, the pilot, or in the case of large commercial operations, specially certified persons who work only in cargo loading. In any situation, the loadmaster is the person ultimately responsible for determining how and what gets loaded onto a plane.

Weight as a Limiting Factor

In all aviation, one of the largest factors that impact speed and price is the overall weight of the airframe and its contents. In cargo operations, the take-off weight of an airframe in flight can vary substantially – an airframe fully loaded with heavy cargo easily double the total weight of the same aircraft without cargo. All aircraft have what is known as a “maximum take-off weight” – or the maximum weight at which an aircraft can safely take off and reach the desired altitude and flight path. This weight is calculated as a combination of the physical aircraft, cargo, passengers, and fuel. The maximum take-off weight can also be impacted by outside conditions, such as the wind direction, ambient temperature or the length of a landing strip. Pilots and loadmasters have ultimate discretion for the safety of their aircraft and crew, and will make the final calculations on what is safe and achievable for an aircraft, and what is not.

Based on the aforementioned factors, the acceptable weight of the payload may fluctuate, changing costs and overall delivery schedules. For this reason, light but voluminous cargo might always be able to fill up an entire cargo hold – or “cube out” by reaching the maximum available load through volume – while more dense and bulky cargo might be able to take a relatively small portion of a cargo hold – or “weighing out” by reaching the maximum lift weight. The orientation of a cargo inside of an aircraft is also very important, and loadmasters and crews will need to properly place and balance loads to maximise aircraft safety while taking off, flying and landing.

Fuel as a Limiting Factor

Aircrafts consume relatively large amounts of fuel per kg compared to other transport methods, and unlike other modes of transport, stopping to undergo refuelling is a complicated process. Whereas a boat or vehicle running out of fuel in mid-movement might strand a vehicle or leave it adrift, an aircraft running out of fuel has immediate and tragic consequences. In aviation, fuel calculations are estimated per flight, based on range, altitude, cargo load, wind conditions, and if the airport of arrival has refuelling capabilities. In real terms, there are many factors that might make travel over the same distance consume more or less fuel than it would in a similar route. An increase in the take-off and carriage weight increases fuel used per km, while flying into a prevailing wind-current will also increase fuel consumed per km. Knowing this, crews will increase the fuel in their tanks, which might adversely affect maximum take-off weight. In other words, the cost for kg of cargo might go up, while the total quantity of kg you can ship might go down.

Prevailing Conditions as a Limiting Factor

Aircraft – though highly engineered pieces of equipment – can still be heavily impacted by the physical environment. In addition to factors that can be controlled by the crew and pilots (such as load and maintenance) some external factors that might impact an aircraft’s ability to operate safely:

- Take-off/landing altitude – the higher altitude a landing strip or airport is, the more hazardous take-off and landing might be. Fixed wing aircraft will need to approach landing strips at faster speed and reach a faster speed to take off, all while requiring a longer runway to accommodate both. Rotor wing aircraft will need a slightly higher rotational speed to achieve lift at higher altitudes as well.
- Wind – heavy winds can make take-off/landing and flight hazardous. For fixed wing aircraft, a strong tail wind might increase the distance for safe take off, which is why many airports will reverse the landing and take-off directions if the direction of the winds change. A sidewind blows from the lateral/direction of movement of an aircraft, and can make navigation and take-off/landing dangerous. Any strong prevailing wind can make opening or closing the cargo doors particularly difficult, especially in high winds.
- Atmospheric conditions – Dust, fog, and heavy rain can render flight and take-off/landing difficult or impossible, especially in night time settings. Air temperature also plays major factor; excessive outside heat can make taking off difficult, and aircraft may be not be able to take off in extreme heat.

Airport Facilities as a Limiting Factor

Though aircraft may be able to physically fly to a destination, they may not be able to adequately service the cargo needs. Limiting factors might include:

- Lack of refuelling capability on the ground – aircraft on long haul flights may not be able to properly stop and offload if they cannot refuel.
- Lack of ground handling equipment – most commercial aircraft will require some form of specialised MHE to offload and move cargo around. Lack of proper MHE can impede or prevent offloading or loading all together. Some aircraft, especially military aircraft have the capacity to load without MHE, and may have on-board ramps to tail and nose load aircraft by hand.
- Lack of customs capability – not all airports have the ability to clear cargo through customs, limiting movement to domestic flights only.
- Lack of ground service/ground handling – ground crews help load/offload, service and conduct repairs to aircraft. Without ground crews, small technical issues may ground aircraft until proper technicians can arrive. Ground services also conduct de-icing, support catering, and provide other support services that can impact timely departures.
- Lack of storage and holding capacity – airports that lack proper ability to store cargo once offloaded may quickly become unusable for aircraft operations. Cargo building up on the apron space of the tarmac might impede the flow of ground movement and even prevent further cargo from being offloaded.
- Lack of aircraft parking space – an airport may lack the space for multiple aircraft to land, park and offload at the same time. Landing strips or airports limited to one or a small number of aircraft that can park at the same time will need to schedule flights accordingly, impacting delivery schedules.
- Lack of communications equipment – immediately after disasters, surface to air communication, radar equipment or even observation towers may be damaged, which impede safe approach, landing and take-off of aircraft.
Regulations as a Limiting Factor

Local and internationally recognised regulations may impede cargo operations by limiting or preventing aircraft from operating all together. Some of these regulatory factors might include:

- Overflight clearance – aircraft must obtain overflight clearance from relevant in-country CAAs to operate in any country specific airspace. Countries may have bans on specific airlines or aircraft from registered in certain countries. Overflight clearances may also be delayed or rejected based on political or security concerns.
- Landing permits – like overflight, aircraft must obtain permission to land at an airport through both the CAA and airport authorities. Restrictions might include airframe type, origin or intended purpose. Aircraft may also be limited by the already in place schedule.
- Noise restrictions – airports near urban centres may ban certain large body aircraft that have excessively loud engines. Many of the larger high lift capacity cargo aircraft also happen to be very noisy, which might impact what airports cargo can fly out of.
- Maintenance Schedules – many air craft will require annual maintenance that might take them off line for up to a month, depending on the aircraft and the location an aircraft might need to be serviced at. This will impact the availability of leased aircraft for regular activities.
- Flight-hours – both aircraft and the crews have a maximum number of flight hours they can operate at any given time. Aircraft may be restricted to the number of hours they can fly in a week or month, while crew – and especially pilots – are restricted to the number of hours they can operate in any given 24 hour period, accompanied by what is called mandatory “crew rest” hours.
- Pilot Rating – in addition to being fully licensed to operate an aircraft, pilots also must be rated for key airports or conditions. In some contexts, pilots may need to undergo additional training or simulation time to fully reach this rating, possibly impacting ad-hoc delivery of emergency goods.

Aircraft Registration

Aircraft operating in any domestic airspace, or above any controlled territory of a country should be legally registered to operate. The registration process varies from country to country, and there are different types of registration depending on the intended use of the aircraft, such as military or non-international. As a general rule, most countries:

- Won’t allow an aircraft to be registered twice, even in another country.
- Require that registration numbers (sometimes referred to as a tail numbers) be printed on a fireproof plate on the fuselage.
- Require aircraft be registered in the country in which the carrier is based or domiciled.

If an aircraft will operate internationally – fly between/over two or more different sovereign countries – it must also have declared an intent to operate internationally through its local CAA and comply with international standards including IATA and ICAO requirements for marking, communications equipment, and safety standards. If an aircraft operates internationally, it is considered a “flag-carrying” vessel of its originally country of registration, however while in the airspace of another country it must comply with all local laws and regulations. Without declarations of intent to operate internationally and without fully compliance with international standards, aircraft may not be allowed to register a flight plan, land or load/offload passengers or cargo, or even receive technical assistance when operating in a country outside of where the aircraft is registered.

<table>
<thead>
<tr>
<th>Example Registration/Tail Numbers</th>
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<tbody>
<tr>
<td><img src="image1.jpg" alt="Example Registration/Tail Numbers" /></td>
</tr>
<tr>
<td><img src="image2.jpg" alt="Example Registration/Tail Numbers" /></td>
</tr>
<tr>
<td><img src="image3.jpg" alt="Example Registration/Tail Numbers" /></td>
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</tbody>
</table>

Airport / Airfield Operations

Large commercial airports can be busy places, and access is usually highly restrictive and controlled. Humanitarian actors won’t usually get direct access to airside operations of a major airport, but from time to time humanitarian personnel will need to gain access to and facilitate cargo alongside the aircraft. In less developed or more rural field settings, it’s quite common that humanitarian actors will need to operate on or around landing strips.

Commercial Airports:

Activities in and around commercial airports tend to be highly regulated for a variety of reasons; aviation equipment is expensive and highly sensitive, customs operations may necessitate access control, and airports are considered key infrastructure choke points.

Commercial airports may have a relatively high volume of throughput, with aircraft taking off, landing and exchanging goods and passengers frequently. The immediate airspace surrounding airports is highly restricted, and only aircraft who have registered a flight plan or communicated well in advance are typically allowed to land. Air-traffic is controlled through a control tower, that typically has line-of-sight, radar and radio communication capabilities for arriving and departing aircraft. Aircraft follow a flight path on approach or take off, meaning there is a very specific route aircraft can travel long while moving around the airspace above an airport. Flight paths reduce the chances of mid-air collisions and near misses, and even helicopters and other vertical take-off aircraft are expected to follow the flight path around airports.

Controlling the flow of aircraft is vital for a functioning airport. There is a limited number of landing strips, and a limited amount of space on the ground for planes to taxi and park. Too many aircraft taking off, landing or operating on the ground can cause accidents and serious damage. It’s difficult for airplanes to manoeuvre quickly while on the ground, and planes landing or taking off may collide with planes moving around a runway. Additionally, too many aircraft on the ground may lead to planes touching wings or colliding with each other, which can damage and ground an aircraft.
Large airports should have the ability to service large aircraft and manage cargo operations. Large commercial or long haul aircraft typically won't carry enough fuel for a return journey and will need refuelling upon arrival. Many large commercial aircraft also frequently require an external electrical power source to start the engine ignition process, usually referred to as a Ground Power Unit (GPU). Without fuel or a GPU, many aircraft simply cannot land in an airport even if they are physically capable of doing so - there would be no way for them to safely start their engine or take off again.

Ground Power Unit (GPU) | Airside Refuelling Truck
--- | ---

Large commercial airports will also have other services available for aircraft and crews. Service technicians and spare equipment may be kept on site for commonly used aircraft, especially if the airport is a hub for a commercial airline with a pre defined fleet. Commercial airports are also likely to have rapid response emergency crews, including emergency medical technicians and fire suppression systems such as fire trucks.

In rapid onset emergencies, the break down in communications equipment or airport amenities can lead to airports ceasing to function for days or weeks at a time, which can severely impact response activities.

Cargo operations in commercial airports are heavily aided by ground handling teams and specialised MHE. Many large wide-bodied commercial aircraft are specifically engineered for efficient high altitude long-haul flights; this unfortunately results in aircraft bodies that are not optimised for loading or unloading. The majority of aircraft used for commercial cargo will have significant ground clearance, requiring what is called a high loader / k-loader / scissor lift, container pallet transporters, dolly's or other specialised equipment.

Example Ground Handling Equipment:

**High-Loader / K-Loader / Scissor Lift** - Used to lift pre-made ULDs and pallets directly to the side of large commercial aircraft. High-loaders are adjustable and can move under their own power. The flat deck of a high loader also has powered rollers that can mechanically slide cargo on to the aircraft through the appropriate opening.
**ULD / Aircraft Pallet Mover** - A specialised vehicle designed to move around the oversized ULDs and aircraft pallets on a tarmac or landing strips. The pallet movers have rollers and other equipment to quickly get cargo items on and off, and work in conjunction with high-lights and other MHE.

**Belt Loader** - An automated conveyor belt with adjustable height that can convey smaller items to the door of any sized airframe. Belt loaders are usually used for luggage, loose packages or small specially items. Belt loaders may also be used for aircraft that is too small to accept a high-lift.

**ULD / Airplane Pallet Pull Cart** - A pull cart designed to carry ULDs and pre-built airplane pallets. The pull carts are not powered by themselves, and must be pulled or pushed across the tarmac. Rollers assist offloading and loading, but cargo must be physically pushed as there is no mechanically driven process.

Access to the planes may be through relatively small cargo doors on the side or nose of the aircraft, though tail loading aircraft do operate out of commercial airports as well.
Once cargo is on the ground, it is moved around and handled by ground handling agents. If the airport has customs capabilities, there will typically be an adjacent bonded storage facility of some kind where cargo is held until it is cleared. The overall movement of cargo around an airport is highly controlled and usually quite efficient. As such, cargo operations are usually only carried out by contracted or subcontracted teams of professionals.

**Airfields / Landing Strips:**

In humanitarian contexts, operating small to medium sized aircraft inside specifically to aid the movement of cargo within the area of response are quite common. In some instances, small chartered craft can be used for one or a few individual flights, while other contexts there can be specifically planned “hub and spoke” models for humanitarian air cargo operations, with smaller aircraft delivering throughout a responses from a larger central airport. In the majority of contexts, smaller air fields are entirely for domestic use. Customs is usually never going to be processed at the remote airfield or landing strip level - usually cargo offloading points in remote locations are the final leg of an in-country hub and spoke distribution system.

Remote field locations and small airfields probably will not have most, if any, of the amenities of a larger commercial airport. Aircraft operating around smaller field landing strips should have considered the following:

- Adequate surface to ground communications equipment on a usable operating band accessible by both the pilot and ground actors.
- Fuel for the return flight.
- An onboard power supply to start engines.
- Basic equipment for repairs.

Ideally, there will be an identified safety officer or team on the ground, who can ensure that the landing strip is free of debris, animals or people, and who should have the capacity to coordinate with any potential incoming aircraft regarding scheduling and landing conditions. Some landing strips may be impacted by bad weather, making safe taxi and takeoff impossible. At all times, aircraft operating in or around remote landing strips must still obey local CAA regulations, and may even need to coordinate with local military and local community leaders to avoid incidents.

Aircraft will have to be appropriate for the operating conditions, and the underdeveloped nature of many landing strips in humanitarian contexts tends to limit the size of most cargo aircraft. Aircraft will need to be able to safely take off and reach altitude based on the length of the landing strip, the anticipated cargo weight, and the outside weather conditions. Rotor wing aircraft will need to account for any potential negative side effects of their rotor down-draft while on approach, avoiding damaging homes or property, injuring humans or animals with debris, or making the landing site dangerous for other aircraft.
Cargo operations in small airfields or landing strips should match the available capacity on the ground. Most cargo at remote landing strips will need to be loose loaded and offloaded by hand. The aircraft themselves will need to be capable of being safely accessed and loaded/offloaded by relatively unskilled labour, usually with ramps or low side clearance.

<table>
<thead>
<tr>
<th>Cargo offloaded using ramps - can be done easily by hand</th>
<th>Cargo requiring special ground equipment and MHE to offload</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Cargo offloaded using ramps" /></td>
<td><img src="image2" alt="Cargo requiring special ground equipment" /></td>
</tr>
</tbody>
</table>

Physical access to landing strips may be quite unrestricted, meaning persons and vehicles may be able to operate right next to the aircraft. Any vehicles brought to the landing strip to facilitate cargo movement should be careful not to get near or damage the aircraft; an aircraft grounded in a remote location likely will not have access to special parts or sophisticated repairs for some time, effectively putting the aircraft out of service.

**Personal Safety Around Aircraft**

Operating on landing strips or airports can be extremely dangerous. Aircraft have extremely powerful propellers or jets, while vehicles and MHE may move chaotically around busy tarmacs. The necessity to utilize certain types of personal protective equipment (PPE) depends on the nature and size of the operation. Common PPE used around cargo aircraft might include:

- High-visibility / reflective vests
- Work gloves and close toed shoes
- Ear and eye protection

Reflective vests should always be used in airside operations where motorized ground handling equipment is used, or where multiple aircraft may be taking off/landing/taxing simultaneously. Aircraft and ground handling equipment often have very poor visibility, and their size and weight can easily harm or kill humans.

Aircraft propulsion can also be extremely loud, and operating within any close proximity to an aircraft with jets or propellers turned on can easily permanently damage hearing. Hearing damage may be acute and rapid, or it may accumulate over time. Ground crew operating around active aircraft at any time should wear proper ear protection at all times. Any person travelling in a helicopter for any period of time should also always wear ear protection. Some older fixed wing aircraft also may require passengers to wear ear protection.

Aircraft have powerful propulsion systems to keep them in flight, and these propulsion systems are extremely dangerous to be around when the vehicle is not in flight. When moving around a landing strip or airport tarmac, **never under any circumstances** approach a jet turbine, helicopter blade or propeller while it is in motion, unless it is under the direct supervision of qualified ground safety personnel. Turbines, blades and propellers should also be avoided if the aircraft engine is running or the operating status of the aircraft is unknown.

When operating around an airfield, never assume freedom of movement. Airfields and airports are often highly restricted environments, and air and ground handling crews won’t necessarily expect the presence of unauthorized persons. Before operating in any space where aircraft land, take off, or are repaired, refueled or loaded/offloaded, consult with airport authorities and your local security focal point.

**Sending Goods by Air**

**Air Transport Documentation**
The overall requirements for and types of documentation used for air transport depend on the nature of the air transport. The normal documentation requirements for most shipments (waybill, packing list, proforma, etc) applies to all shipments, including air shipments. There are documents specific to air shipping however. These might include:

**Airway Bills (AWB)** - By far the most common and important document related to airfreight. AWBs are regulated by IATA, and have a standard format for ease of reading and reference. It should be noted that AWBs are only legally required for international transport, however domestic CAA and even non officially regulated air carriers can and do request the use of AWBs. The AWB is the carrier’s receipt by air, evidence of the contract of carriage and is usually non-negotiable. It is made out to a named consignee who is the only party to whom the carrier can deliver. Many carriers even make it easy to track and trace cargo in real time using AWB numbers on their website. Through its standardised layout, AWBs will denote:

- Shipper name and contact details
- Consignee/Notify party name and contact details
- Special handling information
- Cargo description, including item description and total chargeable weight
- Customs value

The above information should match the information coming on other shipper generated shipping documents. In the top right corner of every official AWB, there will be an AWB number, which is unique to that one AWB. The AWB number is always eleven digits; the first three are the IATA designated airline prefix, while the last seven digits are the unique serial number. Many airlines make AWB numbers easy to trace online.

Original, airline generated AWBs are generally the only acceptable AWBs that customs authorities will recognise. The original paper copy will go with the consignment, but scanned copies are usually acceptable for customs purposes. The AWB generated by the airline is typically referred to as the “Master” AWB, or sometimes MAWB.

Example AWB:
**Air Waybill**

Issued by

Copies 1, 2 and 3 of this Air Waybill are originals and have the same validity.

It is agreed that the goods described herein are accepted in apparent good order and condition (except as noted) for carriage SUBJECT TO THE CONDITIONS OF CONTRACT ON THE REVERSE HEREOF. ALL GOODS MAY BE CARRIED BY ANY OTHER MEANS INCLUDING ROAD OR ANY OTHER CARRIER UNLESS SPECIFIC CONTRARY INSTRUCTIONS ARE GIVEN HEREIN BY THE SHIPPER, AND SHIPPER AGREES THAT THE SHIPMENT MAY BE CARRIED VIA INTERMEDIATE STOPPING PLACES WHICH THE CARRIER DEEMS APPROPRIATE. THE SHIPPER'S ATTENTION IS DRAWN TO THE NOTICE CONCERNING CARRIER'S LIMITATION OF LIABILITY. Shipper may increase such limitation of liability by declaring a higher value for carriage and paying a supplemental charge if required.

**Accounting Information**

**Optional Shipping Information**

<table>
<thead>
<tr>
<th>Reference Number</th>
<th>Optional Shipping Information</th>
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</table>

**Handling Information**

<table>
<thead>
<tr>
<th>No. of Pieces</th>
<th>Gross Weight</th>
<th>Weight Charge</th>
<th>Collect</th>
</tr>
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<tbody>
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<td></td>
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</table>

**Nature and Quantity of Goods**

<table>
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<tr>
<th>(Incl. Dimensions or Volume)</th>
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**Other Charges**

<table>
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<tr>
<th>Valuation Charge</th>
<th>Other Charges</th>
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</tbody>
</table>

Shipper certifies that the particulars on the face hereof are correct and that insofar as any part of the consignment contains dangerous goods, such part is properly described by name and is in proper condition for carriage by air according to the applicable Dangerous Goods Regulations.

**Signature of Shipper or his Agent**

**Executed on**

**Signed at**

**Signature of Issuing Carrier or its Agent**
House AWB – A “House” AWB – sometimes referred to as a HAWB - is generated by a forwarder or broker and provided to a client upon request. HAWBs generally have all the same information as a regular AWB, but are not necessarily signed or have the same tracking information as the MAWB. Customs authorities generally do not recognise HAWBs as an official document for customs procedures as there may be some difference between the HAWB and the MAWB. HAWB may still be useful for internal tracking purposes, however.

Non-Standard Waybills – In emergency settings, especially when in-country movement is required via air, the AWB may not be applicable or available. Cargo moved via unconventional air movement will generally always require some form of documentation, however this may look like a stand-alone packing list, self-made cargo manifest (similar to a packing list), or in the case of movement on military assets, a standard form internal to that specific military.

Shippers Declaration of Hazardous Goods (HazDec) – Much like AWBs, HazDecs are predefined by IATA, and are essential to the shipping process. HazDecs contain relevant information on any and all DG items for loadmasters and pilots. Any airline following IATA regulations will not accept a completed HazDec unless it was filled out and signed by someone who is fully certified in DG handling through an IATA accredited program. Failure to comply with proper completion of a HazDec, or incidents that may occur from incorrectly documented DG can result in fines, court action and jail time. Please consult the Dangerous Goods section to this guide for more detailed information.

Blank HazDec:
SHIPPER'S DECLARATION FOR DANGEROUS GOODS

<table>
<thead>
<tr>
<th>Shipper</th>
<th>Air Waybill No.</th>
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<tr>
<td></td>
<td>Page of Pages</td>
</tr>
<tr>
<td></td>
<td>Shipper's Reference No. (optional)</td>
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</table>

Cconsignee

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for:

PASSenger and CARGO aircraft  CARGO  AIRCRAFT ONLY

Airport of Departure (optional):

Airport of Destination (optional):

<table>
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<th>Shipment type: (delete non-applicable)</th>
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<tr>
<td>NON-RADIOACTIVE  RADIOACTIVE</td>
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NATURE AND QUANTITY OF DANGEROUS GOODS

<table>
<thead>
<tr>
<th>Dangerous Goods Identification</th>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (subsidiary hazard)</th>
<th>Packing Group</th>
<th>Quantity and Type of Packing</th>
<th>Packing Inst.</th>
<th>Authorization</th>
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</thead>
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Additional Handling Information

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. I declare that all of the applicable air transport requirements have been met.

<table>
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<tr>
<th>Name of signatory</th>
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<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Signature</td>
</tr>
<tr>
<td>(See warning above)</td>
</tr>
</tbody>
</table>
**Chargeable Weight**

When procuring air transport services, planners must contend with what is called “chargeable weight”. As a general rule, airlines charge customers per the gross weight of their cargo. Due to the nature of air travel, an increase in weight generally means an increase in fuel, which is an increase in cost. However, some shipments by their nature are extremely light even though they may take up a large volume. Even though light cargo may take up less fuel, airlines still charge some basic minimum to recover their operating costs as charting per weight would actually lose them money.

To address income loss to non dense cargo, air operators may speak in terms of "volumetric weight" or "cubic weight." Volumetric weight is a method of determining how to evaluate the relative costs of transporting items based on their volumes. Volumetric weight can be calculated using the following equations:

<table>
<thead>
<tr>
<th>Metric</th>
<th>( L (cm) x W (cm) x H (cm) ) ÷ 6,000 = Volumetric Weight (KG)</th>
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</thead>
<tbody>
<tr>
<td>Imperial</td>
<td>( L (in) x W (in) x H (in) ) ÷ 166 = Volumetric Weight (LB)</td>
</tr>
<tr>
<td>Imperial to Metric</td>
<td>( L (in) x W (in) x H (in) ) ÷ 366 = Volumetric Weight (KG)</td>
</tr>
</tbody>
</table>

Chargeable weight then refers to the "relative" weight an airline will bill customers at. As a general rule, the will quote customers at which ever the greater between the two weight values - the actual gross weight of the cargo or the volumetric weight of the cargo. The airline will be the ultimate party determining how to charge customers, but users of air service should pay close attention to the resulting "chargeable weight" contained on their AWBs. There may be situations where the chargeable weight is significantly higher than their gross weight, which can impact budget and planning.

**Movement Timing**

In the world of aviation, timing is an enormous factor. Aircraft operating out of commercial airports must adhere to strict schedules and time tables.

- Regularly scheduled air craft typically have pre-defined routing that means they will land and take off at specific intervals that will not change much.
- Charter aircraft are frequently being bid upon by multiple parties, and unless a contract is signed they cannot commit for long periods of time.
- All aircraft are subject to the time tables of the airport they operate in. Large commercial airports might limit the amount of time aircraft can spend on the ground before accruing additional charges. Aircraft will typically only be allotted a limited time in specific parking spots as well.

When arranging to ship cargo by air, parties should be prepared well in advance and have all cargo ready at exactly the time specified by the forwarder or the air operator. A failure to deliver cargo on time could result in additional charges, or losing space on the aircraft all together.

**Local Aircraft Contracting**

In austere operating environments, individual response agencies may require the use of ad-hoc cargo movement using local air operators. Identifying and understanding the proper aircraft or proper service provider can be extremely challenging, especially at local levels operating with limited time and budgets.

Locally operated aircraft in emergency or conflict settings pose unique and enhanced risks to parties who may wish to contract the service:

- Local/small aircraft may not be fully registered to operate in the context of operation.
- Local operators may have insufficient safety standards, or a known history of safety and security incidents humanitarian agencies may not know.
- In conflict settings, local air operators may be involved with transportation of weapons or supplies to parties of the conflict, sometimes along the same route humanitarian organisations operate.
- In any context, local operators may be involved with smuggling, human rights violations, or other illegal or unethical activities.

As a general rule, humanitarian agencies should not charter local aircraft directly with owners of aircraft. Instead, small scale or local charter aircraft should still be solicited through a reputable and known freight forwarder or brokerage service. Though going through a third-party may add some additional costs, forwarders and brokers have access to information or tools that enable them to screen for inappropriate or unethical transporters. The contracted payment terms and arbitration processes will also likely be more transparent and well defined when going through a reputable third-party.

In the event a third-party forwarder or brokerage is not available or not able to sufficiently fulfil the charter needs, and a humanitarian agency still wishes to solicit local air transport, there are a few steps to be considered by contracting agencies:

- Obtain aircraft registration/tail number, and names of pilot and crew. Though a forwarder may not be able to contract with the party, they may still be able to do a due diligence check.
- Ask other agencies who used the service in the past, as well as consult with local UN offices who may track aircraft (ICAO, UN agencies contracting air assets in country, etc).
- If possible, contact local Civil Aviation Authorities to both check registration and obtain information on safety history.
* Search for the registration/tail number online to see if the aircraft has been flagged for any reason.
* Ensure the air operator understands the route, locations, and cargo (type, dimensions).
* Never sign a contract unless it has been reviewed by both a lawyer locally, and by a designated legal focal point in headquarters.
* Payment terms should indicate payment is only due on successful delivery of cargo – never accept terms that include payment even if aircraft is unable to perform its contracted duties for whatever reason.

**Cargo Configuration for Aircraft**

Cargo shipped via air tends to require more attention to details. Unlike the inside of a standard shipping container or regular box truck, the inside of aircraft tends to be irregularly shaped. Fixed wing aircraft – especially fixed wing aircraft that operate at high altitude – will have curved cylindrical interiors, while larger aircraft may have multiple decks of varying heights. Additionally, the width and height of interior cargo holds and aircraft doors doors is different for virtually every aircraft. Frequently, more than one aircraft will be used for multiple legs of a transport route, meaning pallets can be broken down and cargo reloaded multiple times to match the different types of aircraft. This tends to lead to cargo being broken down and re-consolidated extensively throughout the transport process.

- **Cargo Hold** - the physical space inside an aircraft that is used to transport cargo.
- **Payload** - the maximum carrying capacity of an aircraft, usually expressed in weight. Max payloads may change for a single aircraft based on distance and operating conditions.

Example upper deck of a cargo plane:

To accommodate the variance in the size needs for different airframes, cargo shipped via air tends to be “loose-loaded,” being loaded at the lowest handling unit (carton, sack, etc), so that handling crews can maximise space and shape cargo builds to fit the interior of the available cargo space. Oversized cargo, or pre-made pallets that don’t fit the specific dimensions of the airframe in question will either not be loaded, or will need to be broken down into smaller units for loading.

**Unit Load Devices** - Many aircraft will utilise what are known as “Unit Load Devices,” (ULD) or pre-made containers that facilitate the easy transport of cargo via air. ULDs are sometimes referred to by the term “Build Up Pallets” or BUPs, however ULD is a more accurate term as many ULDs are not actually pallets, but rather custom designed frames of irregular shapes.

Each airframe has its own specific dimensions of UDL which are used internally by the air carriers and won't be the responsibility of the shipping party to obtain or manage. UDLs require the assistance of MHE or other vehicles to move and load, and are usually managed out of larger professional airport with trained ground crew. Understanding UDLs can help transport planning for shippers.

Some aircraft will load cargo on a type of UDL called an “airplane pallet” – the pallets thin sheets of metal that can be easily moved on rollers, and have much more storage surface than warehouse pallets. Airplane pallets come in a variety of sizes, and are usually purpose built for one or a few aircraft types. Cargo will be loaded loose on the pallet pre-shaped to match the interior of the specific aircraft in question, and will be covered in cargo netting. Airplane pallets and cargo netting can be very expensive, and should be treated as any other expensive equipment.

Example airplane pallet and netting:
Larger and mixed-use aircraft will often use a form of ULD called a “contoured container.” Contour containers are sold containers with one or more rigid sides that are pre-shaped to match specific compartments inside of an aircraft. The containers are made of extremely thin metal, and are designed to take the guess work out of space planning. There are a variety of contour containers, including partially open containers, refrigerated containers, etc. The use of these specific variations will be decided by the airline and the load master based on the needs of the shipper.

Example contoured container:

Many ULDs are custom designed for specific purposes, including transporting of refrigerated items or handling livestock. Any form of ULD usually requires specialised handling equipment, and won’t be loaded or moved without a trained professional knowledgeable about the cargo, the aircraft and the ULD handling requirements.

Hand Loading – Aircraft used in smaller or irregular flights are often loose loaded by hand. This entails loaders and crew manually loading items into a cargo hold at the handling unit level, stacking and stuffing where ever space is available, and where ever is safe or appropriate. Aircraft used in humanitarian operations at the domestic level frequently use hand loading due to lack of equipment and aircraft type. Hand loading aircraft has limitations, including requiring additional time to complete and being less secure than netted cargo, but is useful insofar as it can be done in almost any environment and under almost any condition.

Regardless of ULD or hand loading method, each cargo hold maximum allowable weight may fluctuate from the published weight based on the weight of items loaded into other cargo holds. The Loadmaster should communicate payload limitations in advance and will control cargo at the point of loading.

Dangerous Goods

Dangerous Goods (DG) has special packaging and labelling requirements. IATA continually publishes an updated guide for DG packaging and labelling for air transport. Dangerous goods of different classification will need to be labelled with the appropriate and corresponding label. Additionally, IATA and other safety guidelines may stipulate the maximum size and quantities of certain DG items that can be transported, and will stipulate any required “overpacking,” or an additional layer of packaging over the handling unit packaging. Packaging and labelling standards for cargo should be overseen by persons who are properly certified and accredited through an IATA approved DG certification program. Please consult the Dangerous Goods section to this guide for more detailed information.

Templates and Tools