Basic Principles of Air Cargo Transport

Presented by
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Learning Objectives:
The applicant should be proficient with the basic regulations for air transport. He should be able to explain the ground handling and the documentation procedures of air cargo transport.
SPECIFIC FEATURES OF AIR Transport

participants
- military aviation
- civil aviation

transport objects
- persons
- mail
- cargo

accessibility
- publicly accessible aviation
- private aviation

economic targets
- commercial air transport
- non-commercial air transport

regularity
- scheduled liner services
- non-scheduled services

traffic area
- regional services
- interregional services
- continental services
- intercontinental services

air space
- national traffic
- cross-border traffic

Caption:
specific feature

Air freight markets & main economic regions

Air traffic flow on between 500 largest airports worldwide
Air freight markets & main economic regions - 2

National level:
* mainly in large countries with long domestic road / rail distances (replacing or complementing them)
* also very important: intraregional markets and connections (e.g. within SADC, EU etc)
Air freight markets & main economic regions - 3

International level I:

* intra-continental trade with valuable and/or urgent cargo (e.g. urgent spare parts, medical supplies etc.)

* intra-continental supply chains
e. g. USA – East Coast to West Coast & vice versa

* coverage of trans-continental distances
e. g. Africa – N to S / E to W & vice versa)
**Major intercontinental routes**
e. g.
* North Atlantic route (USA ↔ [Western] Europe)
* Asian/Pacific destinations ↔ USA
* Asian/Pacific destinations ↔ Europe)
* Europe ↔ Latin America
* Europe ↔ Africa
* Europe ↔ Middle East
Advantages of air cargo transport

* fastest means of transport available on long distances
* smallest damage quote of all means of transport (relative to distance covered)
* modest packaging requirements
* short transport times mean short capital lockup periods
Disadvantages of air cargo transport

* high transport costs (in absolute figures)

* load capacity is limited

* stowage problems due to egg-like cross-section of aircraft

* Dependency on airports

http://encyclopedia2.thefreedictionary.com “The egg”
Analysis of consignment structure

* Generally, Air cargo typically is:-
  * (relatively) small
  * lightweight
  * urgent
  * valuable

* However,
  “modern” air planes can carry cargo of (almost) any size & weight;
  the limit is the aircraft itself
AIRCRAFTS: types and specifications
Types of aircraft

- cargo only
- pax (with belly cargo in compartment 5)
- mixed versions (combi, convertibles)
- Piggyback cargo

Aircraft Range

* short haul
* medium range – intra-continental distances
* long haul / extended range – inter-continental
**Loading capacity**

The loading capacity depends on:
- maximum take-off weight
- maximum landing weight
- maximum zero fuel weight
- basic weight of aircraft
- fuel
- no. of pax
- weight of cargo (and mail)
- safety margin

**Load & trim sheet**
Specification of cargo holds

- typical structure
- dimensions of cargo hold
- dimensions of cargo doors
- weight per square yard/meter //
  per longitudinal yard / meter

Video:
Jumbo 747-8


https://www.youtube.com/watch?v=yrHOwZQ300k
https://www.youtube.com/watch?v=0JeDrrOL5gk
### Comparisons of cargo aircraft (commercial only)

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Cargo Volume</th>
<th>Cargo Mass</th>
<th>Cruise Speed</th>
<th>Maximum Range</th>
<th>Aircraft Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airbus 330-200F</td>
<td>475 m³</td>
<td>70,000 kg (154,324 lb)</td>
<td>871 km/h (537 mph)</td>
<td>7,400 km (4,000 nm, 4,600 mi)</td>
<td>Commercial</td>
</tr>
<tr>
<td>Antonov 124</td>
<td>-</td>
<td>150,000 kg (330,000 lbs)</td>
<td>800 km/h (430 kn, 490 mph)</td>
<td>5,400 km (2,900 nm, 3,360 mi)</td>
<td>Commercial*</td>
</tr>
<tr>
<td>Boeing 737-700C</td>
<td>107.6 m³ (3,800 cu ft)</td>
<td>18,200 kg (40,000 lbs)</td>
<td>931 km/h (503 kn, 578 mph)</td>
<td>5,330 km (2,880 nmi)</td>
<td>Commercial</td>
</tr>
<tr>
<td>Boeing 757-200 Freighter</td>
<td>239 m³ (8,430 cu ft)</td>
<td>39,780 kg (87,700 lbs)</td>
<td>955 km/h (516 kn, 593 mph)</td>
<td>5,834 km (3,150 nmi)</td>
<td>Commercial</td>
</tr>
<tr>
<td>Boeing 747-8F</td>
<td>854.5 m³ (30,177 cu ft)</td>
<td>134,200 kg (295,800 lbs)</td>
<td>908 km/h (490 kn, 564 mph)</td>
<td>8,288 km (4,475 nmi)</td>
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<tr>
<td>Boeing 767-300 Freighter</td>
<td>438.2 m³ (15,469 cu ft)</td>
<td>52,700 kg (116,200 lbs)</td>
<td>850 km/h (461 kn, 530 mph)</td>
<td>6,025 km (3,225 nmi)</td>
<td>Commercial</td>
</tr>
<tr>
<td>Boeing 777 Freighter</td>
<td>653 m³ (23,051 cu ft)</td>
<td>103,000 kg (230,000 lbs)</td>
<td>896 km/h (484 kn, 557 mph)</td>
<td>9,070 km (4,900 nmi)</td>
<td>Commercial</td>
</tr>
<tr>
<td>McDonnell Douglas MD-11</td>
<td>440 m³ (15,530 cu ft)</td>
<td>91,670 kg (202,100 lbs)</td>
<td>945 km/h (520 kn, 587 mph)</td>
<td>7,320 km (3,950 nmi; 4,548 mi)</td>
<td>Commercial</td>
</tr>
</tbody>
</table>
Load devices in air cargo transport

**payload factor** = ratio between:
- empty weight of aircraft and
- payload (pax, cargo, mail)

“Unit Load Devices“ (ULD)
* air cargo pallets
* air cargo containers
  - usually made of light alloy / aluminum
  - thin, but stable
  - reducing tare weight
  - not easy to handle by forklift (**solution: roller beds**)
Cargo handling at airport (examples)

Video: Ground handling at Frankfurt Airport
https://www.youtube.com/watch?v=C5CPtSQkgpI
https://www.youtube.com/watch?v=i2wu1Qm41ic
Cargo handling at airport (examples, continued)

![Main deck loader](http://www.airportsystems.info/main-deck-loaders/windhoff-cml-7-56.html)

![Container dolly](http://en.wikipedia.org/wiki/File:Container_dolly.JPG)
Cargo handling at airport (examples, continued)

belt loader
http://en.wikipedia.org/wiki/File:Belt_loader.JPG

ground handling at FRA
http://www.fraport.com/content/medialib/...
The full monty of ground handling

http://www.fraport.com/content/medialib/raport/raport-ag/bilddatenbank0/ground_handling_cargo/
lufthansa_cargo_md-11cdg-17/_jcr_content/renditions/mv22450.download_attachment.file/file.jpg
AIR TRANSPORT GOVERNING BODIES

IATA – International Air Transport Association - 1
* is an association of airlines performing
* international scheduled (liner) services
  → full members, full voting rights
* airlines only nationally operating
  → associated members, limited rights
**IATA – Organs**
* General Assembly
* Executive Committee
* IATA-Secretariat (located in Montreal and Geneva)

**IATA – Main targets**
* co-operation between airlines and exchange of information
* co-operation with international organizations (e.g. ICAO)
* standardization of rates and conditions etc. for pax and cargo transport
* setting rules for IATA agency
* Simplification of reciprocal accounts
The role of the air cargo forwarder
IATA-Cargo-Agent

* represents the air cargo carrier(s), mediates transports
* also represents his client / shipper / consignor
* but: it is **not** mandatory to be an IATA agent
  in order to handle air cargo
* accreditation by IATA

**Duties of IATA Cargo Agent:**
* deliver consignments "ready for carriage"
* obey the IATA rules
* clearance / settlement of all freight charges claimed on behalf of airlines in time
* violation of rules can lead to denial of agency
International Civil Aviation Organization (ICAO)
- ICAO (1944 Chicago Convention)
- is a United Nations subdivision
- Members are UN member states
  * that participate
  * or want to participate in international air traffic.

[ICAO Freedoms of the Air (see Appendix 1)]
Main goals of ICAO:

* **Safety**: Enhance global civil aviation safety
* **Security**: Enhance global civil aviation security
* **Environmental Protection and Sustainable Development of Air Transport**: Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment
* **The role of air traffic controllers - video**
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 1

Direct cargo –
* one consignment (with one or more items, by all means)
* from one shipper
* to one consignee
* with one air waybill
* without reloading (transshipment possible)
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 2

Forwarder’s duties:

**order**

* usually by phone, mail, fax, sometimes by handing over consignment to our driver

* results in conclusion of contract
  (depending on relevant national law regulations!)
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 3

Forwarder’s duties:

order (cont’d)
* necessary information to be contained in order:
  - name of customer & consignee
  - kind of cargo (and special handling information)
  - no. of pieces & (gross) weight
  - requested day and of pickup
  - accompanying documents
  - any requested tasks to be done by forwarder
    (in lieu of shipper)
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 4

**pickup**
* pickup of consignment at shipper’s premises

* ordering haulier (short haul), own truck or third party
  (usually for next day, in urgent cases special transport)

* pickup by driver, checking all details of consignments and documents **before** loading consignment on truck
  (interface control by driver; preventing claims against forwarder)
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 5

acceptance at forwarder’s depot

* acceptance of consignment at transshipment depot (interface control)

* checking all items (correct marking, physically unharmed, number of items, documents), i.e. comparing documents and actual consignment items
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 6

**internal processing of order (dispatching forwarder)**

* checking next possible flight
e. g. online, inquiry directly with airline
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 7

booking / reservation
* booking the flight (availability provided)
* usually no specific compartment / lot
* sometimes: specific allotment

BEWARE:
entry of booking data in respective box of AWB
does NOT guarantee flight!!!!
Carrying out direct cargo consignments – 8

documentation
* preparation of documentation
* fill in AWB according to specifications of shipper (see below)
* using IATA form (internationally accepted; part of IATA agency requirements)
* assistance is given in IATA Rules Book (orange)
Carrying out direct cargo consignments – 9

**documentation**

* cargo manifest (usually if consignment consists of more than one item, differently marked, obligatory with consolidated cargo – see below)
* preparing export clearance for customs (necessary export documentation may vary from country to country)
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 10

ready for carriage
* preparing packages ready for carriage
* checking of packaging, suitability for air cargo transport
* applying labels to each package item (see next slide)
* checking measures and weight
* if necessary, adjusting and / or reinforcing packaging (outer)
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 11a
ready for carriage (detail - labelling)

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*FLYING DUCK AIR SERVICES*

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</table>
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 11b
ready for carriage (detail – alternative label)

[Diagram]

[Diagram Description]

- [A] FLYING DUCK AIR SERVICES
- [B] 000-2358 1470 00001
  - Air Waybill No.
- [C] 000 – 2358 1470
  - Total No. of Pieces
- [D] KUL
  - Destination
- [E] 6
  - Product name
- [F] machinery
  - additional information
    - e.g. H-AWB-no., weight a.s.o.

Coded data: Airline-Prefix; AWB-no., separator, no. of items
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 12a
delivery to airport
* delivery within deadline given by airline (LAT – latest acceptance time)
* handing over to airline with all documents (the latter usually in a pouch)
* claiming clean receipt of acceptance by airline (interface control, transfer of liability),
* acceptance stamp with date and time (hh:mm)
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 12b
delivery to airport

* **air freight security** is crucial today
* a complete and unbroken security chain is required for air cargo being accepted without delay caused by security checks

Video: „Your freight in good hands“ (Lufthansa Cargo)

https://www.youtube.com/watch?v=TnrvLYkCEZc
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 13

**departure control**
* checking actual dispatch, usually following day, online or by phone
* if required by customer: tracking and tracing of flight / delivery

**invoicing**
* billing the customer (according to offer)
* maybe: charging consignee (usually via charges collect in AWB, if accepted by airline!!)
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 14

control of transport process
* dealing with any impairment of transport performance (any circumstances preventing carriage, damages, loss of consignment, delays in delivery)
* assisting in regulating claims and liabilities
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 15

Air Waybill - 1
* standard form provided by IATA
* worldwide acceptance
* usually multipart form, consisting of
  3 „originals“, 6 to 11 copies
Original 1 (green or marked green) for carrier
Original 2 (red or marked red) for consignee (doc accompanies consignment)
Original 3 (blue or marked blue) for shipper
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 16

Air Waybill - 2
* copies (usually 6 to 11) serve as
  - proof for further parties involved in transport
    -- forwarder
    -- airport of departure
    -- airport of destination
    -- second / third ... carrier
    -- delivery receipt at final destination
    -- ETC.
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 17

Air Waybill - 3

* AWB usually issued by shipper, can transfer this task to forwarder
* If AWB is completed by carrier, he will demand a "Shipper's letter of instructions" in order to avoid any misconceptions (responsibility for correct specifications remains with shipper!!)
An air cargo forwarder‘s practical work
Carrying out direct cargo consignments – 18

Air Waybill - 4
Functions of an AWB:
* **proof** of conclusion of contract
* **receipt of acceptance** by carrier at airport of departure
* **reference to legal basis** of contract
* **invoice** for freight and supplementary costs (if applicable)
* **insurance policy** (if applicable; value must be given in box „amount of insurance“)
* document for **subsequent instructions** by shipper (after departure)
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 19

Air Waybill - 5
Functions of an AWB:
* delivery receipt at airport of delivery
* shipping list documenting accompanying papers and instructions (see also manifest)
* statement for submission of goods to customs in country of destination
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 20

Air Waybill - 6
Functions of an AWB:
* but: AWB is not negotiable (no document of title to goods)
* AWB may nevertheless be used for L/C (letter of credit) purposes
An air cargo forwarder’s practical work
Carrying out direct cargo consignments – 21
Excursus: Electronic Air Waybill - 1

* eAWB is introduced by IATA
* already in use by a number of airlines and forwarders
* still some problems in practice
* e-AWB – benefits (according to IATA)
  - reduced processing cost (removal of paper AWB, elimination of requirements to file paper AWB)
  - greater accuracy of air waybill data
  - reduced cargo handling delays due to missing or illegible paper AWB
  - real-time access to AWB information (all staff / all stations)
Contract of Carriage

Handing over the consignment to and stamping (clock in) the AWB by the carrier concludes a contract of carriage between carrier and shipper (according to same box in AWB).

(1) direct contracting
(2) **direct contracting with inclusion of a forwarder**
* forwarder takes over all air cargo related services for shipper
* nevertheless contract is concluded between shipper and carrier

(3) **with inclusion of a forwarder (IATA agent)**
TACT (The Air Cargo Tariff)

System of freight rates

* **Class Rates**

* commodities:
  1. unaccompanied baggage,
  2. newspapers, magazines, catalogues a. s. o., equipment/material for bind people,
  3. human remains,
  4. live animals,
  5. valuable cargo, value exceeds 1,000,-- $ per kg gross

* special regulations possible, depending on Traffic Conference Area (within or between)
General Cargo Rates (GCR)

Rate:
* rates are charged per kg
* with actual or volume weight
* rounded to the next half kg.
OBSTACLES IN AIR TRANSPORT

Possible reasons for any obstructions in transport (carriers side)

* fuel problems – necessity to fly around bad weather cells requires additional fuel (influences MTOW – payload ratio)
* equipment change
* passenger overload – (precedence of pax over cargo)
* weight restrictions
* load space problems
* item no. Discrepancy - part-shipments not accepted
Possible reasons for any obstructions in transport
(carriers side – cont’d)
* flight cancelled
* dgr-irregularity
* backlog situation
* delay (caused by connecting flights)
* bad weather situation
* trucking / RFS delayed
* booking failure by airline
* technical reasons; flight in danger
Possible reasons for any obstructions in transport (Agent / forwarders side)

* missing notify address
* missing p.o.d. - proof of delivery
* failure with COD procedure
* missing documents
* missing cargo
* mixed-up cargo
* weight discrepancy
IATA DANGEROUS GOODS REGULATIONS (DGR)

* Dangerous goods are
  * goods or substances that emanate major dangers or
  * risks for health and/or safety of human beings or
  * pose a danger or risk for other goods and / or
  * the environment
IATA Dangerous Goods Regulations (DGR) – 2

These dangers / risks derive from the **physical** and / or **chemical characteristics** in combination with **external influences** on these goods (temperature, pressure, physical impact a. s. o.).

**Dangerous goods have to be properly packed, marked and signed according to the relevant regulations!!!**
IATA Dangerous Goods Regulations (DGR) – 3

**Regulatory basis** for the transport of dangerous goods in aircrafts are the *Technical Instructions of ICAO*, which take the position of laws or at least statutory orders in IACO signatory states.

**Staff of carriers** as well as **forwarders** have to be trained appropriately **in regular periods** with an appointee responsible for all dangerous goods handling within a company.
IATA Dangerous Goods Regulations (DGR) – 4

Shipper's Declaration for Dangerous Goods

The shipper (consignor) has to provide a
* **shipper’s declaration** for **dangerous goods**

* filled in correctly and true and

* signed by him.
IATA Dangerous Goods Regulations (DGR) – 5

Shipper's Declaration for Dangerous Goods (cont’d)

Main contents of a *Shipper’s Declaration*:

- name and address of consignor and consignee
- proper shipping name (no brands!), dangerous goods class, UN or ID number, packing instructions; specific instructions if applicable
- kind of packaging
IATA Dangerous Goods Regulations (DGR) – 6

Shipper's Declaration for Dangerous Goods (cont’d)

Main contents of a Shipper’s Declaration (cont’d):

- declaration if consignment is suitable for pax and/or cargo aircraft or cargo aircraft only
- declaration if consignment contains radioactive or non-radioactive material
- subsidiary dangers, if existing
IATA Dangerous Goods Regulations (DGR) – 8

The DGR handbook contains all necessary information that has to be regarded when transporting dangerous goods.

- dangerous goods classification
  - Class 1: explosives
  - Class 2: flammable gas; non-flammable, non-toxic gas; toxic gas
  - Class 3: flammable liquids
  - Class 4: flammable solid; spontaneously combustible; dangerous when wet
IATA Dangerous Goods Regulations (DGR) – 9

DGR handbook (cont’d)

Class 5: oxidizer; organic peroxide
Class 6: toxic; infectious substance
Class 7: radioactive
Class 8: corrosive
Class 9: miscellaneous
### IATA Dangerous Goods Regulations (DGR) – 10

#### Dangerous goods list - contents:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<th>H</th>
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<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
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<tbody>
<tr>
<td>1490</td>
<td>potassium permanganate</td>
<td>5.1</td>
<td>Oxidizer</td>
<td>II</td>
<td>Y508</td>
<td>2.5 kg</td>
<td>508</td>
<td>5 kg</td>
<td>511</td>
<td>25 kg</td>
<td>5L</td>
<td></td>
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</tbody>
</table>

Meaning of each column:

* A - **UN / ID Number**
* B - **Proper Shipping Name/ Description**
* C - **Class or Division**
* D - **Subsidiary Risk**
* E - **Hazard Label/s**
* F - **Package Group**
* G - **Packaging instructions - passenger aircraft**
* H - **Max Net Qty/Pkge_pax**
* I - **Packaging instructions - passenger aircraft**
* J - **Max Net Qty/Pkge_pax**
* K - **Packaging instructions - cargo aircraft**
* L - **Max Net Qty/Pkge_cargo**
* M - **Special Provisions**
* N - **Emergency Response Drill Code**
Examples of Hazard & handling labels

Class 1: Explosives
Different labels for sub-categories of Class 1

Class 2: Gases
* Red: flammable gas
* Green: non-flammable, non-toxic (compressed)
* White: toxic gases

Source pictures: http://www.gefahrgutshop.de
Class 7:
Radioactive material - type of label depending on transport index and radiation intensity

Source pictures: http://www.gefahrgutshop.de
RR II: http://de.wikipedia.org
Hazard & handling labels - 7

- Dangerous for the environment
- Label stating UN number of contents of package
- Limited Quantity
- For air cargo only: Cargo not allowed in passenger acft.

Source pictures: http://www.gefahrgutshop.de
Appendix

1
ICAO Freedoms of the Air

First

Country A

Country B

Home

Second

Third

Fourth

Fifth

Sixth

Seventh

Eight

Ninth
ICAo: Freedoms of the Air – 2

First Freedom of The Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State or States to fly across its territory without landing (also known as a First Freedom Right).

Second Freedom of The Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State or States to land in its territory for non-traffic purposes (also known as a Second Freedom Right).

Third Freedom of The Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State to put down, in the territory of the first State, traffic coming from the home State of the carrier (also known as a Third Freedom Right).

Source: Manual on the Regulation of International Air Transport (Doc 9626, Part 4)
ICAO: Freedoms of the Air – 3

**Fourth Freedom of The Air** - the right or privilege, in respect of scheduled international air services, granted by one State to another State to take on, in the territory of the first State, traffic destined for the home State of the carrier (also known as a Fourth Freedom Right).

**Fifth Freedom of The Air** - the right or privilege, in respect of scheduled international air services, granted by one State to another State to put down and to take on, in the territory of the first State, traffic coming from or destined to a third State (also known as a Fifth Freedom Right).

ICAO characterizes all "freedoms" beyond the Fifth as "so-called" because only the first five "freedoms" have been officially recognized as such by international treaty.

**Sixth Freedom of The Air** - the right or privilege, in respect of scheduled international air services, of transporting, via the home State of the carrier, traffic moving between two other States (also known as a Sixth Freedom Right). The so-called Sixth Freedom of the Air, unlike the first five freedoms, is not incorporated as such into any widely recognized air service agreements such as the "Five Freedoms Agreement".

Source: Manual on the Regulation of International Air Transport (Doc 9626, Part 4)
ICAO: Freedoms of the Air – 4

**Seventh Freedom of The Air** - the right or privilege, in respect of scheduled international air services, granted by one State to another State, of transporting traffic between the territory of the granting State and any third State with no requirement to include on such operation any point in the territory of the recipient State, i.e. the service need not connect to or be an extension of any service to/from the home State of the carrier.

**Eighth Freedom of The Air** - the right or privilege, in respect of scheduled international air services, of transporting cabotage traffic between two points in the territory of the granting State on a service which originates or terminates in the home country of the foreign carrier or (in connection with the so-called Seventh Freedom of the Air) outside the territory of the granting State (also known as a Eighth Freedom Right or "consecutive cabotage").

**Ninth Freedom of The Air** - the right or privilege of transporting cabotage traffic of the granting State on a service performed entirely within the territory of the granting State (also known as a Ninth Freedom Right or "stand alone" cabotage).

**Source: Manual on the Regulation of International Air Transport (Doc 9626, Pt. 4)**

[https://www.youtube.com/watch?v=DNhH1X8x63A](https://www.youtube.com/watch?v=DNhH1X8x63A)
THANK YOU SO MUCH!

Dankie!