



**Development of the Common Standard Curricula on International Transport and Logistics Basic Training for ASEAN Member States under Sustainable Human Resource Development in Logistics Services**



# **Chapter 2**

# **Most Used**

# **Aircrafts and ULD**

Summarized by FMFF/Wong Kim Chuan



**Development of the Common Standard Curricula on International Transport and Logistics Basic Training for ASEAN Member States under Sustainable Human Resource Development in Logistics Services**

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# Objective

- **Upon completing this unit, the participant should**
  1. Know the types and specifications of most used **aircraft**;
  2. Further have knowledge of the types of air **loading devices** used the most; and
  3. Understand Know aircrafts' **weight limitations & volume limitations**, and maximum cargo dimensions loadable into aircraft and to use **loading charts** correctly.

# Introduction

- Aircraft – one of the **major elements** affect air cargo transportation.
- Aircraft **weight and volume capacity is finite**, cannot be increased.
- Most restrictions and limitations on movement of air cargo are due to the particular nature of this mode of transport;
  1. Aircraft
  2. Bulk load limitations
  3. ULDs



# Aircraft Structure

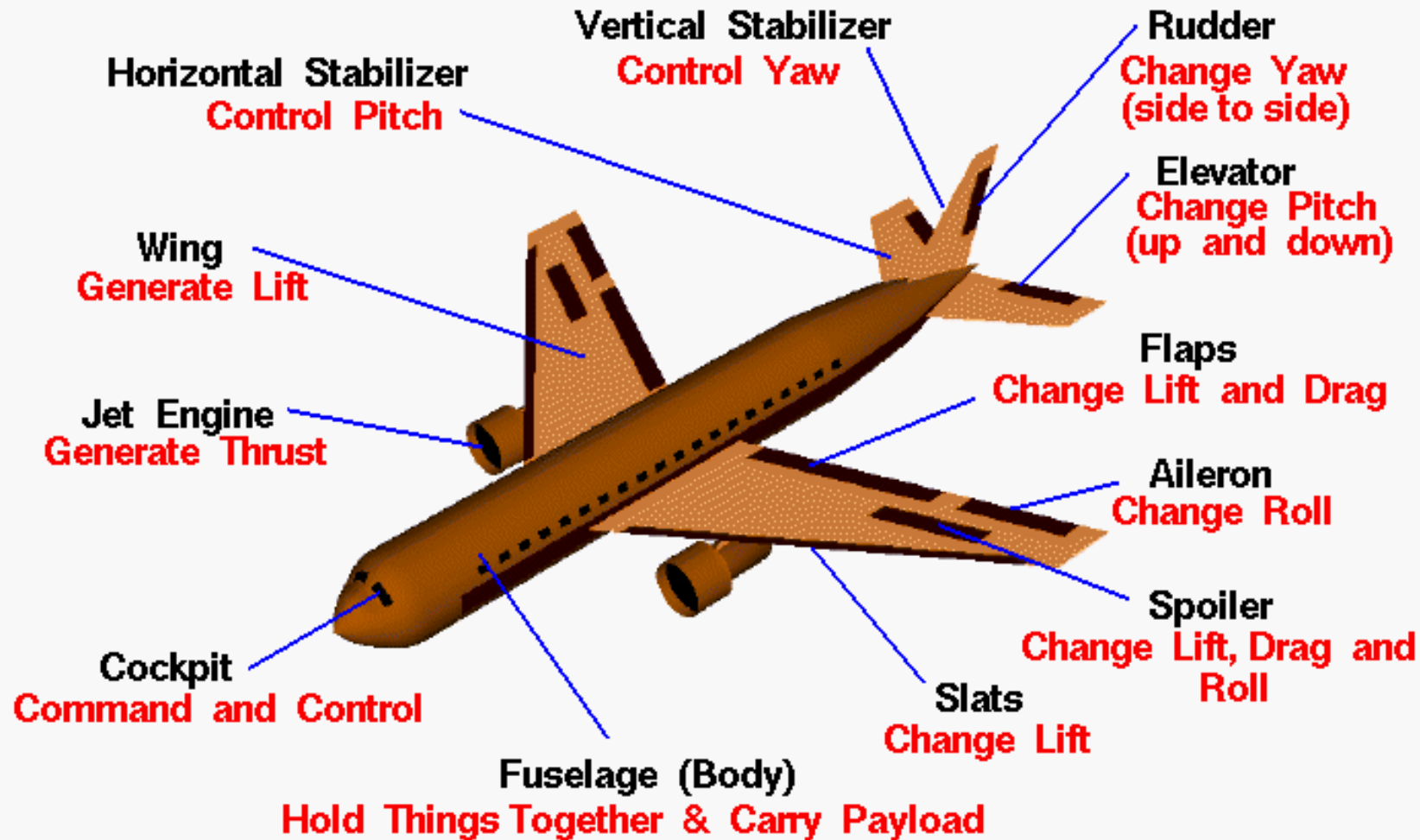
A large, semi-transparent watermark of the ASEAN logo is centered in the background. It features a yellow sunburst design with ten rays, set against a light blue circular background. Below the sunburst, the word "asean" is written in a light blue, lowercase, sans-serif font.

# Aircraft Structure

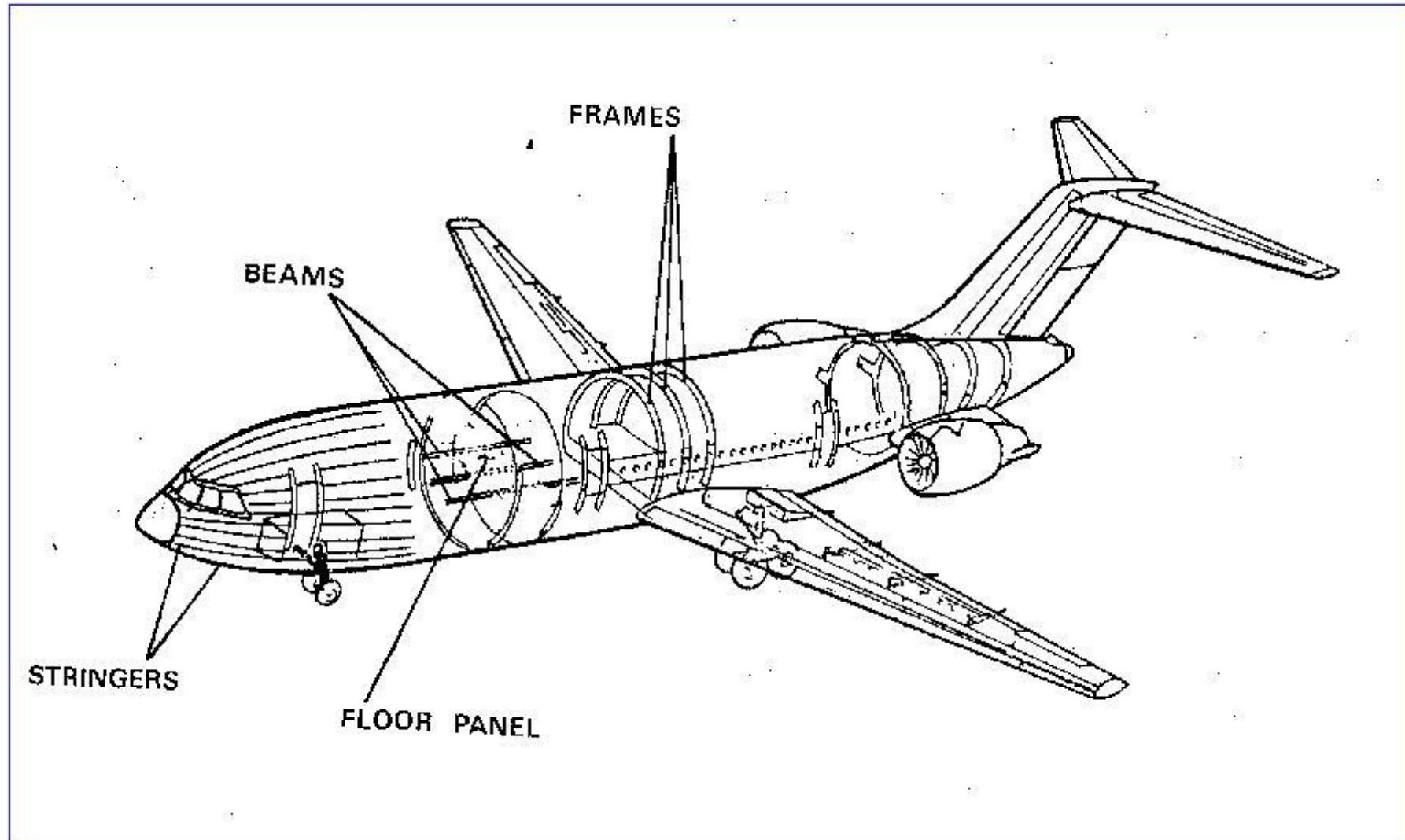


## Airplane Parts Definitions and Function

Glenn  
Research  
Center

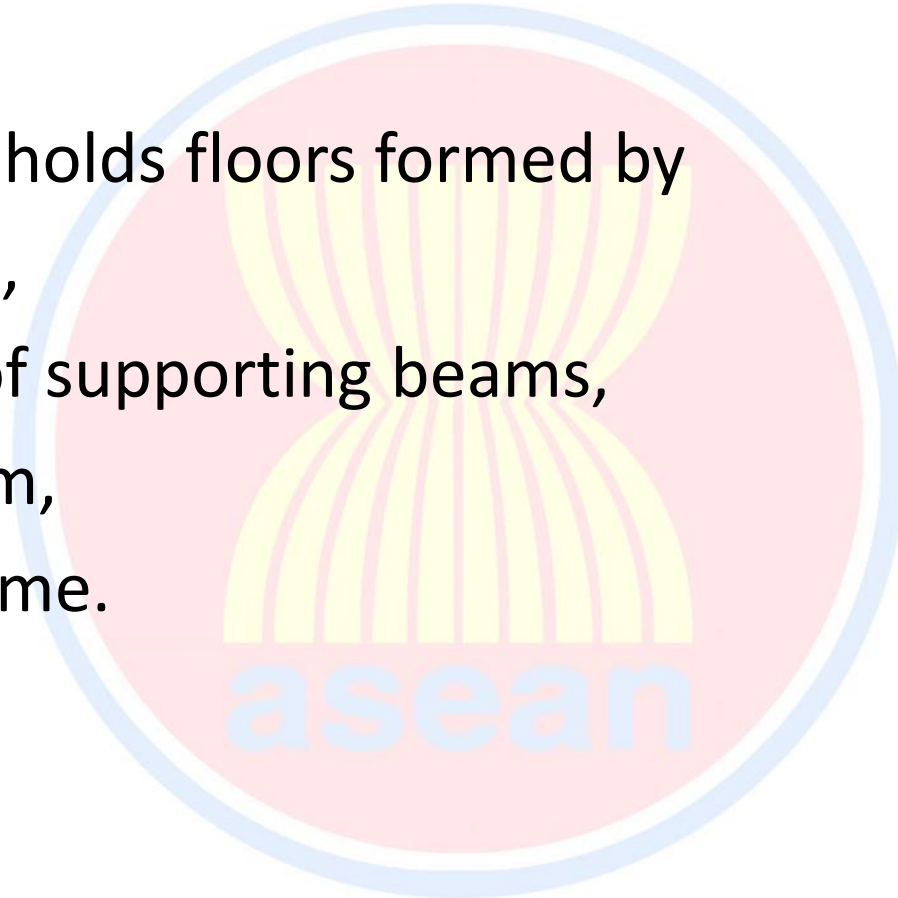


# Aircraft Structure



# Aircraft Structure

- In an aircraft, the ability to carry a load in the fuselage dependent upon the strength of its structure.
  
- The cabin and holds floors formed by
  1. floor panels,
  2. a network of supporting beams,
  3. a cross beam,
  4. fuselage frame.



# Aircraft Structure

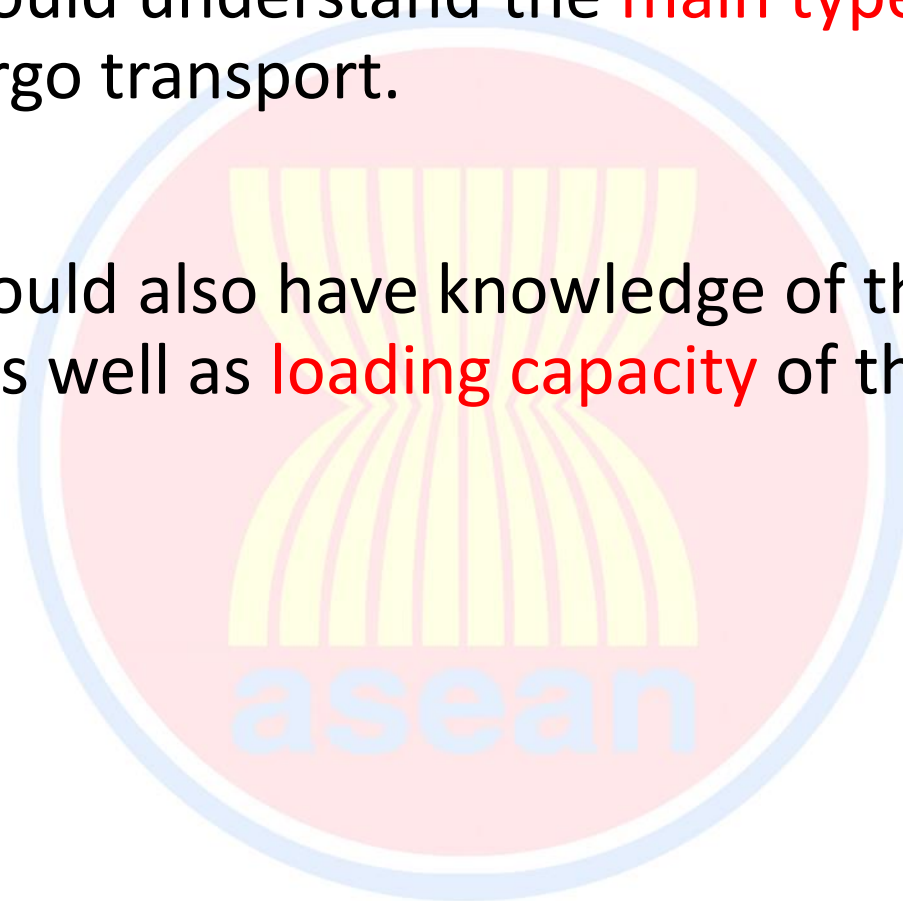
- Weight of **load on floor panel transfer to main fuselage structure.**
- Provided maximum load limitations (maximum hold loads) are observed, **fuselage structure will be able transmit the weight of load onto wings.**
- If the load transfer to the wings exceeds the wings lift capacity, the aircraft is overloaded and unsafe to fly.
- **Compartment limitations** must never be exceeded.

# **The Most Used Aircrafts (Passenger and Freight)**



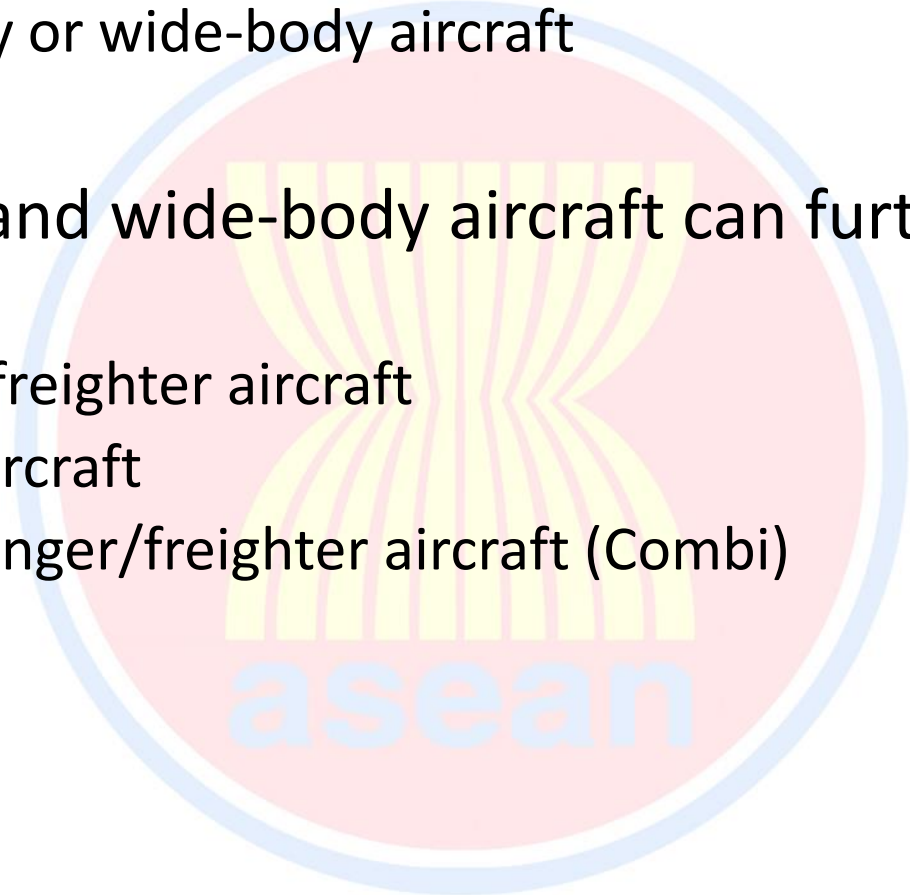
# Objectives

- The student should understand the **main types of aircrafts** that are used for cargo transport.
- The student should also have knowledge of the **main specifications** as well as **loading capacity** of the above aircrafts.



# Introduction

- Aircrafts can be categorized as
  1. Conventional or narrow-body aircraft
  2. High capacity or wide-body aircraft
  
- Narrow-body and wide-body aircraft can further be divided into
  1. All cargo or freighter aircraft
  2. Passenger aircraft
  3. Mixed passenger/freighter aircraft (Combi)

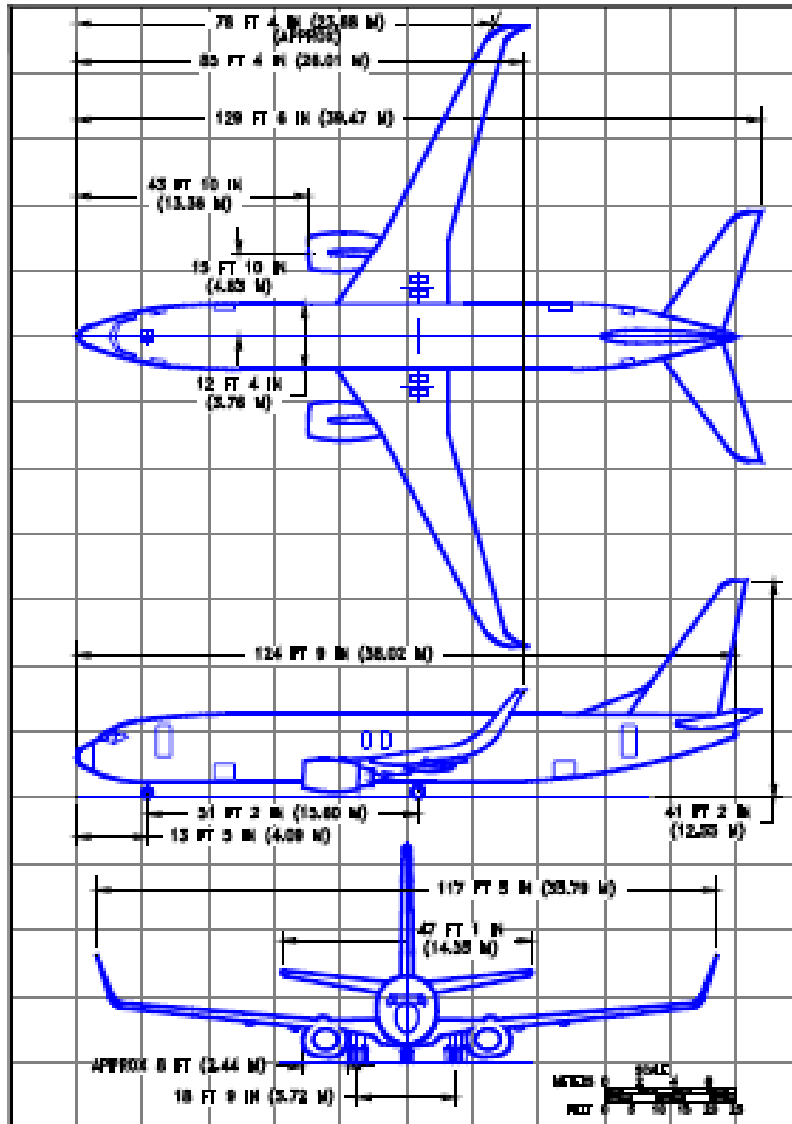




# **Conventional or Narrow-Body Aircraft**

# Conventional or Narrow-Body Aircraft

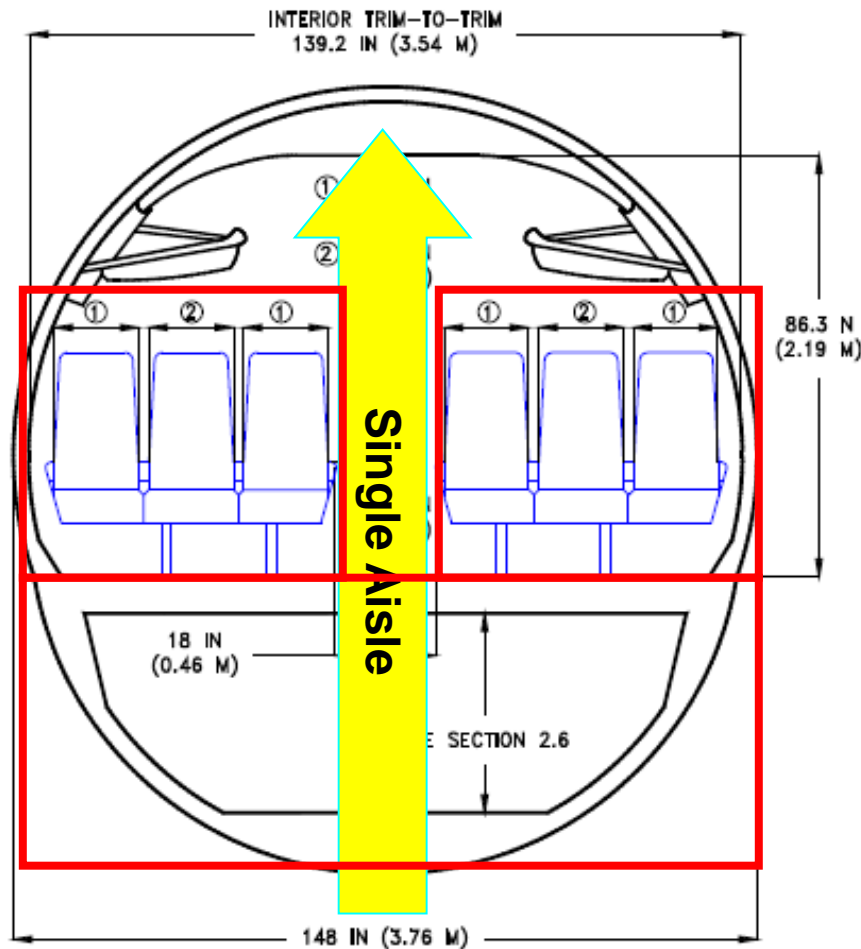
## ■ Boeing 737-800



## □ Aircraft Types:

- Airbus Industrie – A318, A319, A321, A320
- Boeing – B707, B717, B727, B737, B757
- Fokker – F100
- Boeing (Douglas) – DC-8, DC-9, MD-80 series, MD-90

# Conventional or Narrow-Body Aircraft



- Fuselage width 10 to 12 feet or 3 meter to 3.7 meter

- Single aisle

- 2 axial groups of passenger seats

- Cargo holds in lower deck carry bulk cargo **except A320 (maximum height 117 cm)**

# Conventional or Narrow-body Aircraft



Main Deck



Lower Deck

The background features a large, semi-transparent watermark of the ASEAN logo. It consists of a circular emblem with a yellow sunburst design in the center and the word "asean" in blue lowercase letters at the bottom. The entire emblem is set against a light pink circular background.

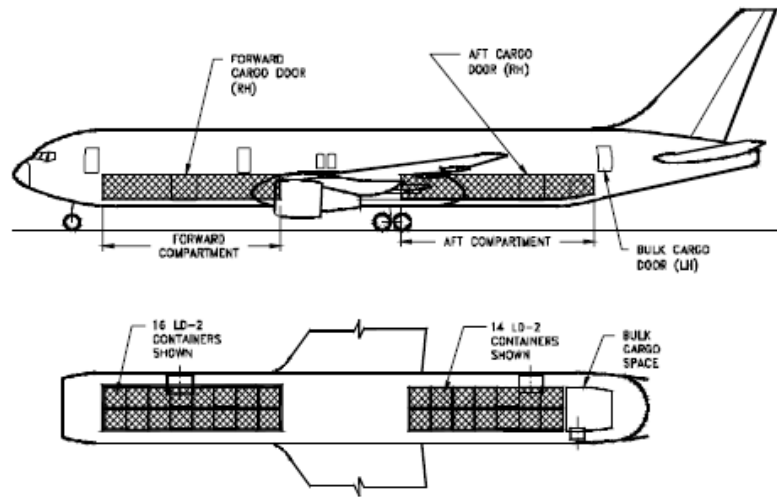
# Show Time

## 737 Build Up.mp4

# High Capacity or Wide-Body Aircraft

## □ Aircraft types

### ■ B767



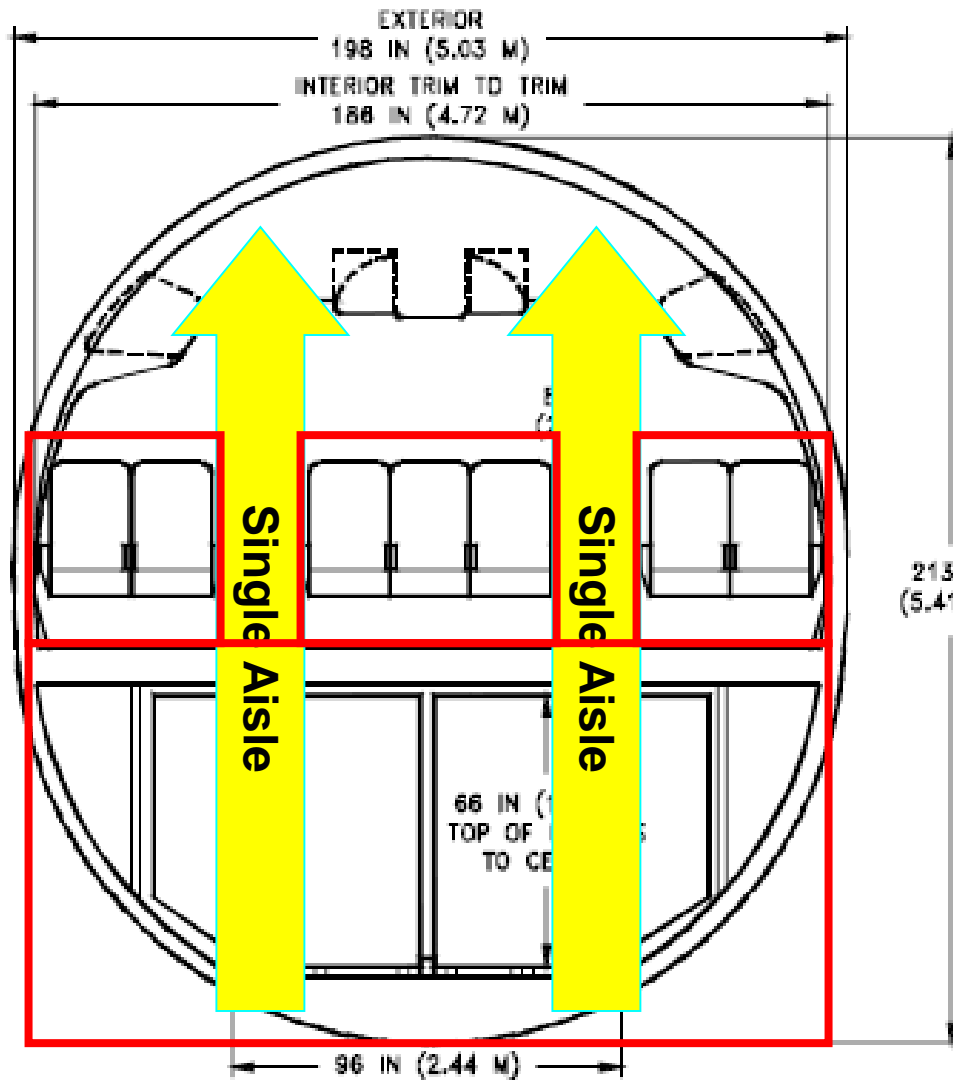
- Airbus Industrie – A300-B, A310, A330, A340, A380

- Boeing – B747, B767, B777

- Lockheed – L1011 Tristar

- Boeing (Douglas) – DC10, MD11

# High Capacity or Wide-Body Aircraft



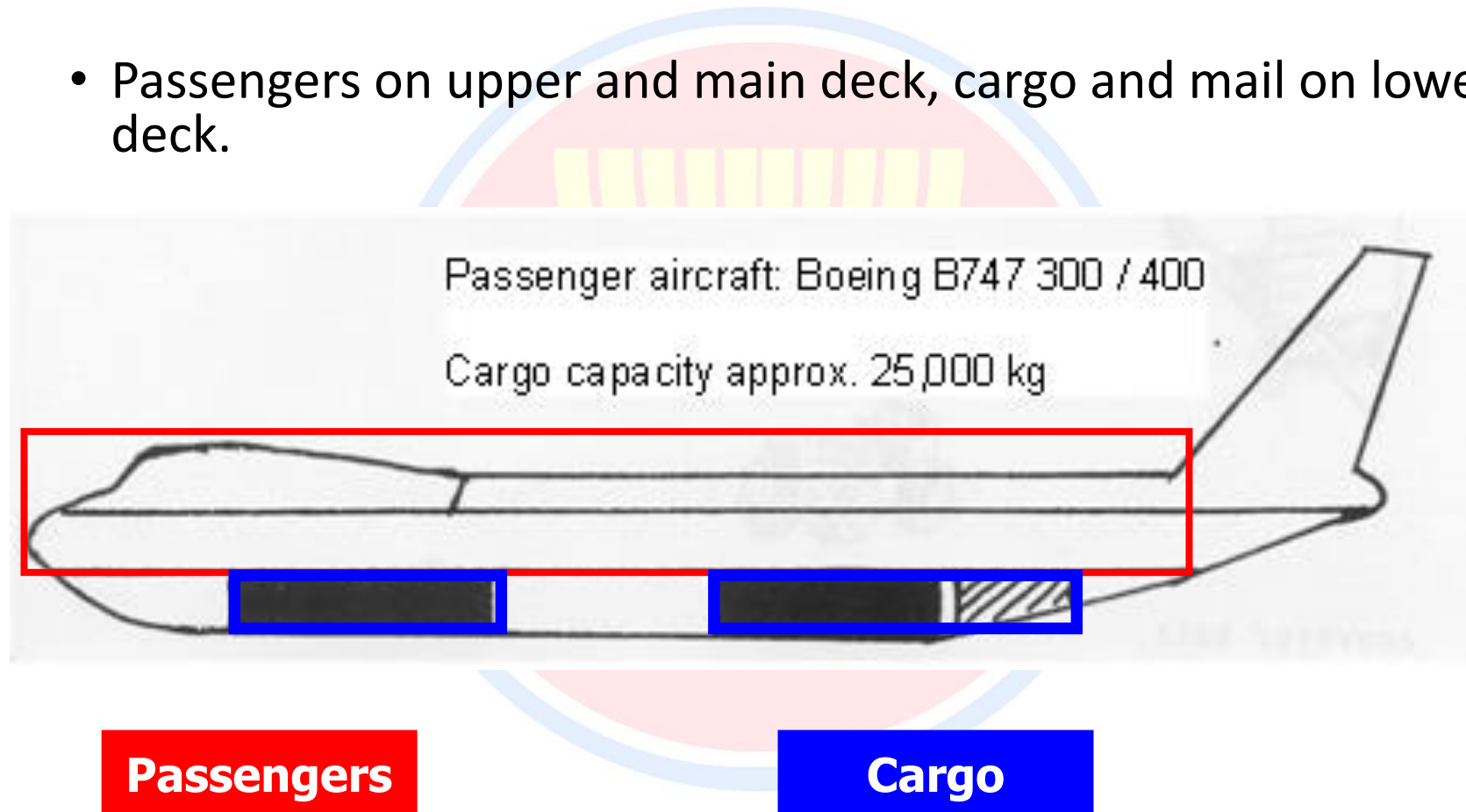
- Fuselage width more than 15 ft. 6 inches (4.72 meter).
- 2 aisles
- 3 axial groups of passenger seats
- Main cargo holds in lower deck carry cargo in ULDs, loose cargo in bulk cargo hold.

# High Capacity / Wide-Body Aircraft

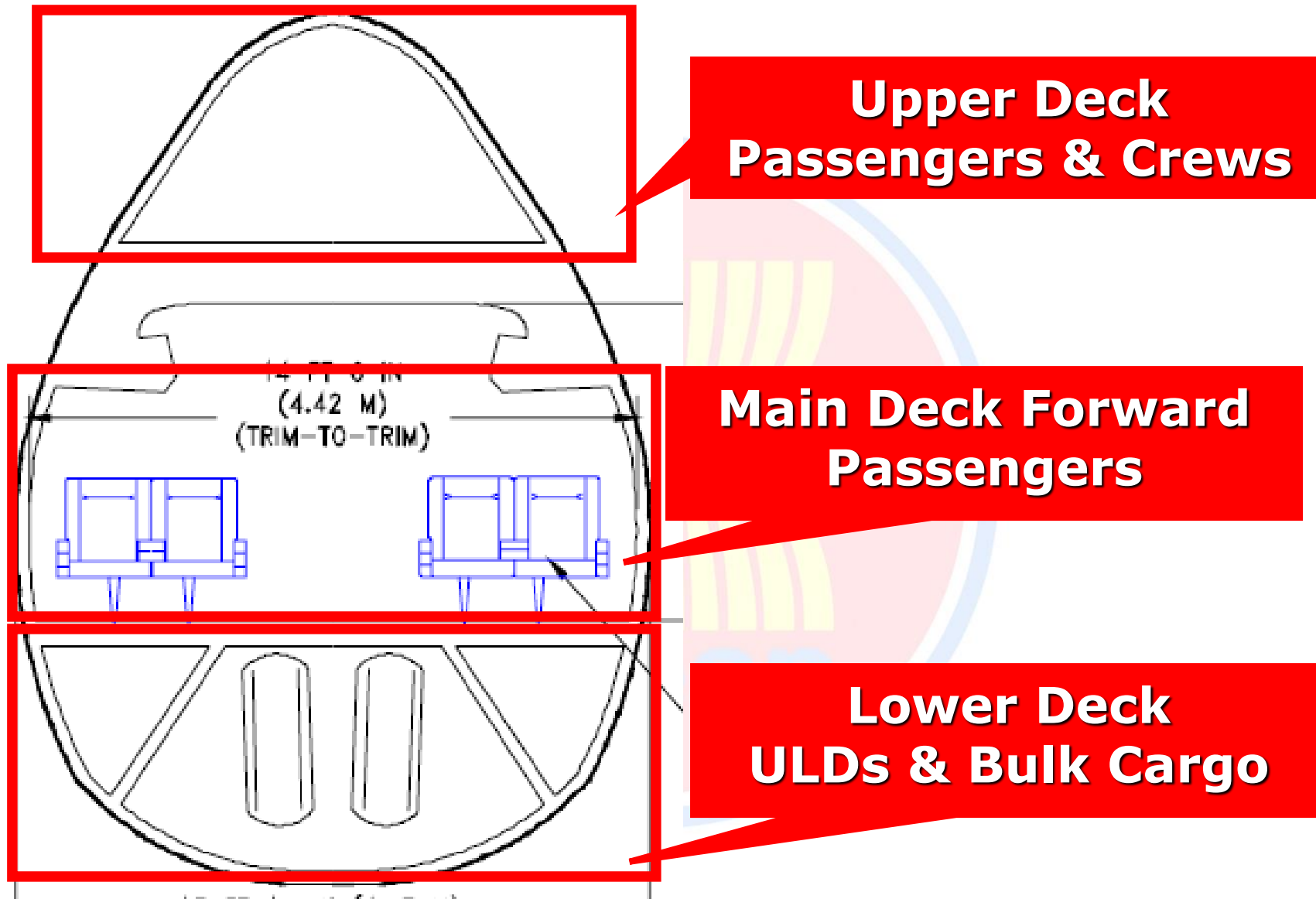


# Passenger Aircraft

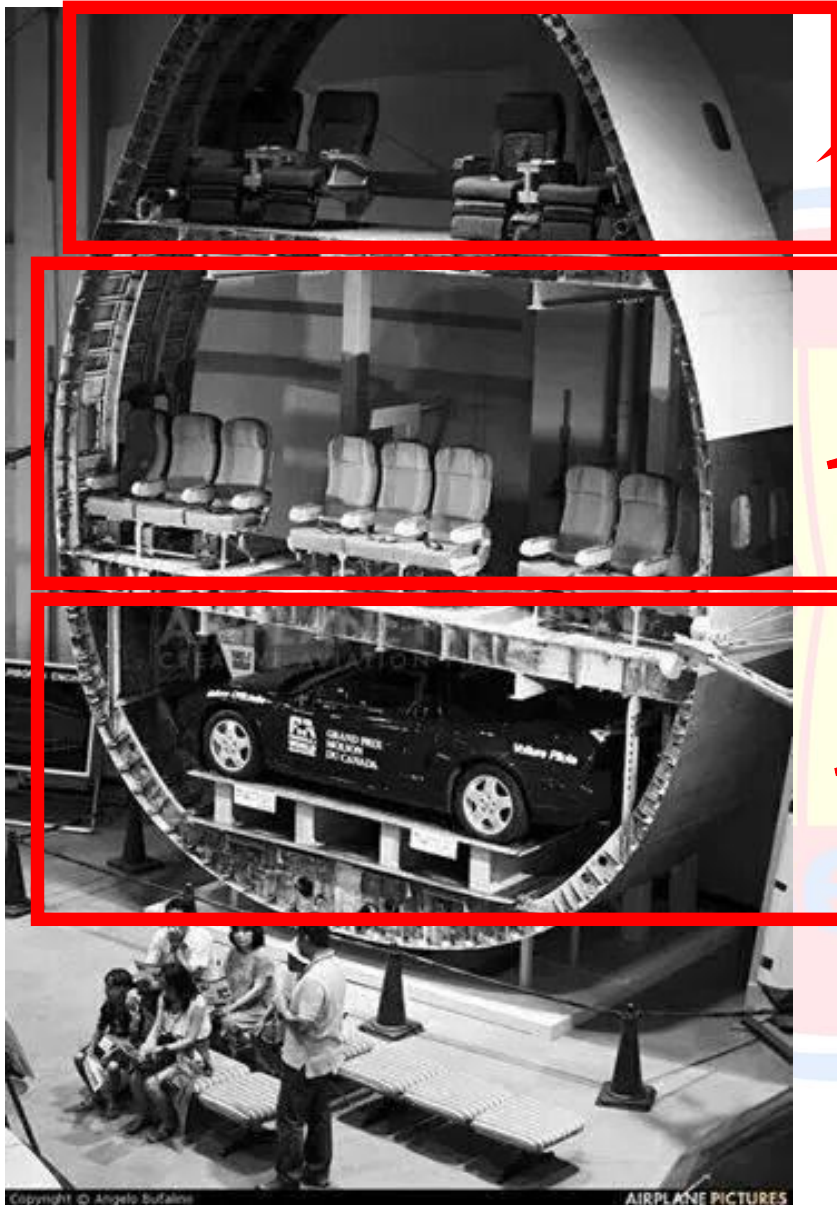
- About 50% of air transportation is done in passenger aircrafts.
- Passengers on upper and main deck, cargo and mail on lower deck.



# Passenger Aircraft B747



# Passenger Aircraft B747



**Upper Deck  
Passengers & Crews**

**Main Deck Forward  
Passengers**

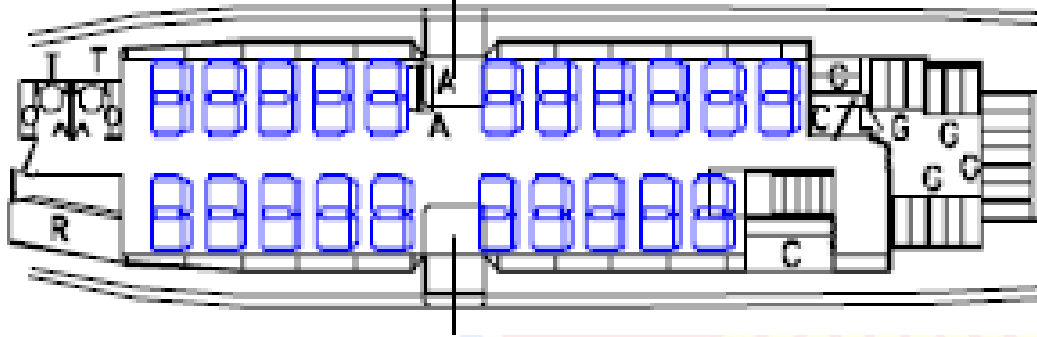
**Lower Deck  
ULDs & Bulk Cargo**

# A330-300 Lower Deck Cargo Hold



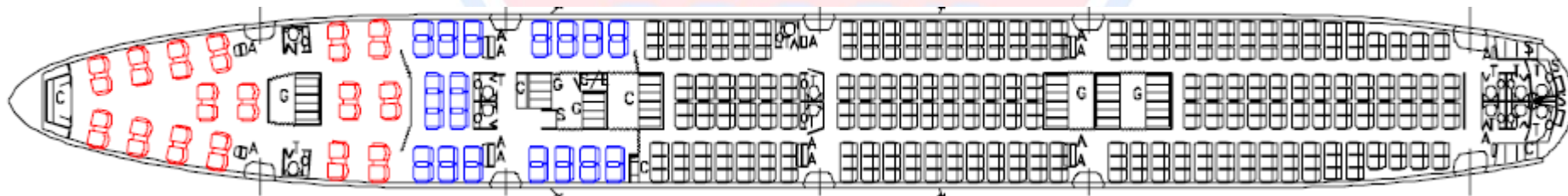
# Passenger Aircraft

UPPER DECK  
\* 42 BUSINESS CLASS SEATS  
AT 38-IN (0.96-M) PITCH

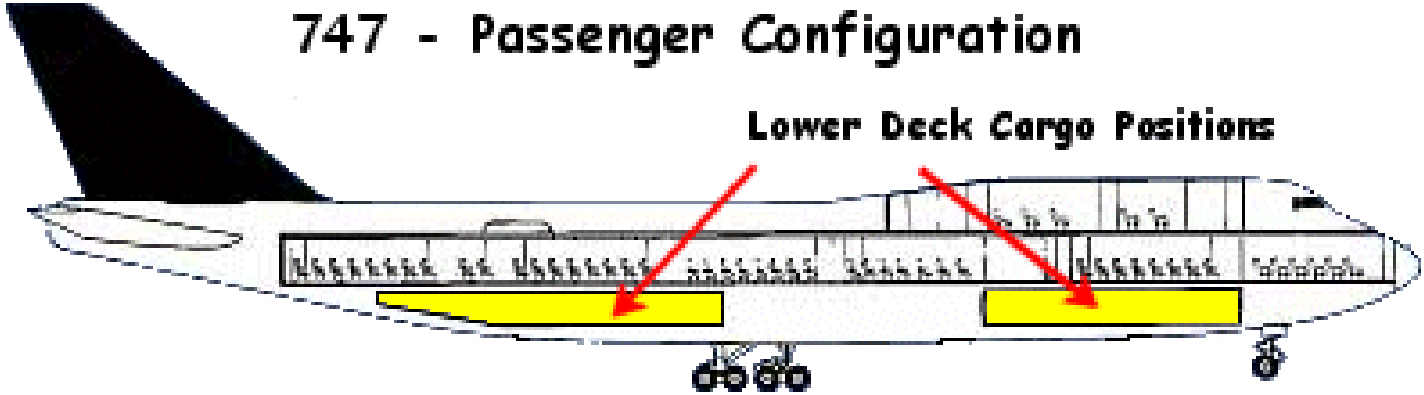


**Upper Deck  
Passengers &  
Crews**

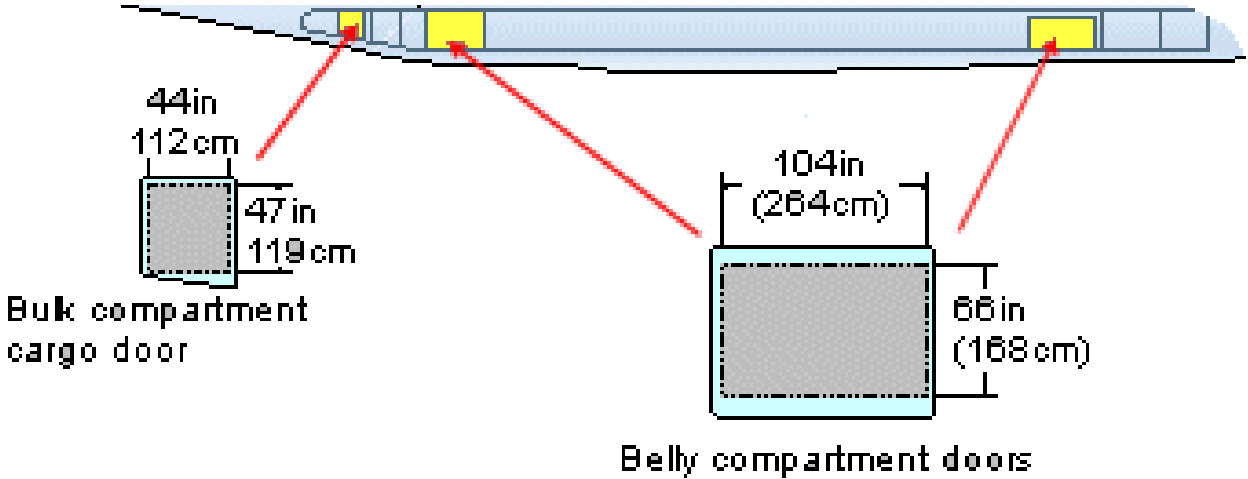
**Main Deck  
Passengers**



# B747 Passenger Configuration



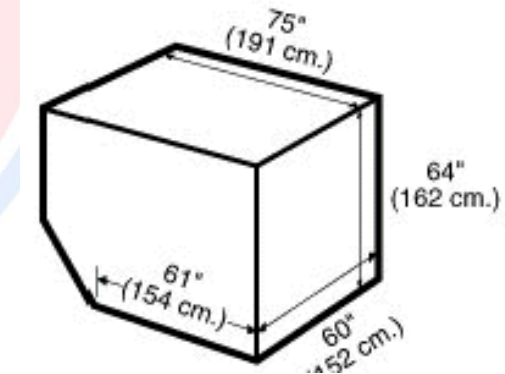
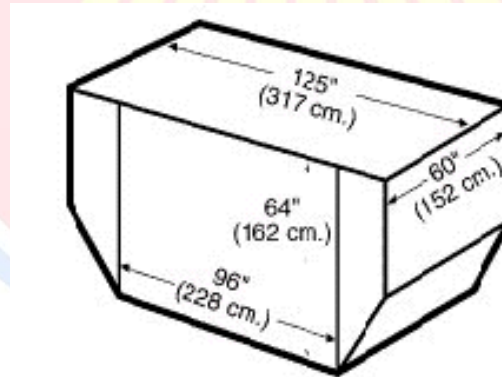
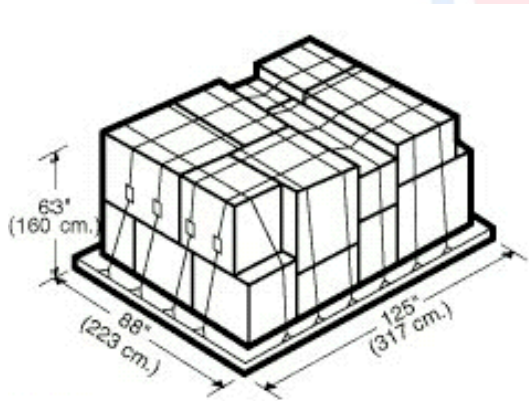
## B747 Passenger Aircraft



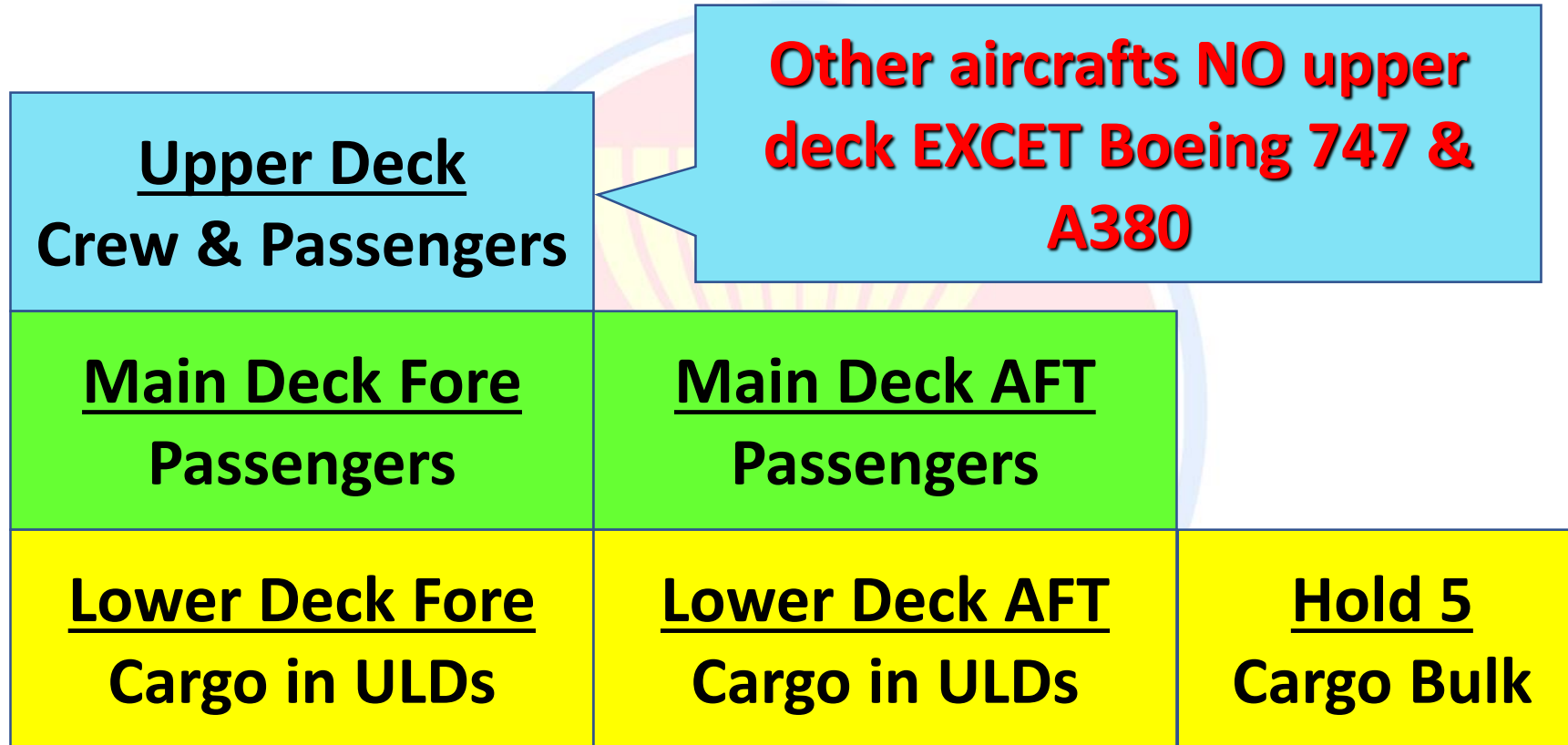
## B747 Aircraft Lower Deck Door Dimensions

# B747 Passenger Configuration

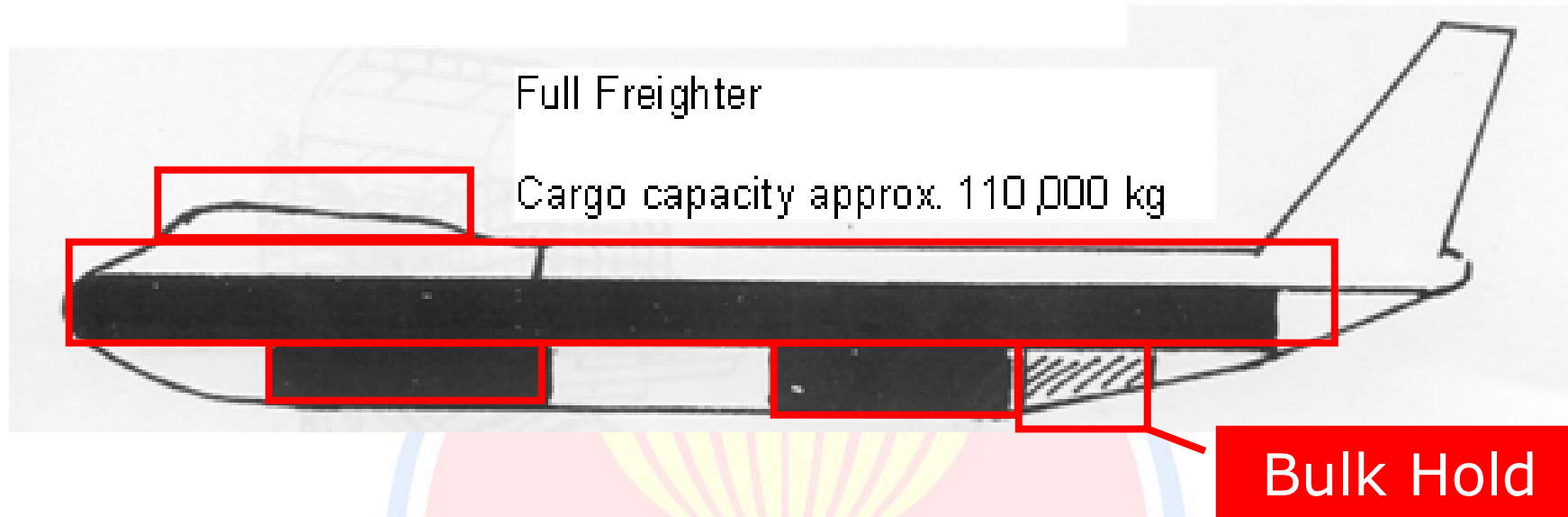
- Cargo can only be placed in the lower deck (bottom) of the aircraft, either front or back of the wings.
- Cargo load in this part of the aircraft is described as “lower deck” cargo and usually load in Unit Load Devices (ULDs).



# Passenger Aircraft Layout

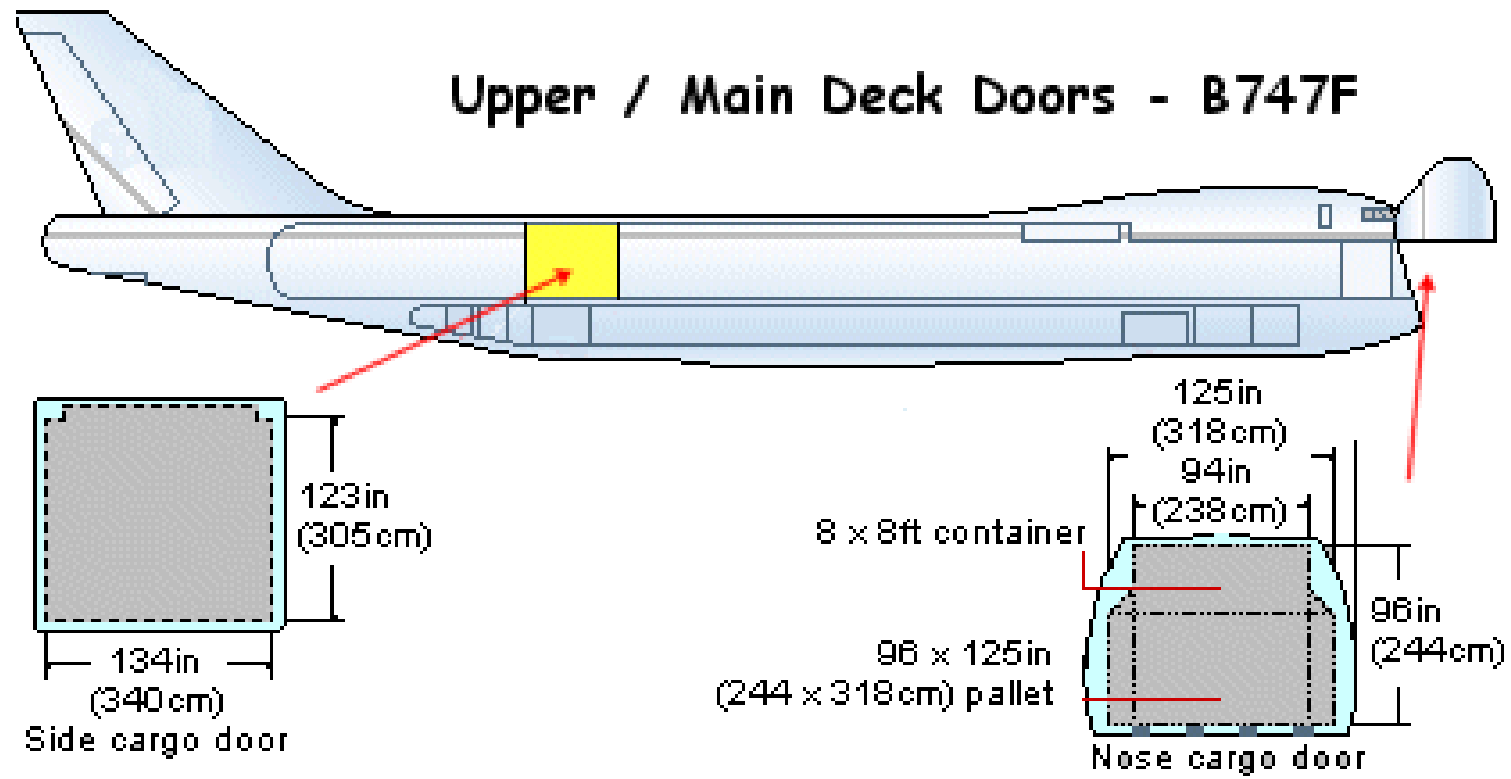
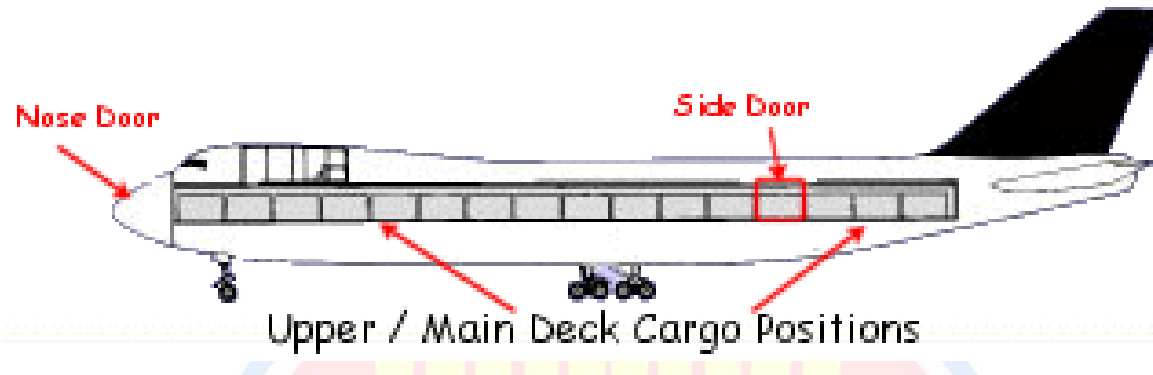


# Freighter – All Cargo Aircraft



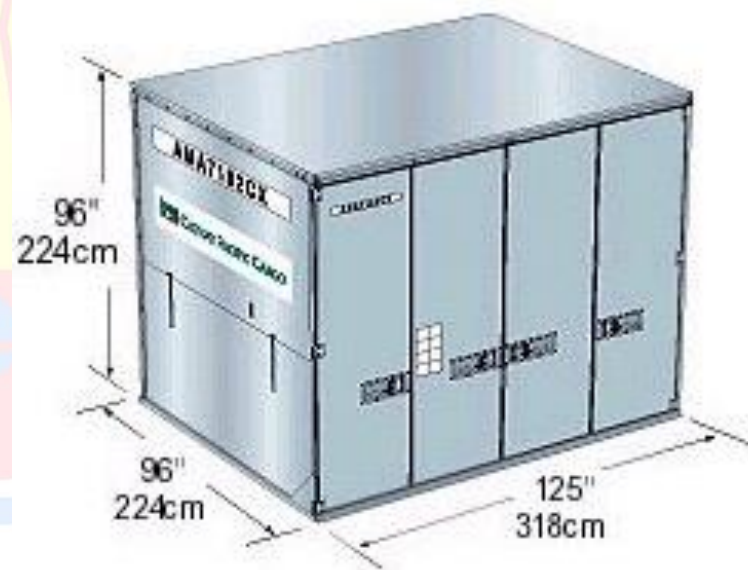
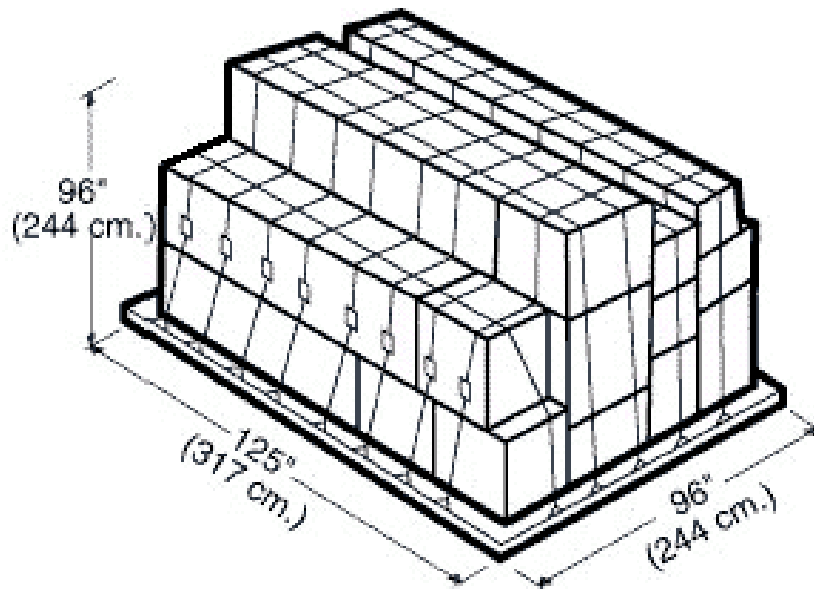
- Main deck, lower deck and upper deck
  - Aircraft is divided between a main deck & a lower deck.
  - Except B747 have an upper deck for cockpit crew and passengers.

# Freighter – All Cargo Aircraft

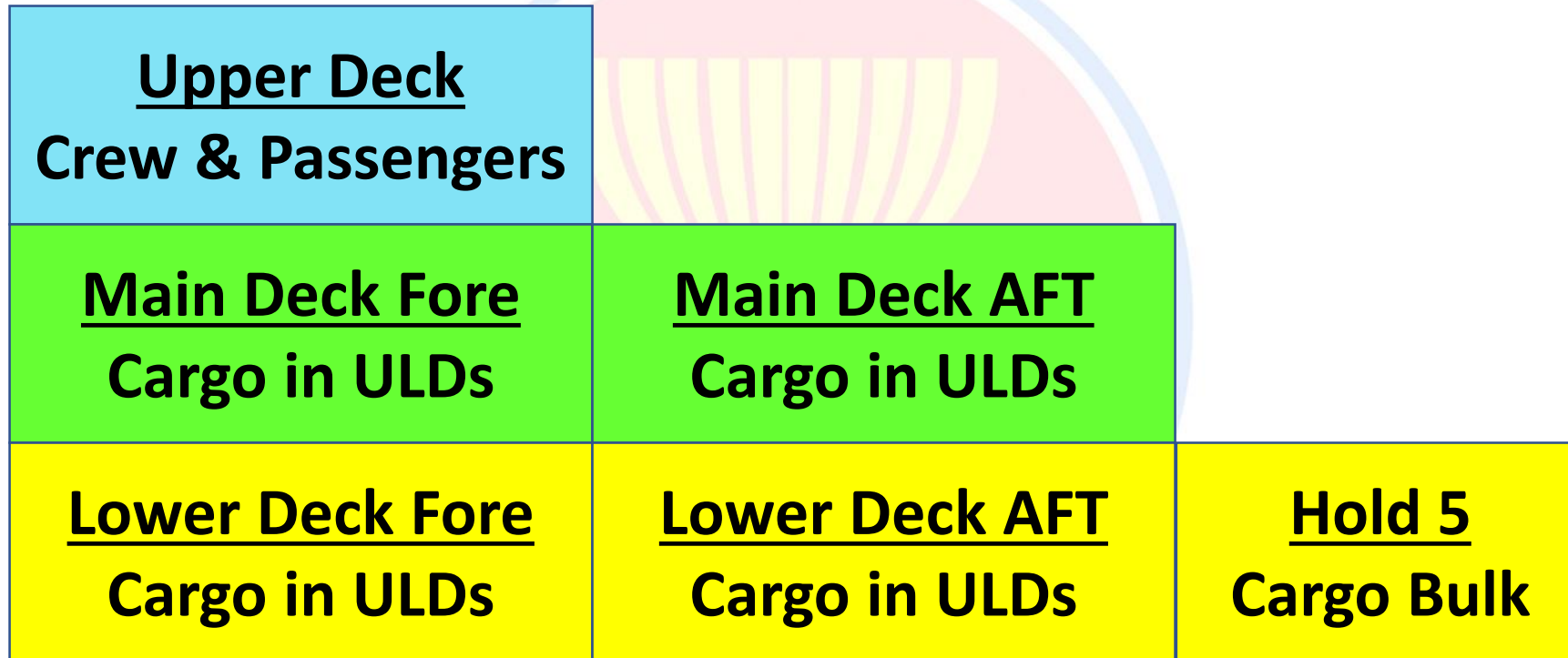


# Freighter – All Cargo Aircraft

- No passengers on freighter, whole aircraft (main & lower deck) for cargo.
- All cargo on “main deck” are built in the ULDs.



# Freighter – All Cargo Aircraft Layout



# Freighter – All Cargo Aircraft



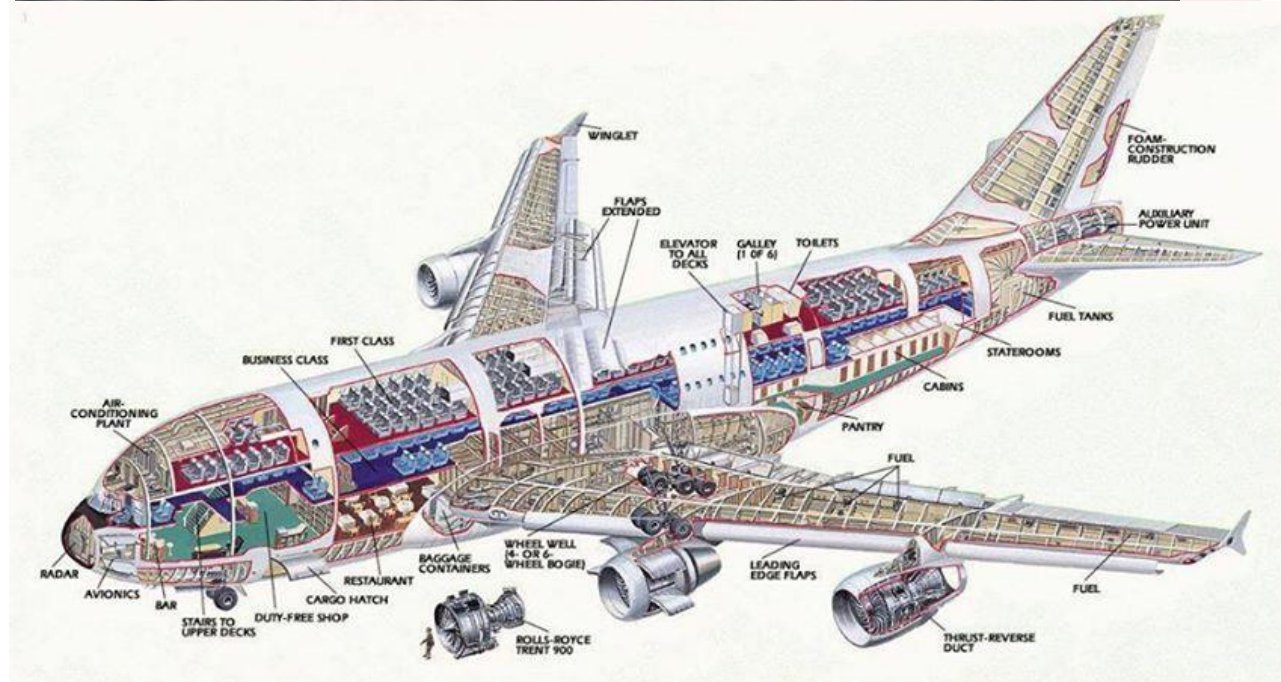
# Antonov 225

Carrying weight 150-250 tons





**Airbus A380-800F**  
Carrying weight  
150 tons



**Airbus A380**  
**Passenger**

# B747 Freighter

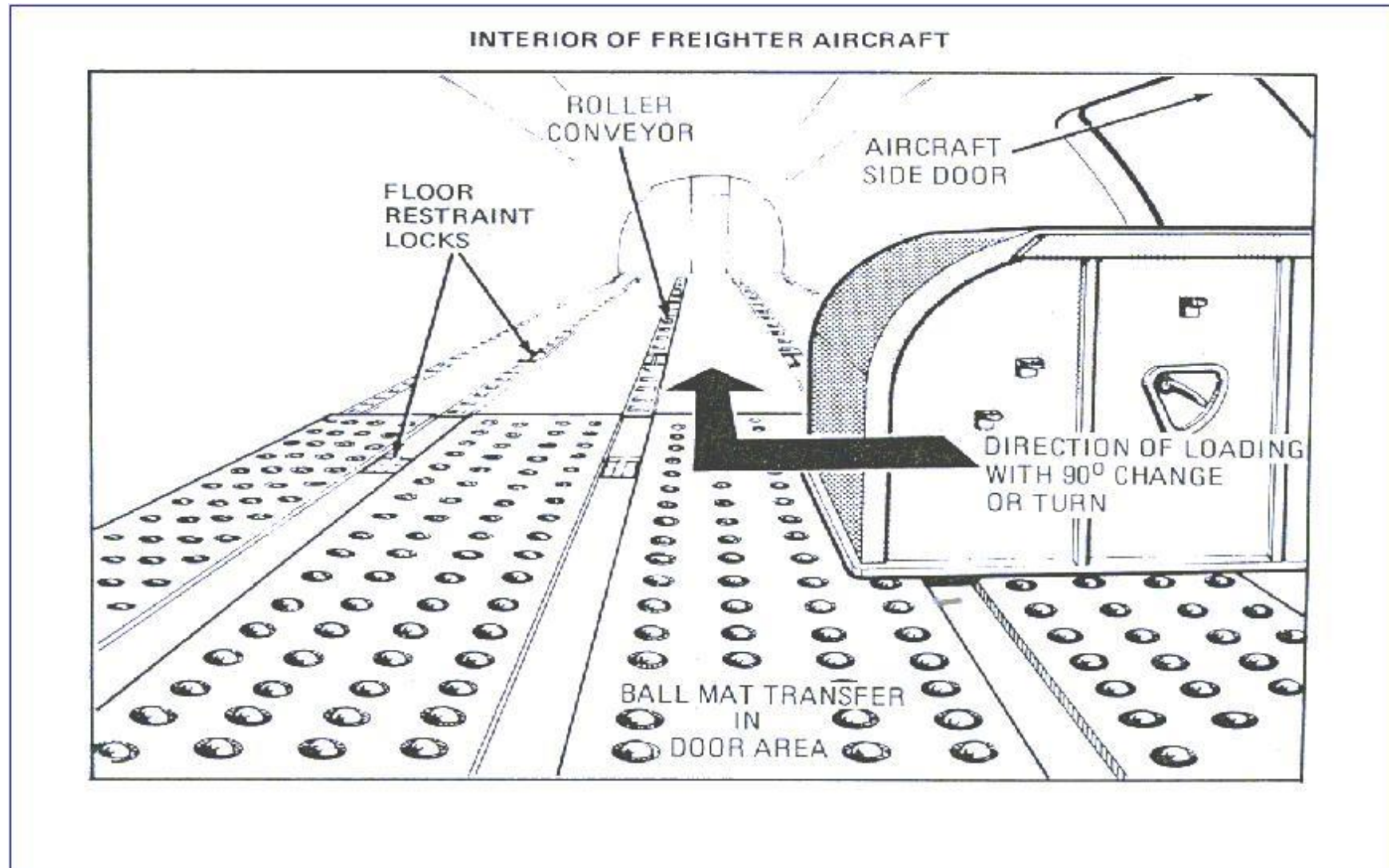
**Carry cargo and mail on main and lower deck.**



# Boeing Vs. Airbus



# Ball mats (roller beds) and Roller trays





# Main Deck Side Cargo Door



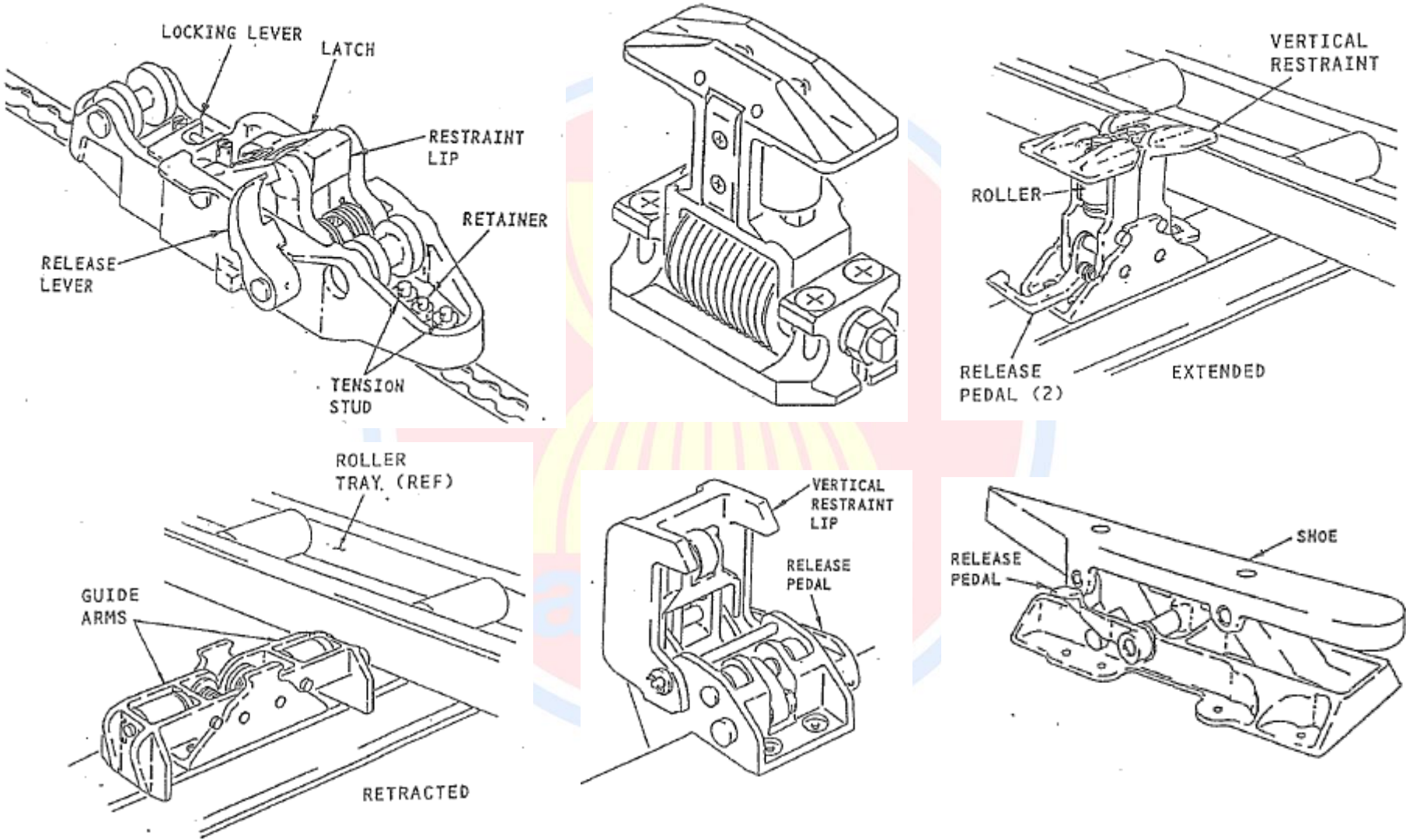
Show Time

B-777



# Restraint System

- Pallets and containers locked by restraint system in the floor.



# Restraint System

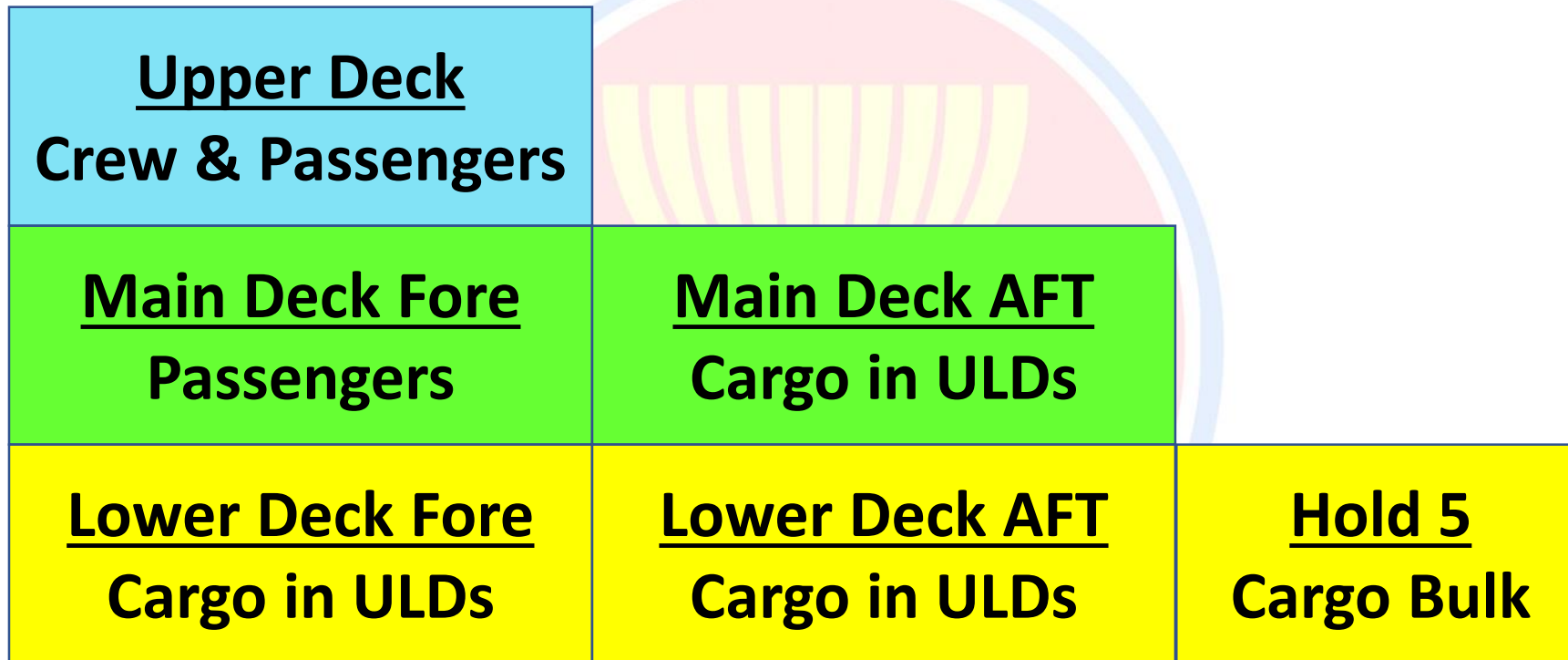


# Combi aircraft layout

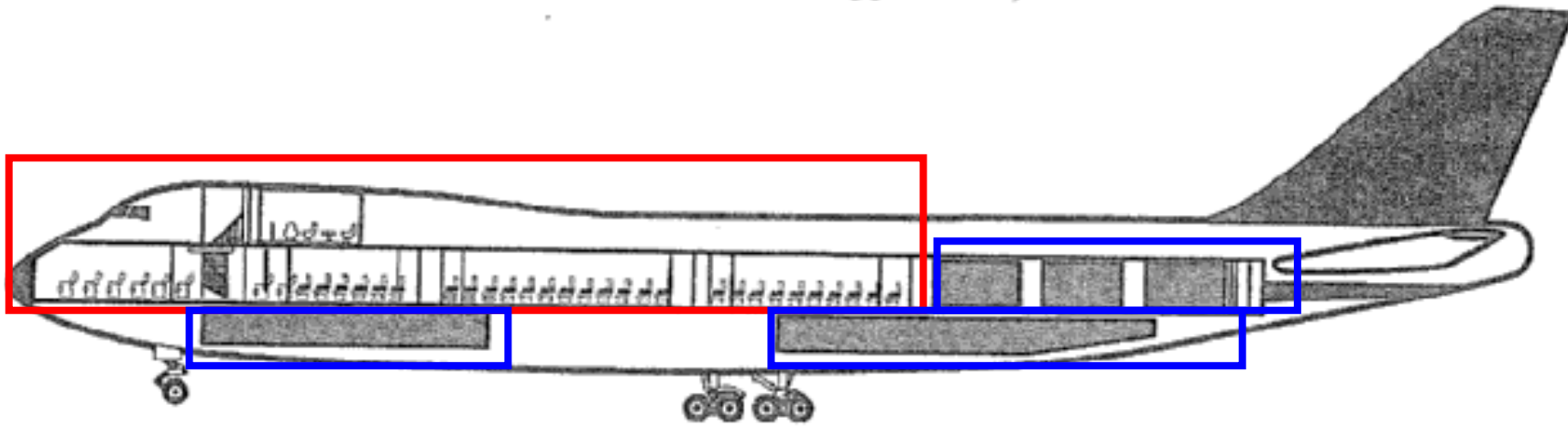
- Main deck for passengers and cargo loaded on pallets, and in containers.
- Lower deck for cargo loaded on pallets, in containers and/or bulk load in holds/compartments.



# Combi – Mix Passenger & Freighter Aircraft Layout

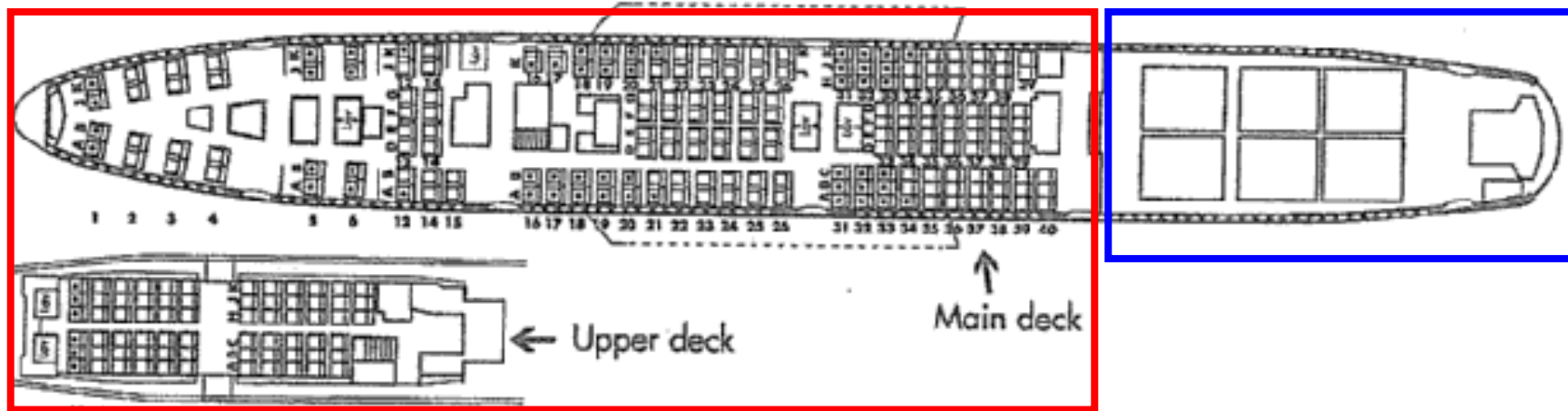


# Combi – Mixed Passenger/Freight Aircraft



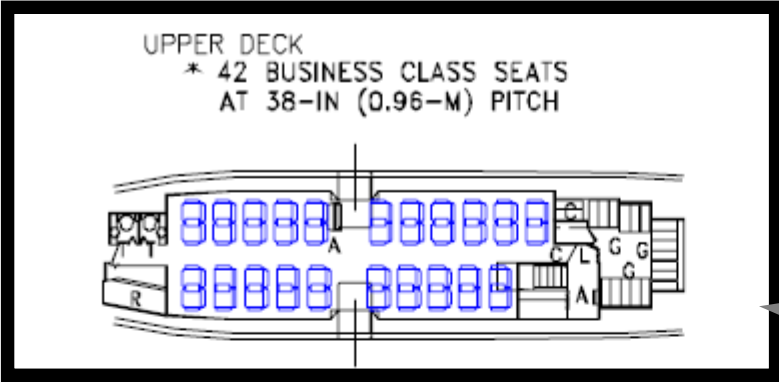
**Passengers**

**Cargo**



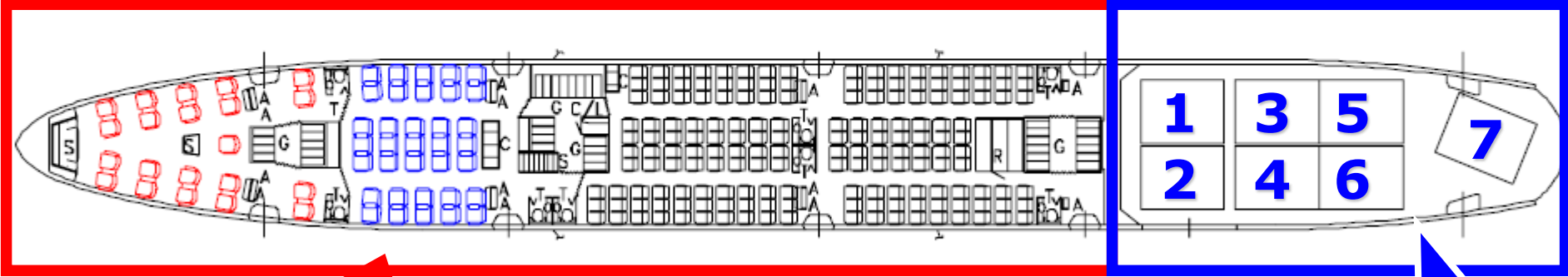
# Combi – Mixed Passenger/Freight Aircraft

Passenger on upper deck & main deck fore, cargo and mail on main deck aft and lower deck.



- T TOILET
- S STORAGE
- G GALLEY
- R CREW REST
- C/L CART LIFT

**Upper Deck  
Passengers & Crews**



**Main Deck FWD  
Passengers**

- MAIN DECK – COMBI LOAD
- \* 21 FIRST CLASS SEATS AT 61-IN (1.55-M) PITCH
  - \* 35 BUSINESS CLASS SEATS AT 38-IN (0.96-M) PITCH
  - \* 168 ECONOMY CLASS SEATS AT 32-IN (0.81-M) PITCH
  - \* 7 PALLETS

**Main Deck AFT  
7 Cargo ULDs**

# Airbus

- **A330-200F**
- **(Airbus 330-200 Freighter)**



# A330-200F



# Deck Layout

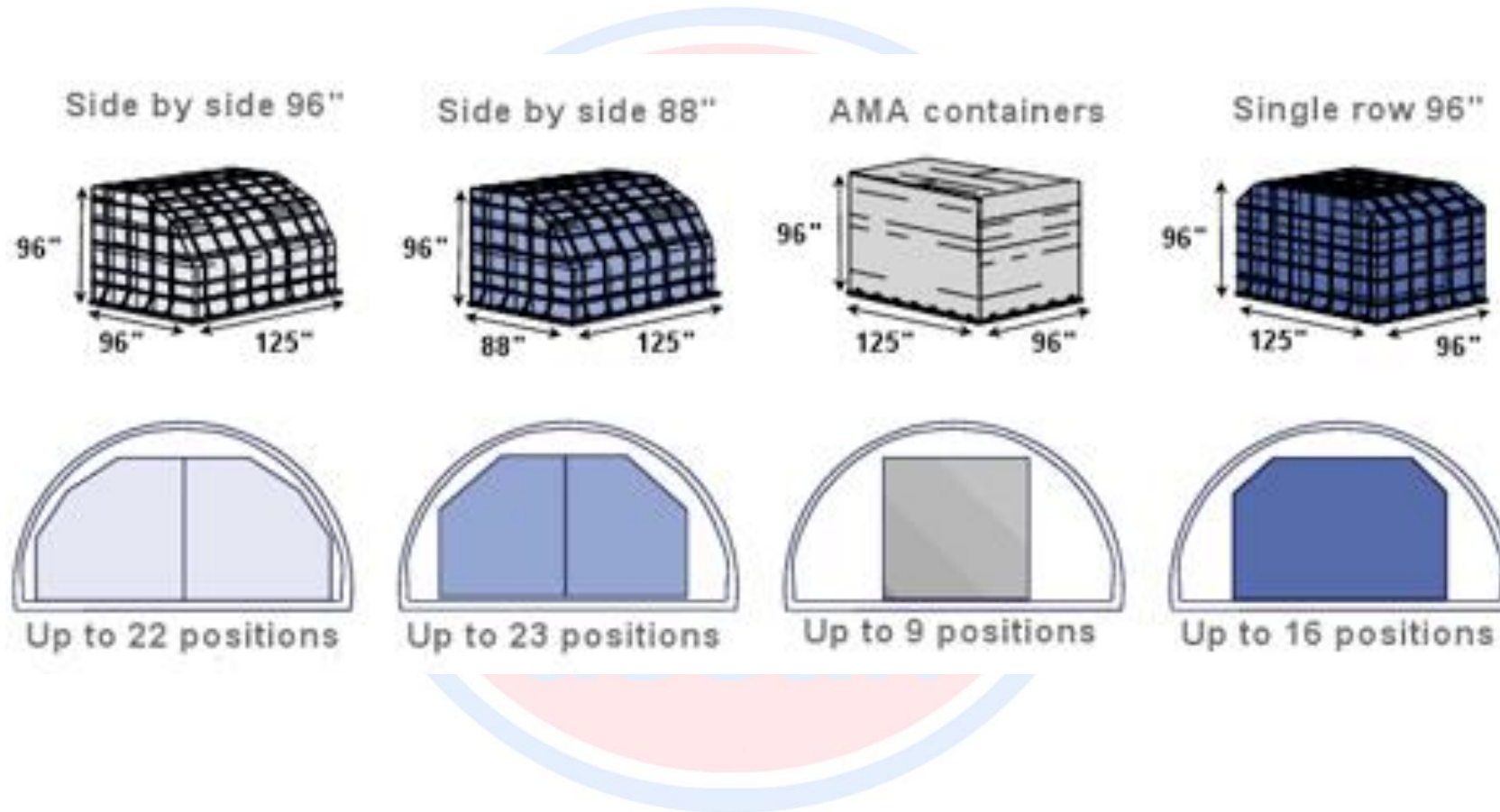


# Deck Layout

## An Optimised Fuselage for Cargo Operations

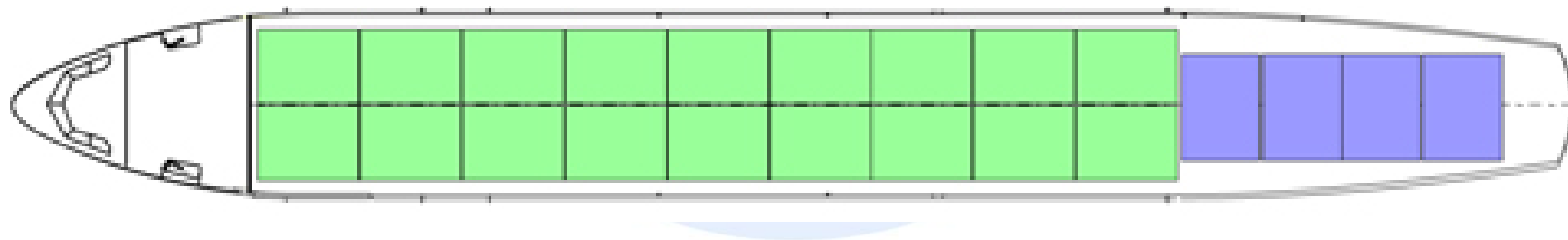
- 23 side-by-side pallets on the main deck, or
- Single-row loading of 16 pallets, and a mix of 9 AMA containers with four pallets.
- The spacious lower-deck cargo hold accepts up to 26 LD3 containers, plus 19.7 cubic m. (695 cubic feet) of bulk cargo.

# MAIN DECK: Cargo configuration and volumes



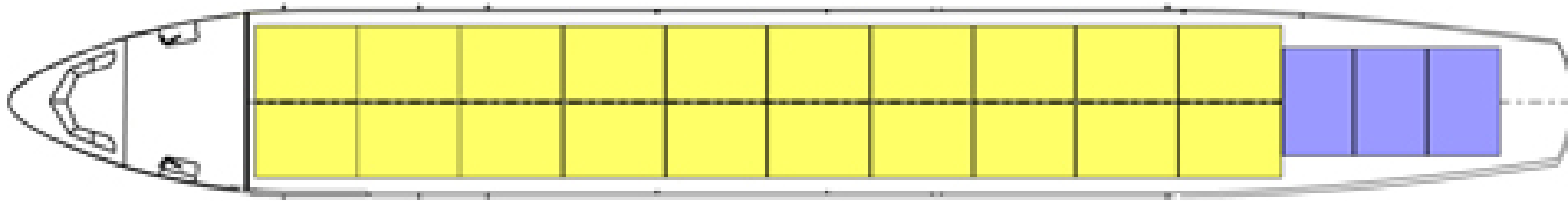
## MAIN DECK: Cargo configuration and volumes

- Side by side 96"x125"x96" pallets (standard)
- Main deck useable volume: 11,865 ft<sup>3</sup> (336 m<sup>3</sup>)  
18 pallets 96"x125" SBS and 4 pallets 96"x125" SR



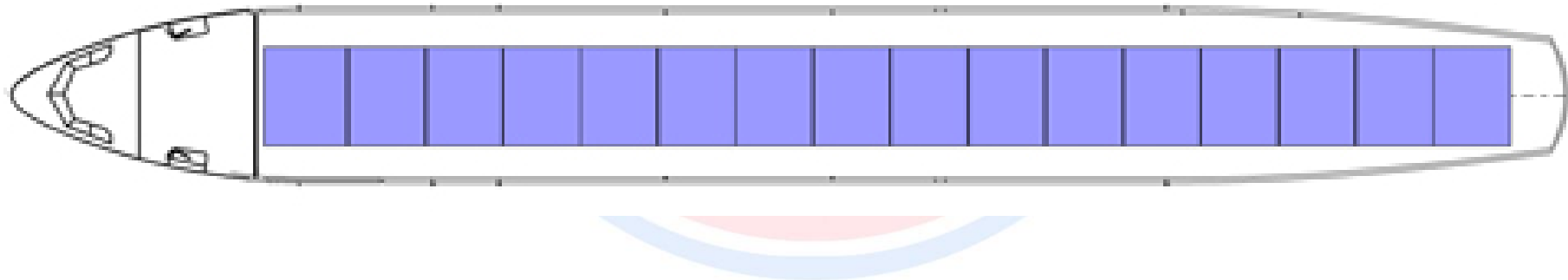
## MAIN DECK: Cargo configuration and volumes

- Side by side 88"x125"x96" pallets (option)
- Main deck useable volume: 11,490 ft<sup>3</sup> (325 m<sup>3</sup>)
- 20 pallets 88"x125" SBS and 3 pallets 96"x125" SR



## MAIN DECK: Cargo configuration and volumes

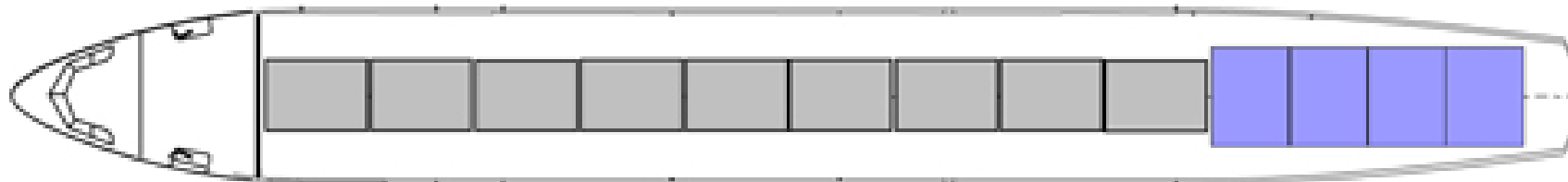
- Single row 96"x125"x96" pallets (option)
- Main deck useable volume: 9,500 ft<sup>3</sup> (269 m<sup>3</sup>)  
16 pallets 96"x125" SR



## MAIN DECK: Cargo configuration and volumes

### AMA containers (option)

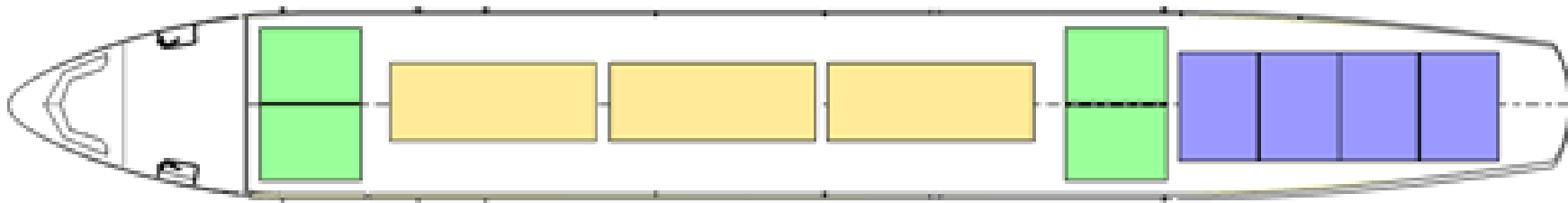
- Main deck useable volume: 7,840 ft<sup>3</sup> (222 m<sup>3</sup>)  
9 AMA containers and 4 pallets 96"x125" SR



# MAIN DECK: Cargo configuration and volumes

## Single row 20ft pallets (option)

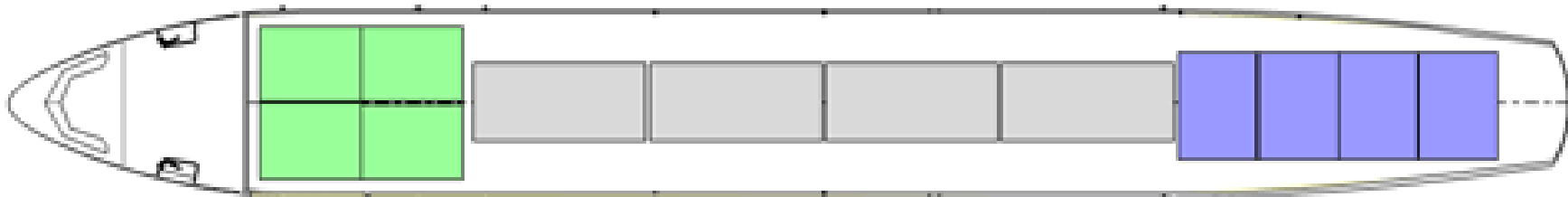
- Main deck useable volume: 7,800 ft<sup>3</sup> (220 m<sup>3</sup>)  
3 pallets 96"x238.5" SR, and,
- 4 pallets 96"x125" SBS, and
- 4 pallets 96"x125" SR  
Recommended configuration for optimized use



# MAIN DECK: Cargo configuration and volumes

## Single row 16ft pallets (option)

- Main deck useable volume: 8,855 ft<sup>3</sup> (242 m<sup>3</sup>)
- 4 pallets 96"x196" SR, and
- 4 pallets 96"x125" SBS, and
- 4 pallets 96"x125" SR
- Recommended configuration for optimized use



# MAIN DECK: Cargo configuration and volumes

## Side by Side 16ft pallets (option)

- Main deck useable volume: 11,206 ft<sup>3</sup> (317 m<sup>3</sup>)
- 8 pallets 96"x192" SBS, and
- 4 pallets 96"x125" SBS, and
- 4 pallets 96"x125" SR
- Recommended configuration for optimized use



# LOWER DECK : Cargo configuration and volumes

*96" lower deck pallet*



*LD-3 container*



*96" lower deck winged pallet*



## LOWER DECK : Cargo configuration and volumes

### 96" lower deck pallets

- 4 pallets 96"x125"x64" + 2 LD-3, and
- 4 pallets 96"x125"x64"
- Lower deck useable volume (regular / winged pallets):  
4,273 / 4,909 ft<sup>3</sup> (121 / 139 m<sup>3</sup>)



# LOWER DECK : Cargo configuration and volumes

## LD-3 containers

- 14 LD-3, and
- 12 LD-3
- Lower deck useable volume: 4,767 ft<sup>3</sup> (135 m<sup>3</sup>)



# References

<http://www.airbus.com/aircraftfamilies/freighter/a330-200f/deck-layout/>



# Aircraft Maximum Payload

Aircraft Type	Maximum Payload (Tonnes)	Cargo Hold (L x W x H) cm	Door Size (W x H) cm	Volume (Cubic M)
AN 124	120	3650 x 640 x 440	640 x 440	800
AN 225	150	4300 x 640 x 440	640 x 440	1000
B707	40	2900 x 320 x 214	340 x 231	180
B727-200	23	2712 x 351 x 218	340 x 218	144
B737-200	15	2100 x 310 x 220	340 x 215	105
B747-200	105	5100 x 317 x 304	340 x 310	600
B747-400	120	5100 x 317 x 304	340 x 310	600
DC10-30	65	3725 x 356 x 234	350 x 260	450
L10-30	21	1707 x 302 x 274	302 x 274	140
MD 11	80	4800 x 350 x 245	355 x 256	590

# Charter Flight

- In order to move large, outsize or project loads which cannot be carried on scheduled services, chartering an aircraft is required.
- Also subject to any government licensing restrictions, an aircraft may be chartered to fly to destinations not served, or infrequently served.
- Charter costs are payable prior to departure.
- A charge for delays (Demurrage) to aircraft at origin or destination which are directly the fault of the charterer or his agent.

# Charter Flight

- Charter Contract stipulates the conditions of the charter:
  1. Aircraft type;
  2. Cubic capacity and maximum weight limitations of the payload offered;
  3. Time and date of operation;
  4. Airports between which the aircraft will operate;
  5. Price and other charges payable;
  6. The charge of cancellation payable by the charterer.

# Charter Flight

- Information required for charter flight:
  1. Charterer name and address;
  2. Nature of goods;
  3. Number of packages;
  4. Weights and dimensions of packages;
  5. Point of departure and arrival;
  6. Date of delivery and deadline of goods;
  7. Any special conditions required.

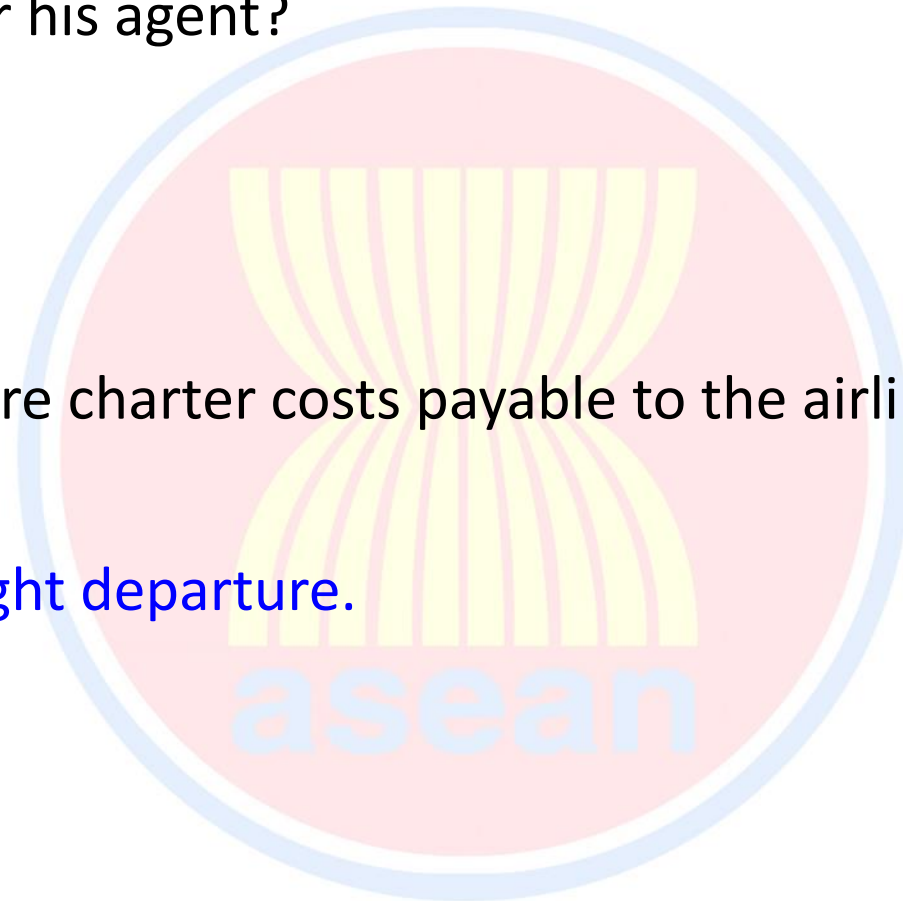
## Q & A

- What is the name of charge made for delays to the aircraft at origin or destination which are directly the fault of the charterer or his agent?

✓ Demurrage.

- At what time are charter costs payable to the airline?

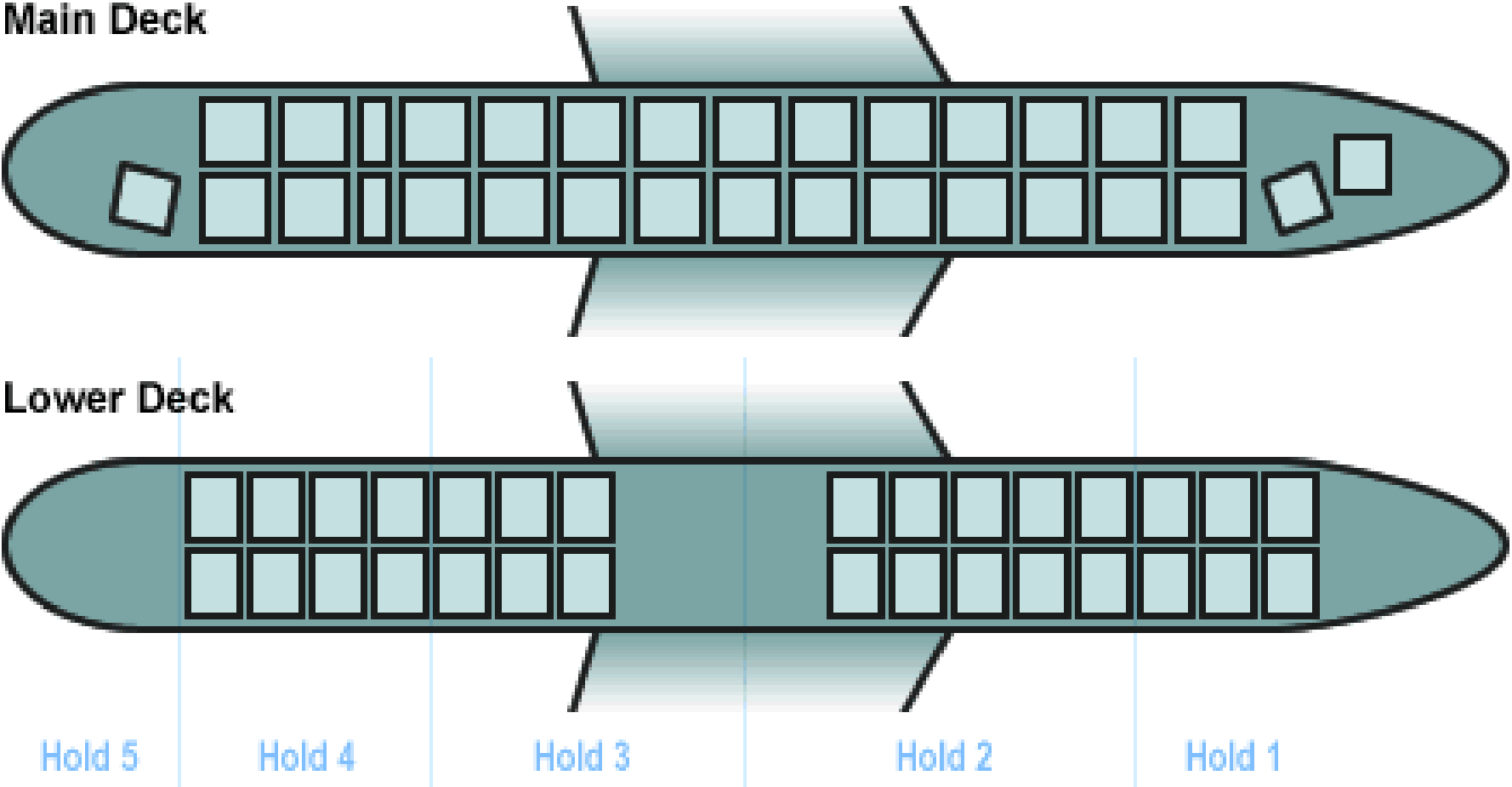
✓ Prior to the flight departure.



# Specification of Loading Holds



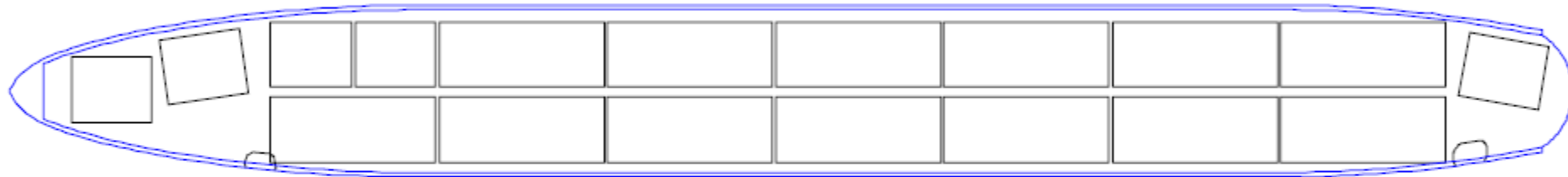
# B747-200F Freighter



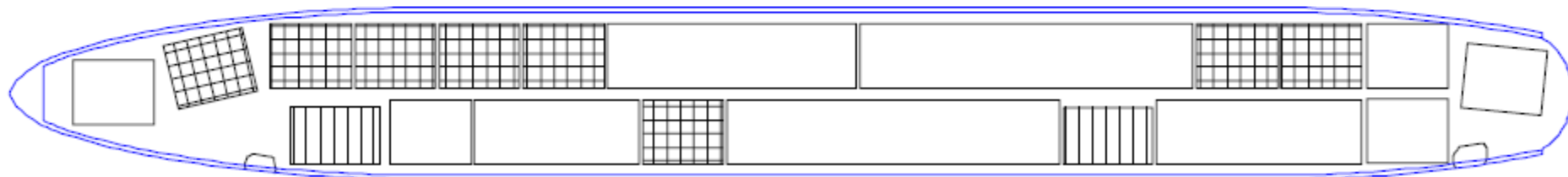
# B747-200 Freighter – Main Deck



\* 29 10-FT (3-M) CONTAINERS



\* 13 20-FT (6-M) CONTAINERS  
\* 5 10-FT (3-M) CONTAINERS



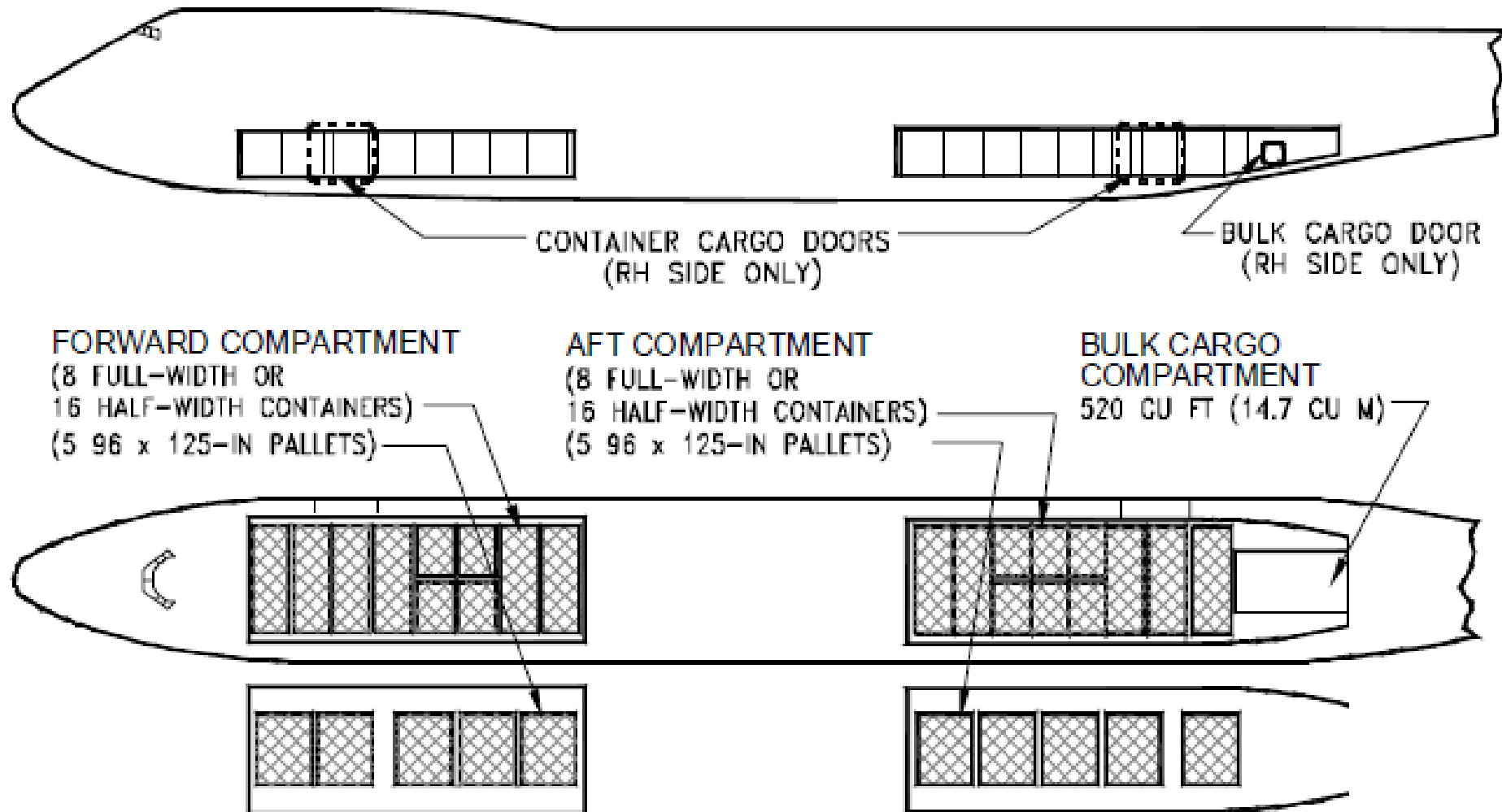
\* RANDOM MIX OF CARGO PALLETS  
AND CONTAINERS UP TO 40 FT (12 M)

# ULD Weight Limitation – Main Deck

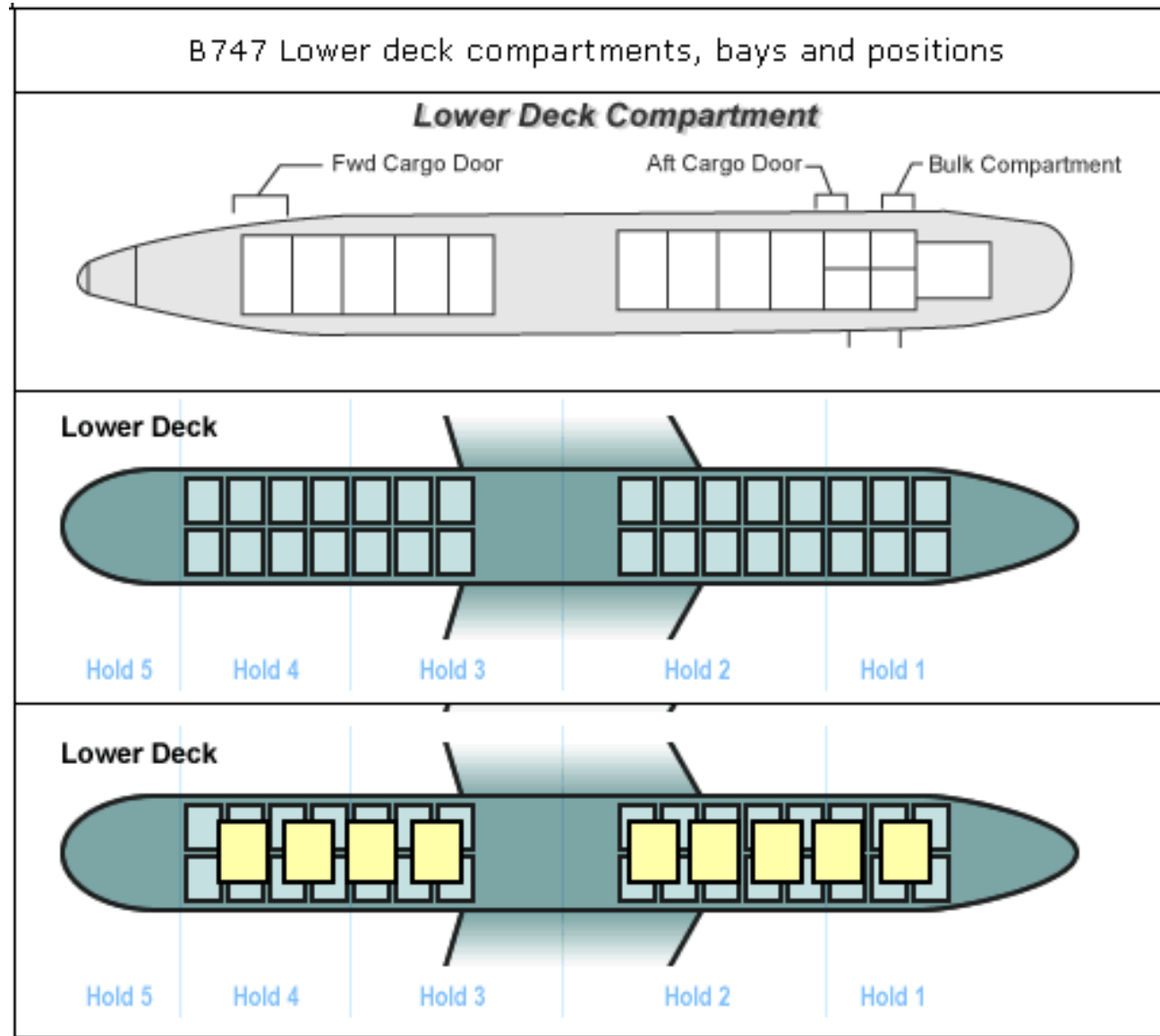
<b>ULD</b>	<b>CODE</b>	<b>Max Load MCI ULD wt</b>
88 x 125 inch Igloo/Container	UAB, UAK, AAP	6033 kg
88 x 125 inch Pallet	P1P, PAG, P1G	6033 kg
96 x 125 inch Pallet/Container	AQ6, P6P, PQP, PMC	6803 kg
96 x 238.5 inch Pallet/Container (20ft Pallet)	ASE, P7E	11339 kg
88 x 53 inch Pallet	PEB	B-HVX 1800 kg B-HVY 1800 kg <b>B-HVZ 1800 kg</b> B-HIH 1300 kg

**B-HVZ (VR-VHZ) retired 29 Jul 2009!**

# B747-200 Freighter – Lower Deck



# B747-200 Freighter – Lower Deck



# B747-200 Freighter

## Lower Deck Cargo Door Dimension

<b>FWD CGO Door</b>	104 x 66 in
<b>AFT CGO Door</b>	104 x 66 in
<b>BULK CGO Door</b>	44 x 47 in

## Main Deck Cargo Door Dimension

<b>Nose Door</b>	104 x 98 in
<b>Side Door</b>	134 x 120 in

## Maximum Weight & Unit - Lower Deck

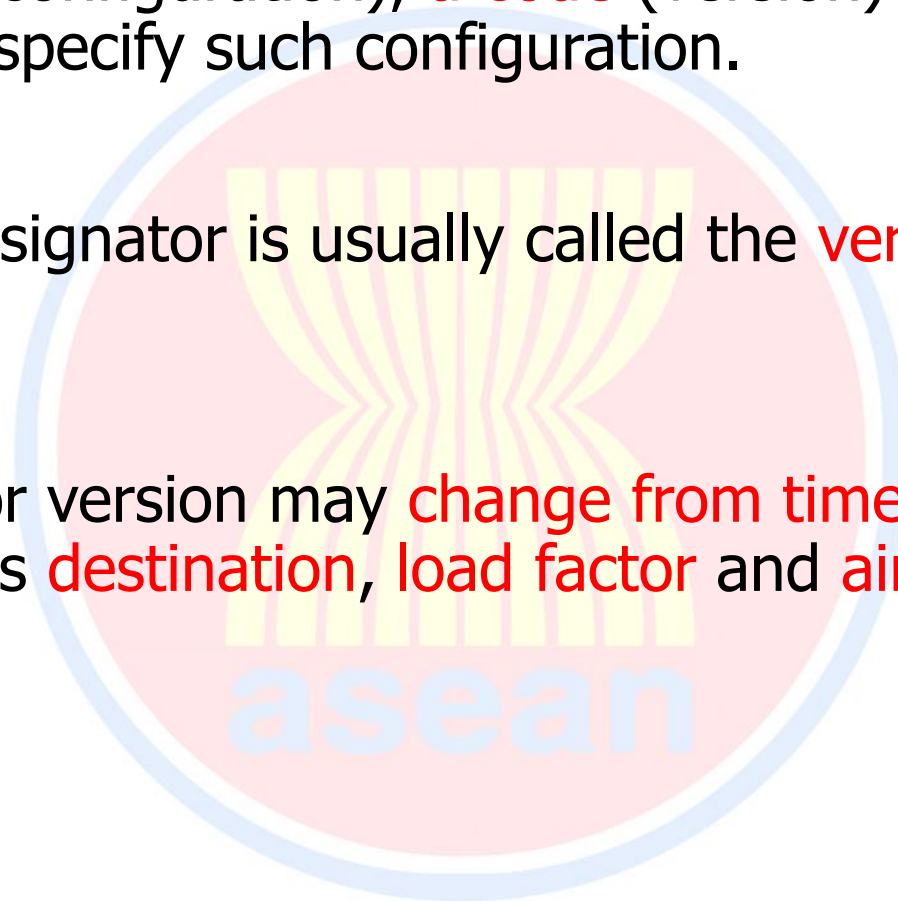
<b>Hold 1</b>	10354 kg	2P / 6A
<b>Hold 2</b>	16136 kg	3P / 10A
<b>Hold 3</b>	9801 kg	2P / 6A
<b>Hold 4</b>	13137 kg	2P / 8A
<b>Hold 5</b>	6749 kg	963 cu ft

# B747-200 Freighter Nose Loading



# Configuration / Version

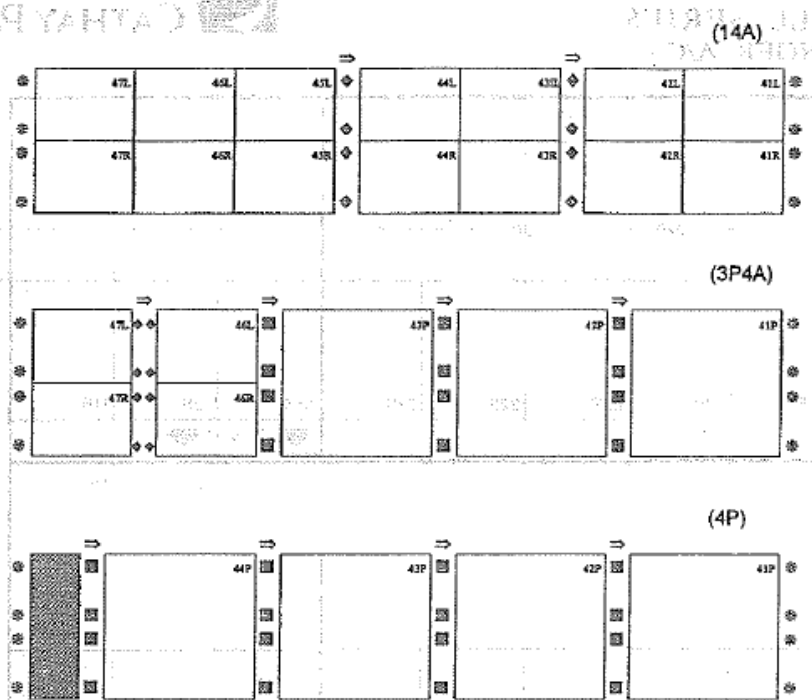
- According to the **planned utilization layout of an aircraft interior space** (aircraft configuration), **a code** (version) is assigned by each airline to specify such configuration.
- The code or designator is usually called the **version of the aircraft**.
- Configuration or version may **change from time to time** depending of its **destination, load factor and airlines**.



# Configuration / Version B747 Lower Deck

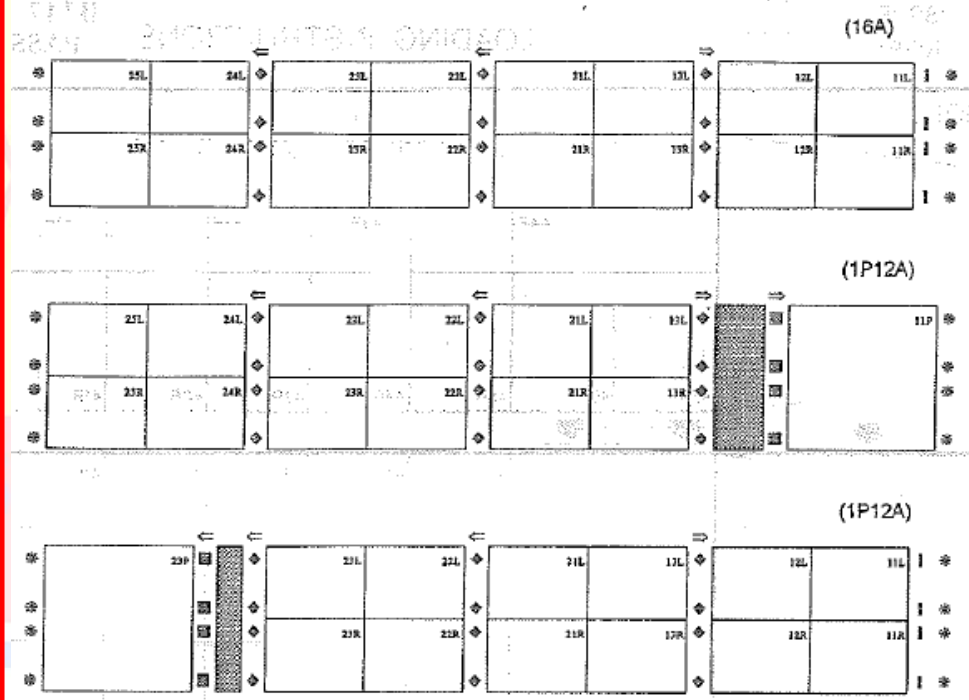
## AFT Hold

RESTRAINT SYSTEM LAYOUT - AFT HOLD (H4)



## FWD Hold

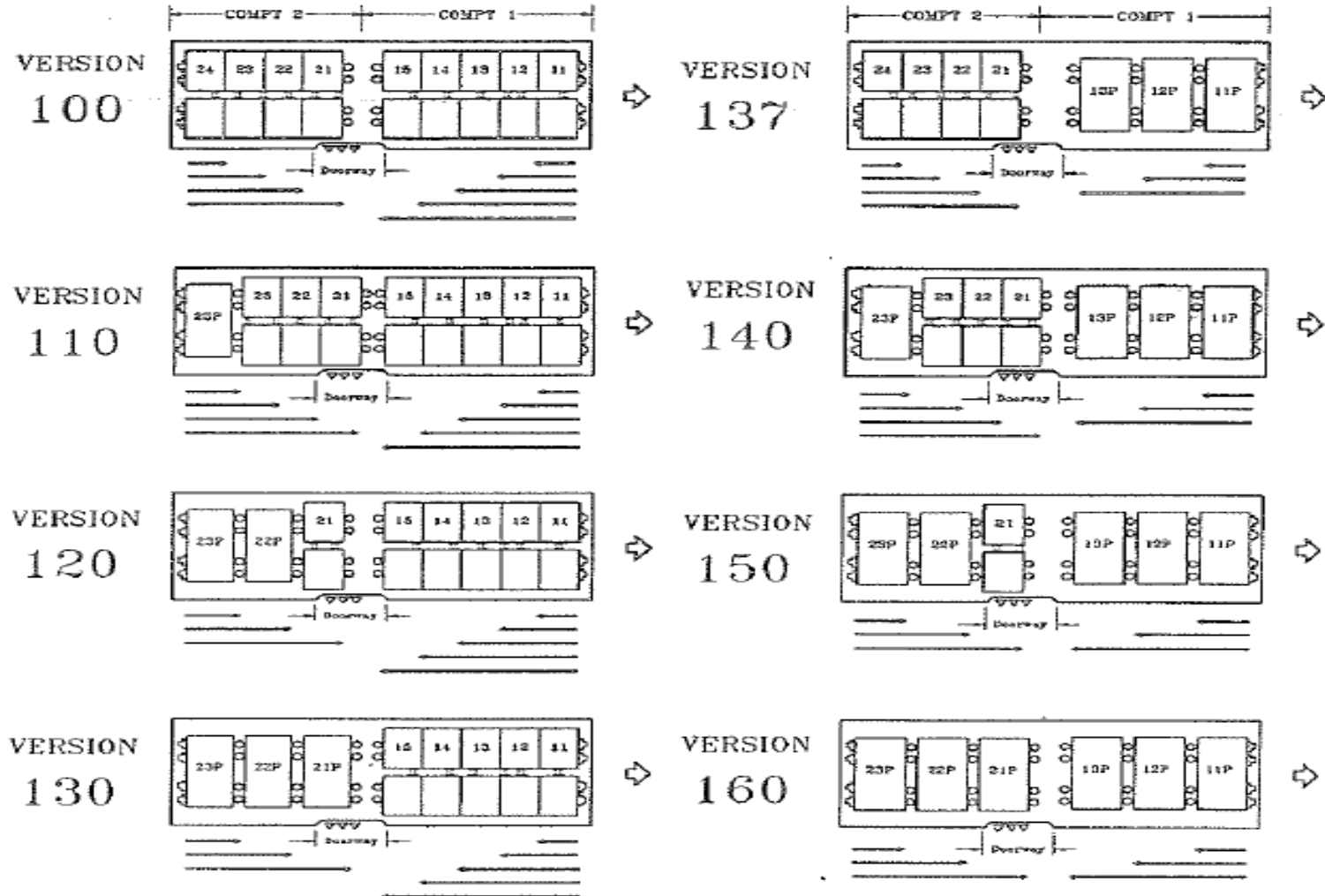
RESTRAINT SYSTEM LAYOUT - FWD HOLD (H1 & H2)



# Configuration / Version

## MD-11 Freighter Lower Deck

### LOWER HOLD VERSION



# Computerised Loadsheet for VRHVX (B-HVX) CX005/26Dec93 TPE/HKG

CATHAY PACIFIC

LOADSHEET  
ALL WEIGHTS IN KG

CHECKED

KC WONG

APPROVED

EDNO

01

FROM/TO FLIGHT A/C REG VERSION CREW DATE TIME  
TPE HKG CX005/26 VRHVX ✓ FOJOWO 3/D/D ✓ 26DEC93 1101

WEIGHT DISTRIBUTION  
LOAD IN COMPARTMENTS 28040 A/280 B/1650 CL/280 CR/1590 DL/280  
DR/1220 EL/280 ER/1245 FL/280  
FR/3410 GR/2140 HR/2330 JR/2370  
RR/2775 BR/2775 11P/730 21P/975  
22P/2340 44L/620 44R/470  
PASSENGER/CABIN BAG 0/0/0 TTL 0 CAB 0  
PAK

TOTAL TRAFFIC LOAD 28040  
DRY OPERATING WEIGHT 156810  
ZERO FUEL WEIGHT ACTUAL 184850 MAX 272155 L ADJ

TAKE OFF FUEL 23300 ✓  
TAKE OFF WEIGHT ACTUAL 208150 MAX 377842 ADJ

TRIP FUEL 11700 ✓  
LANDING WEIGHT ACTUAL 196450 MAX 285762 ADJ

BALANCE AND SEATING CONDITIONS LAST MINUTE CHANGES  
DOI 706.00 DEST SPEC CL/OPT + - WGT & 10X  
LIZFW 549.51 MACZFW 22.24  
LITOW 551.22 MACTOW 22.06  
LILAW 533.45 MACLAW 21.41  
STAB TO 3.6 DOWN

SEATING

UNDERLOAD BEFORE LMC 87305 LMC TOTAL + -

LOADMESSAGE AND CAPTAINS INFORMATION BEFORE LMC  
BW 156810 KGS BI 706.00 ✓  
TZFW/HKG 156810 KGS

LDM

CX005/26.VRHVX.FOJOWO.03/00  
-HKG.A/280.B/1650.CL/280.CR/1590.DL/280.DR/1220.EL/280  
.ER/1245.FL/280.FR/3410.GR/2140.HR/2330.JR/2370.RR/2775  
.BR/2775.1/730.2/3315.4/1090.TW28040

SI

CMR BREMNER COLIN MIDGLEY  
HKG CAO/RFL/CR



# Show Time

B747F Main Deck Loading



# Q&A

- Aircraft weight and volume capacity is finite, cannot be increased.

a. True.

b. False



# Q&A

- Maximum payload for B747-400 is
  - a. 80 tons
  - b. 100 tons
  - c. 60 tons
  - d. 120 tons

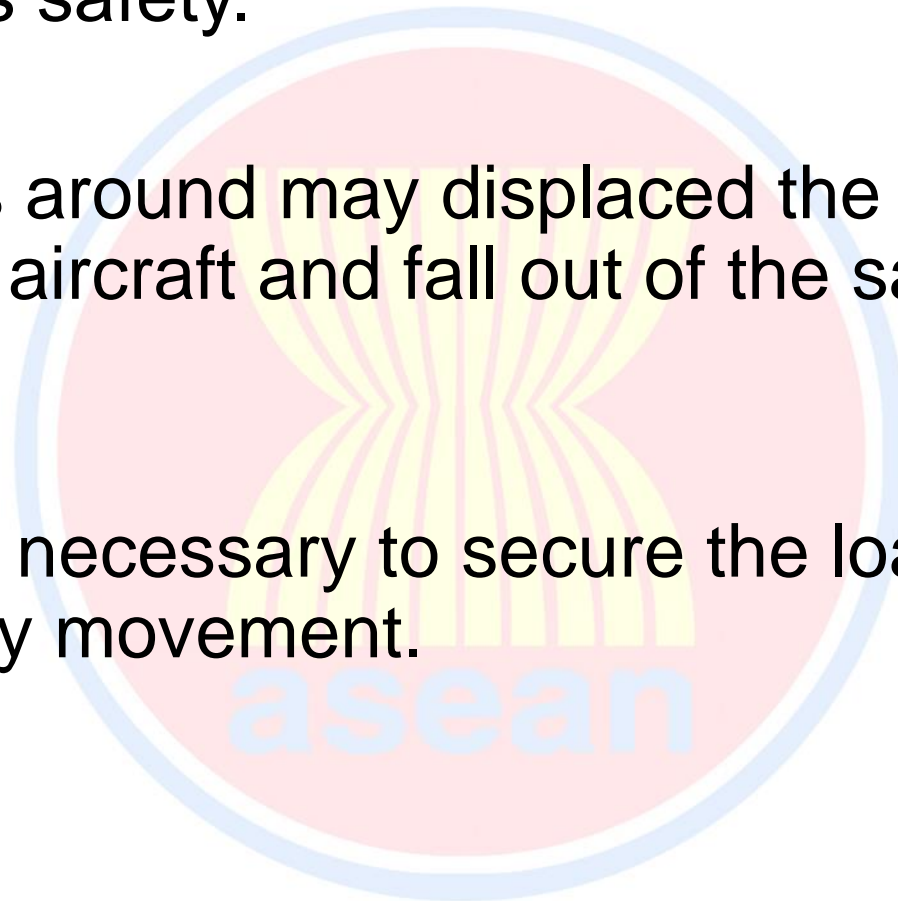


# Causes of Shifting & Securing Equipment



## 4 Main Causes of Shifting

- Moving freight can easily damage an aircraft and jeopardize its safety.
- Loads moves around may displaced the centre of gravity of the aircraft and fall out of the safe permissible range.
- It is therefore necessary to secure the loads adequately to prevent any movement.



# 4 Main Causes of Shifting

- The four main causes of shifting and direction to be covered
  1. **Backwards** – acceleration on take-off.
  2. **Forwards** – deceleration on landing (or aborted take-off).
  3. **Sideways** – yawing (sideward movements) in turbulent conditions.
  4. **Upwards** – vertical, in bumpy conditions.
- **Downwards** motion is secured by the floor.

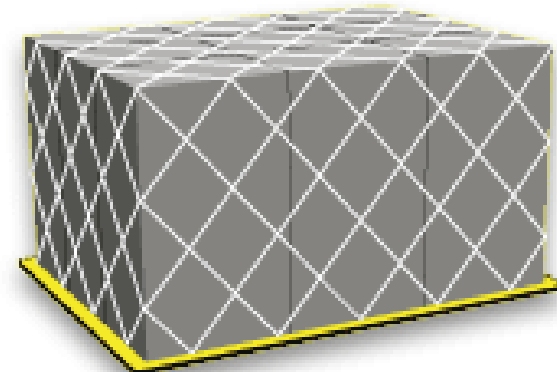
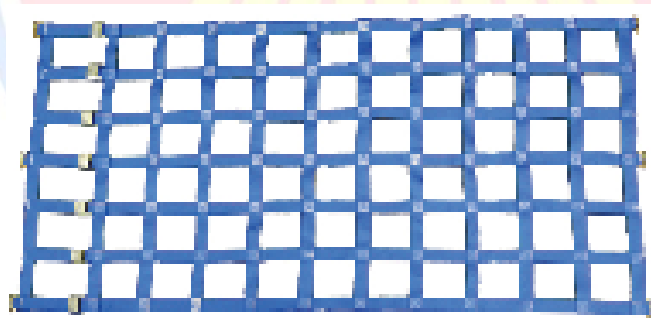
# Securing Equipment

- ❑ **Tie-down** used to secure the loads during flight to prevent
  - Any movement
  - Displaced of centre of gravity of aircraft.



- ❑ **Other securing equipment**

- Nets
- Cables
- Straps
- Ropes

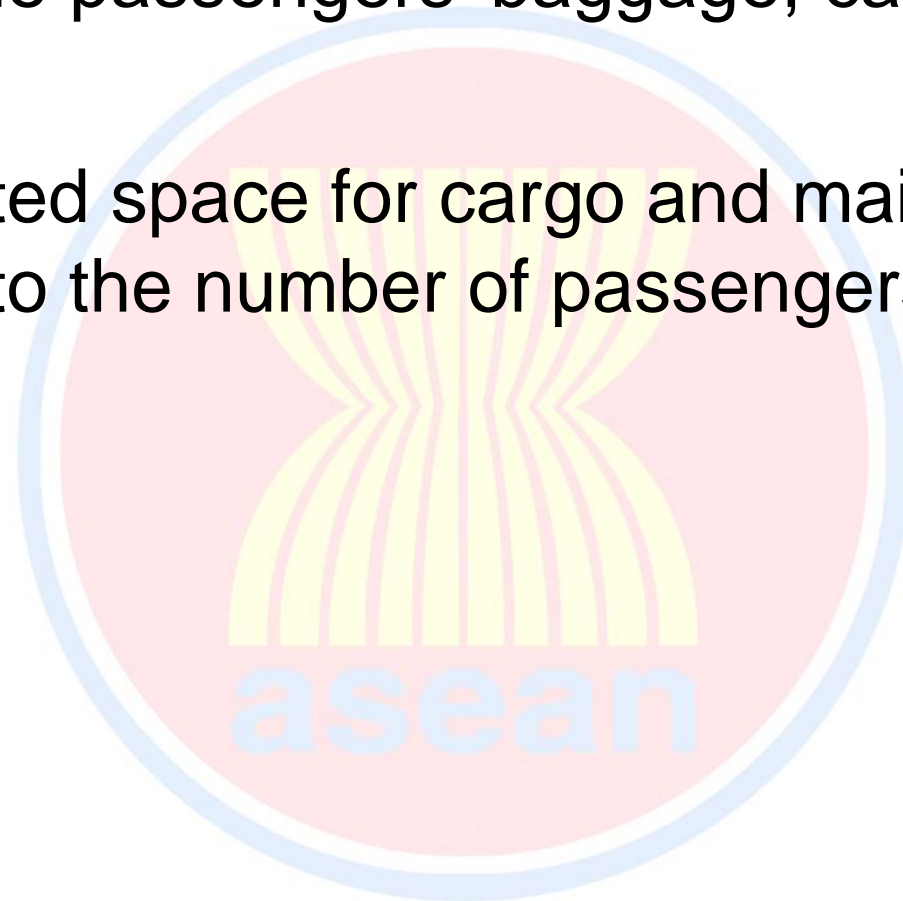


# Pressurization & Temperature

- The pressure, ventilation and temperature on the main deck are controlled.
- Lower deck are vary between aircraft types.
- Lower deck without temperature controlled, may cool near freezing during flight.
- Lower deck temperature and ventilation can be regulated from the flight deck (cockpit) to allow sufficient heating & cooling to transport live animals or perishable cargo.

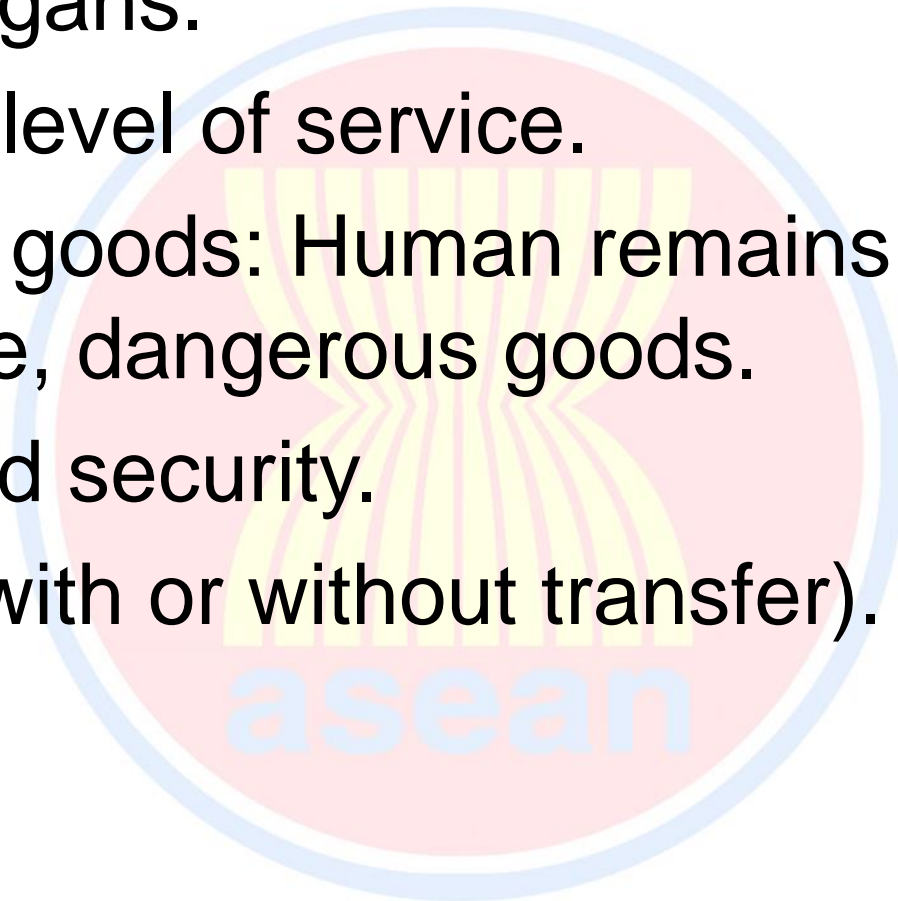
# Space Allocation

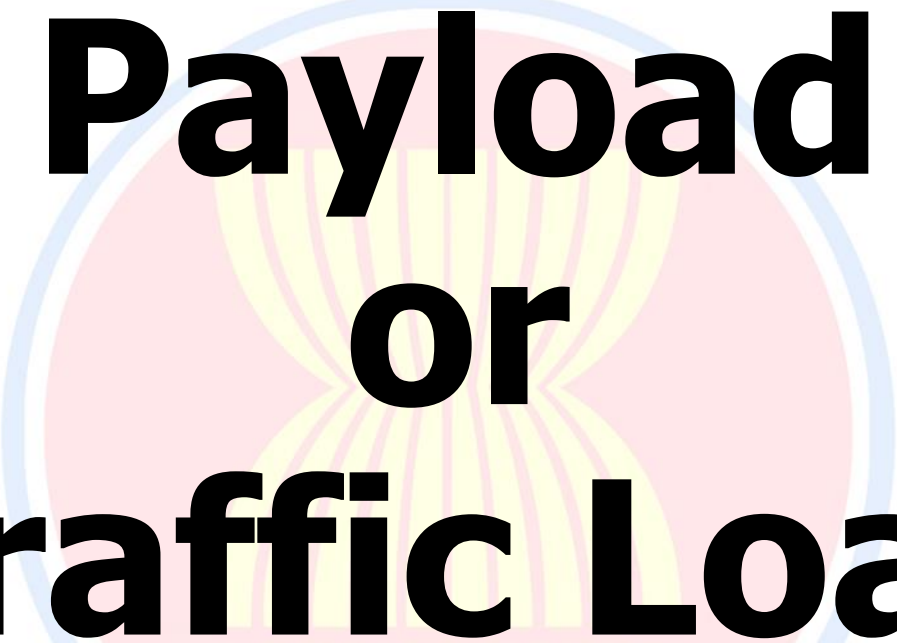
- The space allocation of a flight must be shared between the passengers' baggage, cargo & mail.
- The allocated space for cargo and mail may vary according to the number of passengers booked.



# Priority of Uplifting of Cargo

1. Time element (urgency): Living saving items, human organs.
2. Cost and level of service.
3. Nature of goods: Human remains, live animal, perishable, dangerous goods.
4. Safety and security.
5. Voyage (with or without transfer).
6. Capacity.



The background features a large, semi-transparent watermark of the ASEAN logo. It consists of a circular emblem with a yellow sunburst in the center, surrounded by ten blue rays. The word "asean" is written in blue lowercase letters at the bottom of the emblem.

# **Payload or Traffic Load**

# Maximum take-off weight

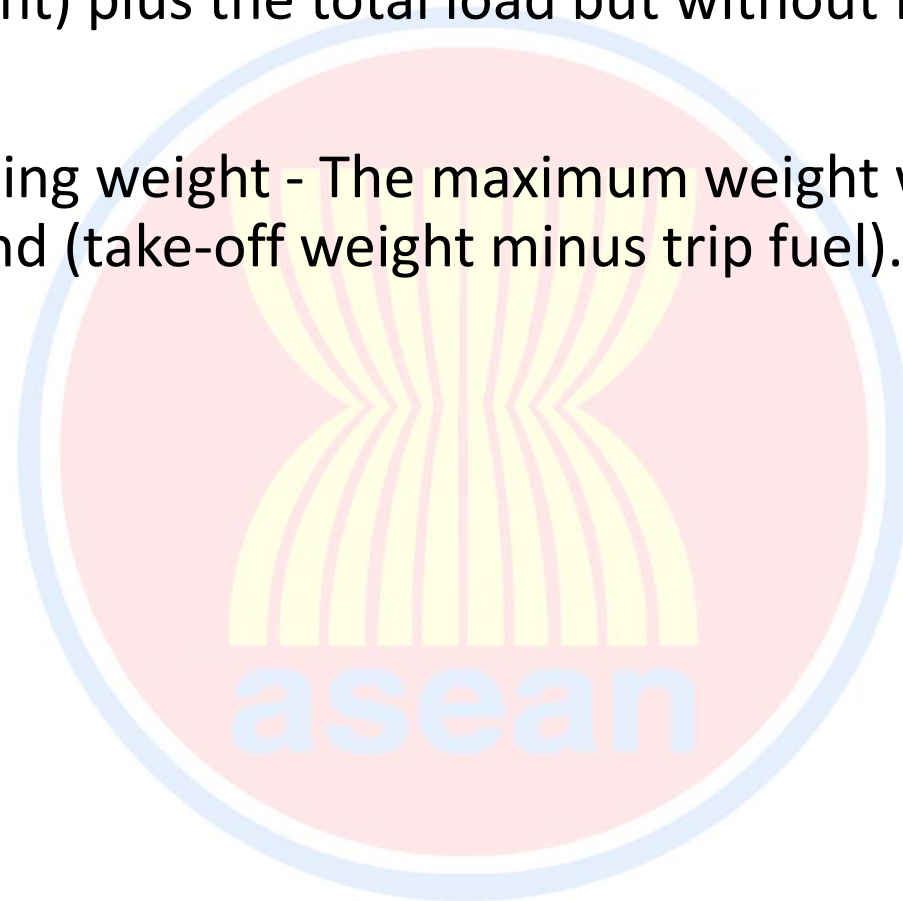
- A maximum limit to the weight that can be lifted by specific aircraft.
- The maximum structural weight limits of an aircraft at take-off.
- Maximum take-off weight can be broken down into following components :
  - Basic weight – The weight of the aircraft ready for operation.
  - Dry operating weight (DOW) – The basic weight of the aircraft plus the weight of the crew, the crew baggage and the pantry.
  - Take-off fuel (TOF) – The amount of fuel on board less the fuel used before the take-off run.

# Payload or traffic load

- Operating weight – The dry operating weight plus the take-off fuel.
- Payload - The total weight of the revenue passenger, cargo and mail on board the aircraft.
- Traffic load – The total weight of the revenue and non-revenue passenger, cargo and mail on board the aircraft.
- Take-off weight (TOW) – The weight of the aircraft before take-off.

# Payload or traffic load

- Maximum zero fuel weight - The maximum weight of the aircraft (dry operating weight) plus the total load but without fuel.
- Maximum landing weight - The maximum weight with which the aircraft may land (take-off weight minus trip fuel).

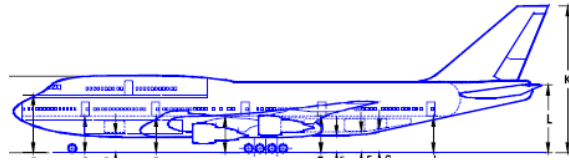


# Fuel

- Ramp fuel - The total amount of fuel on board the aircraft before departure (taxi fuel plus take-off fuel).
- Taxi fuel - The fuel used before the take-off run (from parking area to the beginning of the runway. The taxi fuel is not included in the take-off fuel).
- Take-off fuel - The amount of fuel at take-off (ramp fuel minus taxi fuel).
- Trip fuel - The amount of fuel planned to be used from take-off to the first intended landing. The trip fuel is part of the take-off fuel.
- Reserve fuel - Remaining fuel (take-off fuel minus trip fuel).

# Take-off Weight

Basic Weight



+ Crew & crew baggage



+ Pantry



= Dry Operating Weight (DOW)

Ready to operate, **without fuel**

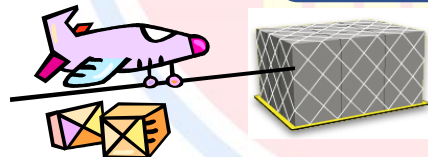
+ Take-off Fuel (TOF)



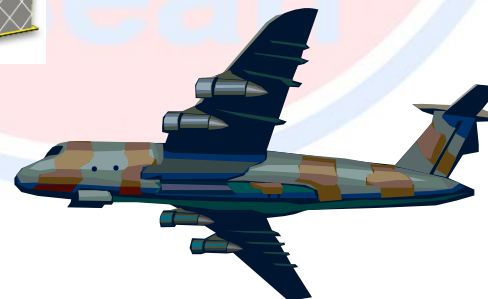
= Operating Weight

Ready to operate, **with fuel**

+ Payload



= **Take-off Weight (TOW)**



## Take-off weight (TOW)

Dry operating weight + Take-off fuel + Payload

Example :

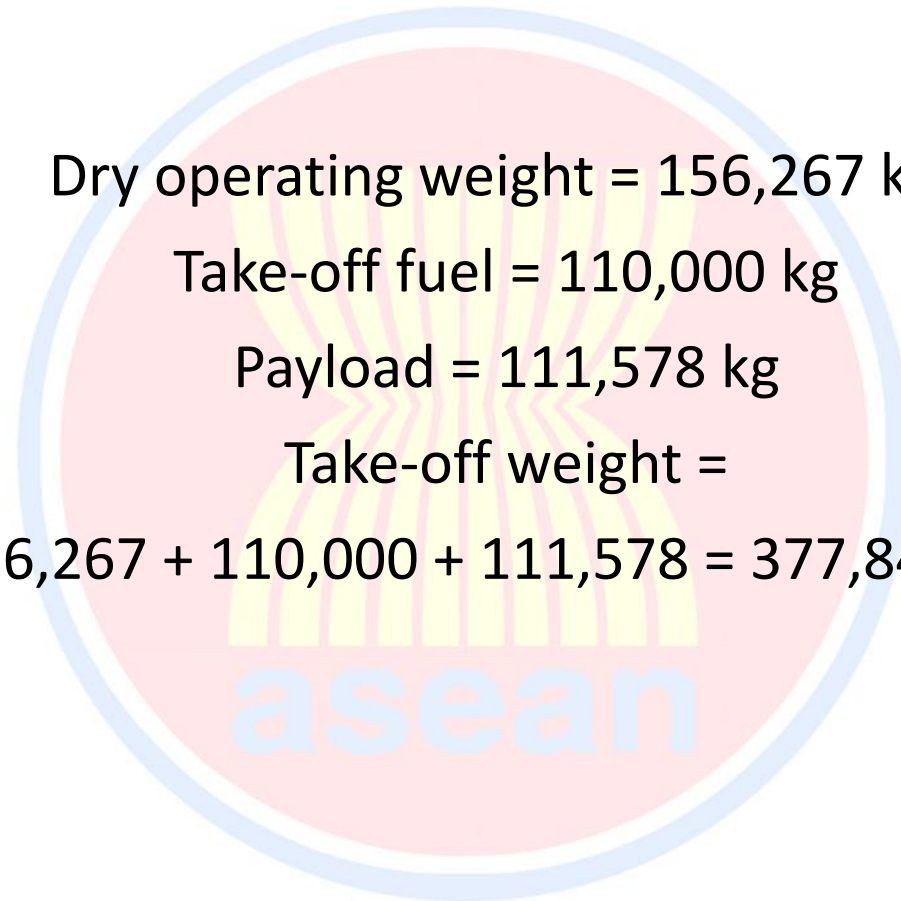
Dry operating weight = 156,267 kgs

Take-off fuel = 110,000 kg

Payload = 111,578 kg

Take-off weight =

$156,267 + 110,000 + 111,578 = 377,845$  kgs.



# Payload

Take-off weight – (Dry operating weight + Take-off fuel)

Example :

Take-off weight = 377,845 kgs.

Dry operating weight = 156,267 kgs

Take-off fuel = 110,000 kg

Payload =

$$377,845 - (156,267 + 110,000) = 111,578 \text{ kgs}$$

# Q & A

☺ Calculate the take-off weight of B747 with following figures.

- Payload = 89,000 kgs
- Dry operating weight = 163,295 kgs
- Take-off fuel = 105,000 kgs

$$✓ \quad \text{TOW} = \text{DOW} + \text{TOF} + \text{Payload}$$

$$163,295 + 105,000 + 89,000 = 357,295 \text{ kgs}$$

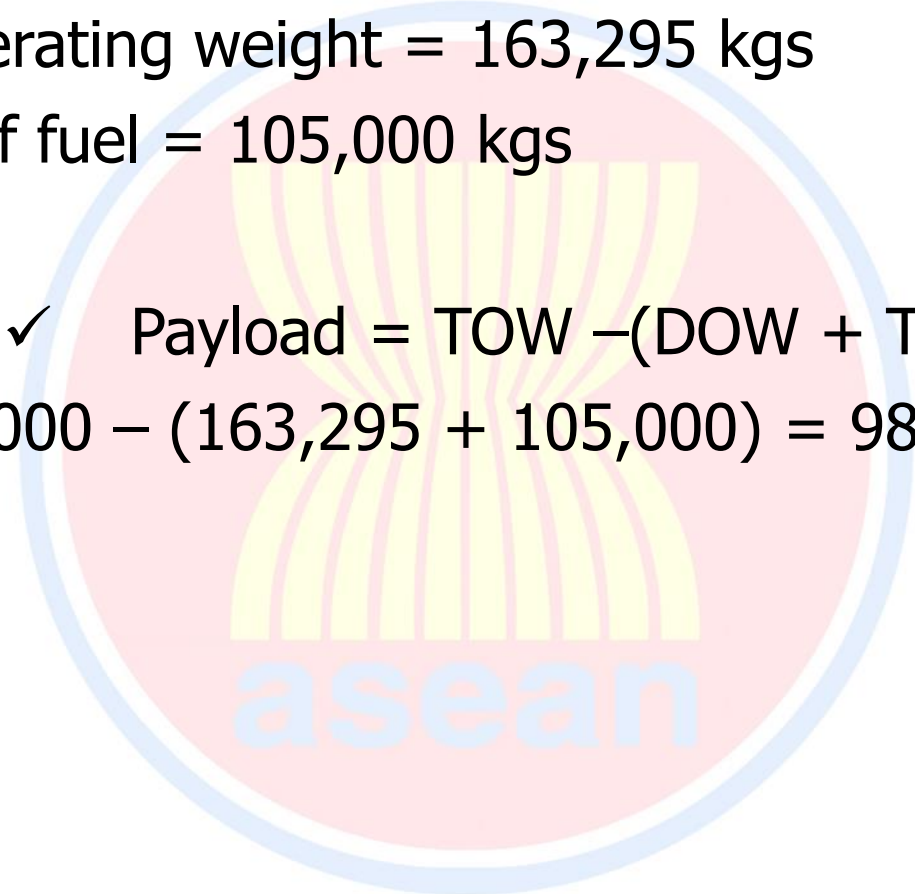
# Q & A

☺ Calculate the payload of B747 with following figures.

- Take-off weight = 367,000 kgs
- Dry operating weight = 163,295 kgs
- Take-off fuel = 105,000 kgs

✓  $\text{Payload} = \text{TOW} - (\text{DOW} + \text{TOF})$

$$367,000 - (163,295 + 105,000) = 98,705 \text{ kgs}$$

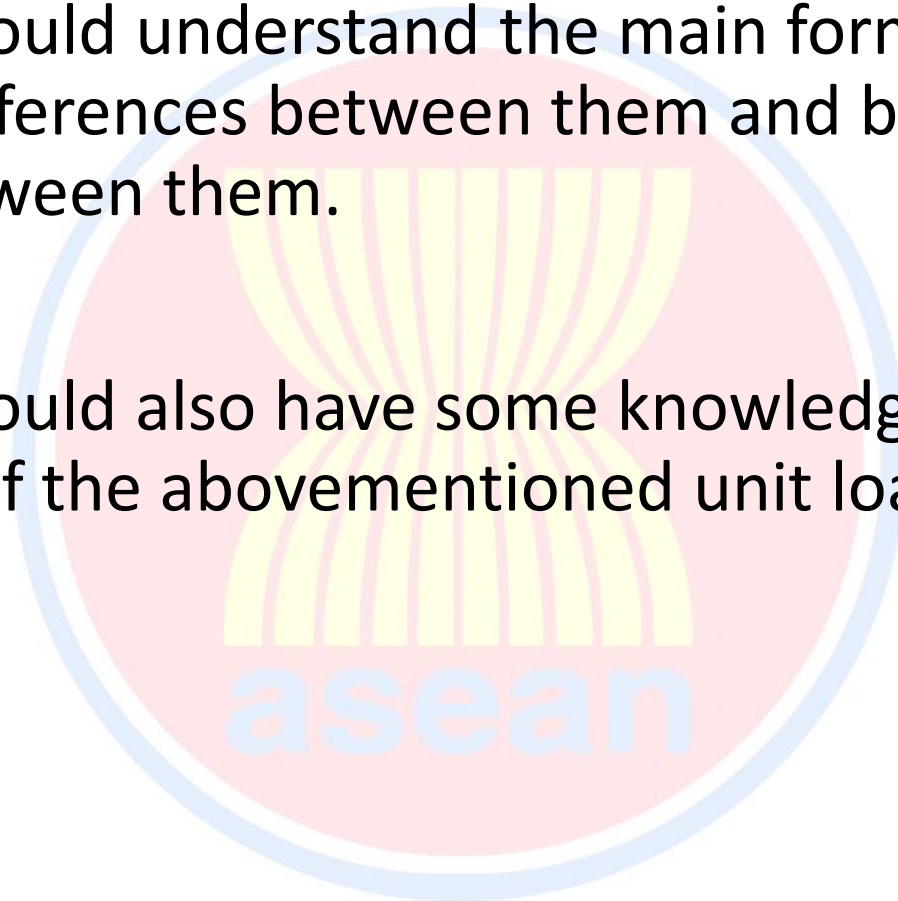


# Loading Devices

**Unit Load Device  
(ULD)**

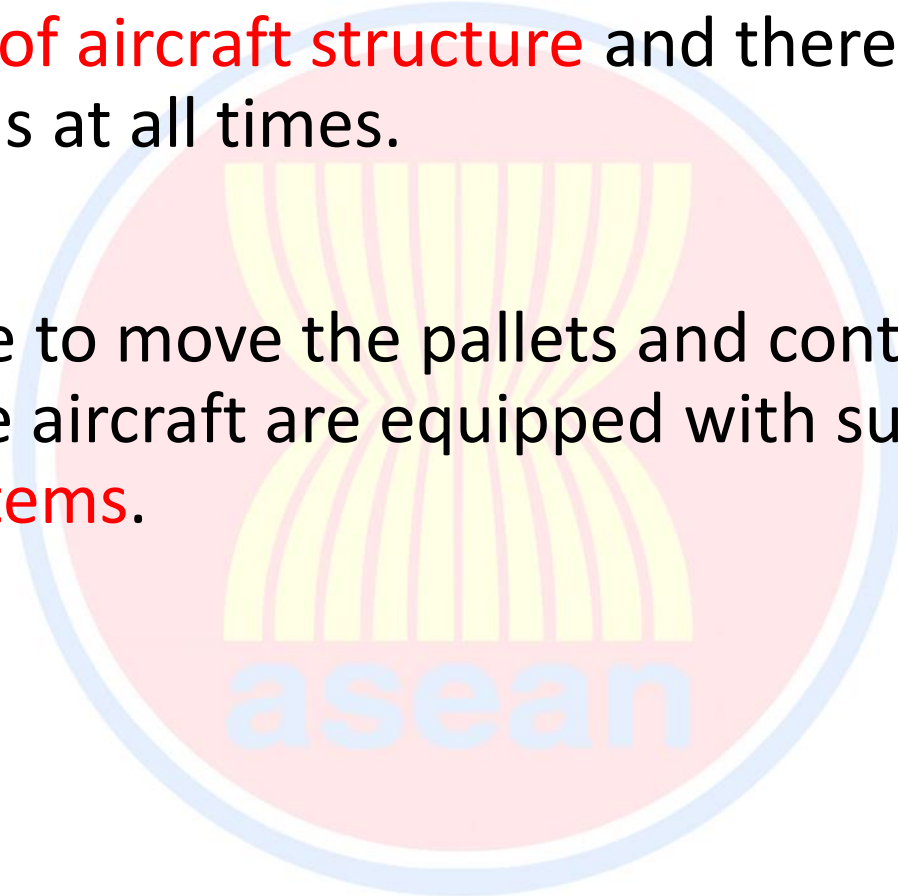
# Objectives

- The student should understand the main forms of unit load devices, the differences between them and be able to distinguish between them.
- The student should also have some knowledge of the specifications of the abovementioned unit loading devices.



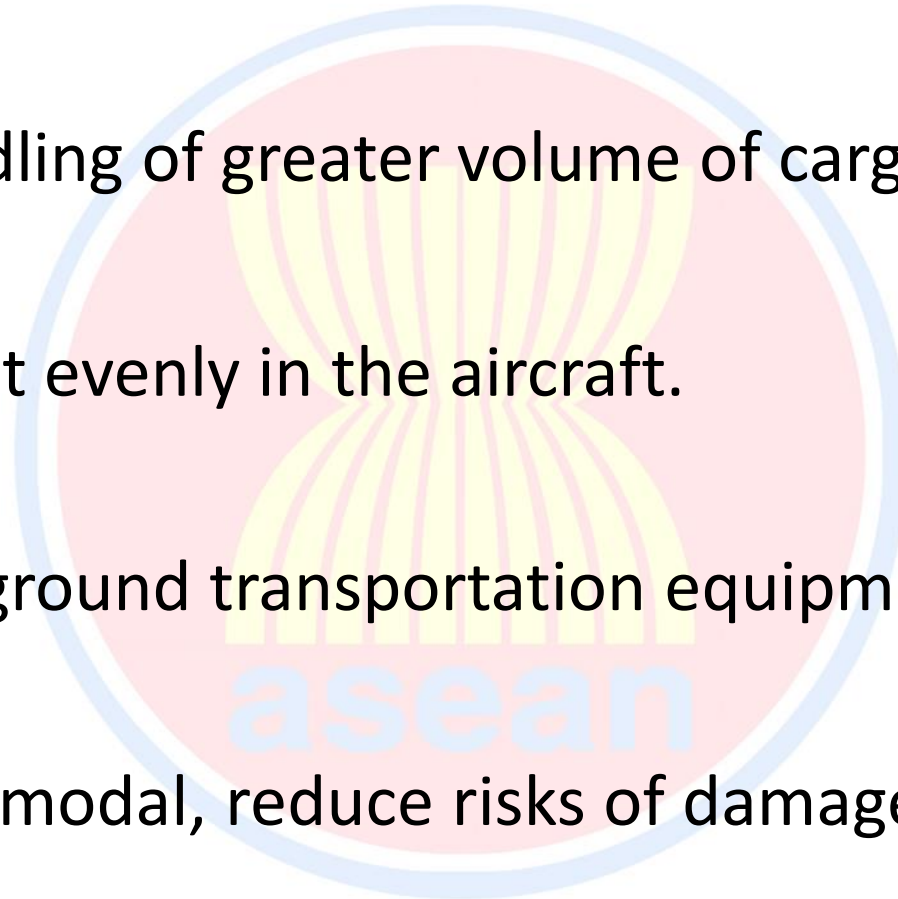
# Introduction

- ULDs → pallets and containers which may be considered as **removable parts of aircraft structure** and therefore must be in perfect conditions at all times.
- With the purpose to move the pallets and containers, the holds or deck floors of the aircraft are equipped with suitable **roller trays and restraint systems**.



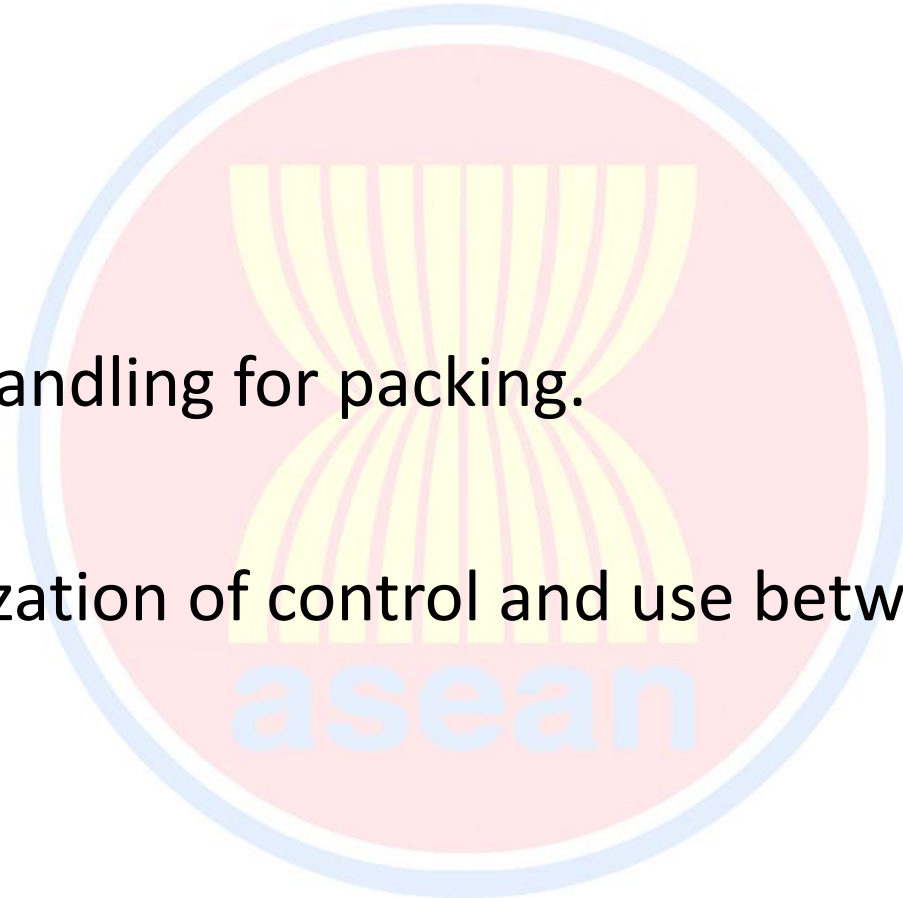
# Advantages of Using ULD's

- Speed up the process of air carriage.
- Improve the handling of greater volume of cargo
- Distributes weight evenly in the aircraft.
- Easily handle by ground transportation equipment.
- Intermodal/multimodal, reduce risks of damages when repacking.



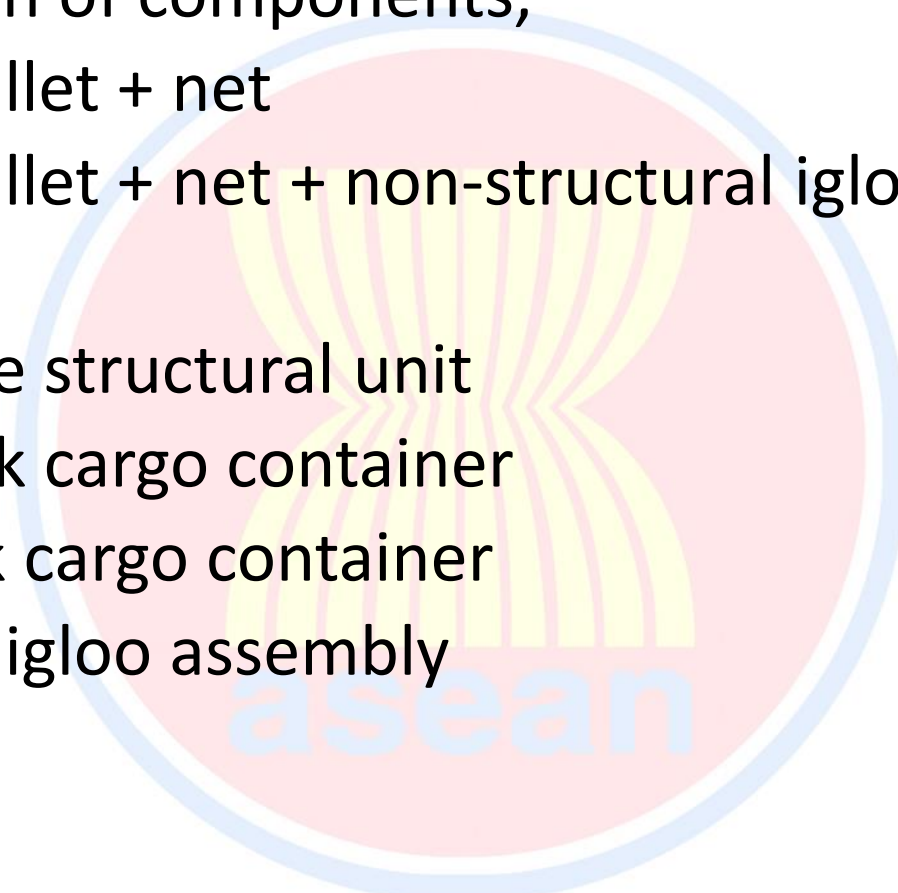
# Disadvantages of Using ULD's

- Increase weight and fuel burn.
- Reduce payload.
- Require special handling for packing.
- Require harmonization of control and use between carriers.



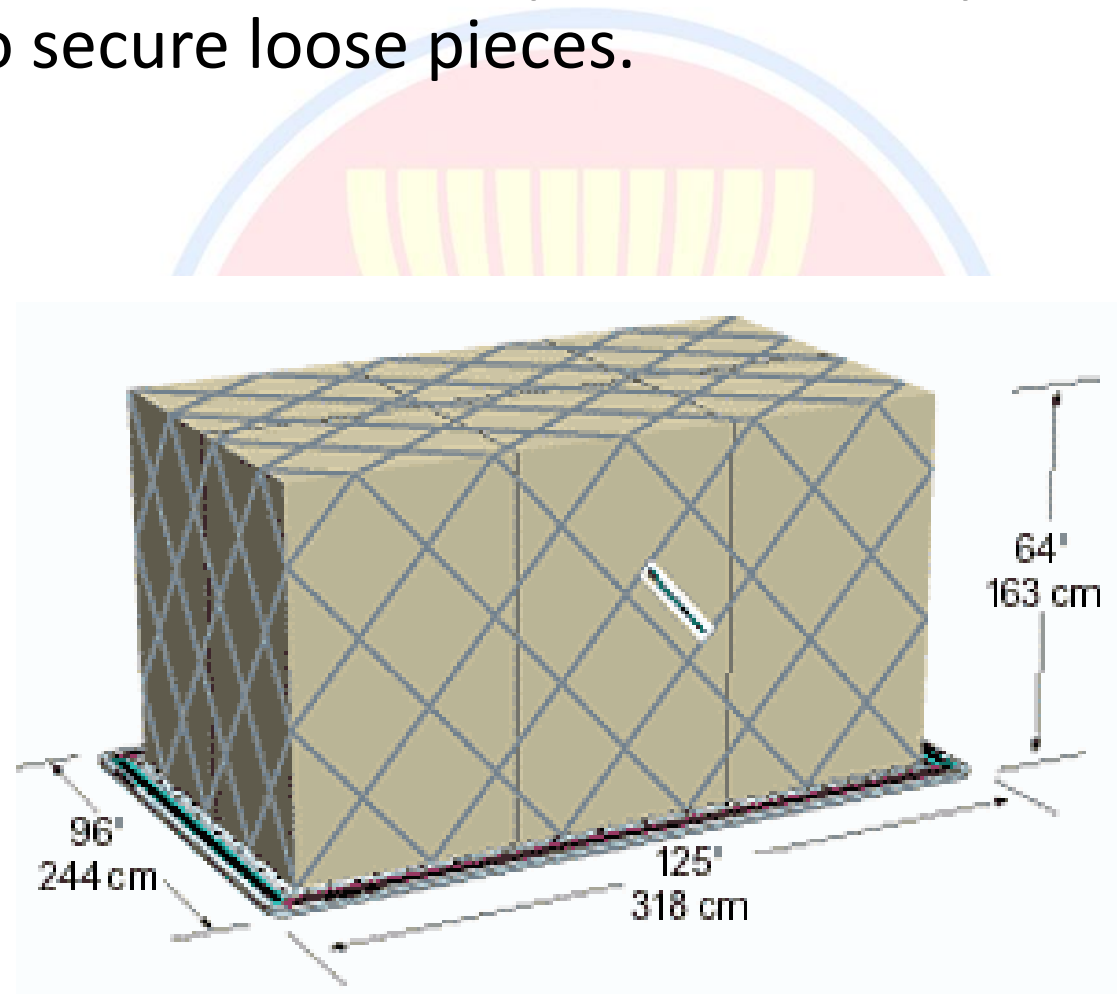
# Unit Load Device (ULD)

- ULD can be either
  - A combination of components,
    - aircraft pallet + net
    - aircraft pallet + net + non-structural igloo
  - One complete structural unit
    - lower deck cargo container
    - main deck cargo container
    - structural igloo assembly



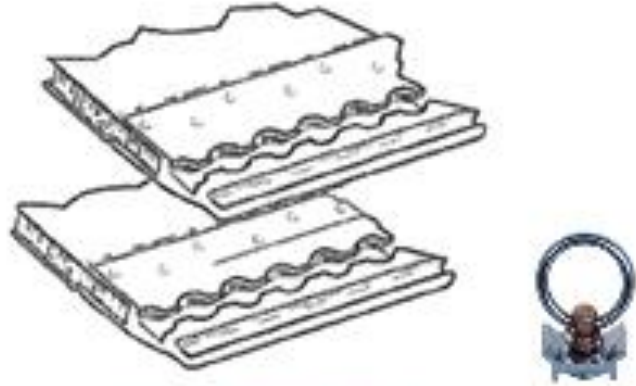
# Aircraft Pallet

- Pallets are flat sheets of aluminum on which shipment pieces are stacked. Each pallet is usually covered with a net to secure loose pieces.



# Aircraft Pallet

Pallet platform and seat track and track end fitting

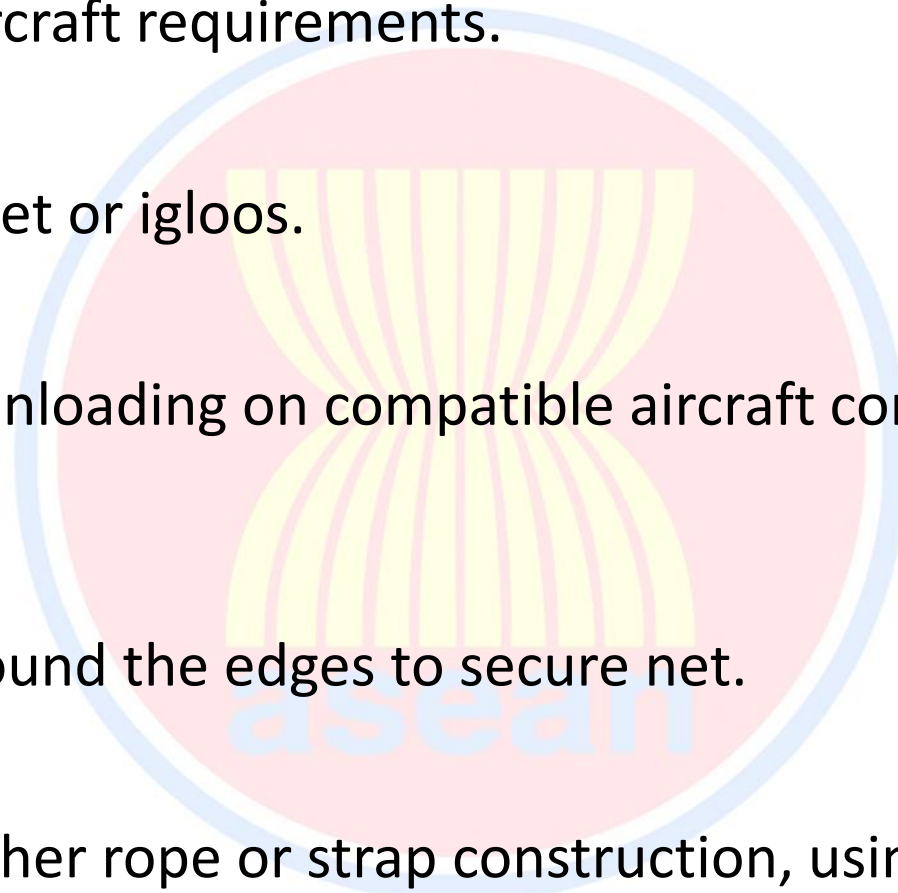


Pallet with diamond mesh net



# Aircraft Pallet

- A platform with a flat undersurface.
- Built to standard aircraft requirements.
- Goods secured by net or igloos.
- Rapid loading and unloading on compatible aircraft conveying and restraint systems.
- With seat tracks around the edges to secure net.
- The nets may be either rope or strap construction, using diamond or square mesh design.



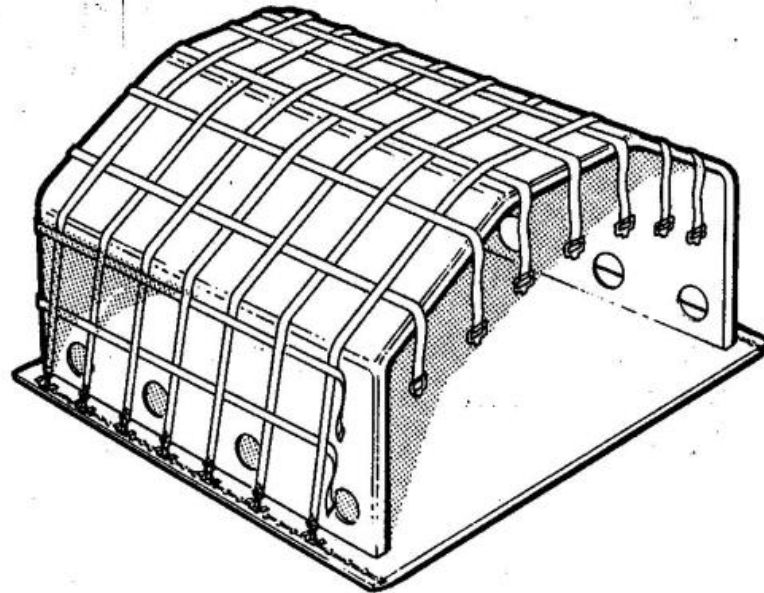
# Aircraft Pallet

- Common pallets standard side
  - 224 x 318 cm or 88 x 125 inches – PAG, PAA.....
  - 224 x 274 cm or 88 x 108 inches – PZA, PBJ.....
  - 244 x 606 cm or 96 x 238.5 inches – PGA, P7E....
  - 244 x 318 cm or 96 x 125 inches – PMC, PQP.....
- Usually less than 1 inch thick EXCEPT heavy duty pallets.

# Igloo

- **A non-structural igloo**

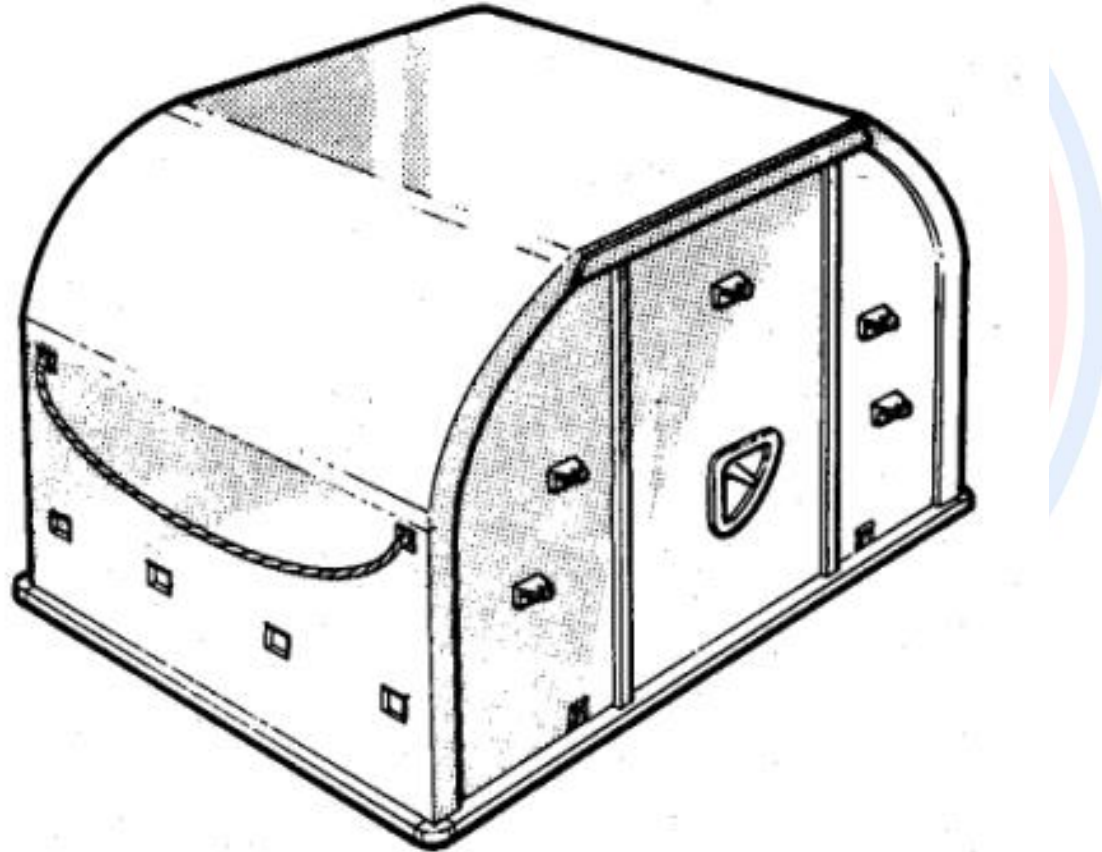
- An open front, bottomless, rigid shell.
- Slop conforms to the contours of the aircraft interior cross section.
- Covers the maximum usable area of an aircraft pallet to which it is secured.
- Used in combination with an aircraft pallet and net assembly.



# Igloo

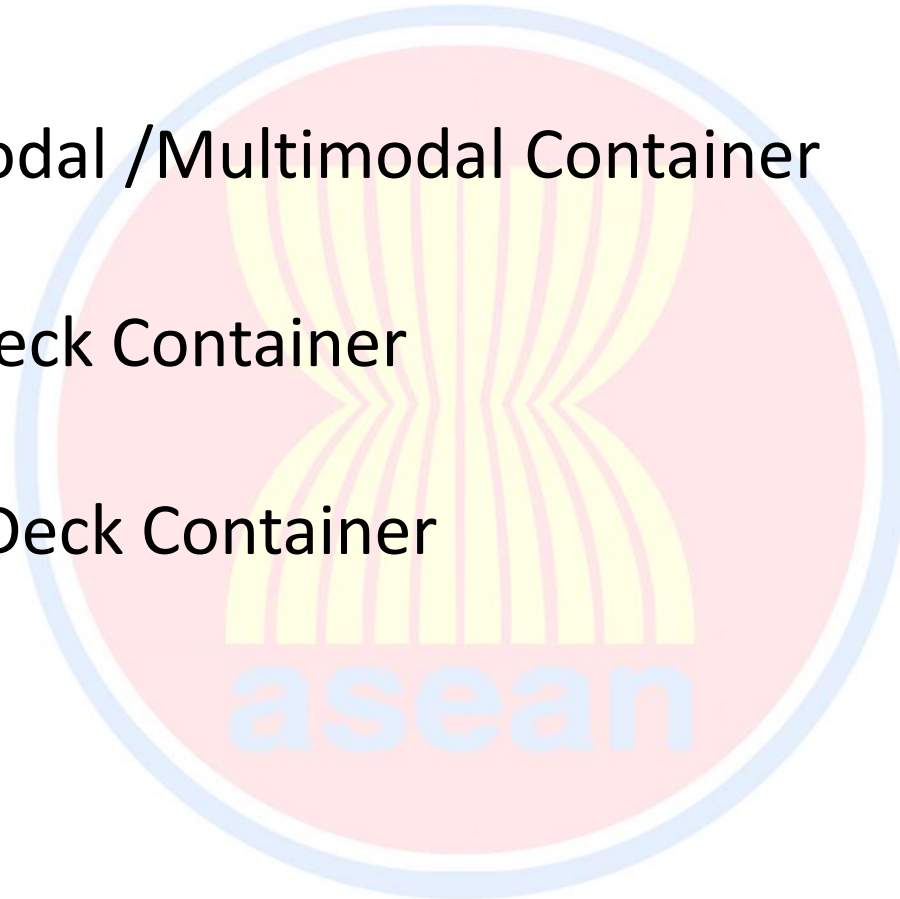
- **A structural igloo**

- The shell is structurally attached to the pallet to form a single unit.
- Stressed to restrain cargo without the use of nets.



# Container

- Containers are similar to structural igloos and they can be divided into following categories:
  - Intermodal /Multimodal Container
  - Main Deck Container
  - Lower Deck Container



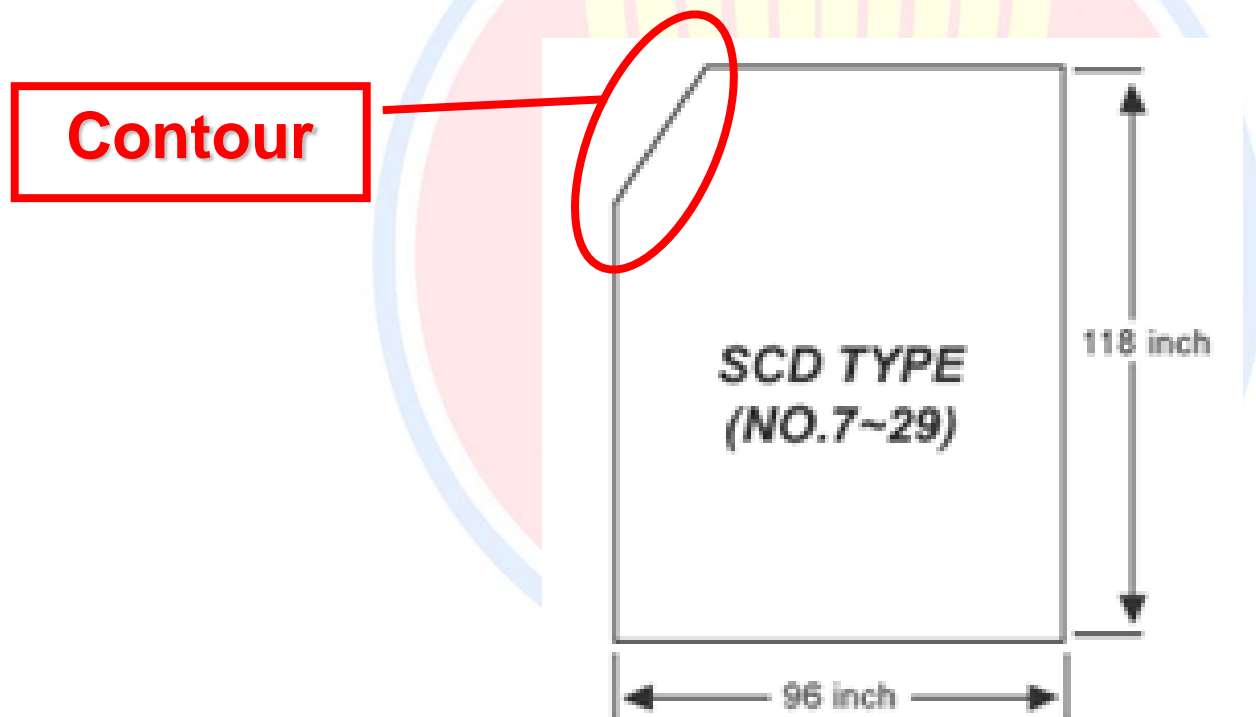
# Intermodal / Multimodal Container

- 20-footer or 40 footer with width and height of 8 feet/96 inches.
- Can be loaded on the **main deck of wide-body freighter and combi aircraft only**.
- For transport by **air** and interchange with surface transport modes (**road, rail and sea**).



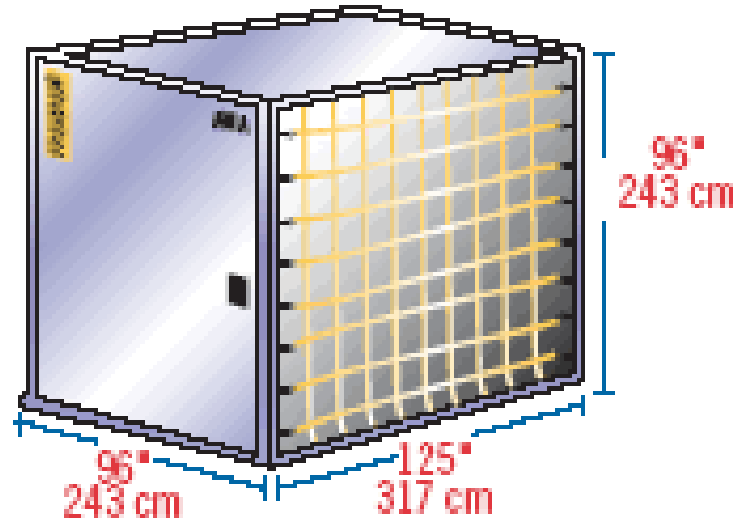
# Main Deck Container

- Can be loaded on the **main deck of freighter and combi aircraft only.**
- Height of containers – 163 cm (64 inches) and over.
- **Q7: 96" x 125" x 118" with contour → B747F only**



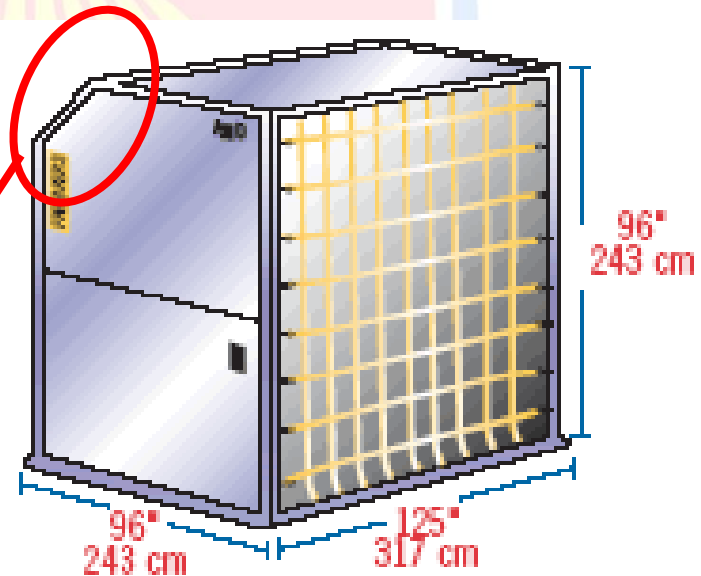
# Main Deck Container

**Q6:** 96" x 125" x 96" →  
B747F.



**QS:** 96" x 125" x 96" with  
**contour** → MD11F &  
B747F

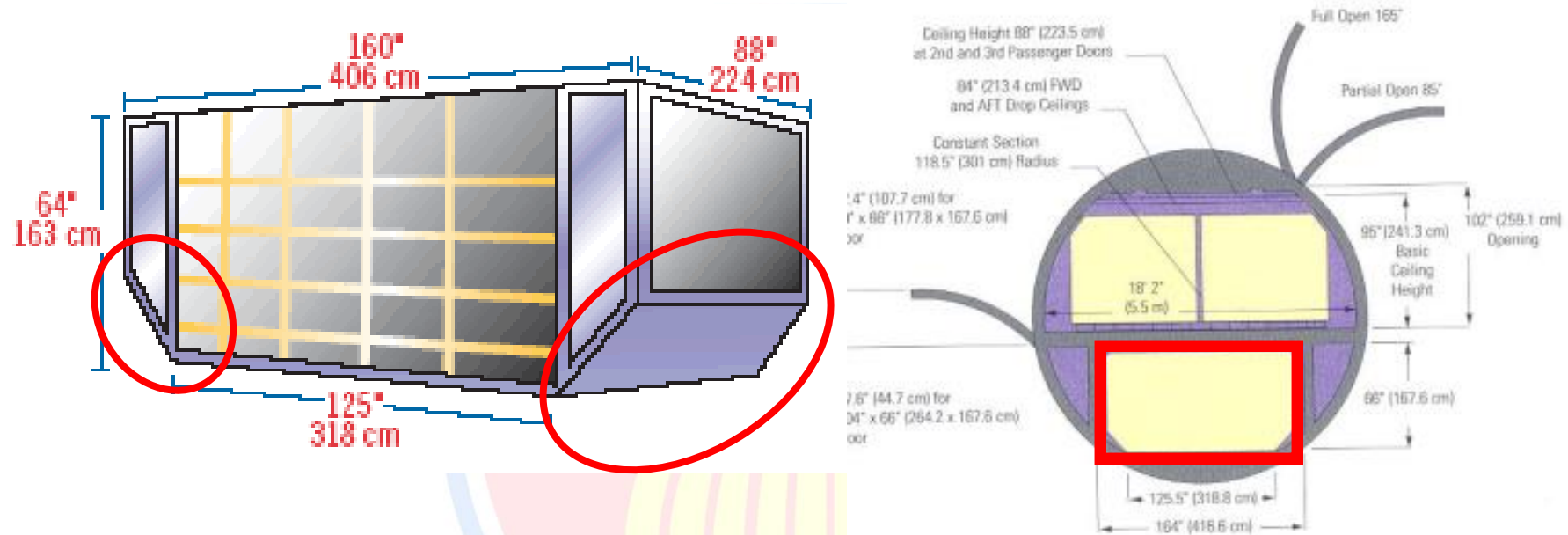
**Contour**



# Lower Deck Container

- Loaded in **lower deck ULD compartments**.
- **Maximum height 163 cm (64 inches)**.
- **Full-size** lower deck containers (AAP-LD9, ALF-LD6) **occupied entire width of the ULD compartment**.
- **Half-size** containers lower deck containers (AKE-LD3, AVJ-LD1) loaded **side by side**.

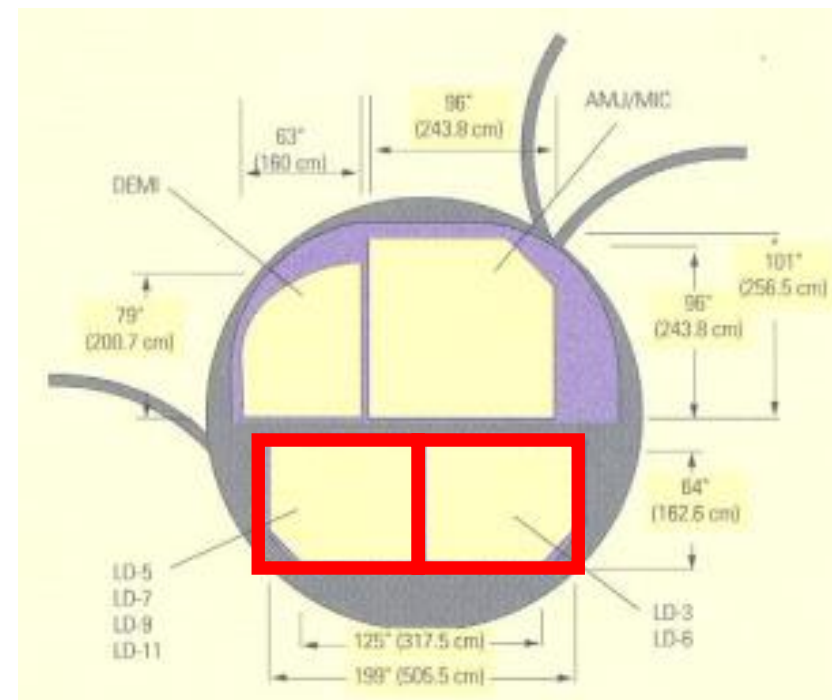
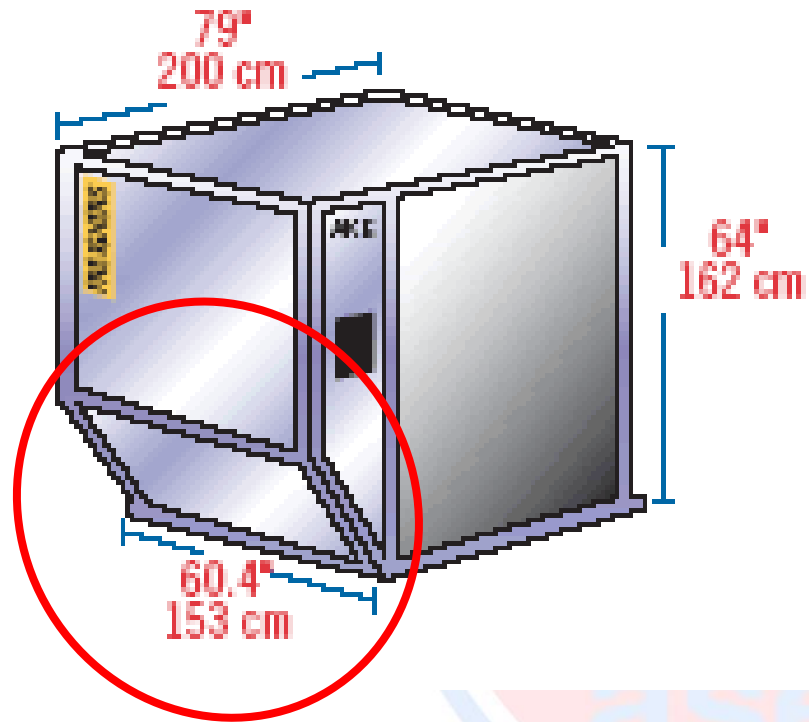
# Full-size lower deck containers



Contour at base



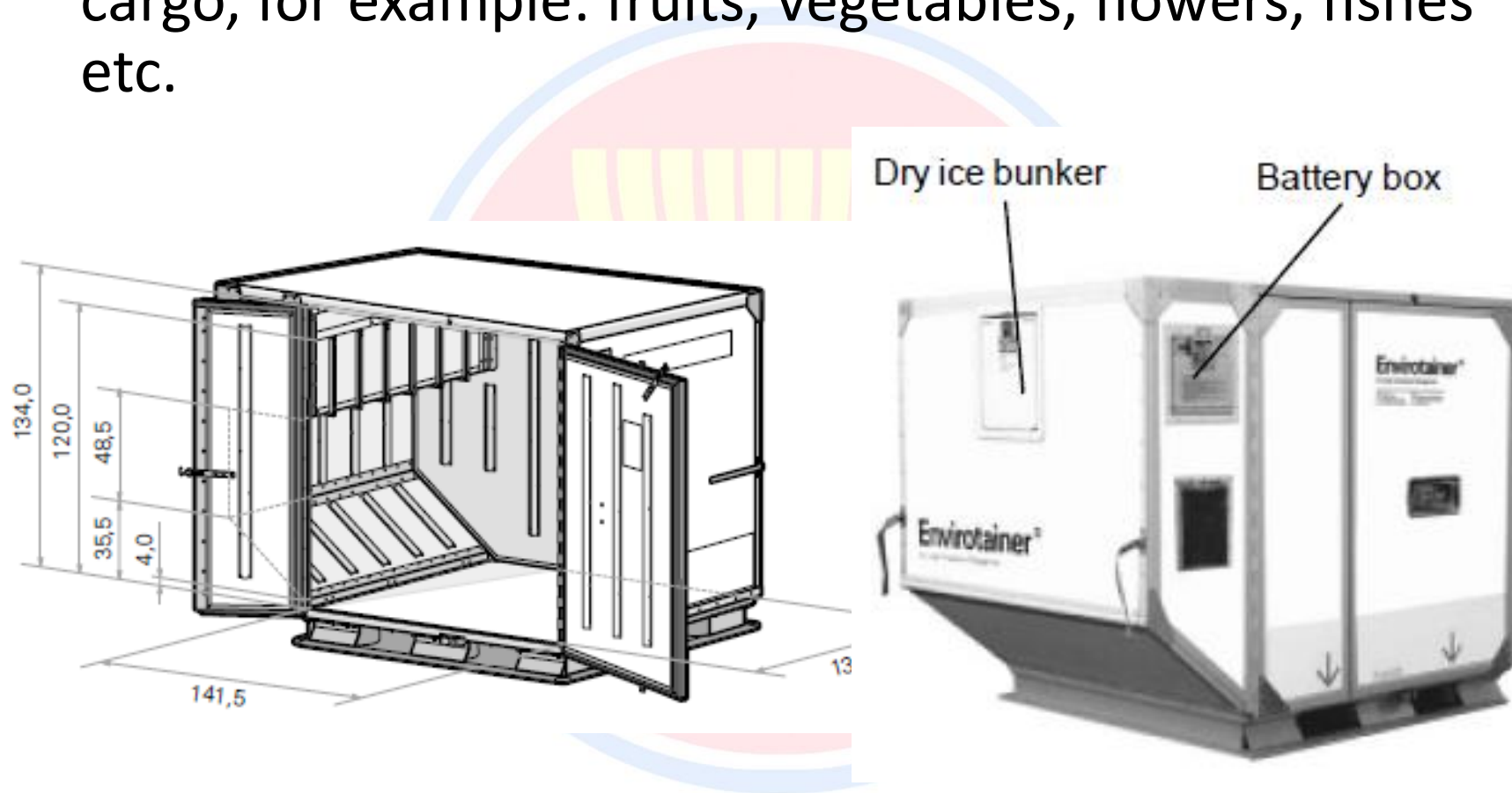
# Half-size lower deck containers



Contour at base

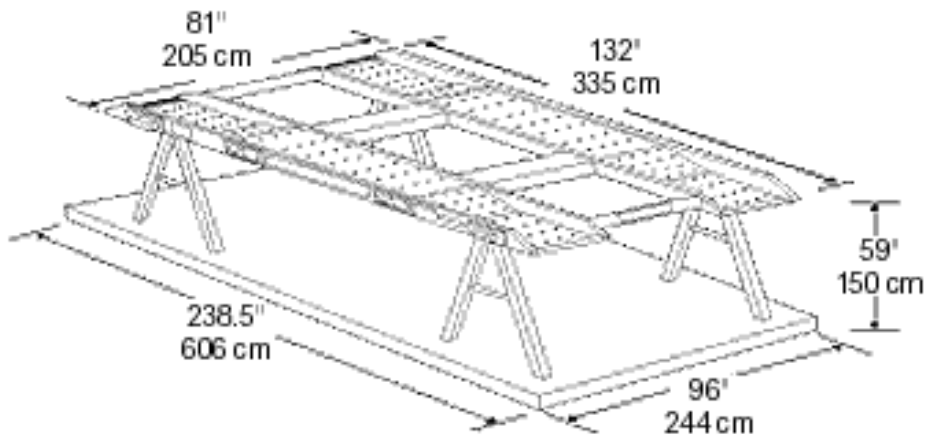
# Other Special Cargo ULD

- **Cooltainers:** Mainly for the carriage of perishable cargo, for example: fruits, vegetables, flowers, fishes etc.



# Other Special Cargo ULD

- **Car Racks:** Car racks are based on pallet PGA. A second car can be stacked above the first one on a single rack.



# Horse Stall & Live Stock Container



**HMA HORSE STALL**

**KMA LIVESTOCK CONTAINER**

# Types of ULD's

- **IATA ULD**

- An IATA ULD is a loading unit **approved and registered by IATA** on or in which cargo can be transported.

- The IATA ULD is further divided into two types:
    - **Carrier's ULD** - property of the airline;
    - **Shipper's ULD** - property of the shipper.



# Types of ULD's

- **Aircraft ULD / Certified Aircraft ULD's**
  - Certification granted to manufacturer by appropriate governmental **airworthiness authority**.
  - The **ULDs meet safety requirements for the aircraft**.
  - Certified ULDs regarded as removable aircraft holds that able to restrain load and protect aircraft system and structure.



# Types of ULD's

- **Non Certified Aircraft ULD's**

- This ULD has **not received airworthiness certification** and **not considered as removable aircraft holds** and do not meet safety requirements for the aircraft.
- They are only allowed on certain aircraft in certain cargo compartments and **prohibited on main deck of freighter and combi.**

# Types of ULD's

- **Non Certified Aircraft ULD's**



**For Airbus 767-200 & 300 series  
Lower Deck**

# ULD Terminology & Indications

- **P** → Pallet (Loaded in lower and main deck)
- **U** → Igloo (Loaded in lower and main deck)
- **A** → Container (Loaded in lower and main deck)

AMD		U.S. Domestic : .....
		Code
		Aircraft Type : 74E/74Y Main Deck
		Internal Volume : 20.1 cum (709 cuft)
		Internal : 229X305X229/290 cm
		Dimensions : (90X120X90/114 in)
		Maximum Gross : 6804 kg (15000 lbs)
		Weight
		Tare Weight : 341 kg (752 lbs)
		Door Clearance : 288X293 cm
		(113X115 in)

# ATA (Air Transport Association of America) indication

- LP = lower deck pallet / igloo
- MP = main deck pallet
- LD3 = container



# Identification For ULD's

- Example:
  - AKE12345MH & PMC56789KE

Position	Example			Refers to
1	A	P	Alphabetic	ULD category
2	K	M	Alphabetic	Base dimensions
3	E	C	Alphabetic	Contour and compatibility
4,5,6,7,8	12345	56789	Numeric	Serial number
9,10	MH	KE	Alphabetic	Owner/registrant

# ULD Categories

**A**KE12345MH & **P**MC56789KE

- The **Position 1** letter describes the container as:
  - certified as to airworthiness or non-certified
  - structural unit or non-structural
  - fitted with equipment for refrigeration, insulation or thermal control (Thermal) or not fitted with refrigeration, insulation or thermal control
  - containers, pallets, nets, pallet/net/non-structural igloo assembly

# ULD Categories

**A**KE12345MH & **P**MC56789KE

A	Certified Aircraft Container
D	Non-Certified Aircraft Container
F	Non-Certified Aircraft Pallet
G	Non-Certified Aircraft Pallet Net
J	Thermal Non-Structural Igloo
H	Horse Stalls
K	Cattle Stalls
M	Thermal Non-Certified Aircraft Container
N	Certified Aircraft Pallet Net
P	Certified Aircraft Pallet
R	Thermal Certified Aircraft Container
U	Non-Structural Container
V	Automobile Transport Equipment

# Base Dimensions

AKE12345MH & PMC56789KE

- Aircraft units by definition are designed to **interface directly with the restraint system** in the aircraft.
- Therefore, there has to be **close relationship between unit base dimensions and the aircraft restraint system** in which they are designed to fit.
- Many units are inter-chargeable between different aircraft and different restraint system.

# Base Dimensions

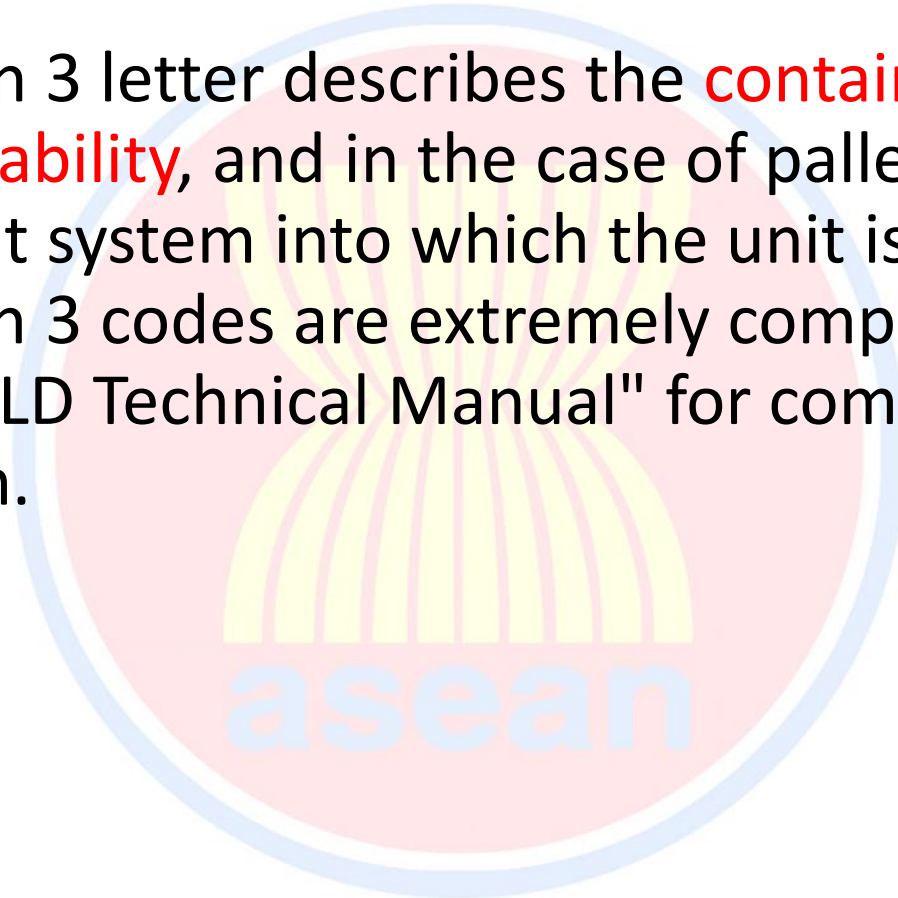
## AKE12345MH & PMC56789KE

A	2,235 x 3,175 mm (88 x 125 in)
B	2,235 x 2,743 mm (88 x 108 in)
E	1,346 x 2,235 mm (53 x 88 in)
F	2,438 x 2,991 mm (96 x 117 3/4 in)
G	2,438 x 6,058 mm (96 x 238 1/2 in)
H	2,438 x 9,125 mm (96 x 359 1/4 in)
J	2,438 x 12,192 mm (96 x 480 in)
K	1,534 x 1,562 mm (60.4 x 61.5 in)
L	1,534 x 3,175 mm (60.4 x 125 in)
M	2,438 x 3,175 mm (96 x 125 in)
N	1,562 x 2,438 mm (61.5 x 96 in)
P	1,198 x 1,534 mm (47 x 60.4 in)
Q	1,534 x 2,438 mm (60.4 x 96 in)
R	2,438 x 4,938 mm (96 x 196 in)
X	Miscellaneous sizes largest dimension between 2,438 mm and 3,175 mm (between 96 in and 125 in)
Y	Miscellaneous sizes largest dimension 2,438 mm (96 in)
Z	Miscellaneous sizes largest dimension >3,175 (>125 in)

# Contours and Compatibility

AK**E**12345MH & PMC**C**56789KE

- The Position 3 letter describes the **container's contour, fork lift capability**, and in the case of pallets and nets, the restraint system into which the unit is classified. The Position 3 codes are extremely complex. Refer to the IATA "ULD Technical Manual" for complete information.



# Serial Numbers

AKE**12345**MH & PMC**56789**KE

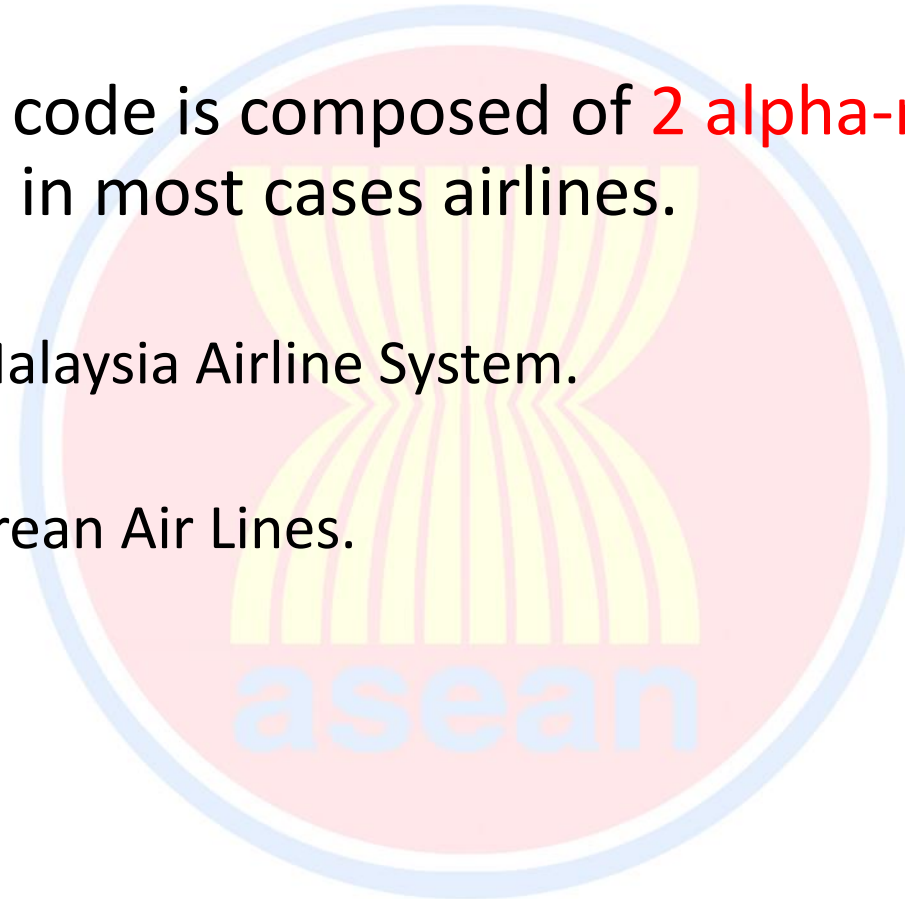
- The serial numbers are assigned by the owner and consists of **4 to 5 numeric digits**.



# Owner/Registrant

AKE12345**MH** & PMC56789**KE**

- The owner code is composed of **2 alpha-numeric characters**, in most cases airlines.
  - MH → Malaysia Airline System.
  - KE → Korean Air Lines.



# ULD Markings

- According to IATA all ULDs must carry the following marking information:
  1. ULD type code
  2. Maximum gross weight (MGW)
  3. The actual tare weight (TARE) in kilograms and pound.

AKE	1 2 3 4 5	MH
MGW	1,588 kg	3,494 lb
TARE	105 kg	231 lb

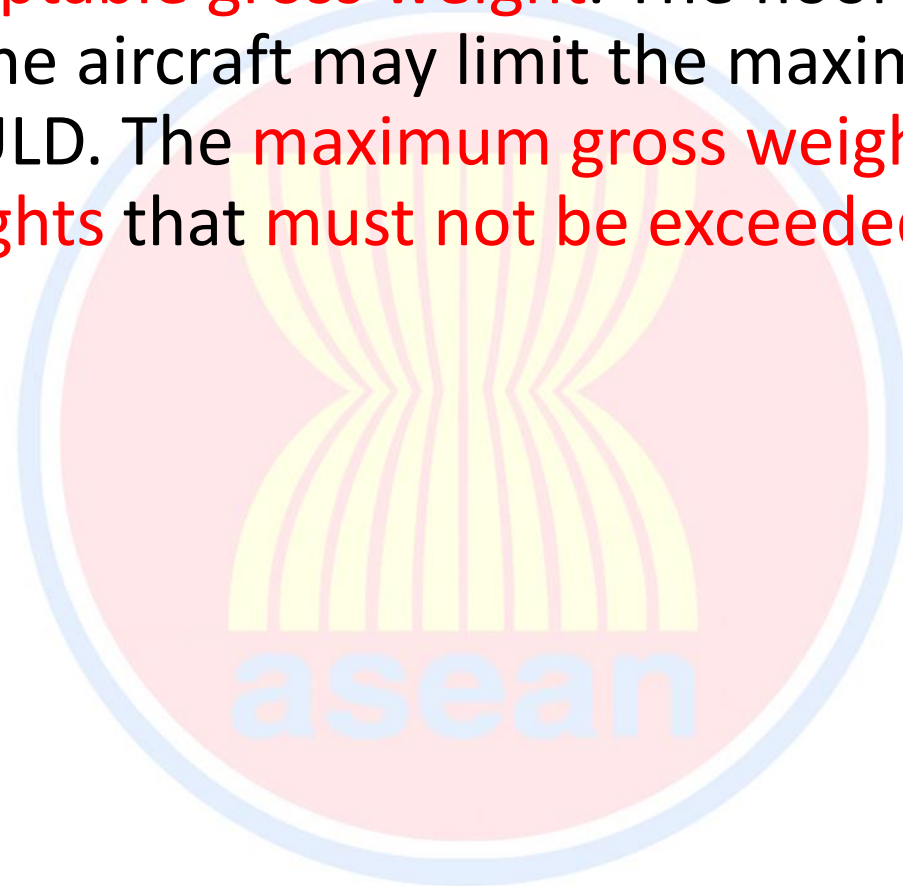
WebsiteS:

<http://www.fredoniainc.com/glossary/air.html>

[http://en.wikipedia.org/wiki/Unit\\_Load\\_Device](http://en.wikipedia.org/wiki/Unit_Load_Device)

# ULD's Weight Limitations

- All ULD's have **structural limitations** which determine the **maximum acceptable gross weight**. The floor loading limitations of the aircraft may limit the maximum gross weight of the ULD. The **maximum gross weights, including ULDs' tare weights** that **must not be exceeded**.



# ULD's Weight Limitations – cont.

IATA ID Code	Dimensions		Maximum Gross Weight (MGW)	
	(cm)	(in)	(kgs)	(lbs)
<b>Main Deck Pallets</b>				
PG	244 x 606	96 x 238.5	13,608	30,000
PM	244 x 318	96 x 125	6,804	15,000
<b>Main and Lower Deck Pallets</b>				
PA	224 x 318	88 x 125	6,804	15,000
PB	224 x 274	88 x 108		
<b>Main Deck Igloos</b>				
AA Structural	224 x 318 x 163	88 x 125 x 86	6,033	13,300
UA Non-Structural (LD7)	224 x 318 x 163	88 x 125 x 86	6,804	15,000
<b>Lower Deck Igloos</b>				
AA Structural (LD9)	224 x 318 x 163	88 x 125 x 64	6,033	13,300
AL Structural (LD11)	153 x 318 x 163	60.4 x 125 x 64	2,449	5,400
<b>Main Deck Containers</b>				
AMA 10 ft. Container	244 x 318 x 244	96 x 125 x 96	6,804	15,000
AGA 20 ft. Container	244 x 606 x 244	96 x 238.5 x 96	11,340	25,000
<b>Lower Deck Containers</b>				
AL Full-Size (LD5)	153 x 318 x 163	60.4 x 125 x 64	3,175	7,000
AK Half-Size (LD3)	153 x 156 x 163	60.4 x 61.5 x 64	1,588	3,500
DK Half-Size Non-Certified	153 x 156 x 163	60.4 x 61.5 x 64	1,451	3,200

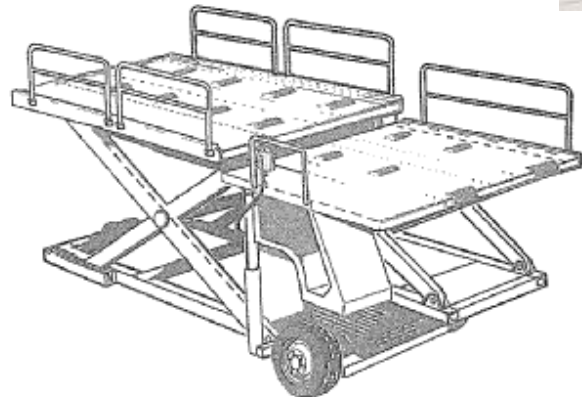
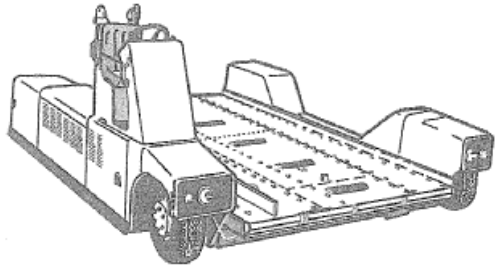
# ULD Weight & Dimensions Limitation

Metric		
	Max. Dimensions (cms)	Max. Weight (kgs)
Lower Deck Cargo ULD	318L x 224W x 163H	4500 per piece/unit
Main Deck Cargo ULD	305L x 220W x 300H	6000 per piece/unit

Imperial		
	Max. Dimensions (ins)	Max. Weight (lbs)
Lower Deck Cargo	125L x 88W x 64H	9923 per piece/unit
Main Deck Cargo	120L x 87W x 118H	13230 per piece/unit

- The dimensions given above are only a guide.
- Different aircrafts will have different size restrictions for ULDs.
- Always consult airlines for confirmation.

# Loading & Unloading Facilities

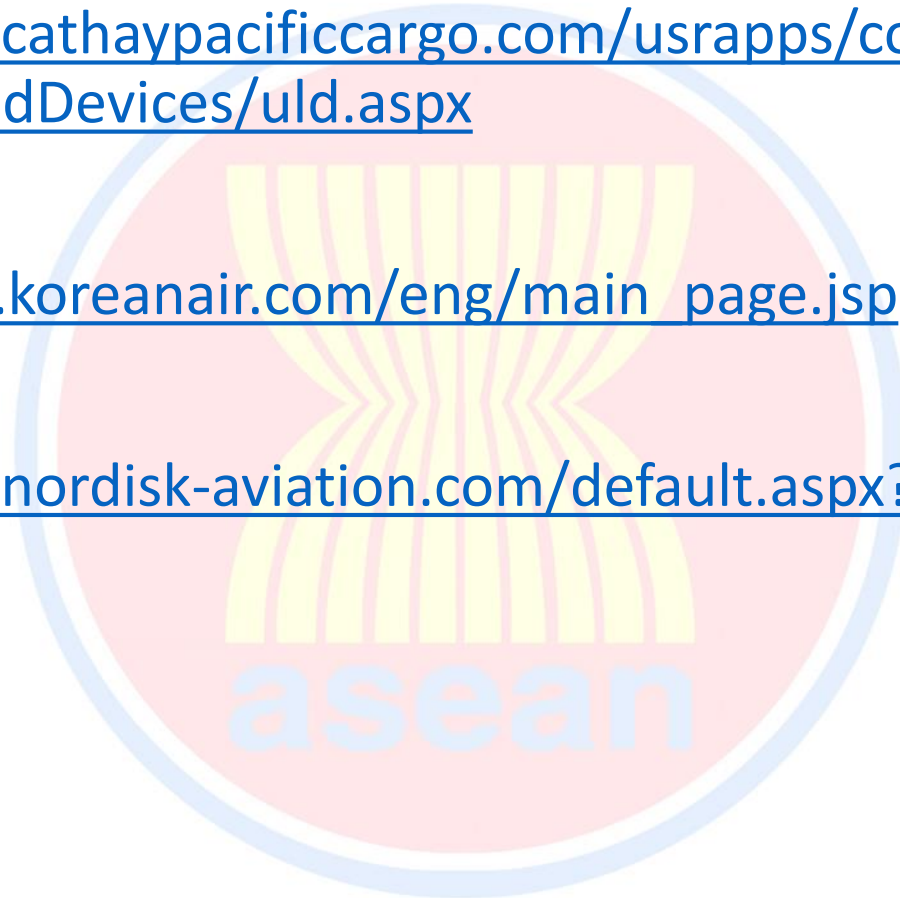


# Links to ULD's Information

<http://www.cathaypacificcargo.com/usrapps/content/shippingSpec/unitLoadDevices/uld.aspx>

[http://cargo.koreanair.com/eng/main\\_page.jsp](http://cargo.koreanair.com/eng/main_page.jsp)

<http://www.nordisk-aviation.com/default.aspx?Cat=12>



**ULD Management - 1**

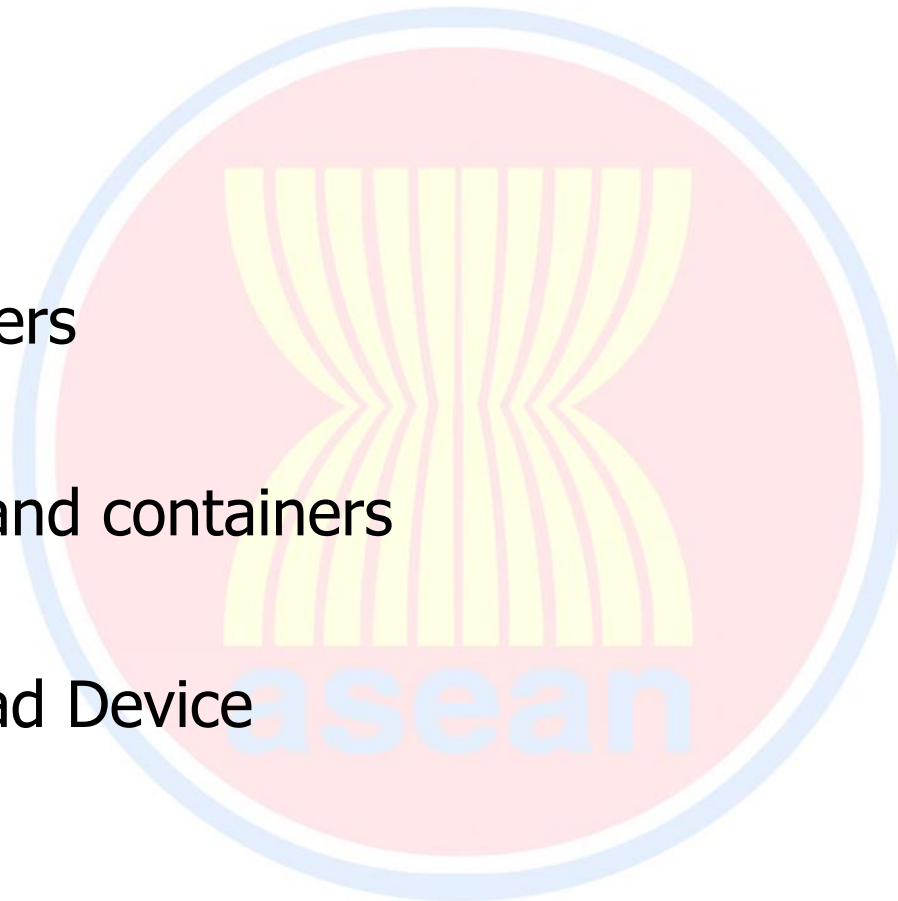
**of 2.flv**

**ULD Management 2 of**

**2.flv**

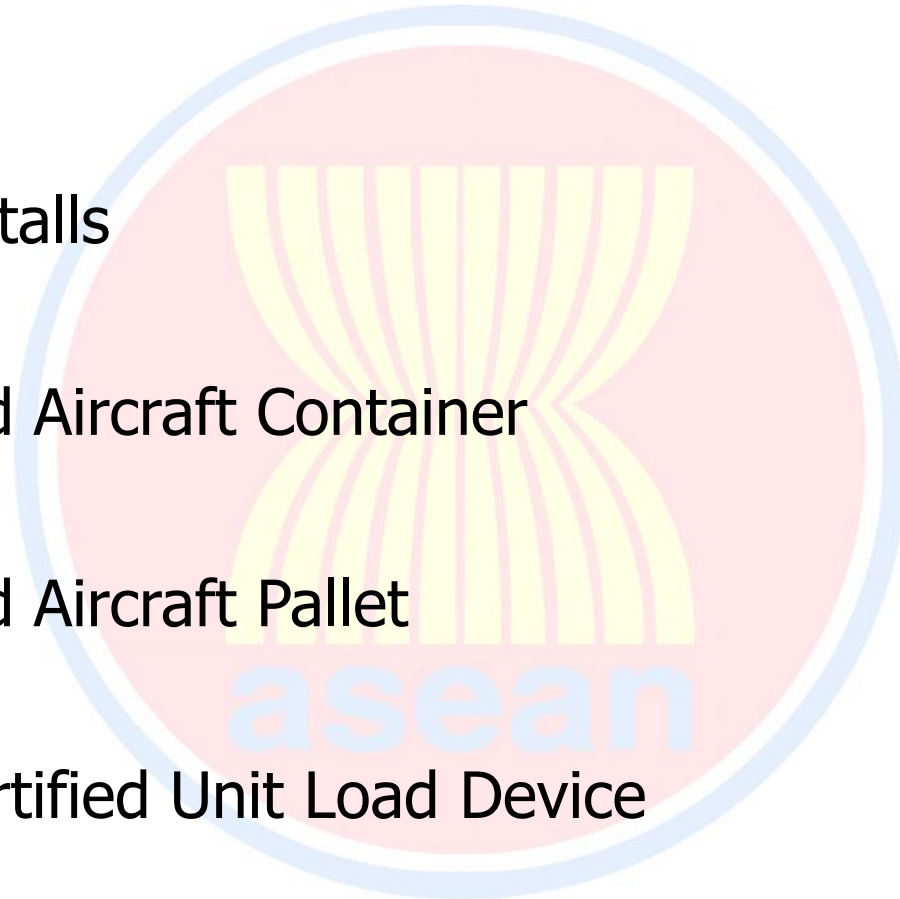
# Q&A

- ULD is the abbreviation of
  - a. Pallets
  - b. Containers
  - c. Pallets and containers
  - d. Unit Load Device



# Q&A

- The first position letter (A) of **A**KE12345CX means
  - a. Cattle Stalls
  - b. Certified Aircraft Container
  - c. Certified Aircraft Pallet
  - d. Non-Certified Unit Load Device



# Q&A

- The maximum gross weight of PG pallet is
  - a. 6,804 kg
  - b. 3,175 kg
  - c. 1,588 kg
  - d. 13,608 kg



# Q&A

- Determine whether this piece of cargo can be loaded into a lower deck or main deck ULD. 130 x 110 x 100 cms, 568 kgs.

✓ Refer to ULD Weight & Dimensions Limitation.

## Step 1

Lower deck dimensions 318 x 224 x 163 cms

Cargo dimensions 130 x 110 x 100 cms

## Step 2

Lower deck maximum weight 4500 kgs

Cargo weight 568 kgs

✓ The cargo can be loaded in lower deck.

Metric		
	Max. Dimensions (cms)	Max. Weight (kgs)
Lower Deck Cargo ULD	318L x 224W x 163H	4500 per piece/unit
Main Deck Cargo ULD	305L x 220W x 300H	6000 per piece/unit

# Q&A

- 118 x 100 x 110 cm x 8 skids / 3,000.0 kg
1. Plan the above shipment on ULD/ULDs with maximum space utilization.
  2. Decide what aircraft type to be used.

Metric		
	Max. Dimensions (cms)	Max. Weight (kgs)
Lower Deck Cargo ULD	318L x 224W x 163H	4500 per piece/unit
Main Deck Cargo ULD	305L x 220W x 300H	6000 per piece/unit

# Q&A

- 350 x 90 x 92 inches x 1 crate / 5,000 kg.
1. Plan the above shipment on ULD/ULDs with maximum space utilization.
  2. Decide what aircraft type to be used.



<b>Imperial</b>		
	<b>Max. Dimensions (ins)</b>	<b>Max. Weight (lbs)</b>
<b>Lower Deck Cargo</b>	<b>125L x 88W x 64H</b>	<b>9923 per piece/unit</b>
<b>Main Deck Cargo</b>	<b>120L x 87W x 118H</b>	<b>13230 per piece/unit</b>

# **Bulk Loading Limitations**



# Objectives

- After completing this section, the learners will be able to understand clearly aircrafts'
  - ❖ Weight limitations,
  - ❖ Volume limitations,
  - ❖ Maximum cargo dimensions loadable into aircraft and to use loading charts correctly.

The background features a large, semi-transparent watermark of the ASEAN logo. It consists of a circular emblem with a light blue border, a pinkish-red background, and a central yellow sunburst design. Below the sunburst, the word "asean" is written in a light blue, lowercase font.

# **Weight Limitations**

# Weight Limitations

- It has been established that there is a maximum payload for each aircraft.
- There are also additional weight restrictions for each hold and/or compartment in the aircraft.
- McDonnell Douglas DC-9-81 weight limitations
  - FWD cargo hold
    - Compartment 1: 3,157 kg
    - Compartment 2: 3,138 kg
    - Compartment 1 & 2 total 6,295 kg
    - Total FWD cargo hold not exceed 5,510 kg
  - AFT cargo hold
    - Compartment 4: 3,014 kg.

# Weight Limitations

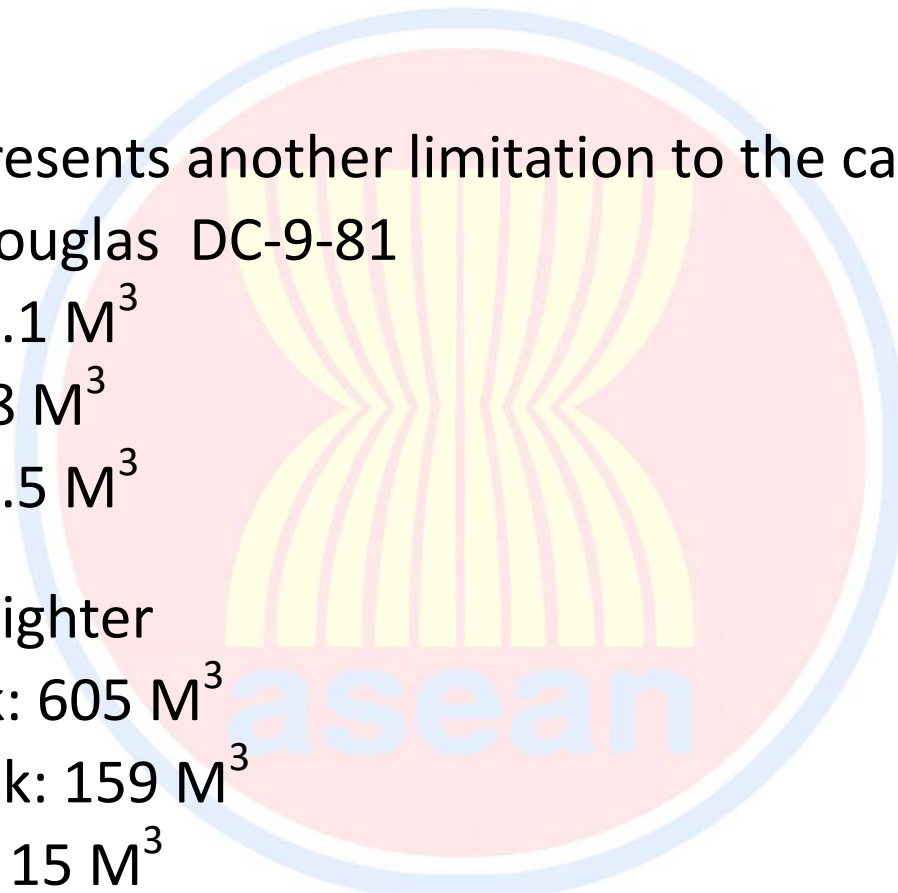
- Weight restrictions
  - ❖ The maximum payload of a particular aircraft.
  - ❖ The maximum weight in a specific hold.
  - ❖ The maximum weight in a specific compartment.
  - ❖ The maximum weight of a piece of cargo. Must consult airline if large and/or heavy pieces are offered for transportation.

# **Volume Limitations**



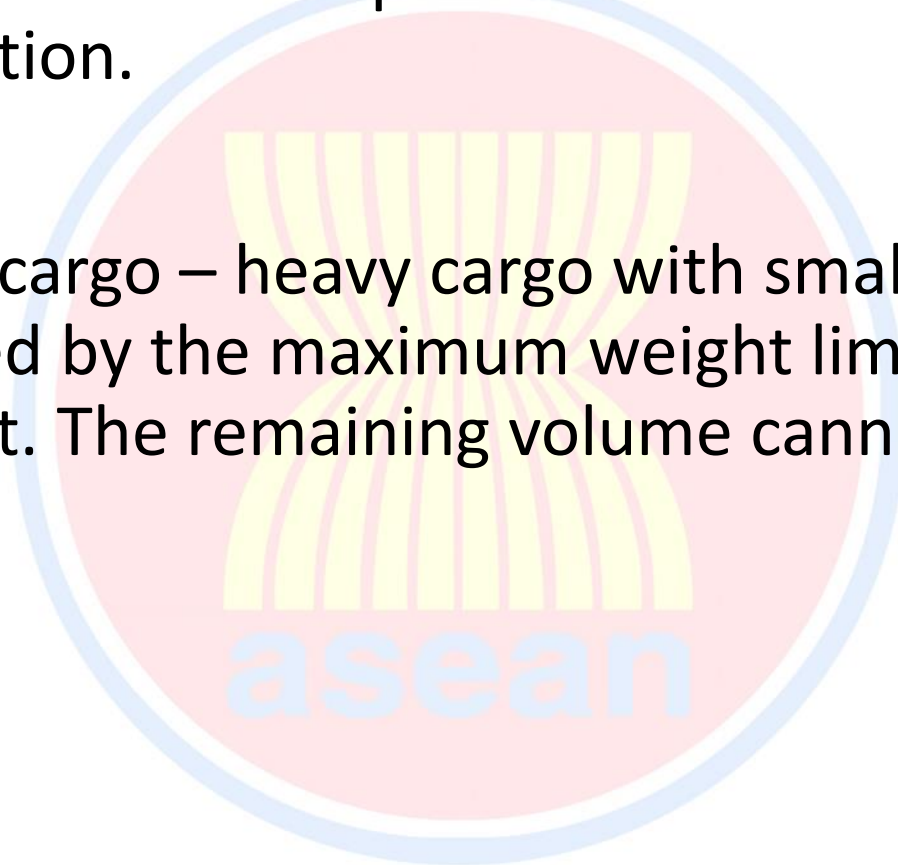
# Volume Limitations

- The volume which can be occupied by the payload in a hold or compartment is **finite** and depends on the internal dimensions of the aircraft.
- The volume represents another limitation to the carriage of cargo.
  - McDonnell Douglas DC-9-81
    - Hold 1: 13.1 M<sup>3</sup>
    - Hold 2: 9.8 M<sup>3</sup>
    - Hold 4: 12.5 M<sup>3</sup>
  - B747-400 Freighter
    - Main deck: 605 M<sup>3</sup>
    - Lower deck: 159 M<sup>3</sup>
    - Bulk hold: 15 M<sup>3</sup>



# High & Low Density Cargo

- Low density cargo – voluminous, bulky cargo will use the entire volume of the compartment before reaching the weight limitation.
- High density cargo – heavy cargo with small volume will first be limited by the maximum weight limitation of the compartment. The remaining volume cannot be used.



# Density = relationship of weight to volume

- The density is the relationship of weight to volume.
- A mixture of low and high density commodities is more advantageous because the weight and volume limitation of a compartment will be utilized to a better extend.
- Payload also comprises the weight of passengers, baggage and mail.
- The volume of unoccupied air within the holds or compartments is critical variable for live stock transportation calculation.

# Density = relationship of weight to volume

- **High Density Cargo**
  - Heavy and small loads will tend to reach the weight limitation of the aircraft before the volume limitation is attained, thus resulting in unsold volume capacity.
  - Examples: Gold, machinery, metal parts.
  - High density cargo is cargo which weighs more than 1 kg per 6,000 cm<sup>3</sup> or 1 kg per 366 cubic inch or more than 1 pound per 166 cubic inch.

# Density = relationship of weight to volume

- **Low Density Cargo**
  - Light and bulky loads which will reach the volume limitation of the aircraft before the weight limitation is attained thus resulting in unsold weight capacity.
  - Examples: Hats, garments.
  - Low density cargo is cargo which weighs less than 1 kg per 6,000 cm<sup>3</sup> or 1 kg per 366 cubic inch or less than 1 pound per 166 cubic inch.

## Q & Answer

- Commodity: Clothing
  - Average density: 120 kg per M<sup>3</sup>
  - Maximum volume of compartment 4: 12.5 M<sup>3</sup>
  - Maximum weight of compartment 4: 3,014 kg

$$12.5 \text{ M}^3 \times 120 \text{ kg} = 1,500 \text{ kg}$$

- Can 1,500 kg of clothing be loaded in the compartment 4?
  - ✓ Yes, only 1,500 kg (less than 3,014 kg) of clothing can be loaded in compartment 4. The loadable quantity of this shipment is limited by the volume limitation of this compartment.

## Q & Answer

- Commodity: Capacitor
  - Average density: 400 kg per M<sup>3</sup>
  - Maximum volume of compartment 4: 12.5 M<sup>3</sup>
  - Maximum weight of compartment 4: 3,014 kg

$$12.5 \text{ M}^3 \times 400 \text{ kg} = 5,000 \text{ kg}$$

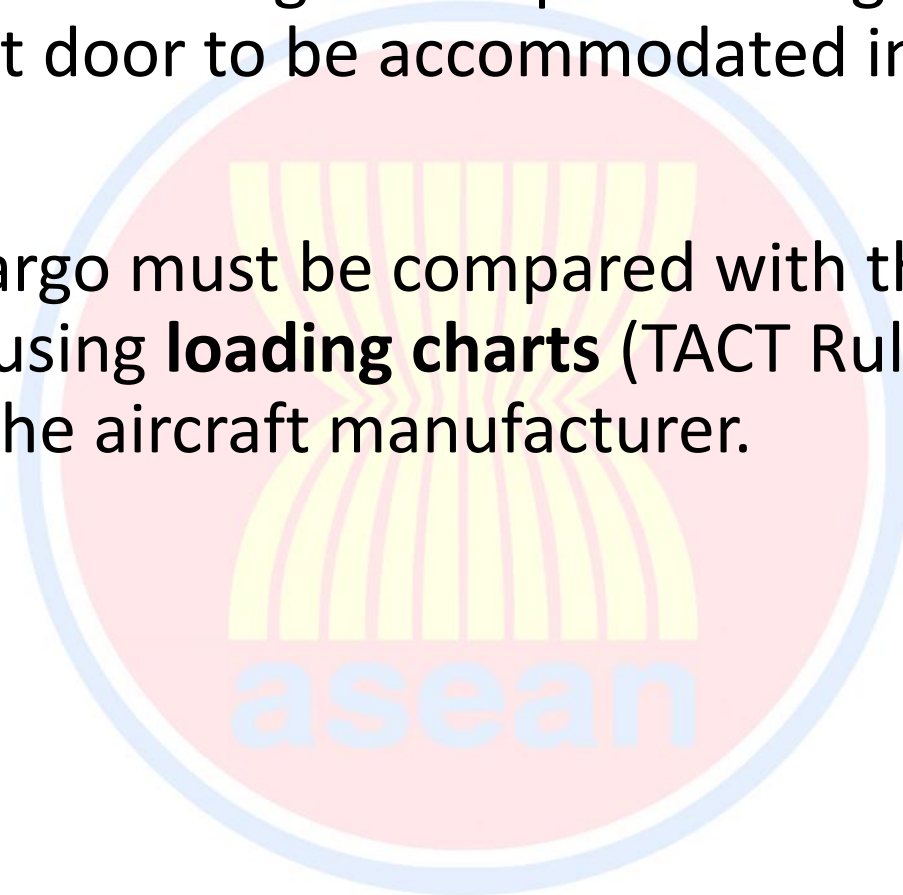
- What is the maximum weight of capacitor can be loaded in compartment 4?
- ✓ Only 3,014 kg of capacitors can be loaded in compartment 4. The loadable quantity of this shipment is limited by the weight limitation of this compartment.



# **Maximum Dimensions and Loading Charts**

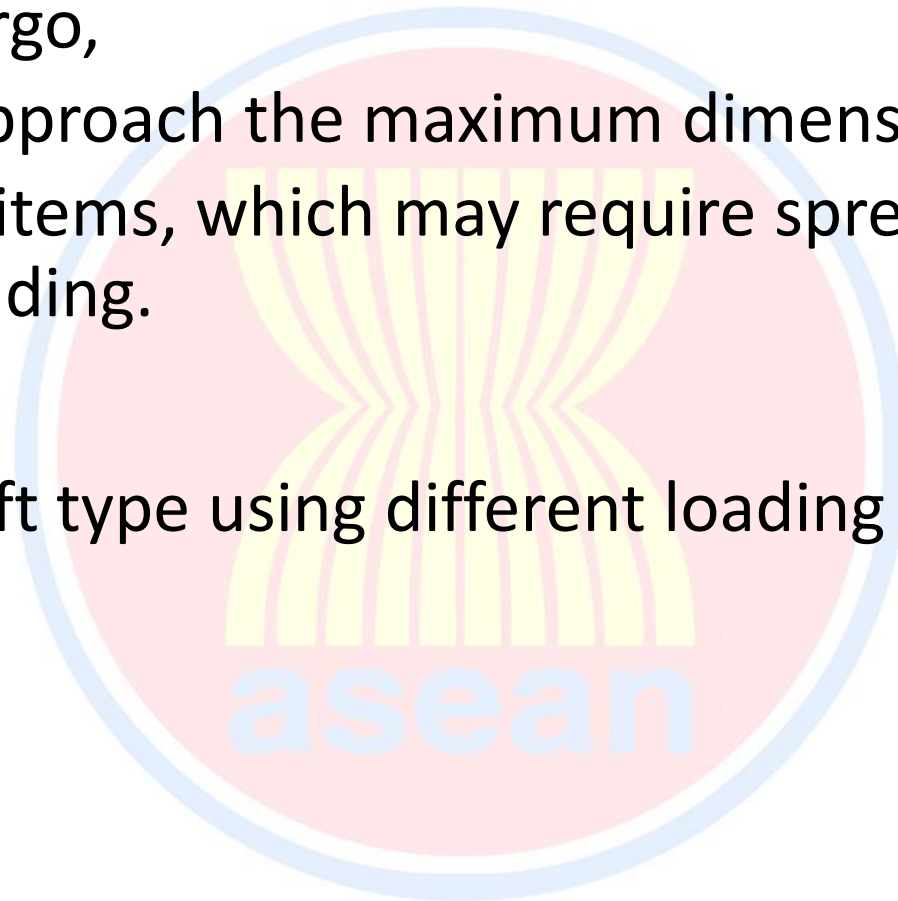
# Maximum Dimensions and Loading Charts

- The dimensions of cargo must pass through the compartment door to be accommodated in the hold.
- The size of cargo must be compared with the compartment door size by using **loading charts** (TACT Rules, Section 8.2.2.) provides by the aircraft manufacturer.



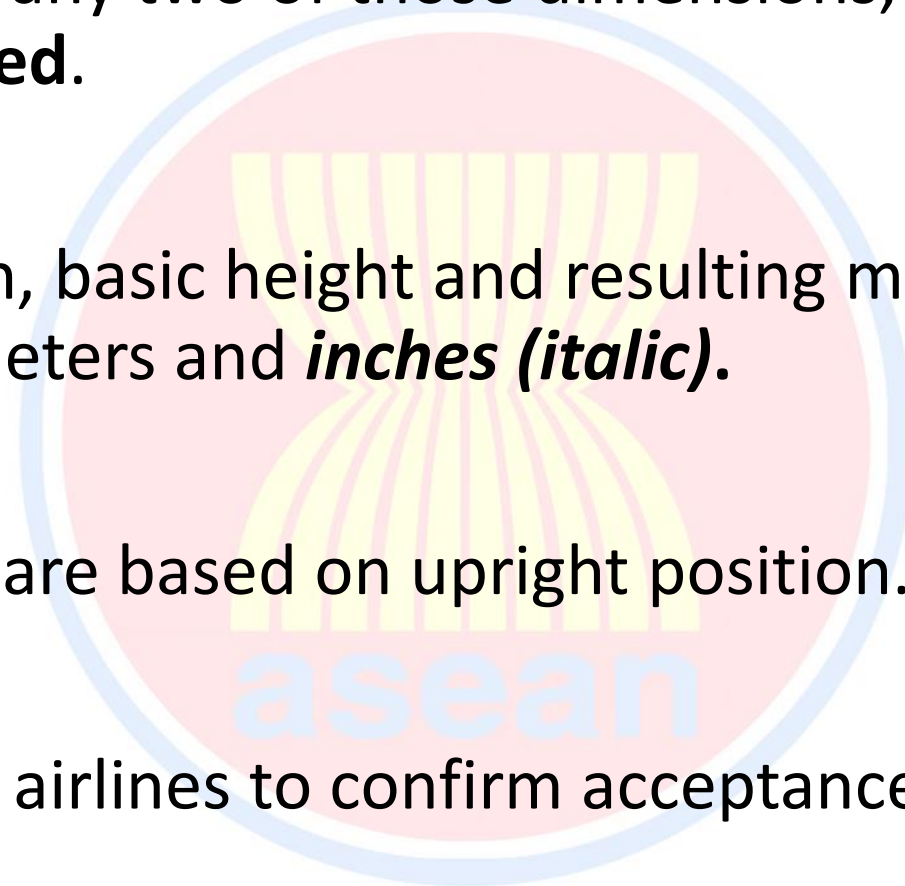
# Loading Charts

- Loading chart is guideline for **loose cargo only** in case of
  - oversized cargo,
  - items that approach the maximum dimensions indicated,
  - heavy bulky items, which may require spreader boards for weight spreading.
- Different aircraft type using different loading chart.



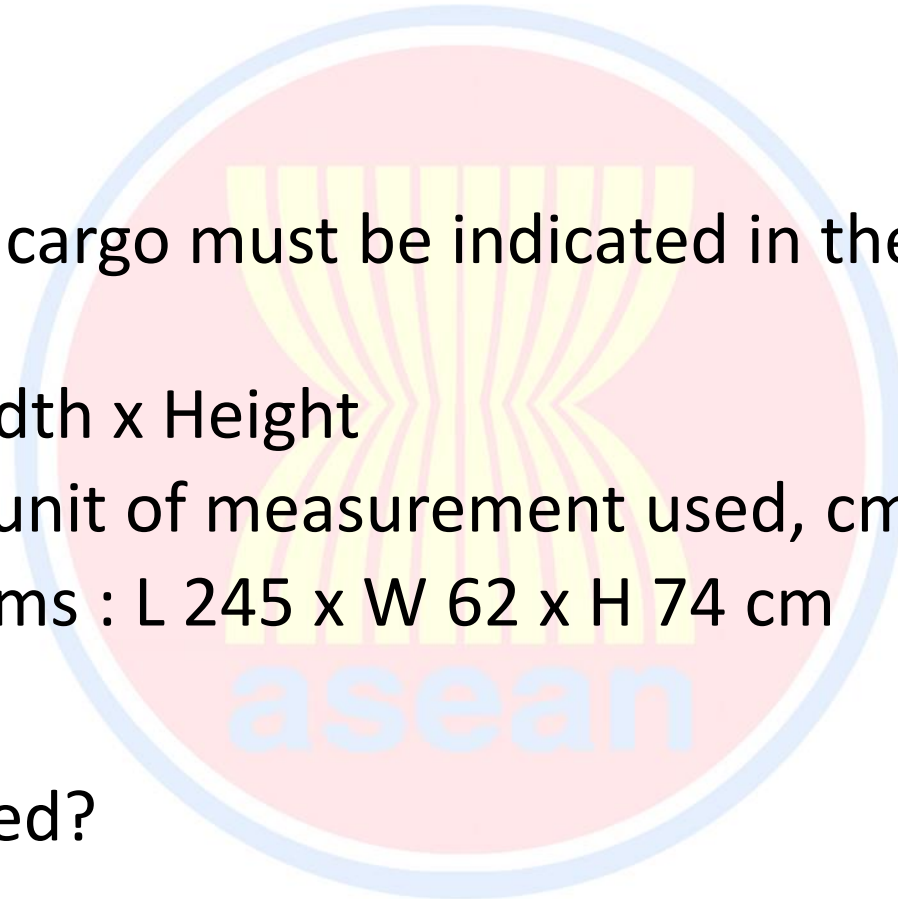
# Loading Charts

- Loading charts indicate basic width and basic height and at the **intersection** of any two of those dimensions, the **maximum length permitted**.
- The basic width, basic height and resulting maximum length are given in centimeters and ***inches (italic)***.
- All dimensions are based on upright position.
- Always refer to airlines to confirm acceptance of cargo.



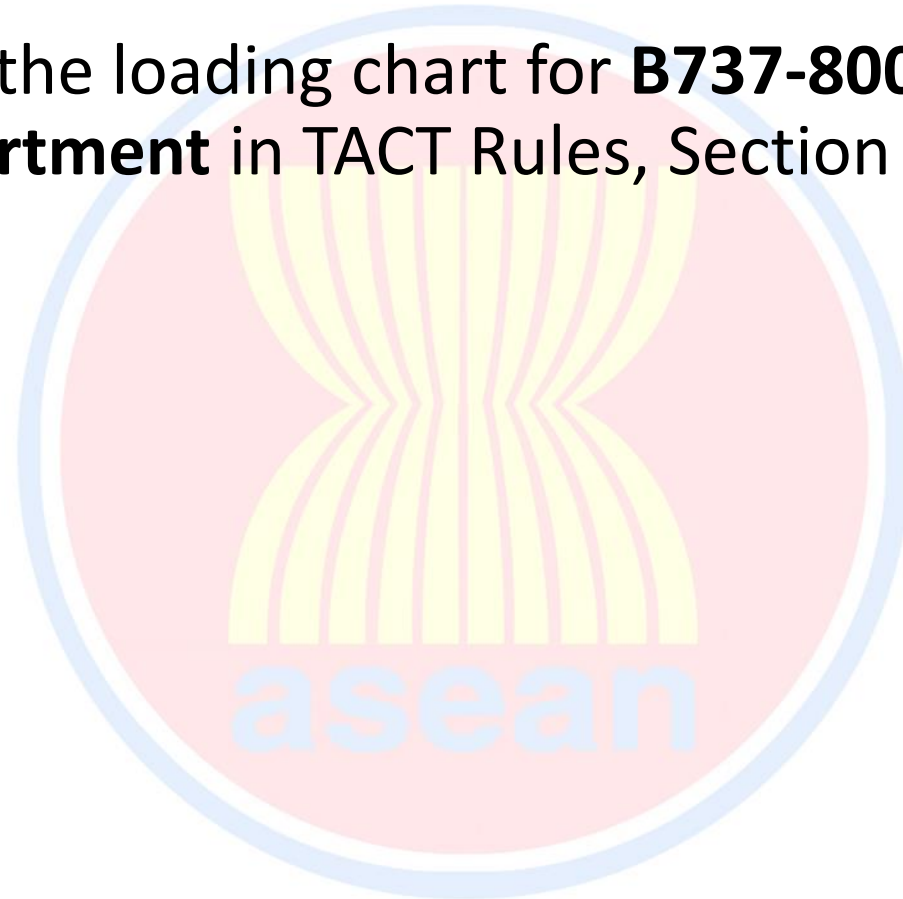
# Procedure of using loading charts

1. Select correct loading chart. Eg. Boeing B737-800 Forward Compartment.
2. Dimensions of cargo must be indicated in the following sequence
  - Length x Width x Height
  - Specify the unit of measurement used, cm or ***inches***.
  - Eg. Cargo dims : L 245 x W 62 x H 74 cm
3. Tilting permitted?



# Procedure of using loading charts – 1

- Step 1 :
  - Locate the loading chart for **B737-800 Forward Compartment** in TACT Rules, Section 8.2.2.



# Dimensions: L 245 x W 62 x H 74 cm

## BOEING 737-800

- Forward Cargo Compartment
- Light packages handled manually
- Dimensions in cms.

HEIGHT	WIDTH									
	12	25	38	50	63	76	88	101	114	121
12	711	701	693	614	520	452	401	360	330	294
25	703	695	635	533	459	403	360	327	299	284
30	703	693	591	500	434	383	342	312	287	279
35	698	678	558	477	429	368	330	302	279	271
40	695	627	523	449	401	353	317	289	269	261
45	693	579	490	424	373	335	302	279	259	254
50	645	533	457	398	353	317	289	266	248	243
55	586	492	424	373	332	299	274	254	238	231
60	533	449	391	347	309	281	256	238	226	220
66	477	408	360	320	287	261	238	223	210	205
71	426	373	314	294	266	241	223	208	195	193
76	381	332	297	266	241	220	203	187	180	175
81	332	294	264	238	215	195	180	167	160	157
86	284	254	228	205	185	170	154	144	137	134

# Procedure of using loading charts - 2

- Step 2 :

2.1. Look at the top of the loading chart under width.

- Eg. A cargo dims: L 245 x W 62 x H 74cm
- No width for 62 cm, go to the next higher column, 63 cm.

2.2. Go to the left hand side of the loading chart under height.

- No height of 74 cm, the next higher line, 76 cm.

# Dimensions: L 245 x W 62 x H 74 cm

## BOEING 737-800

- Forward Cargo Compartment
- Light packages handled manually
- Dimensions in cms.

HEIGHT	WIDTH									
	12	25	38	50	63	76	88	101	114	121
12	711	701	693	614	520	452	401	360	330	294
25	703	695	635	533	459	403	360	327	299	284
30	703	693	591	500	434	383	342	312	287	279
35	698	678	558	477	429	368	330	302	279	271
40	695	627	523	449	401	353	317	289	269	261
45	693	579	490	424	373	335	302	279	259	254
50	645	533	457	398	353	317	289	266	249	242
55	586	492	424	373	332	299	266	249	232	225
60	533	449	391	347	309	281	248	232	215	208
66	477	408	360	320	287	254	221	205	188	181
71	426	373	314	294	266	241	216	200	183	176
76	381	332	297	266	241	220	203	187	180	175
81	332	294	264	238	215	195	180	167	160	157
86	284	254	228	205	185	170	154	144	137	134

**Maximum permissible length**

## Procedure of using loading charts – 2 cont.

- Step 2 cont.

2.3. The maximum permissible length at the intersection of width 63 cm & height 76 cm is 241 cm.

- The length of the package is 245 cm, if kept in upright position, **cannot be loaded** in the lower deck compartment of B737-800 series.

# Procedure of using loading charts - 3

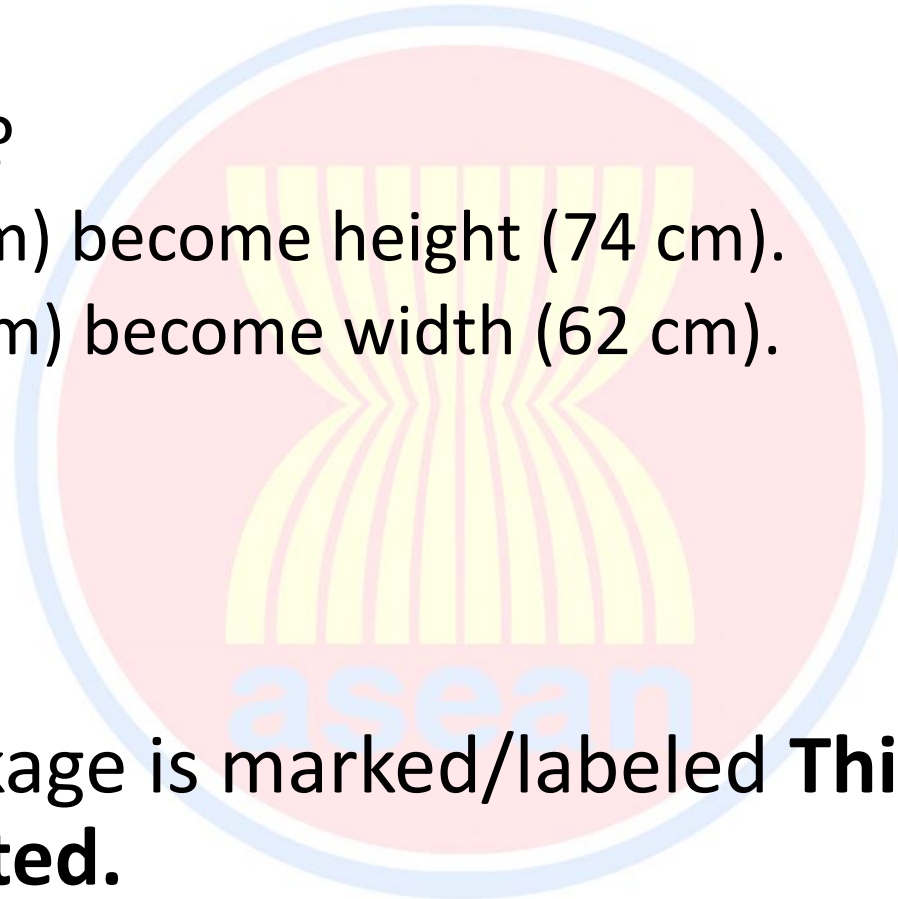
- Step 3 :

## 3.1. Tilting allowed?

- Width (62 cm) become height (74 cm).
- Height (74 cm) become width (62 cm).

## 3.2. Repeat Step 2.

Note : If the package is marked/labeled **This Side Up,**  
**cannot be tilted.**



# Tilted allowed

## Dimensions: L 245 x W 74 x H 62 cm

### BOEING 737-800

- Forward Cargo Compartment
- Light packages handled manually
- Dimensions in cms.

HEIGHT	WIDTH										
	12	25	38	50	63	76	88	101	114	121	
2	401	360	330	294							
3	360	327	299	284							
3	342	312	287	279							
8	330	302	279	271							
3	317	289	269	261							
5	302	279	259	254							
30	643	553	500	455	417	377	289	266	248	243	
55	586	492	424	377	332	299	274	254	238	231	
60	533	449	391	347	308	281	256	238	226	220	
66	477	408	360	320	287	261	238	223	210	205	
71	426	373	314	294	266	241	223	208	195	193	
76	381	332	297	266	241	220	203	187	180	175	
81	332	294	264	238	215	195	180	167	160	157	
86	284	254	228	205	185	170	154	144	137	134	

**Maximum permissible length 261 cm, the cargo with L245 cm can be loaded in the lower deck compartment**

## Q & A

Q1. B737-800 series, L 138 x W 68 x H 38 cm. Tilting NOT ALLOWED.

Q2. B737-800 series, L 358 x W 56 x H 66 cm. Tilting NOT ALLOWED.

Q3. B737-800 series, L 253 x W 58 x H 88 cm. Tilting ALLOWED.



## Tilting Not Allowed

### Dimensions: L 138 x W 68 x H 38 cm

#### BOEING 737-800

- Forward Cargo Compartment
- Light packages handled manually
- Dimensions in cms.

HEIGHT	WIDTH									
	12	25	38	50	63	76	88	101	114	121
12	711	701	693	614	520	452	401	360	330	294
25	703	695	635	533	459	403	360	327	299	284
30	703	693	591	500	434	383	342	312	287	279
35	698	678	558	477	429	368	330	302	279	271
40	695	627	523	449	401	<b>353</b>	317	289	269	261
45	693	579	490	424	373	335	302	279	259	254

The maximum permissible length at the intersection of width 76 cm & height 40 cm is **353 cm**.

The length of the package is **138 cm**, if kept in upright position, **CAN BE LOADED** in the lower deck compartment of B737-800 series.

86	284	254	228	205	185	170	154	144	137	134
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

# Tilting Not Allowed

## Dimensions: L 358 x W 56 x H 66 cm

### BOEING 737-800

- Forward Cargo Compartment
- Light packages handled manually
- Dimensions in cms.

HEIGHT	WIDTH									
		12	25	38	50	63	76	88	101	114

The maximum permissible length at the intersection of width 63 cm & height 66 cm is **287 cm**.

The length of the package is **358 cm**, if kept in upright position, **CANNOT BE LOADED** in the lower deck compartment of B737-800 series.

60	533	449	391	347	309	281	256	238	226	220
66	477	408	360	320	<b>287</b>	261	238	223	210	205
71	426	373	314	294	266	241	223	208	195	193
76	381	332	297	266	241	220	203	187	180	175
81	332	294	264	238	215	195	180	167	160	157
86	284	254	228	205	185	170	154	144	137	134

# Tilting Allowed

## Dimensions: L 253 x W 58 x H 88 cm

**NO 88 cm at height column?**

BOEING 737-800

• Dimensions in cms.

	WIDTH									
	12	25	38	50	62	76	88	101	114	121

The maximum permissible length at the intersection of width 88 cm & height 60 cm is **256 cm**.

The length of the package is **253 cm**, if tilted, **CAN BE LOADED** in the lower deck compartment of B737-800.

**H 88 cm become W 58 cm**

	53	317	289	266	248	243				
	32	299	274	254	238	231				
60	533	449	391	347	309	281	256	238	226	220
66	477	408	360	320	287	261	238	223	210	205
71	426	373	314	294	266	241	223	208	195	193
76	381	332	297	266	241	220	203	187	180	175
81	332	294	264	238	215	195	180	167	160	157
86	284	254	228	205	185	170	154	144	137	134

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- Federation of Malaysian Freight Forwarders (FMFF) FIATA Diploma Course
- B747 All Pax / Combi Load Control Training, EVA Air, May 1996.
- CX B747F Weight and Balance Folder.
- All websites mentioned in this unit.