EVROPSKÁ UNIE
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY
OP Vzdělávání pro konkurenceschopnost
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Basics of transport and handling technology KKS/ZDMT

Lecture 1

TRANSPORT IN THE 21st CENTURY
energy, safety and comfort – introduction

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Project CZ.1.07/2.2.00/15.0383
Inovace studijního oboru Dopravní a manipulační technika s ohledem na potřeby trhu práce

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1. Global perspective of transport in the 21st century

2. Interesting forms of transport and a look into the future of transport

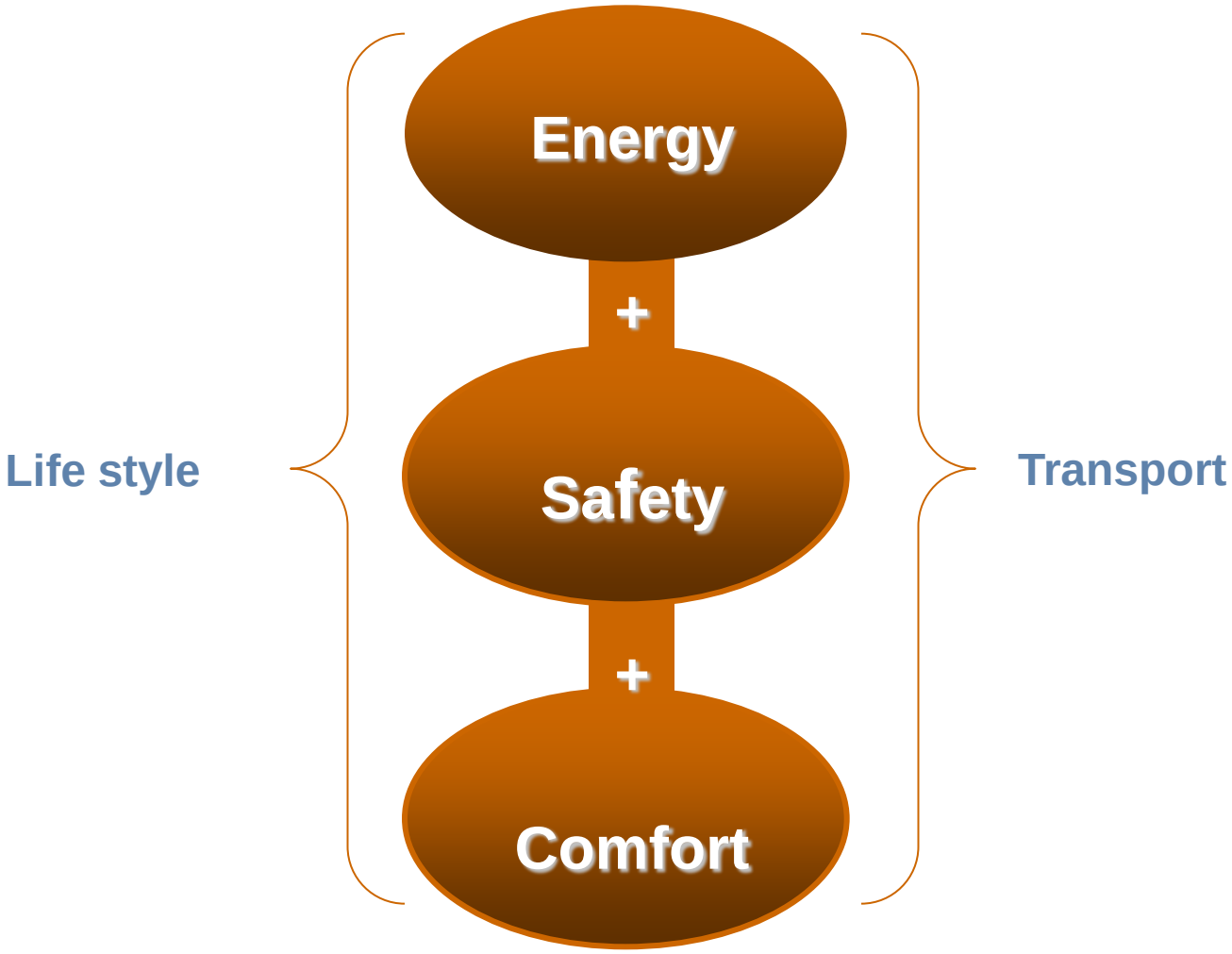
Definition of ‘transport’ :

Transport is a means of moving an object from point **A** to point **B.**

The objects can be things or people but also information or energy

21st century: transport = life style

introduction



Evolution of transport up to the 21st century

3500 BC	first wheel – first wheeled vehicle, river boats with oars
2000	Horses used for transport
181 - 234	first wheelbarrow
770 AD	first horseshoes
1492	Leonardo da Vinci first sketches flying machine
1620	Cornelis Drebbel human powered submarine
1662	Blaise Pascal invents first public bus - drawn by horses
1783	First demonstration of a practical steam engine by Marquis Claude Francois de Jouffroy d'Abbans
1783	Montgolfier brothers invent and fly in first hot air balloon
1787	First steam engine
1769	Nicolas Joseph Cugnot: first self-propelled road vehicle
1790	First modern bicycle
1801	Richard Trevithick invents first movement by steam energy (for travel)
1807	Isaac de Riva creates first hydrogen powered vehicle
1807	First steam ship with regular personal transport - Robert Fulton Clermont
1814	George Stephenson invents first practical steam powered locomotive
1862	Jean Lenoir: automobile with petrol engine
1867	First motorcycle
1871	First cable car
1885	Karl Benz: first vehicle driven by combustion engine
1899	Ferdinand von Zeppelin invents first controllable airship - Zeppelin
1903	Wright brothers: first powered flight
1907	First helicopter: unsuccessful design
1908	Henry Ford improves assembly lines for automobile manufacture
1908	Vessels on hydrofoil
1926	**First liquid fuelled rocket launched**
1940	Modern helicopter
1947	**First flight of supersonic aircraft**
1956	Hovercraft designed
1964	First 'high speed' train
1969	First manned flight (Apollo) to the Moon
1970	First 'jumbo jet'
1981	Space shuttle launched

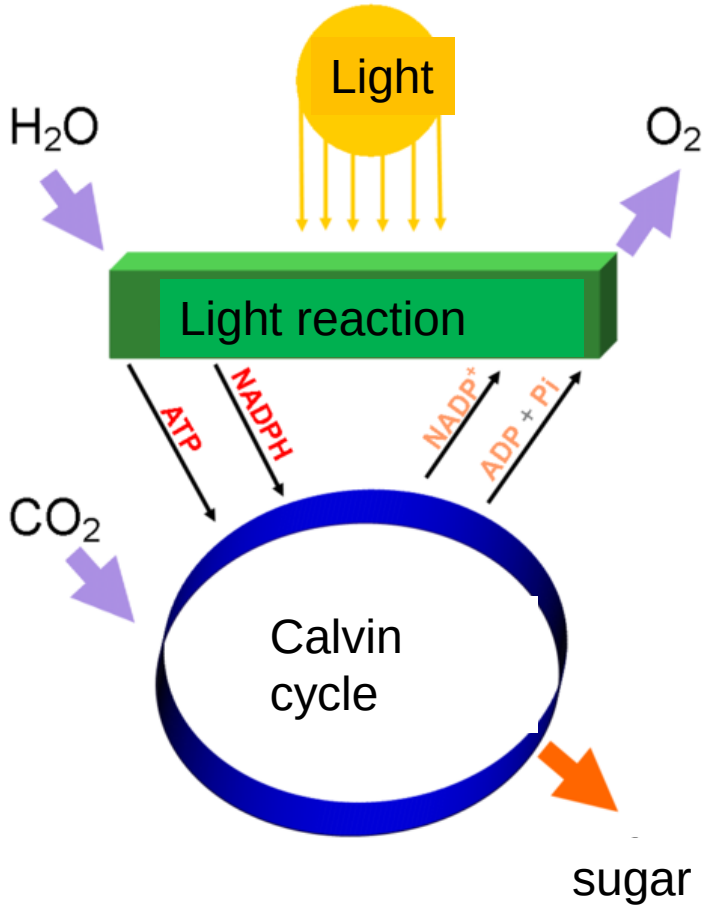
Significance of transport in 21st century

- ‘Reducing distances’
- Comfortable travel

- Environmental damage
- Safety risks- injuries

Transport risks in 21st century

Photosynthesis – uses sunlight and heat to create (synthesise) energy-rich organic compounds – sugars - from simple inorganic materials – carbon dioxide (CO2) and water. Photosynthesis has a fundamental significance for life on Earth.



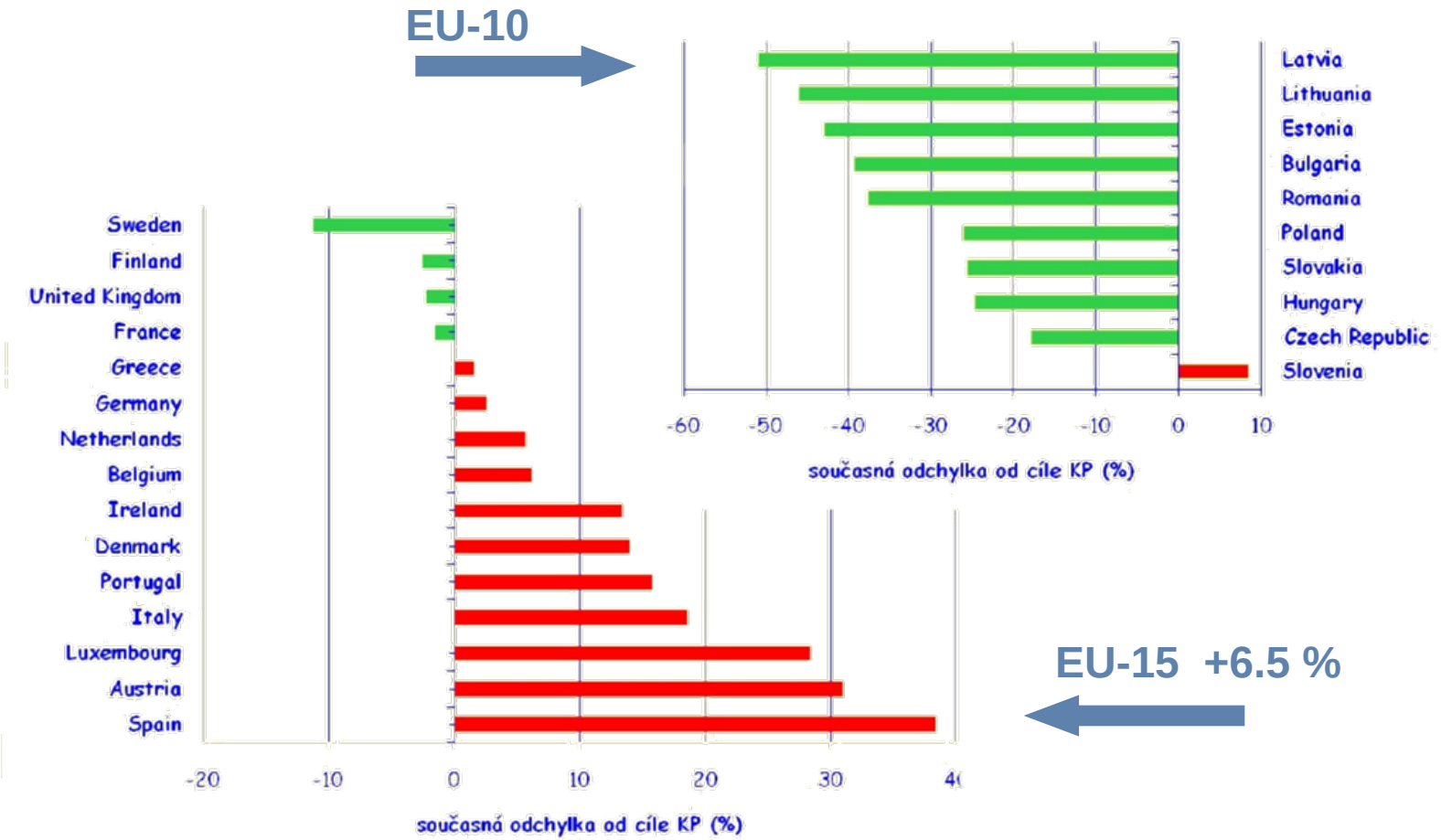
Kyoto Protocol

The Kyoto Protocol (December 1997) is a protocol to the United Nations Framework Convention on Climate Change.

In it industrialised countries commit to reducing greenhouse emissions by 5.2%.

This reduction relates to the aggregate average emissions of a package of 6 gases (in a units called ‘carbon equivalents’) for a 5-year period from 2008-20012. In addition to CO2, methane (CH4) and nitrous oxide (N20), whose emissions will be compared to 1990 levels, it also looks at levels of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6), whose levels will be compared with 1990 or 1995.

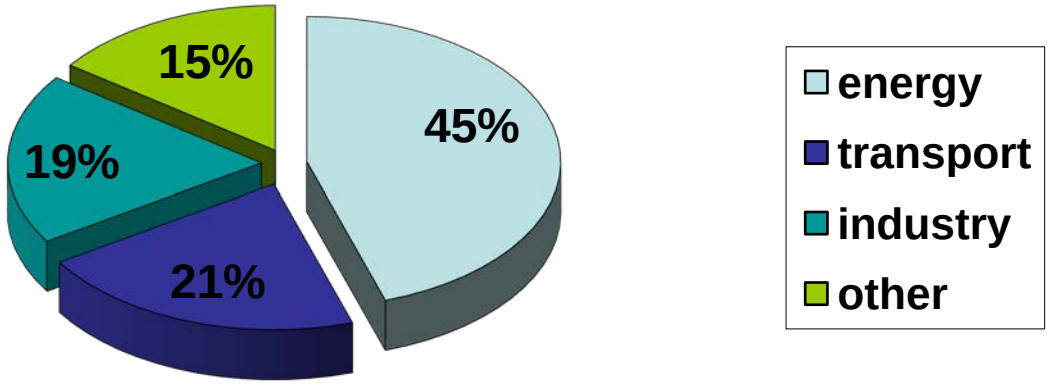
Kyoto protocol



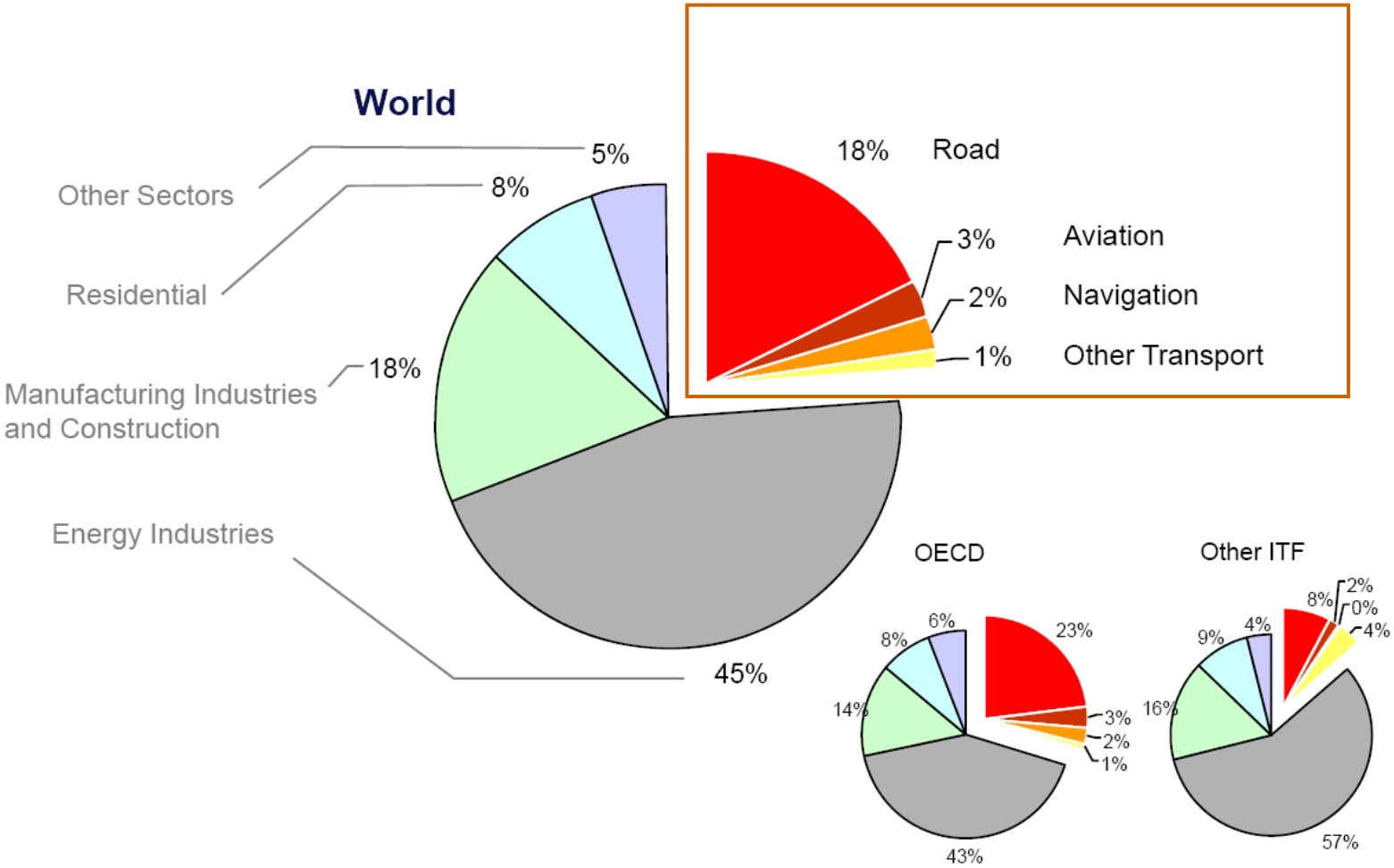
Source EEA (2007)

Worldwide emission production

2.3 million tons of CO_2 (2000)

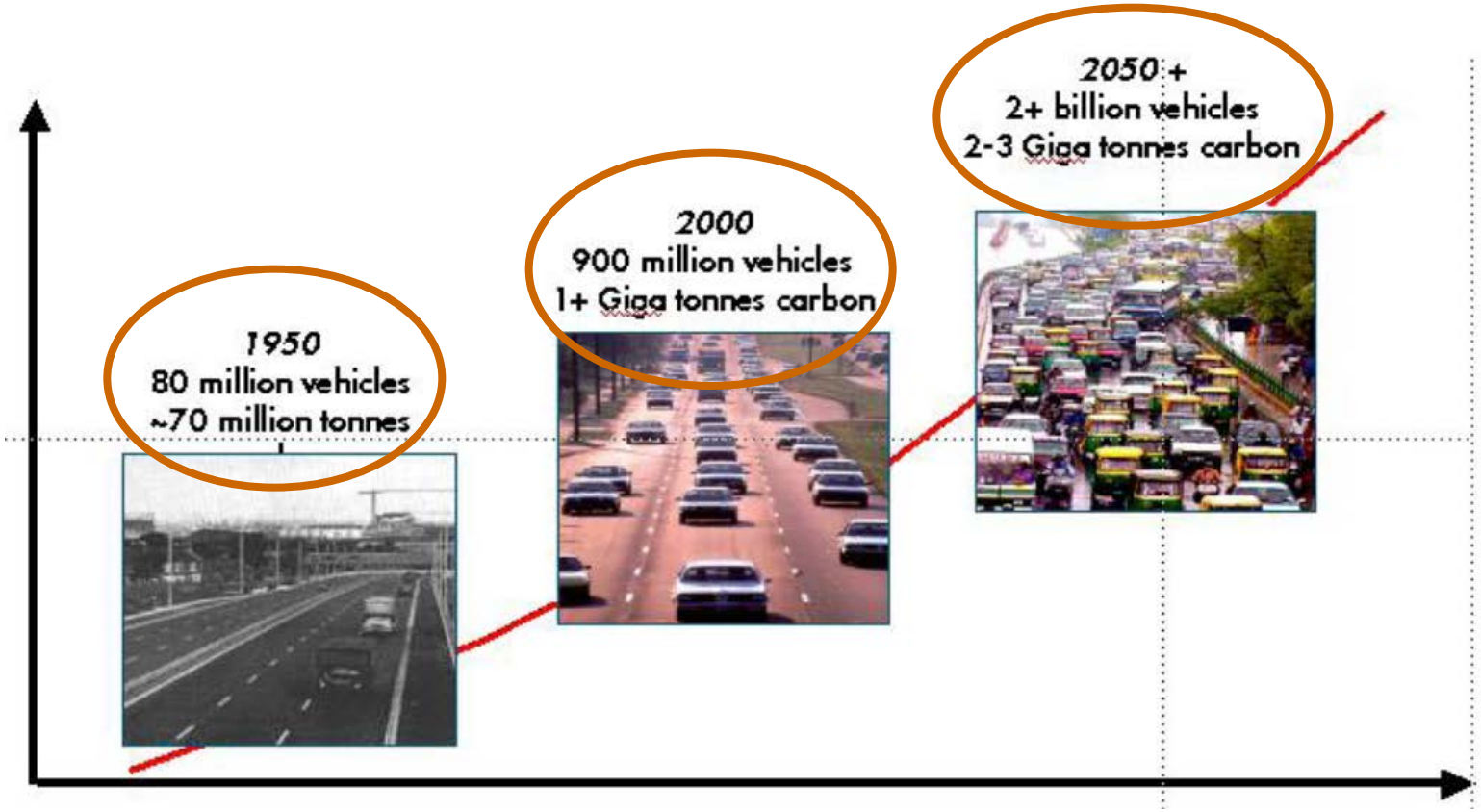


Worldwide emission production



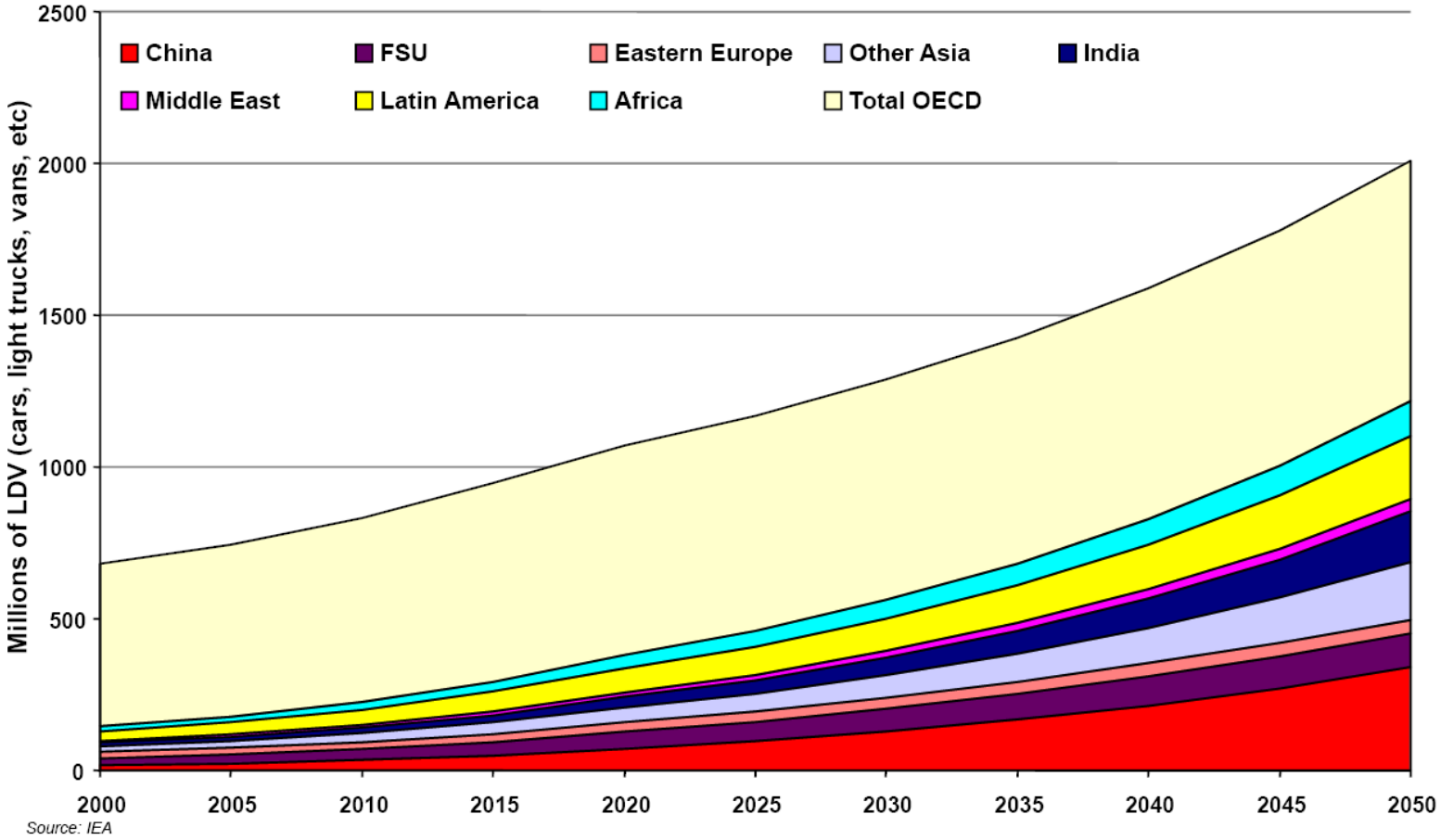
Source: ECMT (IEA data)

Automobile production (trend)

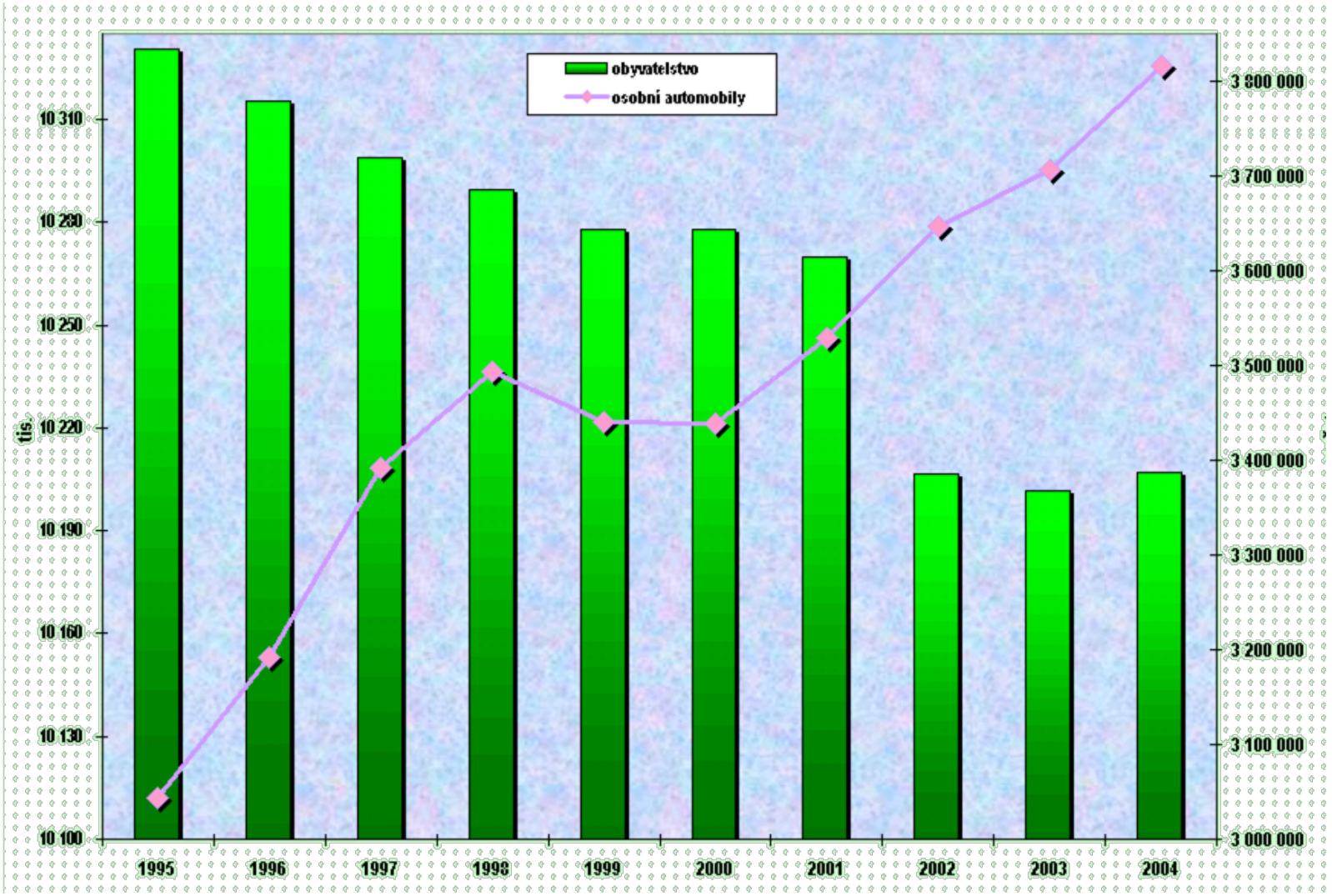


Zdroj: Prof. Lešinský

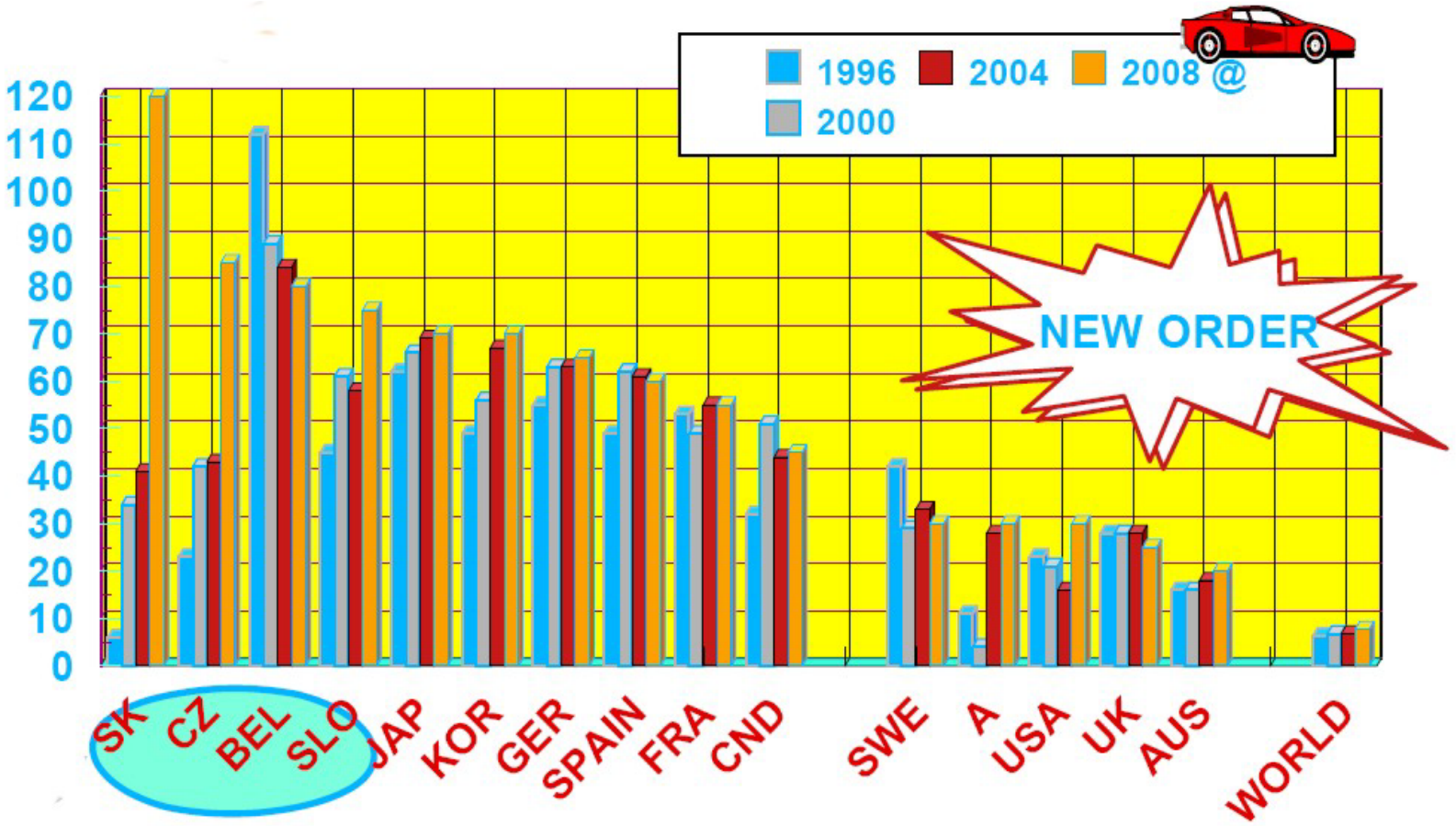
Automobile production (trend)



Number of automobiles in CZ(2004)

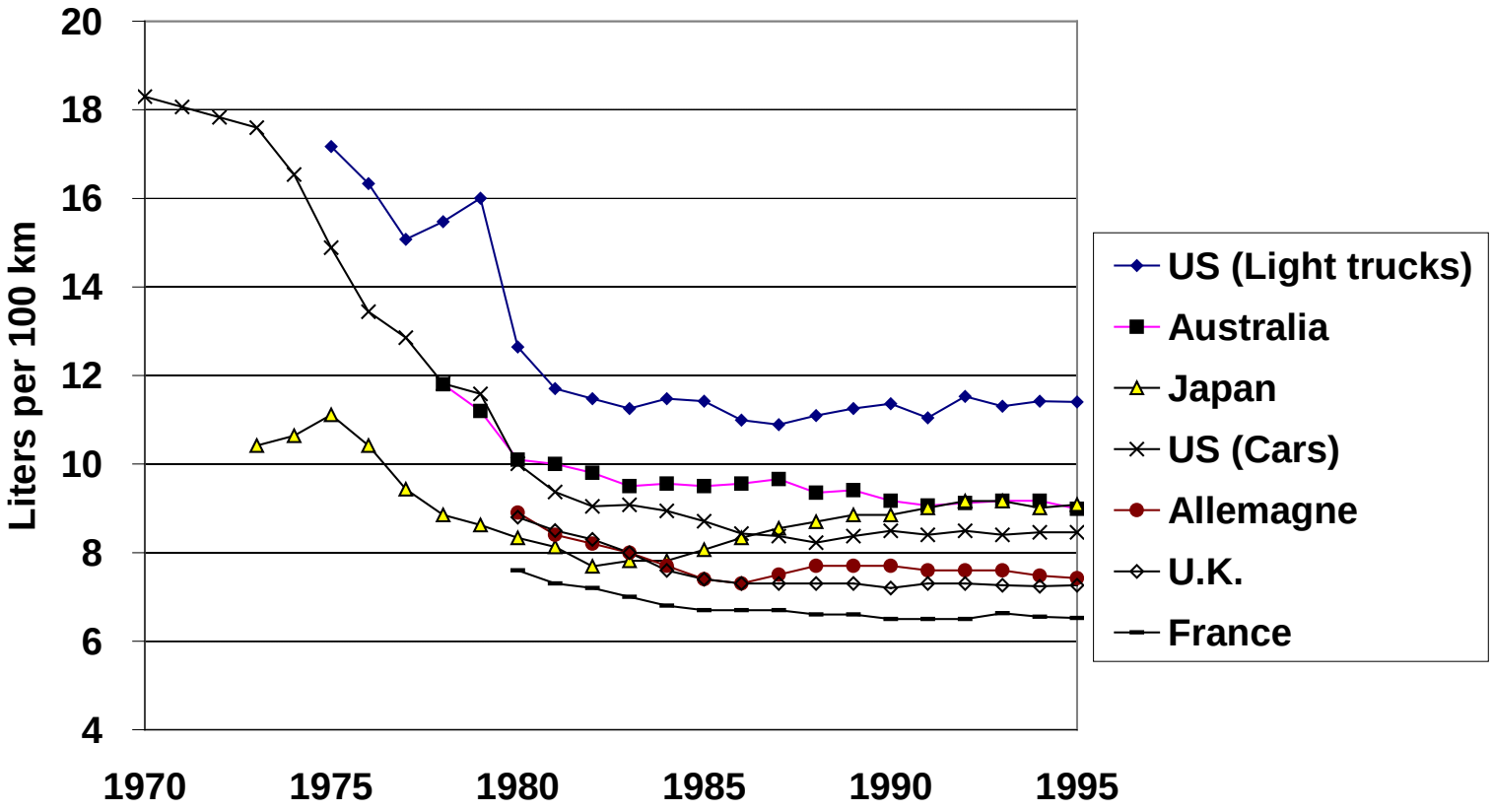


Automobile production (2008)



Source: Prof. Lešinský

Transport in numbers– development of automobile consumption



contents

1. Global perspective of transport

2. Interesting forms of transport and a look at the future of transport

Transport categories

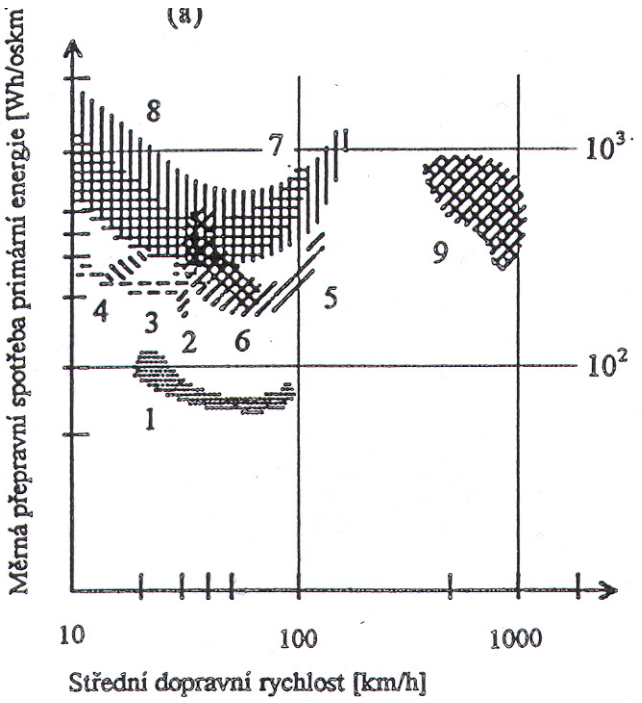
- According to type and drive
  - Road
  - Rail
  - Ship
  - Air

Space
Cable
Combined
Pipeline
Human and animal powered transport

- According to capacity
  - Private
  - Public
- According to ‘radius’
  - Urban and suburban
  - Regional
  - Continental
  - Intercontinental

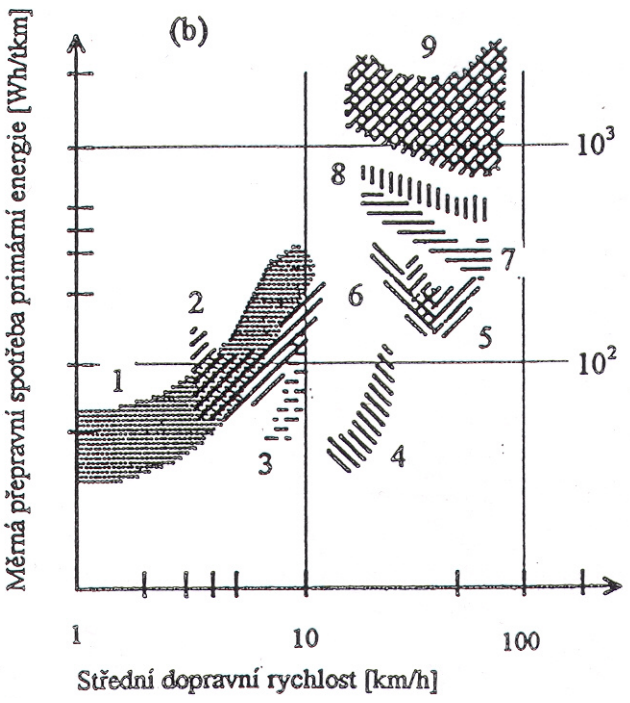
Energy consumption

PERSONS



1 – long distance bus
2 - metro
3 – urban bus
4 - tram
5 – railway – electric traction
6 – railway – motor traction
7 – small bus, minibus
8 – private automobile
9 - aircraft

COMMODITY/TONS



1 - pipeline
2 – river transport upstream
3 – river transport on canals
4 – river transport downstream
5 – railway – electric traction
6 – railway – motor traction
7 – commercial vehicle with trailer
8 - commercial vehicle (over 3.5 t)
9 - commercial vehicle (under 3.5 t)

Road transport

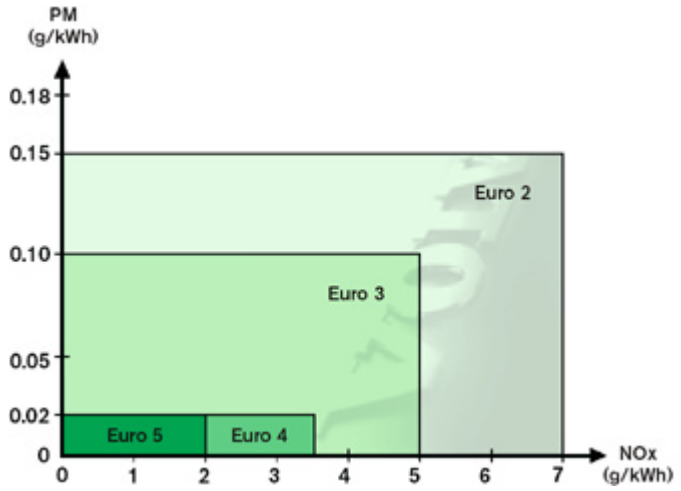
Strict controls on emissions

All vehicles registered since October 1 2006 must conform to Euro 4. Euro 5 came into effect October 1 2009.

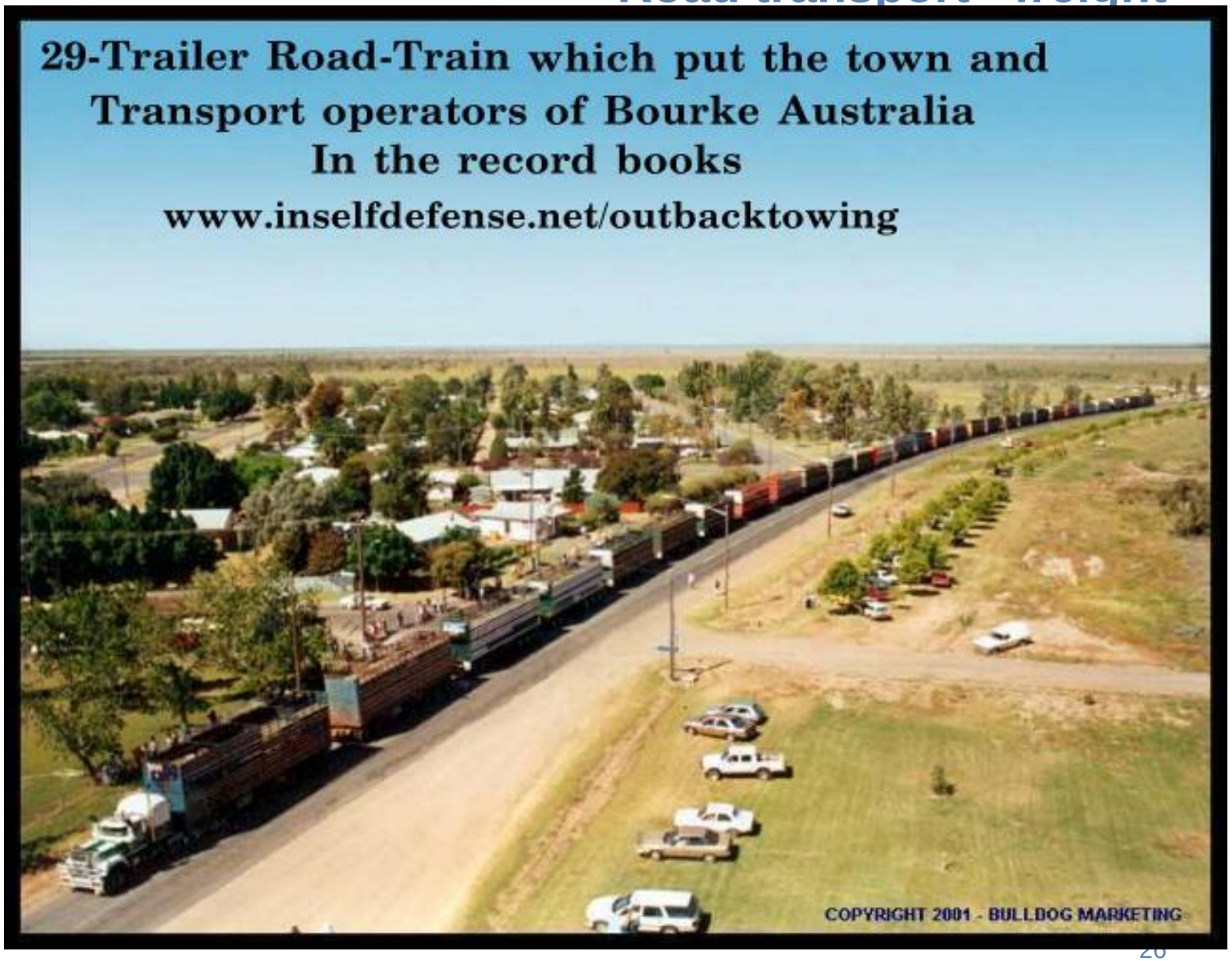
Euro standards for emission reduction place strict controls on all vehicle manufacturers.

There are significant differences in demands on exhaust gas emissions between Euro 3 and Euro 4. Nitrous oxide (NOx) emissions must be lowered from 5 to 3.5 g/kWh, i.e. by 30 %. Particulate matter (PM) emissions must fall from 0.1 to 0.02 g/kWh. A reduction of 80 %.

The graph below illustrates the dramatic reduction of NOx and PM necessary in order to fulfill Euro 4 and Euro 5:



Road transport - freight



Rail transport

Maglev

HMB2 (1976)

TR05 (1979)

TR06 (1984)

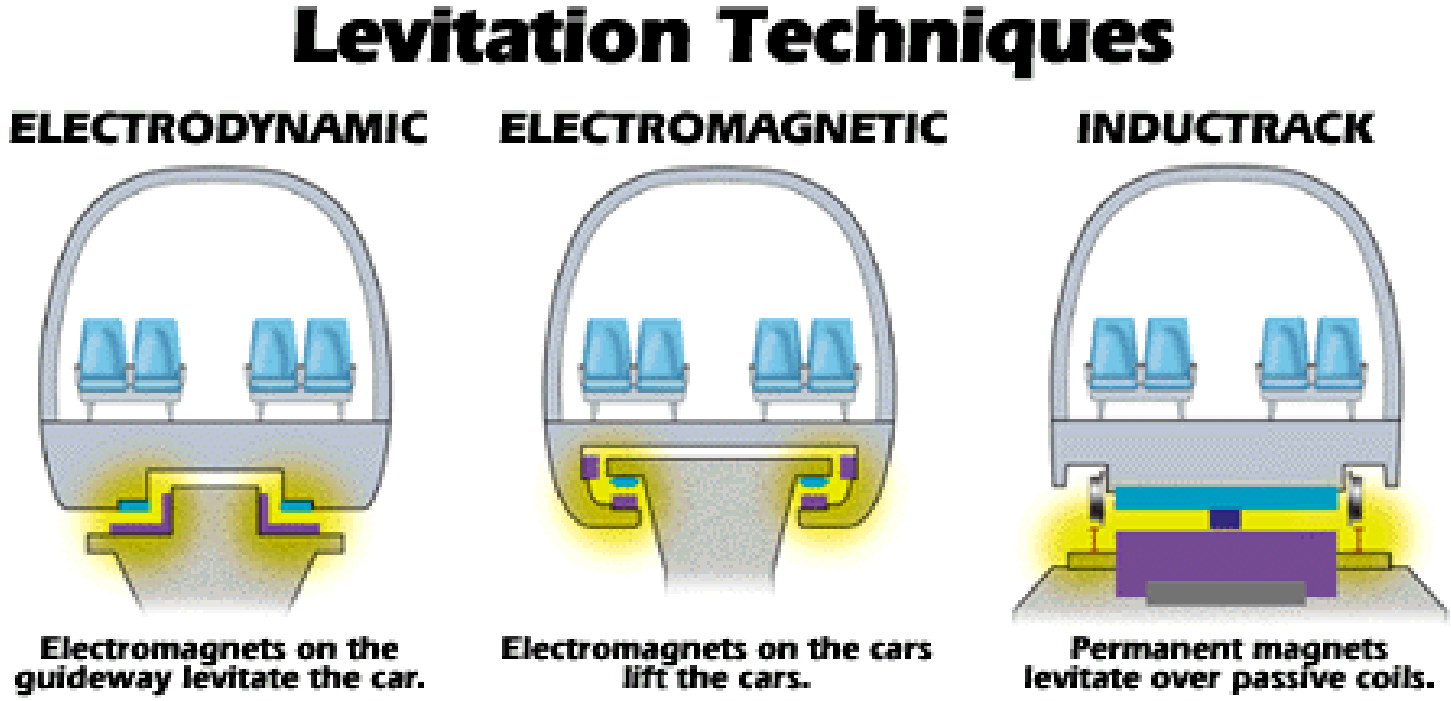
TR07 (1989)

TR08 (1999)

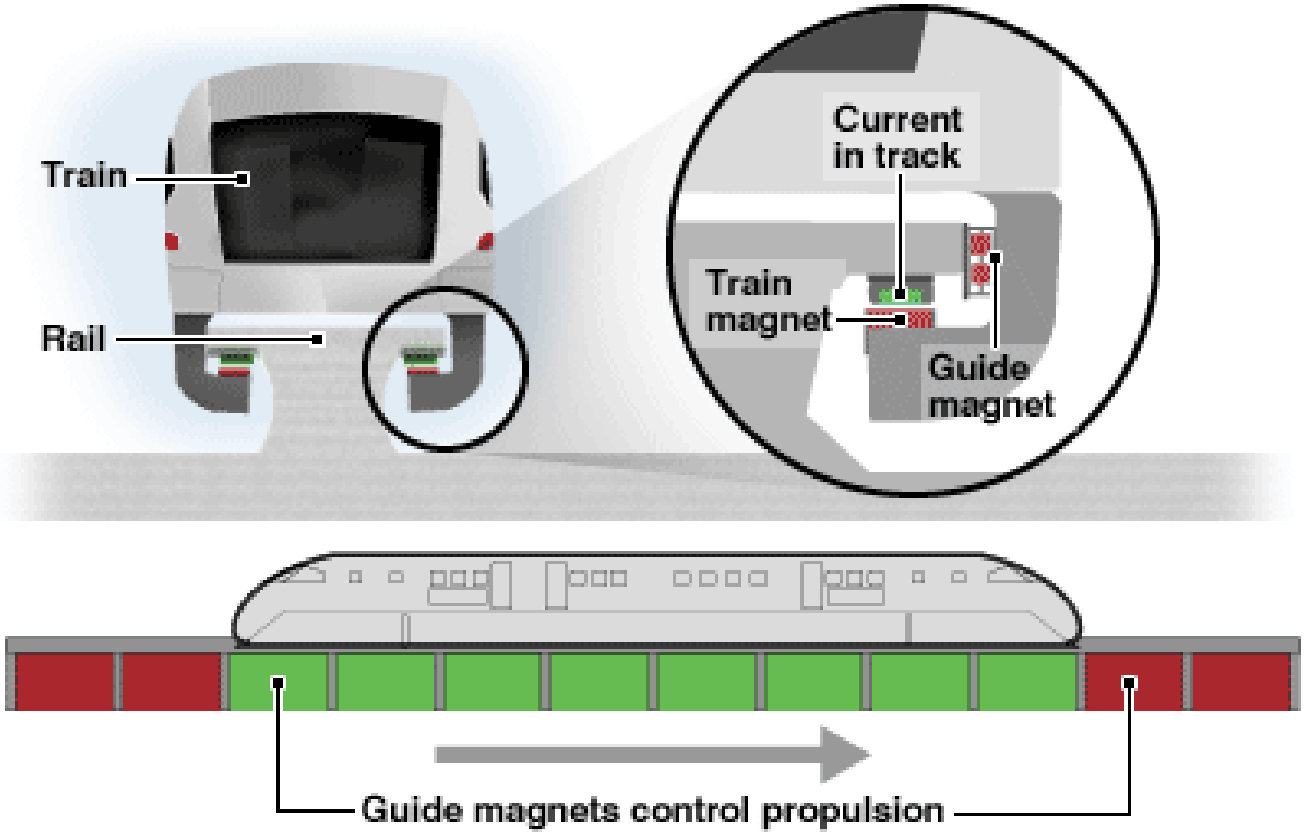
Shanghai (2003)

Maglev

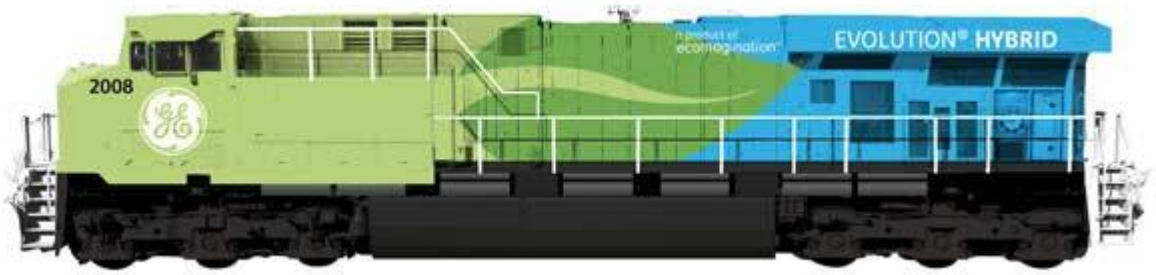
Maglev - principles



Maglev - principles



Hybrid drives in locomotives



Rail transport- freight

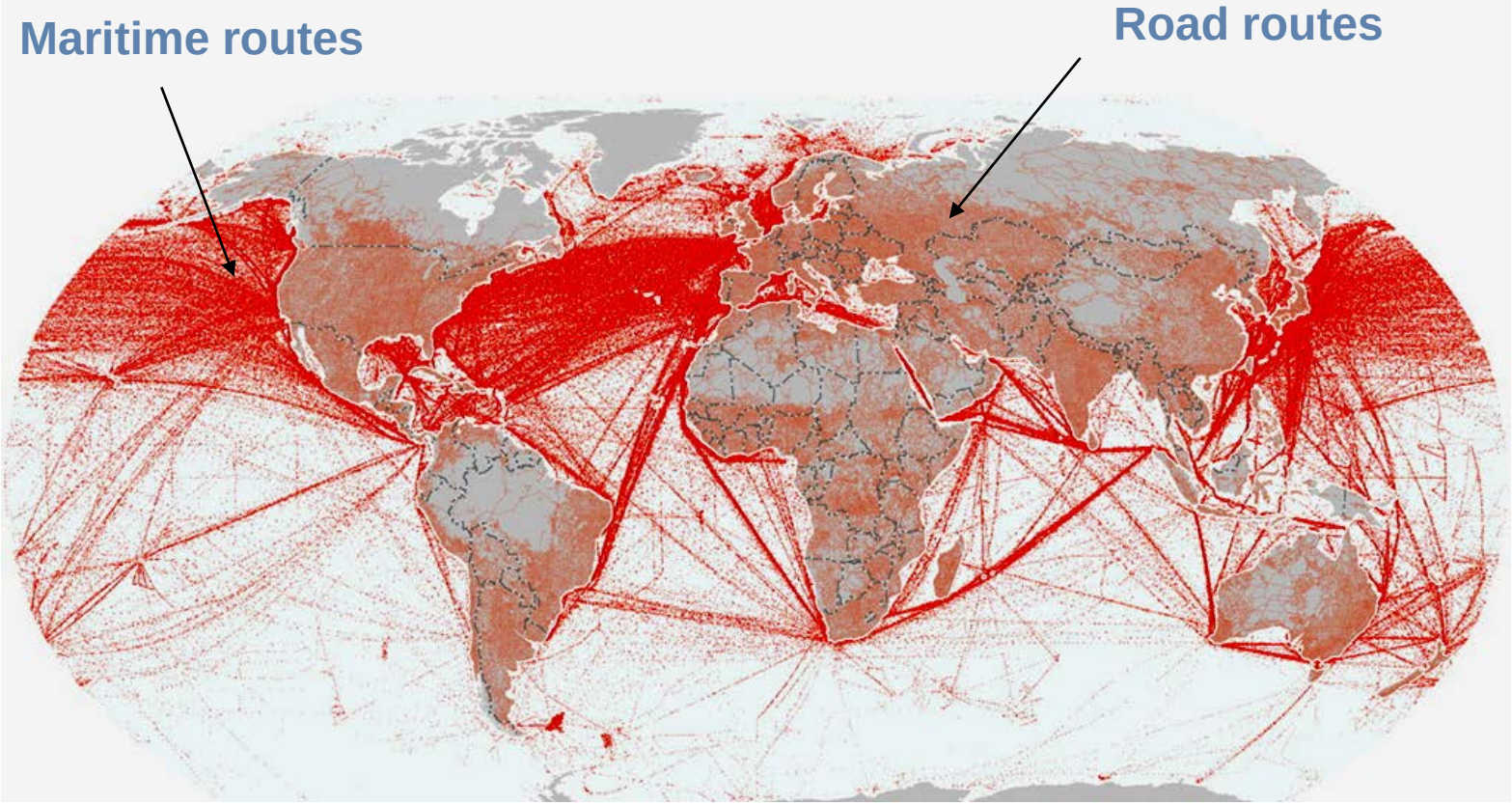
Ship transport

Ship transport

Water (ship) transport is divided into:

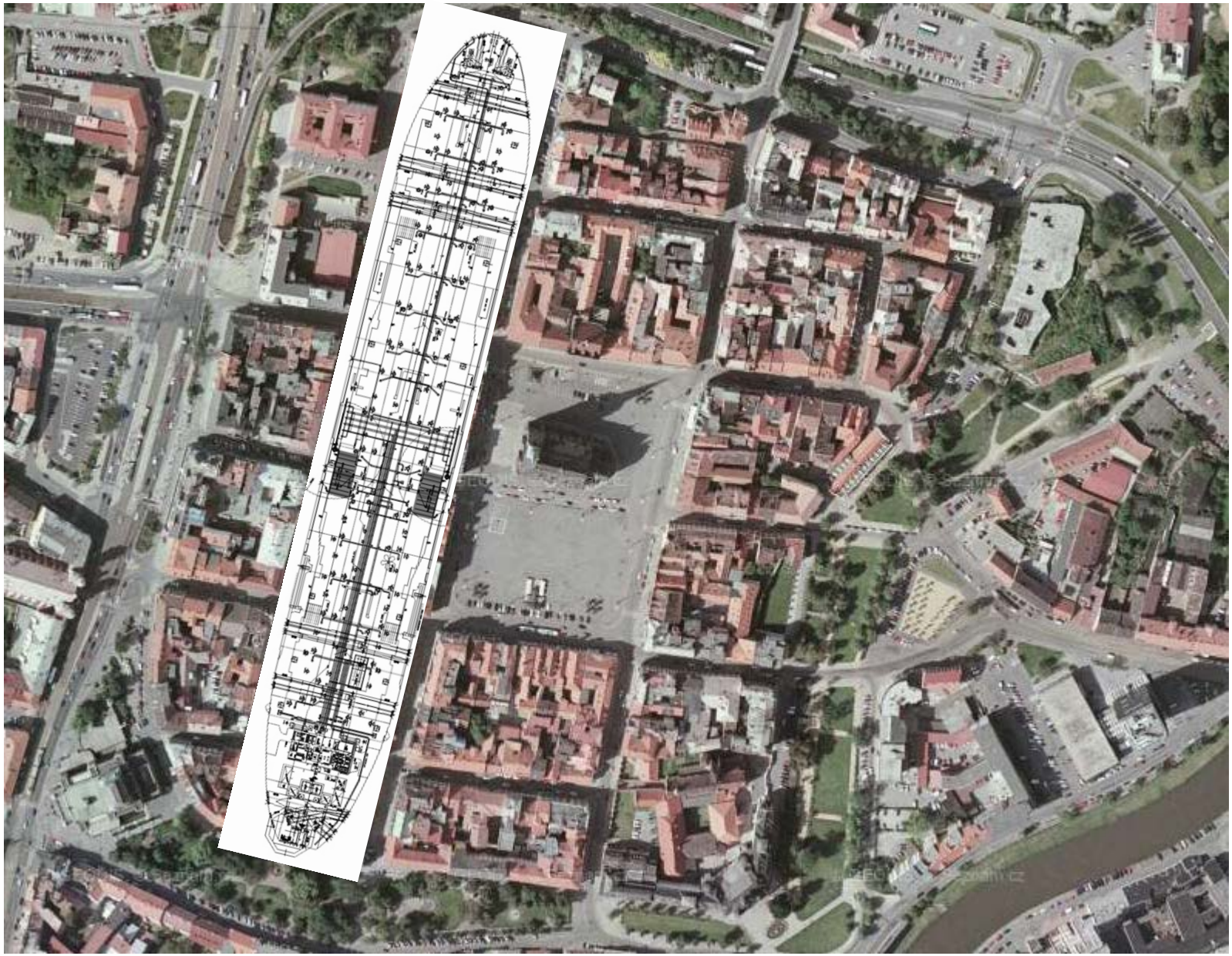
- Maritime and inland
- Private and freight
- Regular and irregular

Ship transport– density

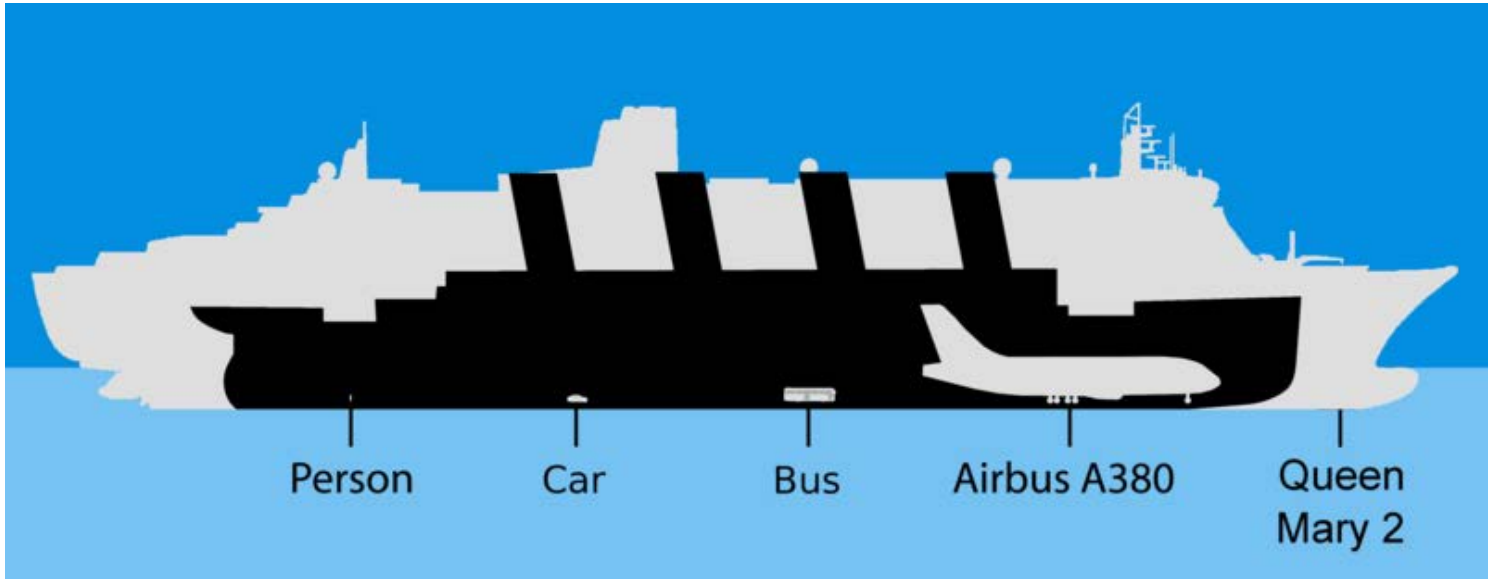


Ship transport - technology

Ship transport - technology

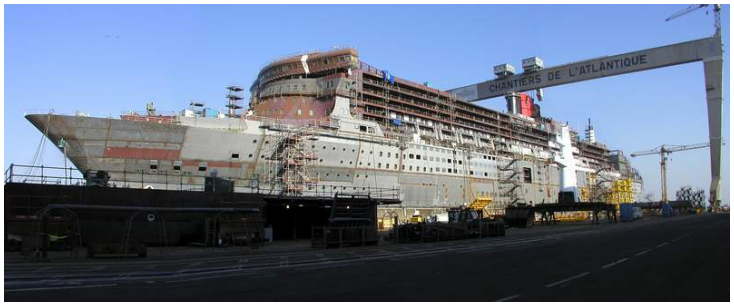


Queen Mary II



QM2 technical data

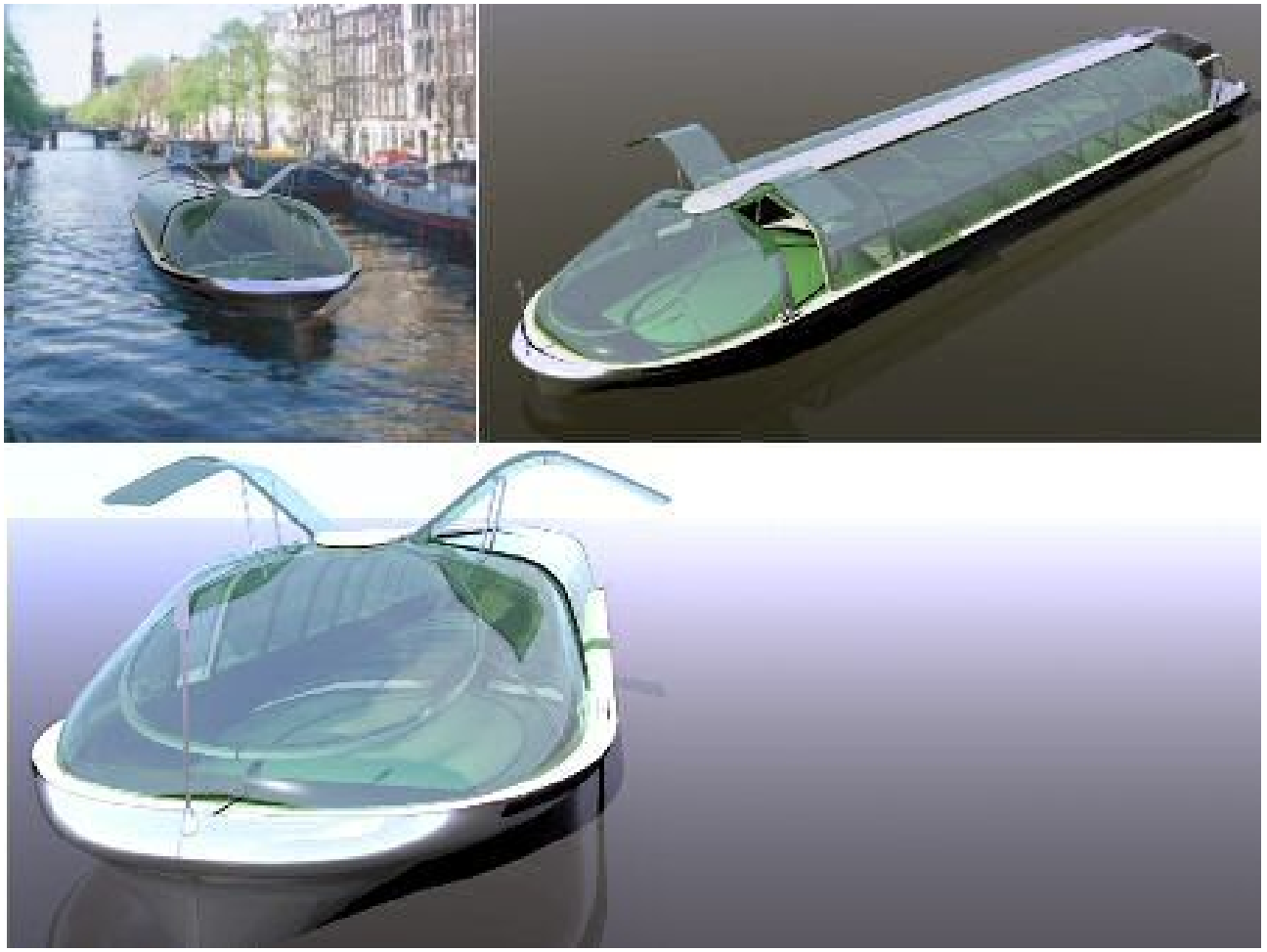
Tonnage:	148,528 t
Displacement:	76,000 t
Length:	345 m (1,132 ft)
Width:	41 m (135 ft) HVR, 45 m (147.6 ft) max
Height:	72 m (236.2 ft) from keel to stack
Draft:	10 m (32.8 ft)
Decks:	13 passenger decks
Power:	117 MW (157,000 k)
Drive:	4 x 21.5 MW electrically powered screw 2 fixed and 2 rotating screws
Speed:	~ 30 knots (56 km/h)
Passengers:	2,620
Crew:	1,253



QM2 facts

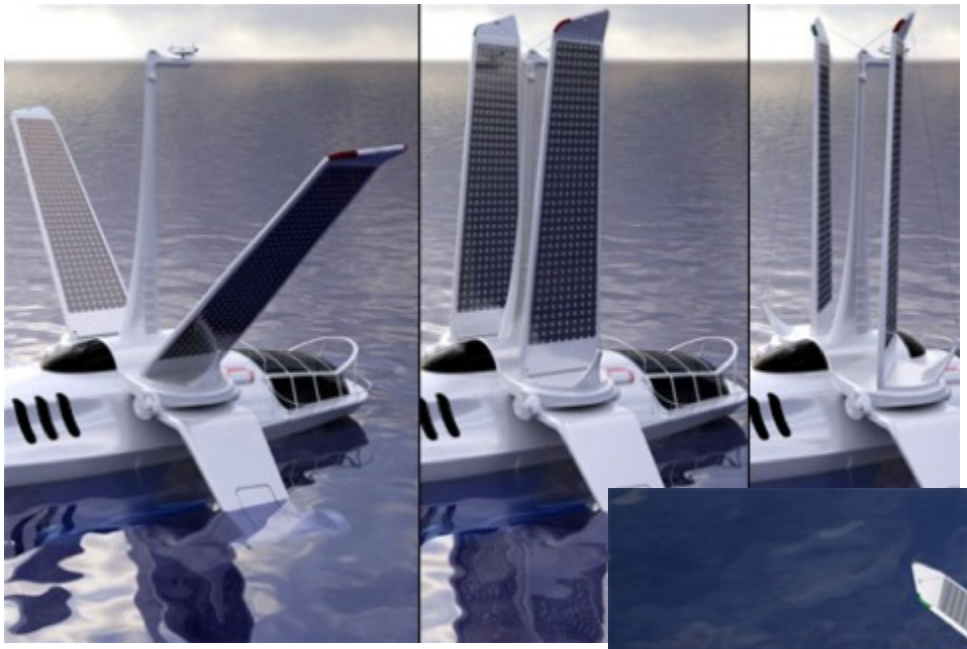
- 500 seat cinema
- 1,310 cabins
- 230,000 bottles of wine
- 27,000 kg coffee
- 1,350,000 tea bags
- 300 original artworks worth125 mil.Kč

Ship transport– hydrogen drive



Tourist boat for 100 passengers driven by hydrogen
Operating in Amsterdam since 2008

Ship transport– solar power- concept

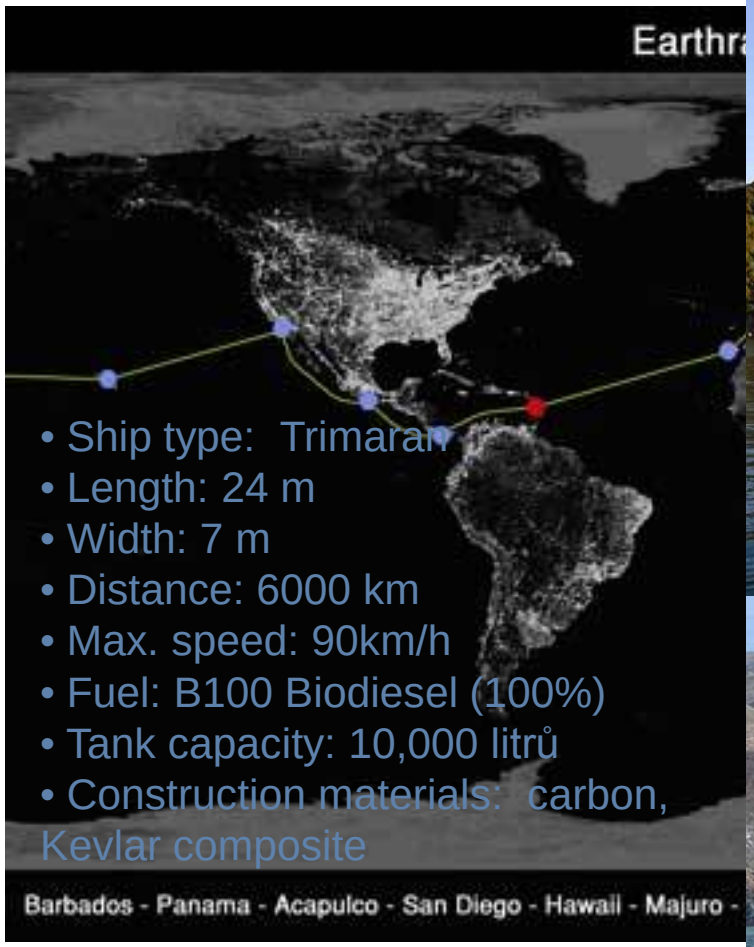


Volitan "flying fish"

Ship transport – solar power

First yacht to use hybrid drive in combination with 2 natural energy sources-wind and sun

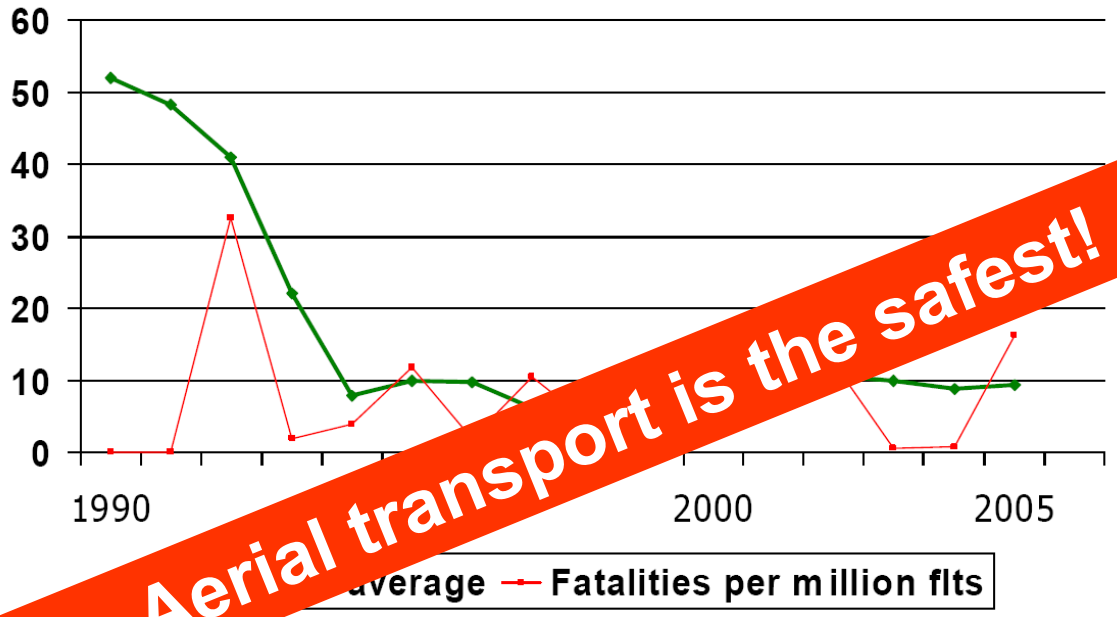
Ship transport – around the world in 65 days



- Ship type: Trimaran
- Length: 24 m
- Width: 7 m
- Distance: 6000 km
- Max. speed: 90km/h
- Fuel: B100 Biodiesel (100%)
- Tank capacity: 10,000 litrů
- Construction materials: carbon, Kevlar composite

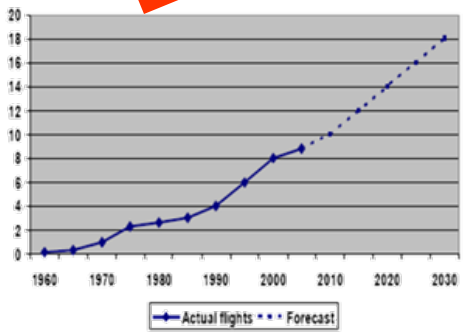
Aerial transport

Aerial transport- safety



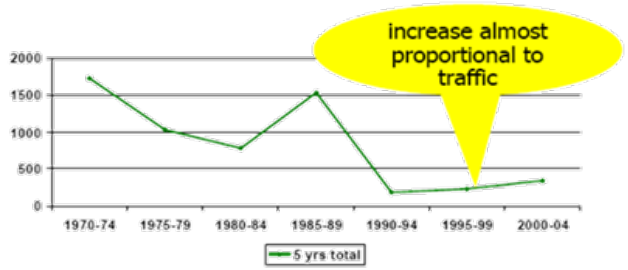
Aerial transport is the safest!

Mill… …s in Europe

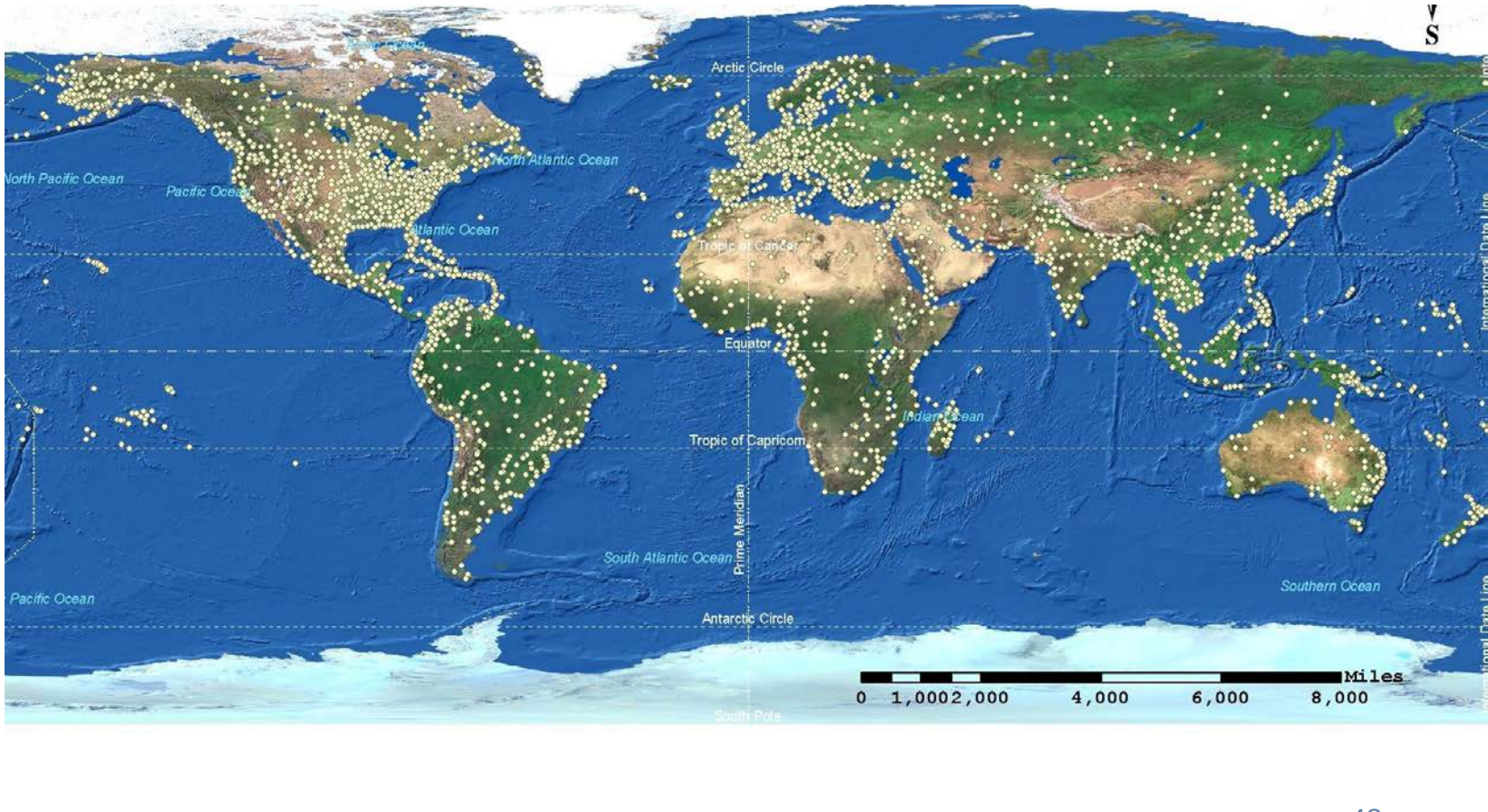


Source: EUROCONTROL Long Term Forecast 2004-2025

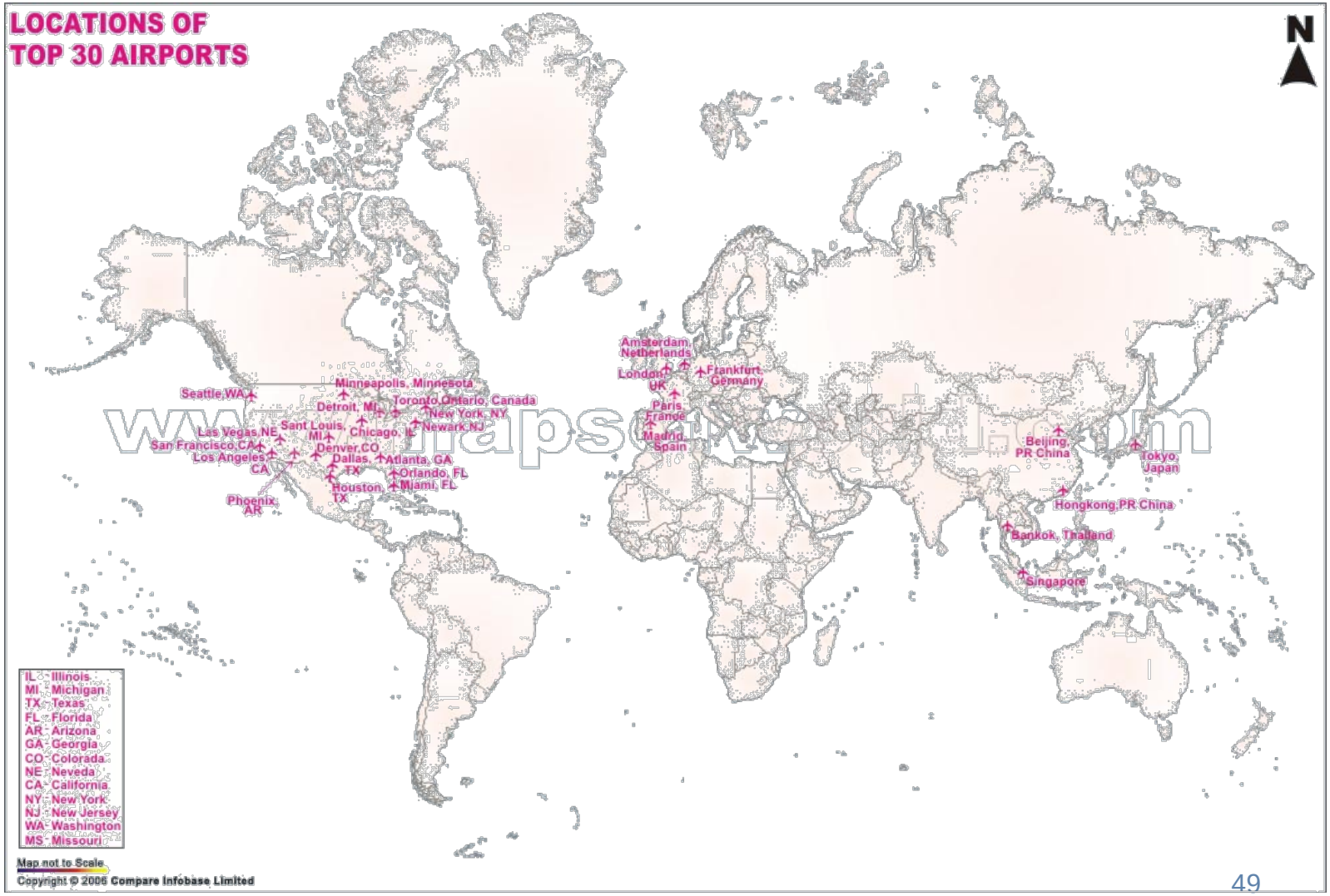
Total number of victims in Europe



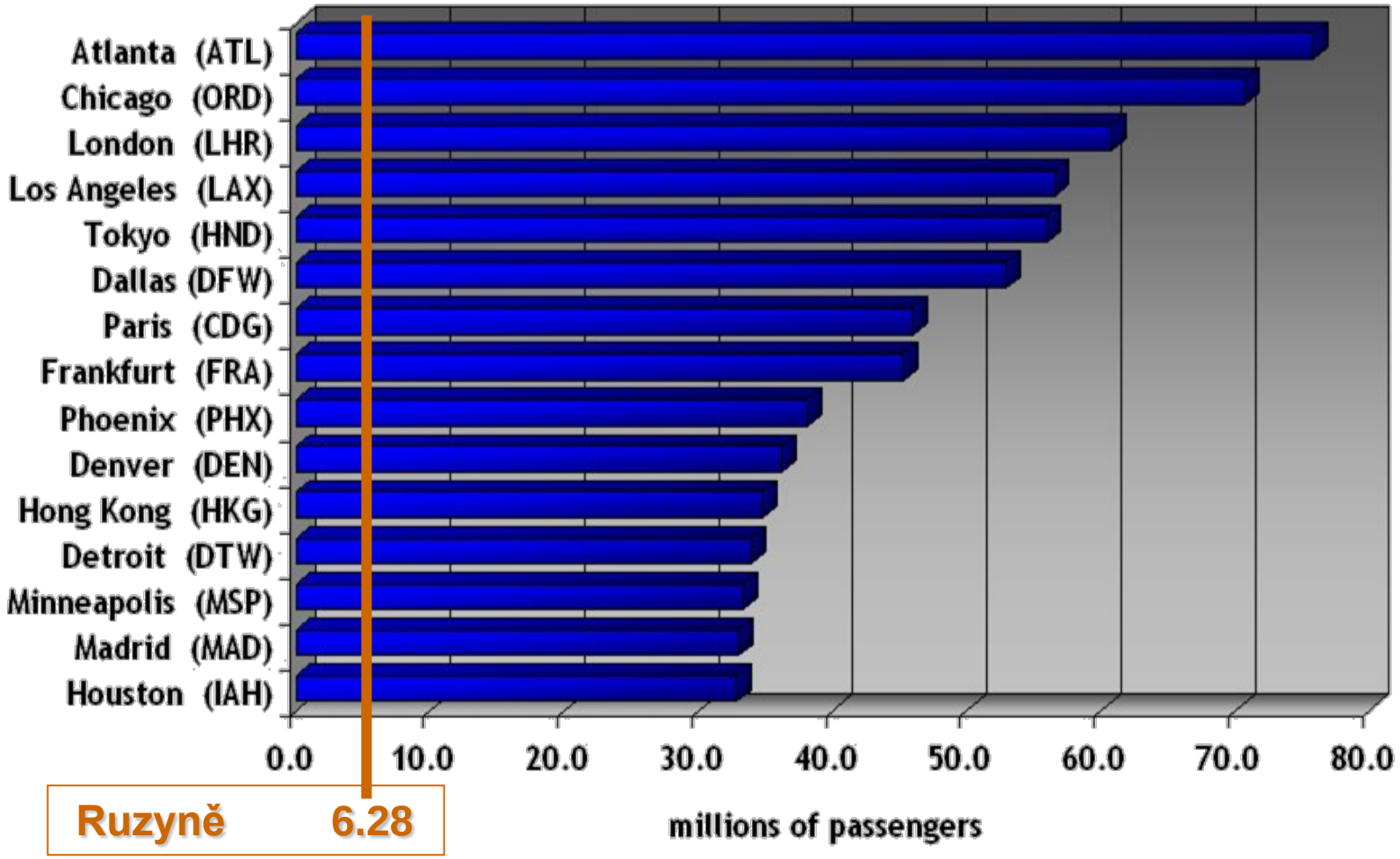
World airports



Top 30 airports



Number of travellers at airports(2002)



Interesting things

Aerial transport - technology

- **Largest passenger plane** – Airbus 380

  (length 73 m, height 24 m, wingspan 79.8m, flight weight 565 t) carries up to 820 passengers up to 15,000 km.

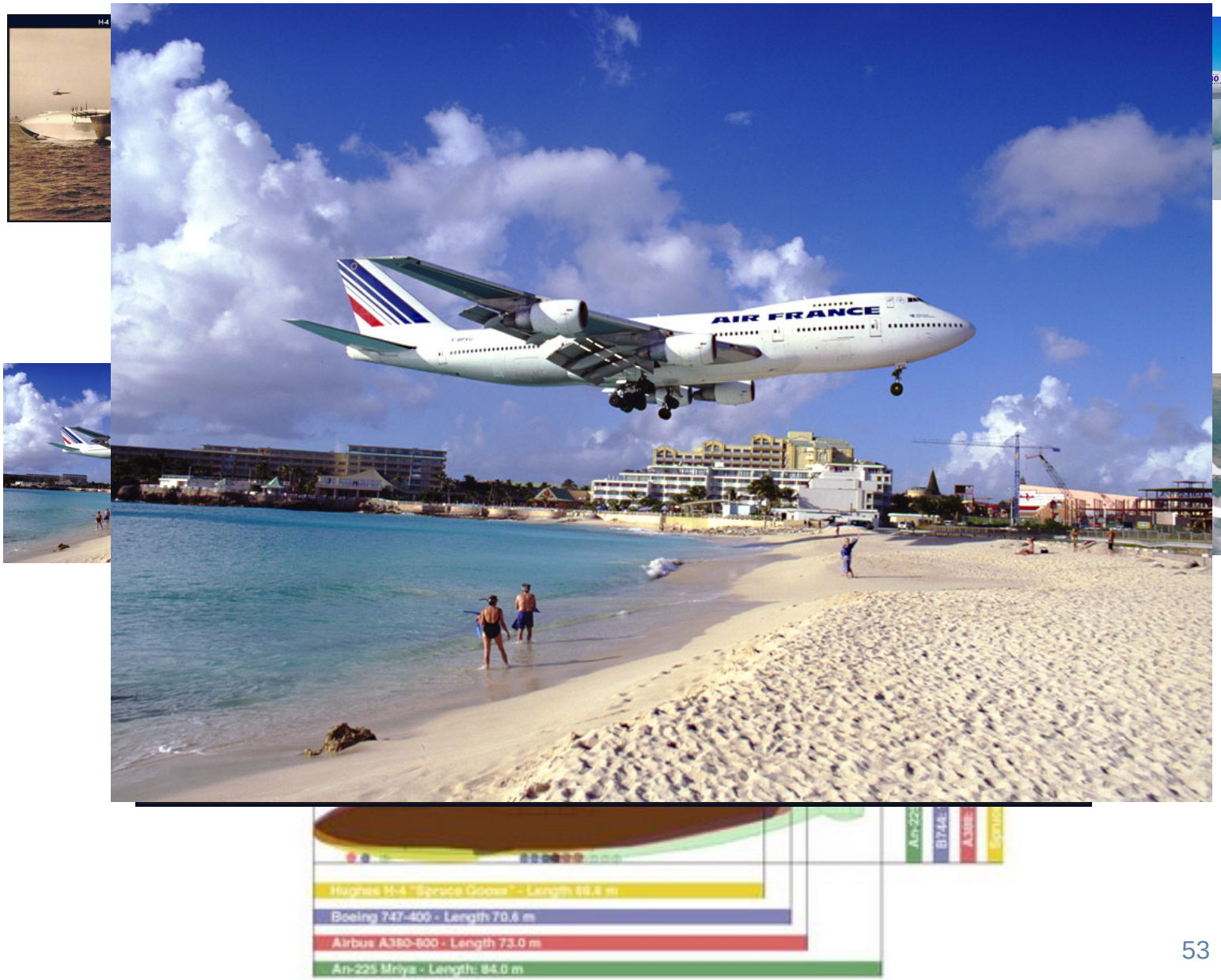
- **Giant cargo plane** – Antonov – 225

  Ruslan with cargo150t flies (can carry up to 6 fully loaded trucks each weighing 25t) at speeds up to 850 km/hod.

- **Vertical takeoff aircraft**

  V22 Osprey, BA126

Comparing the largest aircraft



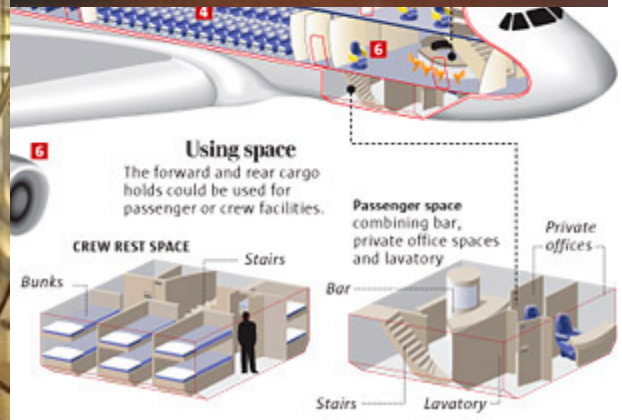
Airbus A 380

Airbus A380

The A380 will be a true colossus, with models seating 555 people.

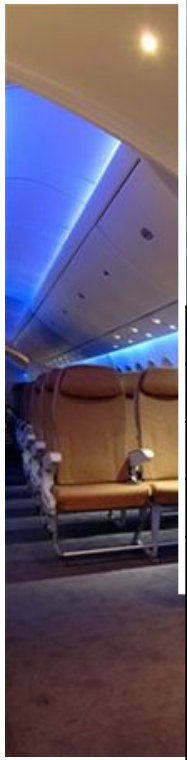
The A380 will be the world's first airliner with passenger cabins on two full decks. Airbus argues that explosive growth in air traffic will fuel a healthy demand for super-jumbo jets. Boeing disagrees, and predicts the A380 will turn into a white elephant.

Suites shown abo lounge could passen air crui



Boeing 777 engine

Boeing 787



Boeing 787 Dreamliner	(787 - 8)
wingspan	60 m
length	57 m
tail height	17 m
width of cabin interior	5,7 m
passengers	210 - 250
range	up to15 700 km
cruise speed at height 10,668 m	913 km/h (0.85 Mach)

New A2 project

Wingspan: 25.6 m, length: 61.66 m
Range: 7250 km
Cruise speed: 2,140 km/h (optimum fuel use) (max. 2,200 km/h)
Max. height: 18,300 m
Flight time from Europe to USA cca 3.5 hours
Max. flight weight: 186,880 kg

Wingspan: 27.65 m, length: 58.4 m, wing surface: 470 m□
Highest thrust: 168 ,507 N
Max. flight weight: 180 000 kg
Cruise speed: 2 430 km · h-1
Range: 6 500 km

Project only

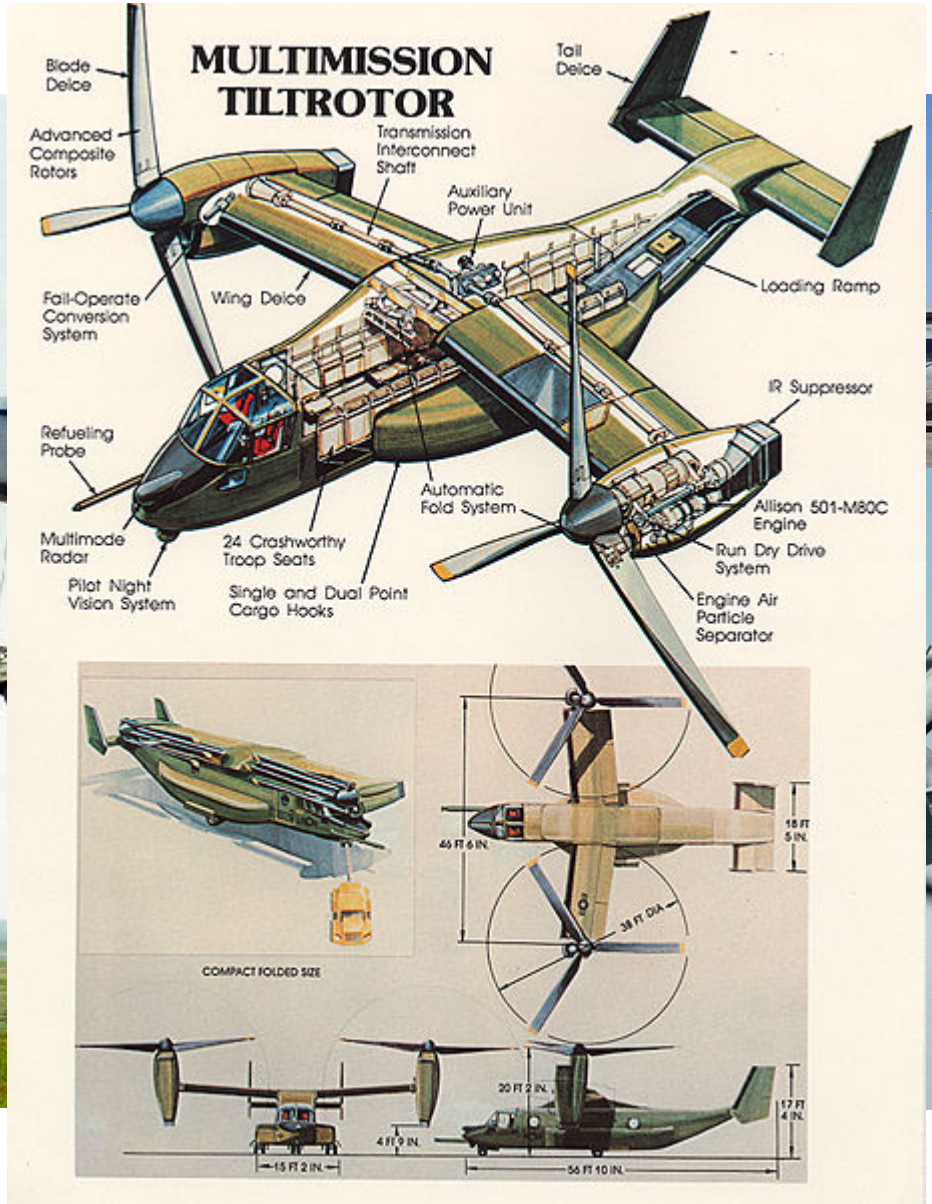
A supersonic aircraft able to carry 300 passengers and fly twice as fast as Concorde which could be in operation in 25 years.

Airbus A300 – 600ST

Airbus A300 – 600ST – spot the difference!

Bell/Agusta BA609

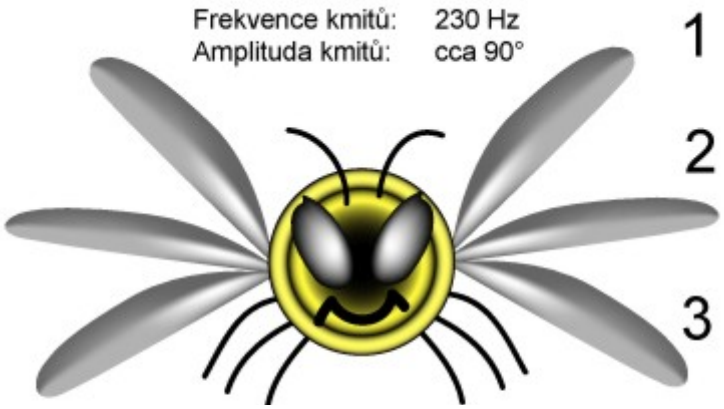
Osprey V 22


MULTIMISSION
TILTROTOR
Blade Deice
Advanced Composite Rotors
Tail Deice
Transmission Interconnect Shaft
Auxiliary Power Unit
Loading Ramp
Fail-Operate Conversion System
Wing Deice
IR Suppressor
Refueling Probe
Automatic Fold System
Allison 501-M80C Engine
Multimode Radar
24 Crashworthy Troop Seats
Run Dry Drive System
Pilot Night Vision System
Single and Dual Point Cargo Hooks
Engine Air Particle Separator
COMPACT FOLDED SIZE
46 FT 6 IN.
38 FT DIA
15 FT 5 IN.
30 FT 2 IN.
17 FT 4 IN.
4 FT 9 IN.
15 FT 2 IN.
56 FT 10 IN.

Osprey V 22

Insects and flight

Mass of bee	1.2 g
Surface area of bee wings	70 mm^2



1. Utilizes rotating wing effect
2. Main lift component arises from vortex overflow and interaction with turbulence from previous wing beat
3. Utilizes rotating wing effect

According to basic laws of aerodynamics, a bee cannot fly

Airship

Hindenburg (1931) - (3 May 1937)
Passengers: 72
Length: 245 m
Diameter: 41 m
Volume: 200,000 m^3
Tonnage: 112,000 kg
Power: 4 × Daimler-Benz diesel engines, each 890 kW (1,200 hp)

Airship

Transport for the third millennium

- Hybrid drive systems
- New types of transport
- Alternative fuels
- Improving efficiency of transport in towns
- Improving network of transit traffic

Acknowledgements

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Inovace studijního oboru Dopravní a manipulační technika s ohledem na potřeby trhu práce