Transport developments

Aim: To explain how a reduction in the friction of distance results in time–space convergence.

**Key terms:**

* **Friction of distance:** The friction of distance is the concept that the length of the journey (distance), and the difficulty of the journey (friction) affects the time needed to complete the journey (time).
* **Space-time convergence:** The process, made possible by technological innovations in transportation and communication, by which distant places are brought closer together in terms of the time taken to travel (or send messages) between them.
* **Shrinking world effect:** Heightened connectivity and the reduction of travel times make different places ‘feel’ closer together; this concept is known as the ‘shrinking world effect’.

Ocean Transport

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| Timeline of technological developments:Maritime transport is the backbone of globalization as it enables international trade.In the 20th century, significant advancements have been made in both the speed and capacity of cargo ships.**Timeline:*** In 1910 the average speed of a cargo ship was 13 knots by 2010 the average was 25-30 knots.
* Redevelopments in cargo ship design e.g. improved hull design have expanded capacity.
* Post 1950 saw the introduction of containerization, this is where goods are loaded into containers and placed on a ship. A container is a metal box 20, 40, 45, 48 or 53 **feet** long and of a standard width – this means that the containers can be stacked on top of one another.
* The ships are loaded with giant gantry cranes - this replaced the need to load goods by hand, making the task much less labour intensive. For the shipping of break-bulk cargo (mixed cargo) containerization has enormously reduced the amount of time ships had to spend idle in the dock while loading/unloading (ships may be loaded or unloaded in 1 day compared to 10 days for an equivalent conventional, non-container break bulk ship).
* Massive capital investment in port infrastructure was required in order to enable containerization.
* All of the world's largest container ports are in Asia, with Rotterdam being the largest non-Asian at rank 11. Seven of the top 10 are in China.
* The Danish TNC Maesrk Line operates one of the world's largest container fleets, which includes the one of the world's biggest ships, the Triple-E class, which can carry 18,000 containers.
* In 2018, the OOCL Hong Kong has a cargo capacity of 21,413 TEU, making it the world's largest container ship.
* Larger ships now routinely carry up to the equivalent of 9000 20 foot containers
* In 1980 containers carried less than 3% of maritime cargo in tonnage, but by 2015 the figure was 16%, and 90% of all non-bulk cargo is carried by container ships.
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| Examples of geographical locations:**Network improvements:**The opening of the Suez and Panama canals did more to facilitate east–west maritime trade than anything before and, arguably, since.**The Suez Canal:*** 1859–1869 opened to navigation
* Shortest maritime route between Europe and the land masses around the Indian and western Pacific oceans. Cape of Good Hope bypassed: the Cape route between Singapore and Rotterdam would take 9 days longer at today's speeds.
* Accounts for 19% of world maritime trade.

**Transit statistics and capacity:*** 1870: 58 transits/day = 444 thousand tonnes of cargo
* 2014: 49 transits/day = 963 million tonnes of cargo
* Weekly 70,000 TEU
* 7780 TEU average ship size
* Maximum ship size 18,000 TEU (as of 2016)
* Transit time through canal
* 1870: 40 hours
* 1975 to present: 11–16 hours
* 2016: 11 hours

**Principal commodities:**Northbound: crude petroleum/petroleum products, coal, wood, cereals.Southbound: cement, fertilisers, fabricated metals, cereals, and empty oil tankers**Improvements to the transit route:*** After successive widening and deepening, by the 1960s the canal had a minimum width of 55 m, a depth of 10–12 m.
* 2015: Two-way traffic became possible in the canal due to the opening of a new channel

**The Panama Canal*** 1869–1914 opened to navigation
* Atlantic and Pacific Oceans connected. East coast to west coast of USA journey shortened by 8000 nautical miles (15,000 km) by short-cutting the Cape Horn route.
* Trade between the east coast of the USA and East Asia dominates international canal traffic. The canal accounts for 51% of all trade on this route and 5% of all maritime trade.

**Transit statistics and capacity:**1916: 807 transits (2.2/day)1970 (peak): 15,523 transits (42/day) = 134.6 million tonnes of cargo2013: 213 million tonnes, 4750 TEU average ship size2016: Maximum ship size 14,500 TEU (more than double previous capacity)**Principle commodities:** Motor vehicles, petroleum products, grains, coal.**Improvements to the transit route:*** As with Suez Canal there have been a number of engineering works to improve the capacity and speed of transit as ships have become larger.
* The most recent expansion was opened in 2016 increasing capacity (see above).
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| Future possibilities:* CMA CGM has announced plans to build the world's largest container ships which will be capable of carrying 22,000 TEU. They are scheduled for service from the end of 2019.
* **China just** **launched (2017) its first all-electric cargo ship, which will travel 50 miles at a top speed of 8 miles per hour on a single charge.**
* **It will be able to carry 2,200 tons of cargo with every haul, that battery capacity is barely enough to fulfill any transatlantic shipments.**
* **It will take two hours to charge, roughly how long a ship takes to unload in port**.
* There is potential for greener ships. In 2009, a solar-powered container ship made its maiden voyage.
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| Geographical advantages and barriers: **Advantages:*** Shipping is the most efficient way of moving goods around the globe. It accounts for 80% of world trade.
* Cheaper over long distances
* No cost in building transport routes (seas/oceans already exist)
* Good for bulky low cost non-perishable goods e.g. coal
* Costs are spread over a large area (modern container ships hold thousands of containers)
* Containerization has sped up the process of loading and unloading. Unlike planes containers can be directly transferred to lorries and trains.
* Refrigerated containers now allow more products to be transported
* Shipping results in much lower emissions than air freight. A Defra study concludes that 2 tonnes of freight carried for 5,000km by a small container ship creates 150kg of CO2e (a measure of relative global warming potential) compared to 6,605kg of CO2e if the freight is carried by plane for the same distance.
* There is potential for greener ships. In 2009, a solar-powered container ship made its maiden voyage. In 2017 China launched its first electric powered container ship.

**Barriers:*** Much slower than air travel
* Some countries are landlocked so cannot receive shipments
* Ships are expensive to build - steel is expensive
* There are long waiting lists for large containers ships
* Oil prices are expensive so fuel for ships is expensive
* Some routes have to be built and maintained and enlarged e.g. Panama and Suez Canal
* Some shipping routes have to be dredged
* Ports are expensive to build and can damage delicate wetland areas
* Risk of attack by pirates and cost of protecting ships e.g. Horn of Africa
* Ships can have accidents and cause environmental damage e.g. oil leaks and hitting reefs
* Cargo can be lost overboard in bad weather
* Can encourage smuggling
* Although improved design has reduced the carbon emissions produced by container ships, they still consume an enormous amount of non-renewable energy – including diesel to power the engines which is very heavily polluting. The industry is responsible for 1bn tonnes of greenhouse gas emissions per year.
* Some shipping lines avoid emission-control areas established in an effort to combat sulphur emissions – this makes the route longer meaning more fuel is consumed.
* The introduction of greener ships will take time due to the enormous capital investment tied up in a ship – owners are loathe to scrap old ships.
* Between 2007 and 2012 we saw a dip in emissions: after the recession containers slowed down to save on fuel. Pre-economic crash a cargo ship typically travelled at 24 knots, and post-crash 16 knots. But now, with economic recovery, it’s full steam ahead. Greenhouse gas emissions from shipping might rise by 250% by 2050.
* The problem with wind and solar powered ships is that the technology to power the ship takes up a lot of space on deck which reduces the ships capacity. Electric powered ships of the future will only be as sustainable as the fuel used to generate the electricity – China, for example, is still heavily reliant on fossil fuels for energy generation.

**Social justice:*** The 2006 Maritime Convention established universal rights for seafarers, but they remain among the most vulnerable group of workers. There’s not much access to lawyers and doctors at sea and the practice of registering ships under flag states with lower human-rights standards persists.
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| How is the development linked to space-time convergence and reduced friction of distance?**Friction of distance has been reduced in ocean travel by:*** The development of gas and diesel turbine engines has increased the speed of container ships from an average of 13 knots to 25-30 knots. This enables good to be transported more quickly and for ships to be able to travel greater distances.
* Journey times have been severely shortened by the development of trade routes such as the Panama and Suez canals.
* Since the 1950s it has become quicker and easier to transport large amounts of goods as a result of containerization.
* **Space time convergence** – this has brought distant places together as it has allowed for increased trade between distant regions - for example trade between Europe and East Asia has increased due to the development of the Suez Canal. The Suez Canal provides the shortest maritime route between Europe and the land masses around the Indian and western Pacific oceans. The alternative trade route between Asia and Europe means circumnavigating the Cape of Good Hope - the Cape route between Singapore and Rotterdam would take 9 days longer than using he Suez Canal at today's ship speeds. Today, the Suez canal accounts for 19% of world maritime trade.
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Air transport

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| Introduction:* By weight, air cargo represents less than 1% of all globally traded commodities (52.2 million tonnes by air compared to 10.8 billion tonnes by sea). However, by value air cargo accounts for 35% of all globally traded commodities.
* Air transport is the mode of transport where freight and passengers are still most closely integrated as passenger airliners will often also carry high-value or urgent freight such as smart phones or human organs for transplant.
* However, cargo/passenger divergence is increasing in this mode: freight-only airlines are increasingly common (Fed-Ex was the first in 1971) and a number of traditional airlines operate freight-only planes

Timeline of advances in air travel:1903 - First powered flight - Orville and Wilbur Wright make the first recorded powered, sustained and controlled flight in a heavier-than-air flying machine.1927 – First trans-Atlantic flight: Charles Lindbergh completes the first solo non-stop trans-Atlantic flight.1952 - De Havilland produces the world's first commercialjet airliner, the Comet. The jet engine allows speeds of 900 km/hour resulting in significant space–time convergence and the potential for longer-range flights **1958** - Pan American initiates its New York to London route with the Boeing 707. Compared to the Comet the 707 is much more advanced:* the 707 is able to carry 189 passengers compared to the Comet's 44
* it is 25% faster than the Comet
* the 707 has a range of almost 5000 nautical miles compared to the Comet's 1300.

1958 - Intercontinental air passenger numbers surpassed maritime transport 1970 – Boeing 747 makes the first commercial flight.1976 – Concorde begins its first passenger-carrying service.1986 – First non-stop flight around world - Dick Rutan and Jeana Yeager fly the US ultralight Voyager around the world in a 9-day non-stop flight from California to California.**1995**First airline tickets are sold via the internet.**1999**First web-based passenger check-in and online boarding passes.2005 - The Airbus A380 is a double-deck, wide-body, four-engine jet airliner manufactured by European manufacturer Airbus. It is the world's largest passenger airliner, and the airports at which it operates have upgraded facilities to accommodate it. It was designed to challenge Boeing’s monopoly in the large-aircraft market. The A380 made its first flight on 27 April 2005 and entered commercial service on 25 October 2007 with Singapore Airlines. An improved version, the A380plus, is under development.2016 – First solar flight around the world - Solar Impulse 2 is the first plane powered by a renewable energy source to tour the globe.**The main technological advances in air transport can be summarised as:**1. Higher speeds *up to a point*: cruising speeds for commercial airliners today range between about 480 and 510 knots, compared to 525 knots for the Boeing 707
2. Greater range without the need for stop-overs and refuelling
3. Greater fuel efficiency: modern jet engines are very fuel efficient
4. Larger passenger payloads, allowing greater economies of scale
5. A shift of airport facilities (check-in) online, improving the customer experience.
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| Examples of geographical locations:* Recent expansion in the cheap flights sector has brought air travel to the masses. For example, easyJet’s cheap flight network in Europe provided 65 million cheap flights to passengers in 2014.
* The rise of the global middle class has driven the expansion of internal flights in India and China.
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| Geographical advantages and barriers: **Advantages:*** Fast over long distances
* Planes don't get stuck in traffic, unlike cars and lorries
* Good for high value perishable goods e.g. flowers, animals
* Can reach landlocked countries

**Disadvantages:*** Planes cause a lot of pollution (noise, air and visual) - contribute greenhouse effect
* Cost of flying is expensive, especially as price of oil increases
* Airports are expensive to build and take up large areas
* Can only carry small loads compared to ships
* Air routes are fixed
* Planes can be cancelled due to bad weather
* Aircraft are expensive to build and maintain
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| Future possibilities:2016 – First solar flight around the world - Solar Impulse 2 was the first plane powered by a renewable energy source to tour the globe.Space X: Elon Musk has revealed proposals for one of his most ambitious projects to date - intercontinental rocket flights for passengers that will take under half an hour.* The billionaire entrepreneur said the BFR spacecraft unveiled by his company SpaceX will be able to fly to most places on earth in under 30 minutes and anywhere in under an hour, with the cost roughly equivalent to an economy flight on a passenger jet.
* The reusable rockets would apparently have a maximum speed of 27,000 km per hour (16,777 mph), although earth flights would travel at just over 7,000mph, allowing flights of thousands of miles in as little as 22 minutes.
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| How is the development linked to space-time convergence and reduced friction of distance?**Friction of distance has been reduced by:*** Air travel has revolutionized the way people move around the globe.
* The arrival of the inter-continental Boeing 747, in the 1960s, made international travel more commonplace.
* It is easier for more people to travel using airlines as it has become very affordable, this has occurred due to the emergence of low cost airlines e.g. easyJet in Europe, Spirit in North America etc.
* Higher speeds *up to a point*: cruising speeds for commercial airliners today range between about 480 and 510 knots, compared to 525 knots for the Boeing 707
* Greater range without the need for stop-overs and refueling
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**Space-time convergence:*** Air travel makes distant places feel closer together because it has vastly reduced the amount of time taken to travel between two locations.
* For example: Sydney & Brisbane in Australia are 1000km apart. In 1902 it took 3 days (4320 mins) by coastal steamer in 2002 it took 1hr 25 mins (85mins) by aeroplane.
* Obviously there are certain areas that converge more than others. When we discuss the time-space convergence of locations, we usually relate major network hubs, or nodes. (A node is a point of connection on a network.) Therefore, we would study the time-space convergence between Hong Kong and Los Angeles, Paris and London, Durban and Brisbane. In globalization, this contributes to the development in 'global cities' which have the transport infrastructure to make ever quicker links between other places.
* However, the areas in between these nodes are much less well connected. It can take longer to travel from Milan to Bari (distance 885km, 8 hours 44 minutes train journey) than from Milan to New York (8 hours, 33 minute flight time).
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Exam question: 