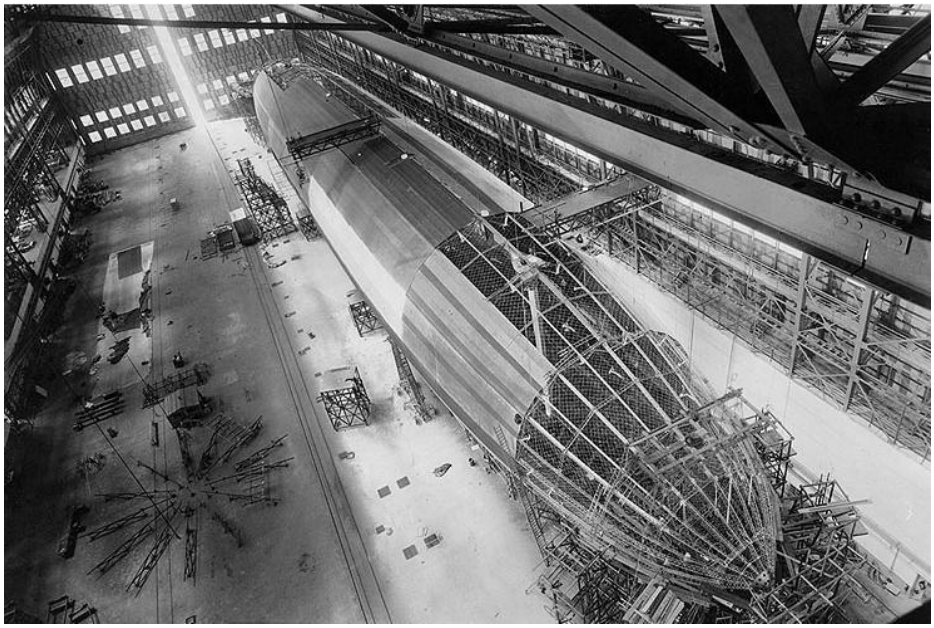
GRWW1 5b Zeppelin airships

- Airships were the first aircraft capable of controlled powered flight.
- Prior to WW1 Germany had become a world leader in the construction and operation of rigid lighter-than-air airships.
- These became universally known as 'Zeppelins' after the most famous company that built them; the *Luftschiffbau Zeppelin GmbH* or Airship Construction Zeppelin Ltd, although other manufacturers existed (i.e. *Luftschiffbau Schütte-Lanz* or the Schütte-Lanz Company).

Zeppelin LZ18 (L2)

- Airships were made of a rigid frame made up of transverse rings (that ran across the craft) and longitudinal girders (that ran along the craft) covered by tough canvas fabric.
- The frame was made of metal or wood. Zeppelins used the metal alloy duraluminium while Schütte-Lanz craft were made from laminated wood.
- Inside the frame were a number of large bags used to hold a lighter than air gas - early Zeppelins used rubberised cotton for the gasbags, but later specially treated cattle intestines (known as 'goldbeater's skin' which was

similar to sausage skins! The gas provided enough lift to counterbalance the weight of the craft allowing the airship to float in mid-air.



An American Navy airship under construction, showing the framework.

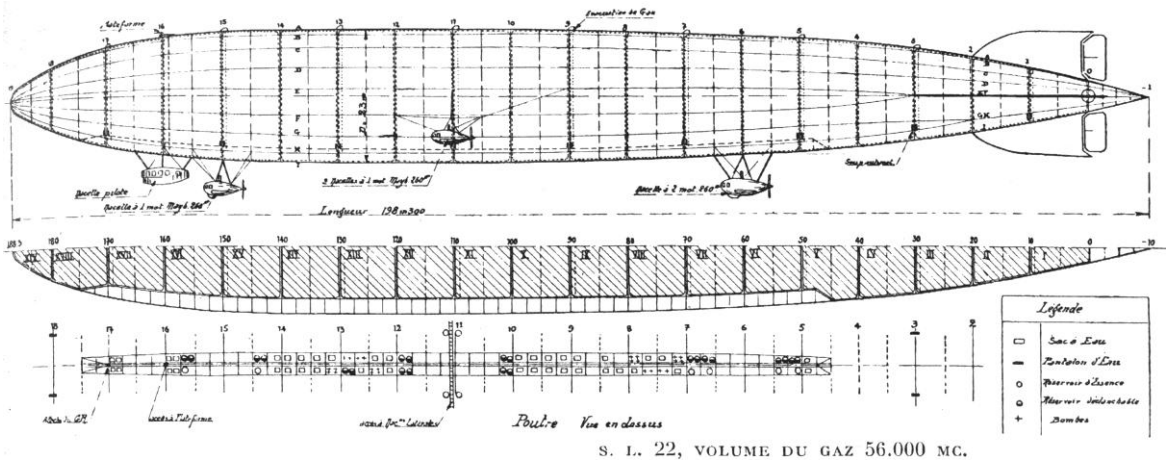
- There are three main gases that could be used to fill the gas bags, hydrogen, helium or hot air: all had advantages and disadvantages, as shown in the table below.

Gas	Chemical symbol	Main Advantages	Main disadvantages
Hydrogen	H	- Lightest known gas (8% more lifting power than helium) - Easy and cheap to manufacture	- Highly flammable - Hard to prevent leaks
Helium	He	- Second lightest gas, has good lifting power - Inflammable	- Very expensive and hard to make - Hard to prevent leaks
Hot air (mix of nitrogen and oxygen)	-	- Fair lifting power - Unlimited supply	- Inefficient, as it requires a system to continually heat the air - Requires a large volume

- The most common gas used for airships was hydrogen, simply because it was easy to make and had good lifting power, but it did mean that airships were

extremely vulnerable in that if any gas escaped, any spark (i.e. electrical or friction) or naked flame could ignite the gas, causing uncontrollable fire.

- Zeppelins had long cylindrical hulls with tapered ends and cruciform tail surfaces which were used for steering and for altitude control (climbing and descending).



Internal framework of an airship

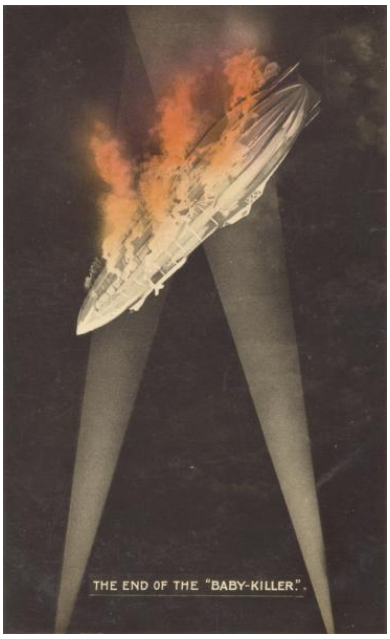
- Propulsion was provided by aircraft engines mounted in external gondolas (often termed 'engine cars') that were attached to the outside of the structural framework. Some of these engines had gearing that allowed them to provide reverse thrust for manoeuvring while mooring.
- Zeppelin engines generally used gas fuels (such as propane) rather than liquid fuels (petrol or diesel). The reason was that as the gas was used up it did not affect the buoyancy of the craft. If liquid fuel had been used it would have made the airships lighter as it was used.
- Zeppelins had an air of invincibility about them but in reality, they were fragile, flammable machines desperately vulnerable to the external conditions, especially bad weather – such as thunderstorms (one lightening strike could cause an explosion), freezing fog & rain (which allowed ice to build up on the fabric so increasing the weight which could cause the

Zeppelin to crash) and strong winds (which could tear the fabric apart and cause structural damage).

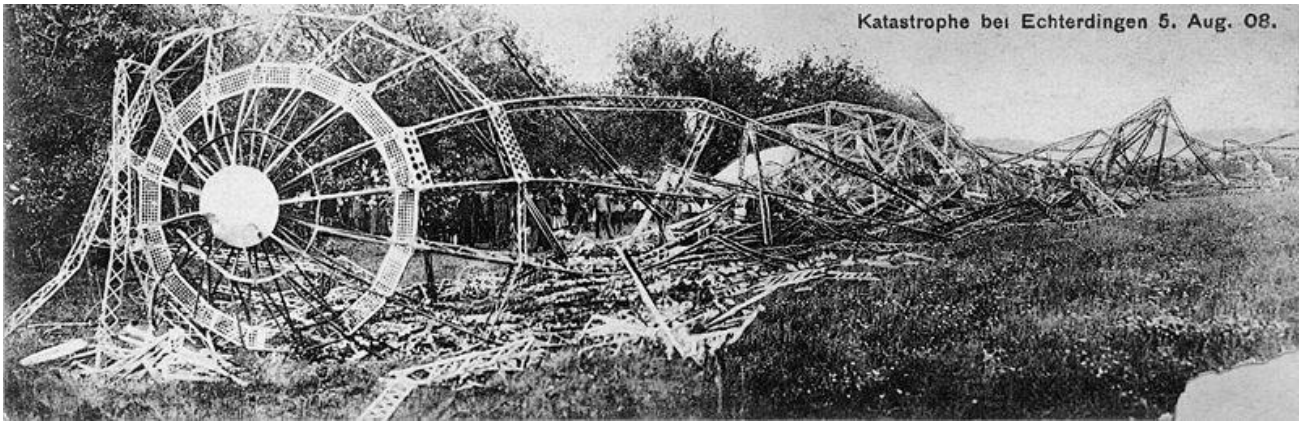
- Early airships had quite small crew and passenger gondolas built into the bottom of the airframe, but later Zeppelins often had internal passengers or cargo compartments.
- The early Zeppelins had a maximum speed of around 136kmph (85mph) and reach an altitude (height) of around 4,250 metres (14,000feet).
- Most Zeppelins had a defensive armament of five machine-guns and could carry around 2,000 kg (4,400 lbs) of bombs.
- Zeppelins were hard targets to destroy because they could fly higher than most WW1 fighter planes.
- However by mid-1916 the British developed a new type of explosive bullet designed to puncture the skin and internal gasbags of Zeppelins and ignite the escaping hydrogen. This inevitably doomed the Zeppelin to a flaming and explosive fall to destruction.

The inside of an engine gondola of a Zeppelin over England painted by Felix Schwormstädt in 1917

- The German Zeppelin crews did not usually carry parachutes (to save weight) and if a Zeppelin caught fire, many preferred to jump to their deaths rather than be burnt alive.



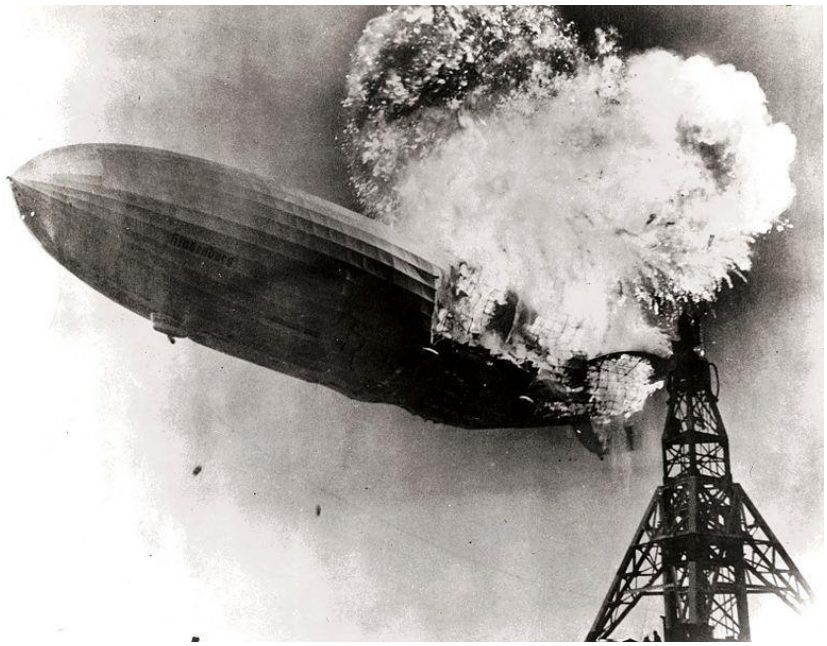
A Zeppelin crashing in flames



The Remains of a crashed Zeppelin

- After the war, airships continued to be made and used, especially for long-distance intercontinental travel – such as Europe to America, South America, etc.
- Although successful in this role, the use of airships decreased over time as aircraft technology improved and this decline was accelerated by a series

of high-profile accidents – such as the 1930 crash and burning of British R101 in France, the 1933 storm-related crash of the USS Akron and the 1937 burning of the hydrogen-filled Hindenburg (below).



The Zeppelin LZ 129 Hindenburg catching fire on 6th 1937 at Lakehurst Naval Air Station in New Jersey, USA.

- Today, airships are still used but primarily in specialist roles such as advertising (Goodyear 'blimps'), tourism, camera platforms for sporting events, geological surveys, and aerial observation – mostly applications where the ability to hover in one place for an extended period outweighs the need for speed and manoeuvrability.
- They are also still being considered for long-range cargo-carrying work and recently the world's largest airship – the *Airlander* - has been built to trial this aspect.
- This craft employs a revolutionary design that is different from the traditional form as it resembles three airships sewn together lengthways – this shape provides aerodynamic lift like an aircraft wing (see http://www.bbc.co.uk/news/business-26337673) , making it greener and more efficient.