

TerranearPMC Safety Share

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Week of May 14, 2018 – The Hindenburg Disaster

Any of us old rock n' rollers can recall (hopefully) the cover of the first Led Zeppelin Album, as it depicted one of the most notable disasters in modern history: The passenger airship Hindenburg bursting into flames as it was ready to land in Manchester Township, New Jersey. The event occurred on May 6, 1937 with the backdrop of international tensions as the Second World War was approaching. Of the 97 people on board (36 passengers and 61 crewmen), there were 35 fatalities (13 passengers and 22 crewmen). One worker on the ground was also killed, raising the final death toll to 36.

Through news reels, photographs and the now famous radio broadcast of Herbert Morrison's eyewitness radio report for station WLS in Chicago, this tragic event has been captured for posterity. And today, Morrison's words "Oh, the humanity!" have been quoted countless times as a cultural idiom.

On the evening of May 3, 1937, the Hindenburg departed from Frankfurt, Germany, on the first of 10 round trips between Europe and the United States. American Airlines had contracted with the operators of the *Hindenburg* to shuttle the passengers from Lakehurst to Newark for connections to airplane flights.

Around 7:00 p.m. local time, at an altitude of 650 feet (200 m), the *Hindenburg* made its final approach to the Lakehurst Naval Air Station. This was to be a high landing, known as a *flying moor*, because the airship would drop its landing ropes and mooring cable at a high altitude, and then be winched down to the mooring mast. This type of landing maneuver would reduce the number of ground crewmen, but would require more time. Although the high landing was a common procedure for American airships, the *Hindenburg* had only performed this maneuver a few times in 1936 while landing at Lakehurst.

At 7:25 p.m., a few witnesses saw the fabric ahead of the upper fin flutter as if gas was leaking. Others reported seeing a dim blue flame – possibly static electricity. At that moment, the *Hindenburg* caught fire and quickly became engulfed in flames. And while the reasons for this tragedy are as numerous as there were eye witnesses (it seems that everyone present had a different view and testimony of this event), to this day, the exact root cause has never been determined. There have been many theories as to why or how the Hindenburg caught fire, including sabotage, lightning, engine failure, and the use of flammable paint on the airship (a plasticized lacquer used to tighten and stiffen the fabric that stretched over the airframe, rendering the craft airtight and weatherproof).

The theory that hydrogen gas (used to make the aircraft buoyant) was ignited by a static spark is the most widely accepted theory as determined by official crash investigations. Offering support for the hypothesis that there was some sort of hydrogen leak prior to the fire is that the airship remained stern-heavy before landing, despite efforts to put the airship back in trim. This could have been caused by a leak of the gas, which started mixing with air, potentially creating a form of oxyhydrogen and filling up the space between the skin and the cells. A ground crew member reported seeing the fabric cover of the upper port side of the airship fluttering, "as if gas was rising



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and escaping" from the cell. He said that the fire began there, but that no other disturbance occurred at the time when the fabric fluttered. Another witness (on the top of the mooring mast) had also reported seeing a flutter in the fabric as well. Pictures that show the fire burning along straight lines that coincide with the boundaries of gas cells suggest that the fire was not burning along the skin, which was continuous. Crew members stationed in the stern (rear section) reported actually seeing the cells burning.

The Hindenburg was classified as an airship, aerostat or lighter-than-air aircraft that was able to navigate through the air under its own power. The first lighter-than air flight was a hot-air balloon built in 1783. One hundred years later, Count Ferdinand von Zeppelin began experimenting with light-weight gas engines, and by the turn of the century, helped launch commercial air travel. Because of hydrogen's lighter-than air properties (hydrogen is the lightest material on the periodic table of elements) and is easily obtained, it became the material-of-choice for lighter-than air aircraft. However, Hydrogen is an extremely flammable gas. It has a flammability range of 4% - 75% (Methane, the main component in natural gas, has a flammable range of 5% -15%). Hydrogen-air mixtures can ignite with very low energy input; 1/10 of that required for igniting a gasoline-air mixture. For reference, an invisible spark or a static spark from a person can cause ignition. These properties make hydrogen a high-risk material. By 1922, the USA abandoned hydrogen for helium (providing about 88% of the lift capacity of hydrogen). Helium's non-flammable nature makes it the only practical lifting gas for manned lighter-than-air flight, but it is not an abundant material and therefore, costly.

Because the United States had much of the world's helium reserves, Germany asked the USA for helium for its Zeppelins. However, the US was concerned that helium had military uses and therefore, decided not to sell helium to Germany (remember international tensions were rising). For this reason, the Hindenburg was still lofted with hydrogen instead of being converted to helium.

Today, any S&H professional would have identified the unacceptable risk of using hydrogen: even if this was the only available material. Many of us in the S&H field would like to believe that such an obvious hazard would have triggered a "stop work" and prohibited the Hindenburg to take flight. S&H professionals would LIKE to believe that. Yet devastating events, such as the space shuttle Challenger as well as the 2013 disaster of the Italian cruise ship, Costa Concordia, still occur. Once again, we can take a look at past catastrophic events and use them as learning tools, hoping that we take the opportunity to ensure that we can prevent similar events from occurring. While most of us are not in the position to prevent such momentous tragedies as the Hindenburg disaster, we, in our own way, can take the time to identify the hazards that are around us and decide whether to stop or pause work when we see something wrong and take the time to examine our safety concerns and, when appropriate, develop the proper controls. The famous words of Herbert Morrison, "Oh the humanity!" can speak volumes for which we all have the ability to ensure such an exclamation lives only in the past.

Of all the preposterous assumptions of humanity over humanity, nothing exceeds most of the criticisms made on the habits of the poor by the well-housed, well-warmed, and well-fed - Herman Melville

