ATLAS

Lightning Protection:
A Life Story

You may understand the crucial importance of lightning protection, but do you know of its naval origins, or just how far lightning protection systems have advanced in the last few centuries? The Association of Technical Lightning & Access Specialists (ATLAS) aims to tell you just that.

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Historically it was well observed that certain objects and structures were more prone to lightning strikes. The two most common man-made structures that were hit were places of worship and tall ships. Church strikes would often be seen as an act of God, but strikes to tall ships were of far more critical concern. The term “St. Elmo’s Fire” (St. Elmo being the patron saint of sailors) was coined to describe the coronal discharges seen from the points of masts during occasions of high electromagnetic activity and atmospheric charge build up. The observation of the “fire” at the tips of the masts would often forewarn of a lightning strike. As the ship was usually the only isolated object above the sea surface, there was little that could be done to alleviate the risk of a strike in storm conditions. The grave concern here being that cargo could include gunpowder, giving a significant probability of explosion and loss of life.

Between 1810 and 1818 a total of 58 ships were struck or sunk with around 600 sailors losing their lives as a result. Due to this, rudimentary conductor systems were applied to ships in an effort to prevent, or at least lessen, the damage caused by lightning strikes. However, these systems were often installed by the sailors themselves and many would simply drape chains from the tops of masts down into the sea - a cumbersome, heavy and expensive system.

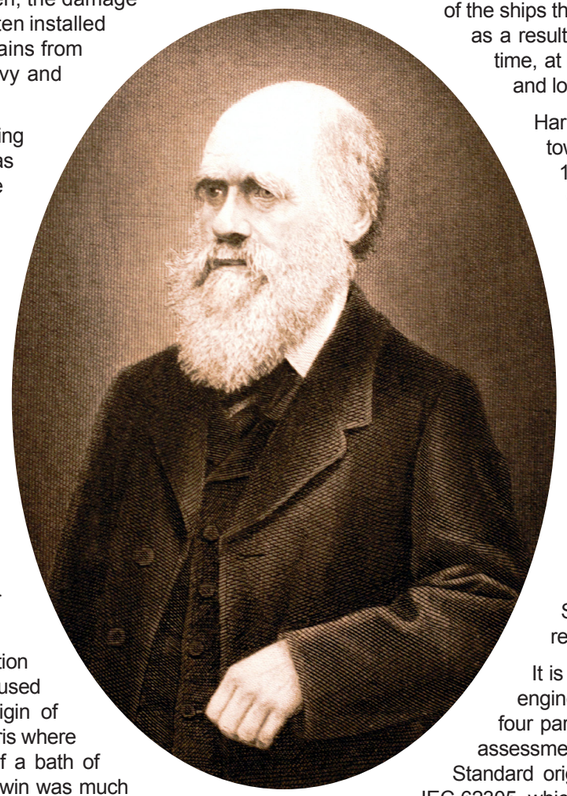
Sir William Snow Harris (also known as Thunder-and-Lightning Harris), a British physician and electrical researcher, was eventually tasked with providing an updated and more effective lightning protection solution. He had presented an initial solution to the Admiralty in 1821, but had been dismissed without interest. He continued to campaign for Naval and public recognition of his system, and in 1839 the Admiralty eventually conceded that their current system was woefully inadequate.

Harris’ system used a series of bonded copper plates, rivetted to the masts, from their tips down to sea level, with all metallic parts of the ship also connected to these plates to avoid risks from secondary flashes, a principle still used today. Secondary flashing has long been known to be one of the most serious consequences from lightning strikes, as these will often occur between parts that are more sensitive and critical to the continued safety and operation of the structure. With ships, secondary flashing was a prime concern due to the practice of lining the powder rooms with copper sheet - a side flash could therefore be devastating.

One of the first test ships that Harris would apply his protection system to was HMS Beagle, the ship that Charles Darwin used during his voyage that later lead to his writing On the Origin of Species. Prior to his voyage, Darwin attended a lecture by Harris where the lightning protection system was demonstrated by way of a bath of water, small model ships, and a hand-cranked generator. Darwin was much impressed by Harris’ work and commented to his sister that he had “breakfasted with a Mr Harris, whom I like more than anybody I have seen – he has written a great deal on electricity.”

HMS Beagle’s voyage around South America, the Galapagos Islands, Australia, and South Africa took around five years. During that time the crew witnessed several occasions of lightning activity with at least two known and verified direct strikes to the ship itself. Captain Fitzroy noted that “nothing unusual had happened” and there was never the “slightest damage” as a result. Darwin himself commented “But for the conductor, the results would have been serious.” On returning to Plymouth, Captain Fitzroy reported that the copper plates had all stayed in place, even on the smallest spars and had served to further strengthen, rather than weaken, them. He later went on to state:

“No objection which appears to me valid, has yet been raised against them; and were I allowed to choose between having masts so fitted and the contrary, I should not have the slightest hesitation in deciding on those with Mr. Harris’ conductors.



Whether they might be farther improved, as to position and other details, is for their ingenious inventor to consider and determine. He has already devoted so many years of valuable time and attention to the very important subject of defending ships against the stroke of electricity; and has succeeded so well for the benefit of others—at great inconvenience and expense to himself—that it is earnestly to be hoped that the Government, on behalf of this great maritime country, will, at the least, indemnify him for time employed and private funds expended in a public service of so useful and necessary a character.”

The Admiralty were convinced, and in 1842, Harris’ system became the first standard to be adopted for the protection of maritime vessels. By this time the Imperial Russian Navy had also adopted Harris’ methods of protection and in 1845, the Tsar presented him with a ring and vase in recognition of his services and achievement.

Harris continued to record known strikes and consequences of those strikes to ships and in 1853 a report was published claiming that, between 1830 and 1846 none of the ships that had been fitted with a Harris system had suffered casualties as a result of a lightning strike. In comparison, over a similar amount of time, at least 45 unprotected ships had suffered catastrophic damage and loss of life.

Harris’ system was saving lives, ships and cargo, but the first move towards modern lightning protection standards was not until 1905, when the report from the 1881 Lightning Rod Conference was made publicly available. The Society for the Protection of Ancient Buildings made a request to the British Standards Institution (BSI) for the writing and publication of a recognised code of practice for lightning protection and in 1942 the first Code of Practice Committee was convened with the Code of Practice number 1 (CP1) being published in 1943. Whilst largely based on the preceding 1881 conference report, several changes were made to take into account more recent developments in construction methods and standard conductor material sizes, which had become available.

After a fire devastated York Minster in 1984, which was believed to have resulted from a lightning strike, it was decided that a revision to the British Standard for lightning protection was needed, and in 1985 BS 6651 was first published (before being subject to several revisions and eventual withdrawal in 2008). Links to Harris’ systems were still obvious throughout the Standard, but revisions to risk assessment and surge protection recommendations were included to modernise the practice.

It is BS EN 62305 which is the bible of ATLAS lightning conductor engineers in Britain today. It was originally published in 2006, as four parts, but parts 1, 3 and 4 were revised in 2011 and part 2 (risk assessment) in 2012 (as this required further work). The current British Standard originated from the International Electrotechnical Commission’s IEC 62305, which was passed to the European Committee for Electrotechnical Standardisation (CENELEC) where it would be re-published as the European standard for lightning protection, EN 62305. Individual member country committees then published their own versions, in BS EN 62305’s case this incorporated considerations for UK lightning activity and types of structures.

ATLAS was founded in 1946 to represent the leading lightning protection experts in the country, with all ATLAS members accredited to BS EN 62305, meaning there is no-one better qualified to protect your structure from lightning strikes. Ensure you are fully protected and contact an ATLAS member today.

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