

## THE NUTS & BOLTS OF JOLTS: A US AIR FORCE SAFETY PERSPECTIVE

by Richard Kithil, Founder & CEO  
National Lightning Safety Institute (NLSI)  
[www.lightningsafety.com](http://www.lightningsafety.com)

**FLASH ! BANG! BOOM !** 35 million lightning ground strikes in the USA each year. A typical thunderstorm may contain 10,000 or more ground strikes. There are approximately 100,000 thunderstorms per year in the nation. Globally, there are about 75-100 lightning strikes per second, or 8.5 million per day on a 24 X 7 X 365 basis. Lightning accounts for some 25,000 worldwide deaths each year. In the USA alone the costs and losses in dollar terms exceed \$5-6++ billion annually. It is a leading weather hazard. Here are some facts and useful information for you to apply at work and at play.

Lightning is static electricity on a giant scale. Nature's evaporation-condensation-high altitude freezing cycle creates immense currents and voltages in clouds -- giant "batteries in the sky". Electrical discharges occur from cloud-to-cloud, cloud-to-ground and ground-to-cloud. The heat is five times hotter than the sun's. There are magnetic effects. And X Rays. And light (of course). And very loud noises...thunder being the acoustic signature of the electrical event...air molecules get shattered by this intense gas plasma pulse. Lightning's overall behavior is arbitrary, capricious, random, stochastic, and unpredictable. Much of its activities still are not fully understood by the scientific community.

Preventing lightning and controlling or manipulating it is impossible. It is the angry 900 lb. gorilla gone berserk in the grocery store! It may cause fires and physical damage to structures. It may upset sensitive electrical and electronic circuits. It may cause severe injuries or deaths to people. US Air Force codes and standards such as AFI 32-1065 and AFI 91-201 provide guidelines for the installation of defensive measures at key facilities so as to mitigate lightning's effects. AFOSH 91-100 section 1.2.15.1 describes "general lightning safety for all AF Activities and Operations". Very useful information in 91-100 is summarized:

+ When lightning is observed:

- Seek shelter in buildings and inside enclosed vehicles
- Dangerous areas are hilltops, under isolated trees, near metal objects and contact with electrical equipment.

+ Each Air Force operational area will develop a two tier notification procedure:

- Lightning Watch* 30 minutes prior to lightning entering a 5 mile radius
- Lightning Warning* when lightning is within a 5 mile radius. Cease activities and seek shelter.

Air Force lightning safety standards have a basis in fact. We looked at 877 USAF lightning-related mishaps to 56 aircraft types over a 13 year period (1). Aircraft mission was affected in 37 percent of the reported incidents. Structural damage was reported in 78 percent of the reported incidents. Electrical/electronic damage was sustained in 8 percent of reported incidents. We also examined work-related injuries to military personnel. This is a high-risk population for lightning-associated injury and death because military training and operational activities occur outdoors in all types of weather conditions. A September 2002 report (2) from the *Center for Disease Control (CDC)* contains a caveat about the accuracy of the statistic due under-reporting methodologies. Notwithstanding possible reporting errors, between 1998 and 2001 there were 246 reported lightning-associated casualties in the military sector. (Similar civilian records show casualties to be under-reported by about 30 percent.)

Your individual safety and that of co-workers and families can be summarized in brief:

1. No place outside is safe, period. During electrical storms stay off the (hardwired) phone, away from electrical circuits, avoid tall trees, avoid metal objects, and avoid water contact.
2. If you hear thunder, the lightning from that thunder happened within your hearing range – say 6 to 8 miles. That is close in the context of successive strikes. Immediately cease outdoor activities and go to shelter. Large permanent buildings and fully-enclosed metal vehicles are best refuges.
3. Remain inside until thunder is no longer heard or lightning seen. *“If you can hear it, clear it. If you can see it, flee it.”*
4. Treatment of the lightning victim includes CPR if criteria are met and an immediate call to the emergency response authority.

**Remember: When Thunder Roars, Go Indoors !** More information on these and other lightning topics can be found at the website of The National Lightning Safety Institute (NLSI). See them at: [www.lightningsafety.com](http://www.lightningsafety.com) . Contact the author at: [rkithil@lightningsafety.com](mailto:rkithil@lightningsafety.com)

References:

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  2. CDC Weekly Report MMWR Sept. 27, 2002, 51 (38) pp 859-862, Center for Disease Control.
  3. NLSI, 2015: “Lightning Protection for Engineers” and “Lightning Protection for Critical Facilities” available from [www.amazon.com/books/nlsi](http://www.amazon.com/books/nlsi)
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