1. INTRODUCTION

Lightning is one the greatest storm-related threats in the United States. Over the past 30 years, National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service (NWS) have documented about 2000 lightning fatalities in the United States based on statistics through 2003 (NOAA 2006). These statistics show that lightning ranks second in terms of storm-related fatalities with only flooding causing more storm-related deaths in the United States.

To reduce the number of lightning casualties (deaths and injuries) in this country, NOAA and the NWS have worked to find ways to draw attention to this underrated killer. In 2001, NOAA and the NWS teamed up with non-governmental organizations and individuals to find ways to draw attention to the dangers associated with lightning. Since then, NOAA’s “Lightning Safety Awareness Team” has worked together to provide lightning safety information to local NWS offices, the media, emergency manager, teachers, and the public. The centerpiece of this effort is NOAA’s Lightning Safety Web Site, which serves as a source of lightning safety information. Also, NOAA’s Lightning Safety Awareness Team and the NWS have designated the last full week in June as Lightning Safety Awareness Week. During this week, NOAA and the NWS work with the media and other organizations to highlight the dangers of lightning.

In this paper, we will discuss NOAA’s efforts to reduce the number of people struck by lightning.

We also examine some lightning fatality statistics to assess the effectiveness of NOAA’s lightning safety awareness efforts.

2. NOAA’S LIGHTNING SAFETY CAMPAIGN – A TEAM EFFORT

While NOAA has promoted weather safety and preparedness for many years, the current effort to highlight lightning safety began in 2001 when NOAA organized a team of individuals to spearhead the lightning safety effort. This “inner core” included people from NOAA and the NWS, as well as non-governmental organizations and individuals, with a knowledge or interest in promoting lightning safety awareness. The overall goal of the effort was to reduce the number of lightning casualties in this country. To accomplish this goal, the inner core initially worked to develop and assemble an array of lightning safety information and materials that could be used as a resource by others.

While the inner core of the team was tasked with assembling information, a critical part of NOAA’s continuing lightning safety effort involves groups of individuals across the country that use this information to promote lightning safety. Included in this “outer core” are of the many meteorologists who work at the 123 NWS field offices. These individuals are critical to the success of the campaign because they have the most direct contact with the many local media outlets (large and small) throughout the country, they can determine the local threat and tailor the information for their particular part of the country, and they can work with local media outlets to get the information out to the public.
Also, local NWS offices are able to issue forecasts or statements at any time to highlight an imminent lightning threat and can broadcast these to the public over NOAA Weather Radio.

NOAA’s partners also play a vital role in getting our safety messages out to the public. These partners include the broadcast and print media, emergency management officials, national and local recreational organizations, and interested individuals. NOAA’s Public Affairs Office and local National Weather Service offices across the country work with national and local media to provide interviews and information for news stories. In addition, various governmental agencies and recreational organizations have worked with NOAA to help get this safety information out to the public.

3. LIGHTNING SAFETY AWARENESS WEEK

One part of the lightning safety campaign has been the designation of a nationwide Lightning Safety Awareness Week. The week serves as an impetus for the media to run lightning safety awareness stories in both the broadcast and print media. Although the timing of the week initially varied between April and June, the team decided to permanently set Lightning Safety Awareness Week as the last full week in June for two reasons. First, the week immediately precedes July which is the most active month for lightning in the United States and also the most deadly month in terms of lightning fatalities. Second, during June, there is sufficient amount lightning activity across the United States (and unfortunately, lightning incidents), that the media are more likely to carry stories related to lightning safety. Because the media plays a critical role in getting information to the public, their participation in this effort is vital to the success of the campaign.

Each day during Lightning Safety Awareness Week, NOAA focuses on a different aspect of lightning or lightning safety. Safety information is provided in various forms and made available to the media and to the public through NOAA’s lightning safety web site. The themes for the days include an overview (Monday), a basic explanation of the science of lightning (Tuesday), outdoor lightning safety (Wednesday), indoor lightning safety (Thursday), and lightning victims (Friday).

During the week, many NWS offices issue public information statements on lightning safety and broadcast this information to the public over NOAA Weather Radio. They also work with local media outlets during the week to provide interviews and/or lightning safety information.

4. NOAA’S LIGHTNING SAFETY WEB SITE

The centerpiece of NOAA’s lightning safety awareness effort is NOAA’s lightning safety web site: http://www.lightningsafety.noaa.gov (Figure 1). The web site serves as a clearinghouse for information on lightning safety. While some basic information is provided on the science of lightning, the main purpose of the web site is to present information on lightning safety issues.

The main web page lists several different topics in the navigation menu on the left-hand side of the page which provide an outline of the information available on the site.

4.1 Overview and Daily Themes

A section of the web site is devoted to each of the daily themes that were selected for Lightning Safety Awareness Week. These include an overview of lightning and lightning safety, a basic scientific explanation of the causes of

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Figure 1. NOAA’s lightning safety web site, lightning, outdoor lightning safety, indoor lightning safety, and the medical effects of lightning on its victims.

In addition to the text available on the lightning safety web site, narrated and annotated presentation files are also available. Figure 2 shows the various forms of the information available for each of the daily themes. Note that each word in the Figure 2 provides a hyperlink to the appropriate web file.

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Figure 2. Files available from the NOAA web site for each of the daily lightning safety themes.

4.2 Teacher Tools

A section of the NOAA web site provides information, tools, and reference materials for teachers. Included in this section are a variety of lightning safety presentations for different grade levels. Figure 3 shows an example of one image from the annotated presentation file on the science of lightning. In addition to the general purpose presentations listed in Figure 2, the site contains information and presentations on lightning safety while at school.

The “teacher tools” portion of the web site also provides instructional materials for use in the classroom. These include curriculum guides, coloring books, games, and puzzles.

4.3 Survivor Stories

A part of NOAA’s lightning safety web site provides stories from victims who have survived being struck by lightning. This section provides insight into just how devastating a single lightning strike can be on both the victim and his or her family. These accounts are frequently updated.

Figure 3. Example of one slide from the annotated lightning safety presentation on the science of lightning.

While the web site contains stories from only a small sample of lightning victims, many other victims have worked with NWS offices or the media to tell their stories. At the national level, NOAA has worked with several victims or their families who were willing and able to speak to the national media about their unfortunate incidents. In addition, NOAA works with two organizations established by lightning strike survivors. These include the Lightning Strike...
and Electrical Shock Survivors, International (LSESSI) and the Struck-By-Lightning organizations. Both organizations do an excellent job to promote lightning safety.

4.4 More Information

The NOAA web site provides a variety of links to access additional lightning safety information or related organizations. These are contained in the section labeled "More..." This section links to general and specialized lightning safety recommendations, statistical information on lightning casualties, medical information, policy statements, and more detailed information on the science of lightning.

5. PRINTED MATERIALS

As part of NOAA’s efforts to promote lightning safety awareness, NOAA has developed, printed, and distributed a variety of lightning safety materials. These include articles, papers, posters, pamphlets, refrigerator magnets, etc. Some of these materials were designed specifically to target certain “at risk” activities (such as water activities) or groups (e.g., golfers). These materials have been distributed by NWS field offices, and electronic versions of these materials are available on the NOAA web site.

Figure 4 shows four of NOAA’s lightning safety posters designed to target people involved in outdoor sports and recreational activities. These, along with other posters, are available for download via NOAA’s Lightning Safety Multimedia Page. The posters feature sports activities such as golf, soccer, and baseball; as well as recreational activities such as hiking and camping, and water-related activities such as swimming and boating.

In addition to the sports posters, NOAA developed a lightning safety brochure specifically designed for coaches and sports officials (Figure 5). The brochure includes basic facts on lightning and lightning safety, recommendations for avoiding the lightning threat, tips on what to do if you get caught outside in a thunderstorm, and information on the immediate medical needs of lightning victims. Local NWS offices distributed over 20,000 copies of this brochure in 2005 and double that number will be available in 2006. In addition, Little League Baseball distributed a similar brochure to safety officers across the country through their ASAP (A Safety Awareness Program) newsletter. The brochure can be downloaded from the NOAA’s web site.
NOAA and the NWS have also passed out thousands of refrigerator magnets containing lightning safety information (Figure 6).

6. **NOAA’s PARTNERS**

While NOAA’s lightning safety team and the NWS field offices have worked very diligently to get information out to the public, our partners in the media and emergency management and response organizations play a very important role in getting this information distributed. NOAA Public Affairs has worked with major news outlets to find opportunities to get lightning safety information out through the media.

7. **PRELIMINARY FINDINGS**

NOAA has a 65-year record of lightning fatality data for the United States. In the early 1940’s, lightning killed an average of about 375 people each year based on documented cases (NOAA 2006). By the early 1970’s, there were just over 100 documented lightning fatalities each year. Figure 7 gives the number of documented lightning fatalities for each 5-year period since 1971. As the figure illustrates, documented lightning fatalities have gradually declined over the past 35 years. The 30-year average from 1971-2000 was about 73 documented deaths per year. This compares with an estimated average of about 41 deaths per year for the most recent 5 years since 2001 when NOAA Management Agency (FEMA) and the American Red Cross. The National Aeronautic and Space Administration (NASA) also has an ongoing effort to promote lightning safety.

At the local level, NWS field offices work with state and local emergency management agencies to promote lightning safety. Some state governors have issued gubernatorial proclamations declaring statewide lightning safety awareness campaigns to highlight the dangers of lightning. Also, information has been distributed through state newsletters or state and local emergency management web sites to promote lighting-safe practices.

Several sports organizations also have partnered with NOAA and the NWS on awareness materials. On the lightning safety posters which featured professional athletes, NOAA partnered with the Professional Golf Association Tour, the Women’s United Soccer Association, and the Minnesota Twins baseball team. To protect its players, parents, coaches, and spectators, Little League Baseball has also partnered with NOAA to help get lightning safety information distributed.

**Figure 6. Two of NOAA’s lightning safety refrigerator magnet designs.**

This has included news stories in the print and broadcast media, interviews for network shows, online chats, and broadcast science shows. In addition, NWS field offices work with their local broadcast and print media to promote lightning safety at the local level.

NOAA’s national partners also include emergency management and response organizations such as the Federal Emergency...
Figure 7. Average number of documented lightning fatalities for 5-year periods since 1971. *Note that the estimated value for the 2001-2005 period is preliminary and includes the authors' estimate of the 2005 fatalities based on print and broadcast media reports of individual lightning incidents during 2005.

While it is not possible to determine all the specific reasons for the reduction in lightning fatalities over the past 65 years, the authors believe that at least part of the reduction, especially during the last ten years, is likely a result of better lightning safety education.

Preliminary results for 2004 and 2005 indicate that both years will have fewer than 40 deaths from lightning. If so, 2004 and 2005 would be the only years in the 65-yr sample with fewer than 40 deaths.

8. CONCLUSIONS

NOAA’s efforts to draw attention to the dangers of lightning appear to be working. As a general rule, when it comes to thunderstorms and safety, people balance the risk of being struck by lightning against the inconvenience necessitated by decisions to be safe. However, because most people have only a vague knowledge of the risks associated with lightning, they tend to underestimate the threat posed by lightning and unknowingly expose themselves to a greater risk than they think. This is especially true since people often make decisions based on past personal experiences which usually include many instances where they may have engaged in unsafe activities without being struck.

While the ultimate goal of NOAA’s efforts is to reduce the number of lightning casualties in this country, an intermediate goal is educate the public on the dangers of lightning so that they can make more informed decisions when thunderstorms are forecast or are nearby. During the past five years, the authors have noticed an increase in the number of media stories related to lightning safety, especially during NOAA’s Lightning Safety Awareness Week. Also during the last five years, the number of lightning fatalities in the United States has been the lowest ever for any five-year period since statistics started to be collected in 1940. While it would be impossible to determine the exact impact of the NOAA’s awareness campaign on the number lightning fatalities, it is very likely that NOAA’s nationwide campaign, along with the efforts of other individuals and organizations, have contributed to the declining number of lightning fatalities in the United States.

With regard to organized outdoor activities, NOAA and the NWS continue to work with both local and national organizations to emphasize the need for written lightning safety policies and plans. It is important that these policies are well known and publicized before any outdoor event begins so that everyone involved in the activity is aware of and ready to follow the policies and act upon the plans.

Continued efforts to inform and educate the public are needed to maintain the downward trend in the number of lightning casualties. Personal experience and a lack of knowledge often give people a false sense of safety. This false sense of safety, combined with the desire not to be inconvenienced, can lead people to engage in unsafe activities when thunderstorms are nearby. Education is the most powerful tool we have for decreasing lightning casualties. People who understand the dangers of lightning and know what actions to take when lightning threatens will make better decisions for themselves and those around them. Without continued lightning awareness efforts, lightning casualties would likely increase.

9. ACKNOWLEDGEMENTS
The authors wish to acknowledge several non-NOAA individuals who are members of NOAA's Lightning Safety Awareness Team and have contributed significantly to NOAA's lightning safety efforts. These include Mr. Ron Holle, Dr. Mary Ann Cooper, Mr. William Roeder, Mr. Richard Kithil, and Mr. Michael Utley. In addition, the authors wish to acknowledge Ms. Melody Magnus for maintaining NOAA's lightning safety web site and the staff of the NWS field offices across the country for their continuing contributions to NOAA's lightning safety awareness efforts.

10. REFERENCES