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## 1. INTRODUCTION

The year 2007 marked the 220th anniversary of the United States (U.S.) Constitution, but also a record year of flood deaths in Texas, and significant flood damage and deaths in many parts of the United States. Decades of awareness efforts have not been fully effective in preventing loss of life and mitigating the financial and emotional impact of flooding. Increasing urbanization and population in coastal and southwestern states indicates that a new type of flood — the urban areal flood — is becoming a major life and property threat for metropolitan areas.

A prime example is Tropical Storm (T.S.) Allison, which struck southeast Texas from June 5-10, 2002. Twenty-two people lost their lives, nearly 50,000 homes were flooded, and over \$5 billion in damage occurred in the Houston metropolitan area. Despite accurate forecasts, extensive pre-event flood awareness outreach, and continuous media coverage during the event, many were still surprised by the intensity of rainfall and consequent flooding.

Some of the outcomes during T.S. Allison (e.g., driving through floodwaters) were also common in prior events. Other outcomes were new, generally resulting from an increasingly urban, unprepared population, expecting to receive instant, detailed flood information. From all of the outcomes, two primary themes emerged. First, there was a general lack of planning by individuals and businesses. Second, a communication gap existed between official warnings and announcements and what the public actually expected. Subsequent floods across the U.S. have reinforced these themes.

Therefore, a new flash flood action paradigm is necessary. The paradigm is based on two tenets: i) flash floods have occurred before and will occur again; ii) protection of lives and property is most effective before an event takes place. The first may seem obvious, but many businesses and individuals do not fully accept their risk from floods, or they have moved to a coastal or flash runoff area and are unaware of the threat. The second tenet is based on the fact that even a flash flood warning lead-time of one hour still leaves precious little time for those affected to take action.

A new approach to personal flood safety is proposed, based on the five main principles in the preamble of the U.S. Constitution: 1. establish justice; 2. ensure domestic tranquility; 3. provide for the common defense; 4. promote the general welfare; 5. secure the blessings of liberty. This offers a solution for personal flood safety, along with an easily remembered mnemonic, and call for a higher level of commitment — as one would pledge to defend the U.S. Constitution.

Section 2 lists five main principles to eliminate or mitigate the emotional, financial, and loss of life risks from flash floods. Section 3 describes outreach efforts and Section 4 contains conclusions.

## 2. MAIN PRINCIPLES

What can individuals do to protect themselves, property, and communities? Five simple steps can nearly eliminate the risks of death, injury, and financial loss from flooding.

### 2.1 *Establish Justice*

Floods happen across the entire country, can occur in all seasons, and range in temporal spectrum from flash floods lasting minutes or hours, to mainstem river floods lasting for weeks. Simple questions can be asked, such as in the case of Houston: if it's known as the Bayou City, and bayous are essentially standing water, why are residents surprised when flooding occurs? In

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another example, the Texas Hill Country has numerous low water crossings (which can only be crossed when the water level is low), yet many die precisely at these locations when their vehicles are swept away while trying to cross when the water level is high, yet there is still surprise when these floods occur.

In short, establishing justice means that each individual is responsible for their own flood safety. Government, through the National Weather Service (NWS), emergency management, and first responders, will attempt to provide warning, planning, and rescue. Yet, it is impossible to respond to every potential situation. Responsibility for taking appropriate action rests with the individual, and hence indicates the need for a simple, low-cost, education program such as the one proposed herein.

## 2.2 Ensure Domestic Tranquility

The largest financial asset for most people is their home. Many have an emotional tie to their home and neighborhood; so protecting the ability to repair or replace one's home is important. The irony is that most homeowners' policies do not cover flood damage. Supplemental, low-cost flood insurance is one of the best deals around. Too often, homeowners find this out after they have been flooded.

Flood insurance is available from the National Flood Insurance Program (NFIP). This program is administered by the Federal Government, available through regular insurance agents (or from the NFIP), very reasonably priced, and covers flood damage. How reasonably priced? Table 1 shows the cost for various amounts of coverage for most homeowners — those who live outside the 100-year flood plain. The 100-year flood plain has a one percent chance per year, or 30 percent chance over a standard 30-year mortgage, of being flooded. For example, coverage for a \$150,000 home and \$38,000 of contents is only \$251 per year (Federal Emergency Management Agency (FEMA), 2008). More than 25 percent of NFIP claims have come from structures outside identified flood plains — meaning those claimants received a substantial benefit for a small cost.

## 2.3 Provide for the Common Defense

Even with flood insurance, repairing flood damage takes time and effort. There are simple, low-cost ways to prevent or minimize damage and the disruption of normal activities caused by flooding. For example, if water starts to enter the home, shutting off the power at the main circuit breaker will prevent appliances from short-circuiting and eliminate the threat of electrocution to those in the home. Similarly, outside air conditioning units can be raised on platforms above ground level.

**Table 1.** Preferred risk coverage and premiums for residences without basements (i.e., most homes in FL, TX, AZ, NV, CA outside the 100-year floodplain).

Structure Coverage	Contents Coverage	Annual Premium
\$100,000	\$40,000	\$257
\$125,000	\$50,000	\$277
\$150,000	\$60,000	\$296
\$200,000	\$80,000	\$326
\$250,000	\$1000,000	\$348

If one's possessions are protected, the focus then shifts to making good decisions to save your life during a flood. In many emergency situations, people either panic or withdraw — neither of which leads to effective action. Gathering information and developing a plan of action beforehand helps alleviate these reactions. One example is purchasing detailed road maps for your area. These maps allow you to plan an evacuation route and alternatives if floodwaters or traffic block your primary route. Most metropolitan areas have detailed maps available at special map stores; residents in rural counties should contact emergency management officials or the county sheriff for assistance.

Once flooding is imminent, an excellent source of information is a National Oceanic and Atmospheric Administration (NOAA) Weather Radio All Hazards (NWR). NWRs receive continuous broadcasts of forecasts, statements, and warnings from the NWS twenty-four hours a day. Many models have an alarm feature that will sound a tone when a warning is issued for user-selected counties. NWRs are available at electronics stores and through Internet sites, generally running from \$30 to \$75.

## **2.4 Promote the General Welfare**

Consider these questions: i) How many people would drive directly into a tornado? ii) Yet, how many have driven directly into floodwaters? Both are a significant risk to one's life; the former is considered an act of insanity, the latter occurs with almost every flood event. Despite consistent warnings to avoid flooded roads over the past thirty years, the majority of fatalities from floods are those swept away in their vehicles or drowned after evacuating a stalled vehicle. Nineteen of the twenty-two deaths and many of the emergency rescues during Allison were related to driving or walking through floodwaters. In contrast, only three died (of electrocution) from the 48,000+ homes flooded.

The Turn Around Don't Drown® (TADD) program has been cited anecdotally as reducing the numbers of those perishing in, or requiring rescue from, flooded vehicles. However, the true success rate of flood awareness efforts such as TADD is unknown, and continued mortality and rescues during floods indicate the message of avoiding flooded roads is still not completely effective.

Therefore, people should be urged toward a higher level of flood avoidance by considering the impact driving on flooded roads has on first responders (police, fire, rescue), whose lives are unnecessarily put at risk when trying to rescue motorists whose cars have stalled or have been swept away by flood waters. Moreover, first responders assisting motorists are not available for medical emergencies or to evacuate the elderly or those needing special assistance. Additionally, people should be encouraged to stay at their current location unless specifically told to evacuate, rather than risk driving in floodwaters.

## **2.5 Secure the Blessings of Liberty**

Most people have accumulated a large number of possessions. Many possessions are replaceable, but a few special items are not. Flood victims often state they wish they had saved pictures, important documents (e.g., a marriage license), collectibles, and family heirlooms from floodwaters. In many cases they didn't have the means nor the time to transport the valuables to safety.

A very simple solution to save these valuables is to buy plastic containers with locking tops. These containers allow one to organize and protect valuables, then be put out of floodwaters' reach (in the attic or evacuated). Home improvement, hardware, and discount stores carry the containers, with prices ranging from \$5 to \$50 each. Regular storage of valuables in the containers greatly reduces the amount of time it takes to move them, or the need to move them at all if stored in a high place such as an attic. NWS flash flood warning lead times currently average around 50 minutes. Assuming an individual may not receive the warning immediately and must still have time to evacuate safely, all valuables should be secured and be moveable within fifteen minutes — the 15-Minute Rule. This implies that most of the items should be in the plastic containers as part of routine storage.

## **3. OUTREACH EFFORTS**

The five principles listed in Section 2 are only a first step toward making a difference in flood impact mitigation. Only cooperation among media, emergency managers, and disaster relief agencies (e.g., FEMA and the American Red Cross), and active outreach by all parties, will result in reduced emotional and financial impacts from floods.

Efforts at the NWS Austin/San Antonio Weather Forecast Office (WFO) include the delivery of local and regional presentations to emergency management, media, business and civic groups. Additionally, the program has been presented at the National Weather Association Annual Meeting (2007), this conference, and in teletraining seminars for NWS Southern Region WFOs

The 2002 NWS Houston/Galveston Hurricane Workshop theme was the flood impacts of T.S. Allison and how to prepare for future events — featuring an earlier version of the five-step action plan described in this paper. In addition, a 15-minute video was produced to provide a visual introduction and demonstration of the five-step action plan (NOAA, 2002a).

A parallel effort was undertaken by the NWS Southern Region Headquarters (SRH) to produce brochures on inland flooding from tropical cyclones to accompany the annual NOAA P-3 Hurricane Research Aircraft Tour. Members of the

team included meteorologists and hydrologists from WFO Houston/Galveston, TX, WFO Ft. Worth, TX, River Forecast Center Peachtree City, GA, and SRH. Two brochures were distributed with the P-3 tour (NOAA, 2002b, c), and additional copies were mailed to all NWS Southern Region WFOs.

#### **4. CONCLUSIONS**

In summary, major inland flooding associated with tropical cyclones, stalled fronts, mesoscale convective systems, and individual or clusters of thunderstorms has occurred, and will occur again. Flood control projects and development planning can reduce some of the risk, but a substantial threat from flooding will remain, especially for those living in coastal areas and the southwestern U.S..

The five principles from the Preamble of the U.S. Constitution: 1. establish justice; 2. ensure domestic tranquility; 3. provide for the common defense; 4. promote the general welfare; 5. secure the blessings of liberty, are simple, low-cost ways to significantly reduce the emotional, financial, and death risks from flooding. Nearly all deaths from flooding are preventable, irreplaceable possessions can be protected, and physical and financial losses to homes drastically reduced. The only question is if individuals choose to act.

#### **5. ACKNOWLEDGMENT**

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