Tsunami: Interesting Facts and F.A.Q.

- Greek historian Thucydides (460–395 B.C.) in his *History of the Peloponnesian War*was the first to associate tsunamis with underwater earthquakes.

- In the deepest part of the ocean, tsunami waves are often only 1 to 3 feet tall. Sailors may not even realize that tsunami waves are passing beneath them.

- The Indonesia 9.0 earthquake in 2004 released more energy than all the earthquakes on the planet in the last 25 years combined. A segment of seafloor the size of the state of California moved upward and seaward by more than 30 feet, displacing huge amounts of water.

- Approximately 99% of all tsunami-related fatalities have occurred within 160 miles (250 km) of the tsunami's origin or within 30 minutes of when the tsunami was generated. Consequently, anyone in a coastal area who feels a strong earthquake should take that as a natural warning that a tsunami may be imminent and leave low-lying coastal areas.

- The states in the U.S. at greatest risk for tsunamis are Hawaii, Alaska, Washington, Oregon, and California.

- While no one has witnessed a tsunami caused by a meteorite, many scientists think that a meteorite may have created a tsunami that wiped out life on Earth more than 3.5 billion years ago.

- Scientists believe that an asteroid struck the Indian Ocean about 4,800 years ago. The tsunami that resulted is theorized to have been approximately 600 feet (180 m) high.

- Palm trees with their long, bare trunks are well adapted to life on the shore and often survive tsunamis intact.

- A "mega-tsunami" is a tsunami with extremely high waves and is usually caused by a landslide. A mega-tsunami occurred at Lituya Bay, Alaska, in 1958, creating the tallest tsunami ever recorded at 1,700 feet (534 m) high. Miraculously, only two people died.

Q. Where and how frequently are tsunamis generated?
Most tsunamis occur in the Pacific and Indian Oceans. The boundary of the Pacific Ocean, known as the Ring of Fire, experiences frequent earthquakes. There are two major subduction zones in the Indian Ocean that can also generate tsunamis. The frequency of tsunamis is variable across the globe and over time. In the two years after the event of 26 December 2004 the Pacific Tsunami Warning Centre (PTWC) issued 52 tsunami alerts for six tsunamia, two of which resulted in significant loss of life. The major Japan (Tohoku) tsunami event of 11 March 2011 killed over 20,000 people.

Q. How are tsunamis detected?
Typically, earthquakes that may generate a tsunami are detected through a network of seismic

monitoring stations. Any resulting tsunamis are then verified by sea-level monitoring stations and deep ocean tsunami detection buoys. The seismic monitoring stations can determine the location and depth of earthquakes that have the potential to cause tsunamis. The sea-level gauges and deep ocean tsunami detection buoys then measure any abnormal changes in sea level to verify if a tsunami has been generated.

Q. What are the warning signs of a tsunami?
The number one warning sign of a tsunami in Australia is the advice you may receive from the media (on radio or television) or from police and other emergency services. Follow their instructions immediately.

The following are natural signs of a tsunami that you may, but not always, experience when you are near the coast in Australia or overseas. If you notice any of these three warning signs take action.

- A shaking of the ground in coastal regions may reflect the occurence of a large undersea earthquake nearby that may generate a tsunami.
- As a tsunami approaches shorelines, the sea may, but not always, withdraw from the beach (like a very low and fast tide) before returning as a fast-moving tsunami.
- A roaring sound may precede the arrival of a tsunami.

Q. What should I do if I notice the warning signs or hear a warning from my local emergency services?

- If you are at the beach, immediately move inland or to higher ground.
- If your boat is in deep water and offshore, maintain your position.
- If your boat is berthed or in shallow water, secure your vessel and move inland or to higher ground.
- If you are on the coast and cannot move inland, seek shelter in the upper levels of a stable building.
- Do not return to the coast until you receive official clearance.
- Continue to follow emergency services instructions.

Q. What does the word "tsunami" mean?
"Tsunami" comes from the Japanese words for harbor ("tsu") and wave ("nami").
Q. Do "tsunami" and "tidal wave"" mean the same thing?
No, but unfortunately some people commonly refer to tsunamis as "tidal waves", which is incorrect since tsunamis have nothing to do with the tides. Tides result from the gravitational attraction of the Moon and Sun.

Q. How are tsunami waves different from normal ocean waves?
Both normal ocean waves and tsunami waves can be described by their period (time between two waves), wavelength (horizontal distance between waves), amplitude (wave height), and speed. Normal ocean waves are caused by the wind, weather, tides, and currents. They have periods of 5-20 seconds, wavelengths of 100-200 meters (300-600 feet), and travel at speeds of 8-100 km per hour (5-60 miles per hour). Tsunami waves have much longer periods of 10 minutes to 2 hours, wavelengths of 100-500 km (60-300 miles), and travel at speeds of 800-1000 km per hour (500-600 miles per hour). The amplitude of normal waves and tsunami waves are similar in deep ocean water, but near shore, tsunami waves can be much larger with heights of 10 meters (32 feet) or more. Furthermore,

normal ocean waves only involve motion of the uppermost layer of the water, but tsunami waves involve movement of the entire water column from surface to seafloor. This means a normal wave is like a small ripple on top of the ocean, but tsunamis are like the entire ocean getting deeper all at once.

Q. How many waves are there in a tsunami?
A tsunami generally consists of a series of waves, often referred to as the tsunami wave train. The amount of time between successive waves, known as the wave period, is only a few minutes; in some instances, waves are over an hour apart. Many people have lost their lives after returning home in between the waves of a tsunami, thinking that the waves had stopped coming.

Q. How fast do tsunamis travel?
Tsunami wave speed is controlled by water depth. Where the ocean is over 6,000 meters (3.7 miles) deep, unnoticed tsunami waves can travel at the speed of a commercial jet plane, over 800 km per hour (500 miles per hour). Tsunamis travel much slower in shallower coastal waters where their wave heights begin to increase dramatically.

Q. What does a tsunami look like when it reaches the shore?
As the leading edge of a tsunami wave approaches shore, it slows dramatically due to the shallower water. However, the trailing p art of the wave can still be moving rapidly in the deeper water. This results in a "piling up" of the tsunami energy, and the tsunami wave height grows. The wave looks and acts like giant river of water on top of the ocean that floods the shore.

Q. How long do tsunamis last when they happen?
Since a tsunami consists of a series of waves, the danger can last for many hours. Large tsunamis are generally recorded for a few days following the event.

Q. Do all large undersea earthquakes generate tsunamis?
No. The earthquake must cause significant vertical deformation of the seafloor in order for a tsunami to occur. Tsunamis are more likely to happen from shallower and larger earthquakes than deeper or smaller ones.

Q. What is the "wrap-around" effect?
As large tsunami waves approach islands, they may refract or bend around them and diffract through the channels between the islands as well. The ability of a tsunami wave to bend around and through the islands is called the wrap-around effect. During the wrap-around effect, the energy of the tsunami often decreases resulting in smaller wave heights. Sometimes tsunami waves will reflect off of a land mass instead of bending around, thereby increasing wave height of the approaching wave.

Q. What should I do in the event of a tsunami warning?
If you are in school and you hear there is a tsunami warning, you should follow the advice of teachers and other school personnel.

If you are at home and hear there is a tsunami warning, you should make sure your entire family is aware of the warning. Your family should evacuate your house if you live in a tsunami evacuation zone. Move in an orderly, calm and safe manner to the evacuation site or to any safe place outside your evacuation zone. Follow the advice of local emergency and law enforcement authorities.

If you are at the beach or near the ocean and you feel the earth shake, move immediately to higher ground. DO NOT wait for a tsunami warning to be announced. Stay away from rivers and streams that lead to the ocean as you would stay away from the beach and ocean if there is a tsunami. A tsunami from a local earthquake could strike some areas before a tsunami warning could be announced.

Tsunamis generated in distant locations will generally give people enough time to move to higher ground. For locally-generated tsunamis, where you might feel the ground shake, you may only have a few minutes to move to higher ground.

High, multi-story, reinforced concrete hotels are located in many low-lying coastal areas. The upper floors of these hotels can provide a safe place to find refuge should there be a tsunami warning and you cannot move quickly inland to higher ground. Local Civil Defense procedures may, however, not allow this type of evacuation in your area. Homes and small buildings located in low lying coastal areas are not designed to withstand tsunami impacts. Do not stay in these structures should there be a tsunami warning.

Offshore reefs and shallow areas may help break the force of tsunami waves, but large and dangerous waves can still be threat to coastal residents in these areas. Staying away fro all low-lying coastal areas is the safest advice when there is a tsunami warning.