



Reading Science

Name: _____ Date: _____

Supersonic Ships?

1 Sound waves move differently through different media. In general, they travel faster in liquids and solids than in air. The speed of sound in dry air is 343 m/s at 20°C. It is faster at sea level than at higher altitude. The extra speed is because the air is denser at sea level. Increased humidity also makes sound a little faster. Airplane speeds are often reported in Mach numbers. The Mach number depends on the medium that the object travels through. To find the Mach number, start with the speed of an object. Divide it by the speed of sound in that medium.



- 2 Sound travels much faster through water. The speed of sound through seawater is 1,533 m/s. However, it is only 1,493 m/s through freshwater at the same temperature and depth. Sound goes faster as temperature and salinity go up. Sound also travels faster as water pressure goes up. Deeper water in the ocean is under higher pressure. By comparison, the speed of sound in steel is about 5,100 m/s. Therefore, you can hear an approaching train from farther away by putting your ear on the railroad track.
- 3 Watch the sky near an Air Force base. A fast-moving fighter jet might be followed by a loud boom. The boom means that the jet has broken the sound barrier. A flying airplane pushes the air ahead of it. It is harder to push the air as it approaches the speed of sound. The air does not have time to get out of the way. A sonic boom happens as the airplane breaks through the sound barrier. The sonic boom wave starts at the nose of the plane. It sweeps to the back, as shown in the picture above. The sonic boom travels at the speed of sound away from the aircraft. It will reach you after the aircraft has passed.
- 4 On October 14, 1947, Charles “Chuck” Yeager flew the *Bell X-1*. He was the first person to break the sound barrier in level flight. Since then, both military and commercial aircraft have broken the sound barrier. The fastest manned plane is the *SR 71 Blackbird*. (Some unmanned aircraft have traveled faster.) It has traveled at 936 m/s. This is about three times the speed of sound, Mach 3. The *SR 71 Blackbird* set records for a manned air-breathing flight. It went higher and faster. The *SR 71 Blackbird* was retired in 1999. The *Concorde* was the only supersonic commercial airliner. It only flew between New York and Paris. It flew at twice the speed of sound and had a cruising speed of Mach 2. Only 20 *Concordes* were ever built. It was retired in 2003.



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- 5 In contrast, the fastest ship was the *Spirit of Australia*. It traveled at 142 m/s in 1978. In freshwater, this would be about 0.1 Mach. Merchant ships carry cargo. They are more concerned about fuel costs than about going fast. They travel about 11 m/s. Cruise ships carry passengers. They try to arrive in port in the morning. They must give the passengers time to explore the city. They may travel slightly faster. The fastest Navy ships travel about 26 m/s. During wartime, ships may have to worry about torpedoes. Torpedoes can travel faster than ships. They are much smaller and more streamlined than ships. Even torpedoes travel below the speed of sound. The fastest torpedo runs about 103 m/s. Ships use sonar to detect torpedoes with sound waves. Ships must detect the torpedo before it arrives; otherwise, they cannot avoid being hit.
- 6 There are many problems that make it hard to build supersonic ships. The first is how objects move through water. Water is much more dense than air. Thus, water has much more drag than air. The friction and turbulence slow things down. Also, sound travels through water much faster than it travels through air. These facts make it difficult to build a supersonic ship.