Solar System Activity Bag

Space Spinoff Answer Key

NASA Problem	Product
1. **How to measure a planet's temperature?** - To take temperatures of space objects such as planets or stars, scientists launched an "Infrared Astronomical Satellite." Onboard was an instrument that looks at distant objects and exactly measures their heat waves. The key component is a sensor that precisely changes the amount of electricity that passes through it according to the energy of heat waves that strike it.	**Infrared Thermometers** - In 1982, to measure temperatures of objects in the sky, NASA devised extremely sensitive heat measuring tools for the IRAS satellite. These tools read infrared radiation emitted from objects in space. Soon after, scientists from NASA's Jet Propulsion Laboratory helped Diatek Corporation adapt these sensors for medical use. In 1991, Diatek released the model 7000 infrared thermometer, which quickly reads body temperature by measuring infrared energy emitted from the eardrum. Although electronic thermometers were already available, this was the first made with sensors modified from spae technology.
2. **Protecting astronauts from impact and g-forces.** - The problem was to protect astronauts while launching, re-entering the atmosphere, and plummeting into the ocean. Also, in a crash, passengers in airplanes needed a better form of padding. For all of these applications, they needed something that could absorb a high-energy impact and still feel soft.	**Temper Foam** - At the time, the rubber foam made with many small bubbles inside would not absorb enough impact and still feel soft. Ames Research Center developed a new foam with interconnected "open" holes inside, called temper foam. Now called memory foam, it is used in cars, motorcycles, safety equipment, and furniture. It is also commonly used for mattresses and pillows.
3. **Protecting a heat-seeking missile's antenna.** - Heat-seeking missiles use an antenna to track heat from jet engines that are their targets. This antenna needs protection in order to work while flying on a missile. It has to be covered by a clear material that can be easily formed over the antenna, yet is hard. To do this NASA developed a special transparent ceramic material.	**Invisible Braces** - While transparent ceramics were being developed, a company called Unitek was redesigning braces. The antenna cover material turned out to be ideal for braces - tough, hard to see, and easy to shape. Invisible braces quickly became very successful.

4. **Stronger parachute straps.** - When NASA recovered Apollo 15 after it returned to Earth in 1971, they found that some of the straps connecting it to its parachute were missing. They could not allow this to happen on Mars landing. To land safely, the parachute straps had to be much stronger than those on Apollo 15. NASA's problem was to find a new material to make those straps stronger than steel.	**Better Radial Tires** - For parachute straps to attach the Mars Viking Lander, Goodyear Tire Company developed a fibrous material five times stronger than steel. Recognizing how durable this material is, Goodyear used it to produce a radial tire that goes 10,000 miles farther than any other radials at the time.
5. **Lightweight parts** - systems that move parts on wings to control flight can be heavy. To make them lighter, NASA wanted parts that did not move but simply changed shape. To do that, they needed metals that change shape when heated or cooled, and return to their original shape when the temperature changes back, a property called "shape memory."	**Golf Clubs with More Control** - Under contract from NASA, McDonnell Douglas and Memry® Corporation developed nitinol metal, an alloy of nickel and titanium. After a force deforms this very elastic metal, it springs back to its original shape. It also changes shape when the temperature changes. It can be used to make super lightweight parts that change shape without otherwise moving. After supplying nitinol to NASA for wing flight controllers, Memry® Corporation saw other applications. One application was in golf club faces. Memry® Corporation developed a version of shape memory allow called Zeemet® for that purpose. Today, these clubs are very popular among golfers.