So You Want To Be A Rocket Scientist?

Rockets have been around for a long time. They were probably invented by the Chinese around 800 years ago. They were used for fireworks and as "fire arrows" in battle as early as 1232 A.D. Today rockets have many uses, most notably as an integral part of the space program.

Rockets work according to Isaac Newton's Third Law of Motion which states, "For every action there is an equal and opposite reaction." Thus rockets send exhaust gasses backwards, the action, causing the rocket to go forwards, the opposite reaction. An example is a balloon where air blows out of the opening causing the balloon to fly in the opposite direction.

In the case of chemical rockets the reaction mass is the hot gas that is the result of the combustion of the propellants. As they burn they produce a lot of gas and build up a great deal of pressure inside the motor. The pressure forces the gas out the rear of the motor, like with the balloon, at a very high speed, making the rocket go forwards.

The reaction mass can be accelerated using many different methods. For example, ion engines use electricity to shoot plasma (a very, very hot gas) out the back of the motor. The experimental NERVA rocket used an atomic reactor to heat the reaction mass and project Orion in the late 1950's planned on using atomic bombs to push a rocket into space.

However most of the rockets you are likely to see use some form of chemical propellant. There are solid propellant rockets where the fuel and oxidizer is mixed together in a solid piece. Examples of this are the Shuttle solid booster motors and model rocket motors. Then there are liquid engines. In these both the fuel and oxidizer are liquids, for example liquid hydrogen and liquid oxygen in the Shuttle's main engines. There are also what are called hybrid motors, where the fuel is solid and the oxidizer is a liquid. An example of this is the motor used on Space Ship 1, the private rocket ship that flew into space in October 2004, winning the X Prize. This motor used nitrous oxide (N_2O) as its oxidizer and rubber, like that in automobile tires, as its fuel. Motors like this are also sometimes used in high power model rocketry.

The first liquid fueled rockets were designed and flown by Robert Goddard in the 1920's and 1930's. The first practical use of modern rockets came in World War II with the development of the German V-2. Designed by Werner Von Braun these liquid fueled rockets flew over 50 miles high and thus became the first man-made objects to reach the edge of space. After the war Von Braun came to the United States and helped design many of the rockets that became the basis of the U. S. space program, including the Saturn V which sent the first men to the moon in 1969.

A wide variety of rockets are in use today, putting satellites into orbit, sending probes to the other planets and transporting supplies and parts for the International Space

Station. Space technology will continue to advance, but rockets of many types will be in use for the exploration and development of space for many years to come.

There are many interesting and rewarding careers available in the aerospace industry. However you don't need to wait until you are older to gain some experience, and have some fun, with rockets. Model rocketry is a fun, safe and educational hobby. Many astronauts and aerospace engineers got their start by flying model rockets. The National Association of Rocketry (NAR) promotes a wide range of rocketry activities. The local NAR section, the Central Illinois Aerospace model rocket club, holds workshops and rocket launches open to everyone who is interested. For more information check out their web sites at **www.nar.org** and **www.CIARocketry.org**.

A list of books, web sites and videos for further information.

Alway, Peter. Rockets of the World. Saturn Press.

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Catchpole, John. Project Mercury. Praxis Publishing, Ltd.

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Gaarder, Jostein. Hello, Is Anybody There? Farrar Straus & Giroux.

Hickam, Homer H., Jr. Rocket Boys. Random House, Inc.

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Reinert, Al. For All Mankind. Video. 1989.

Ride, Sally. To Space and Back. Lothrop Lee & Shepard.

Stine, G. Harry. Handbook of Model Rocketry. John Wiley & Sons, Inc.