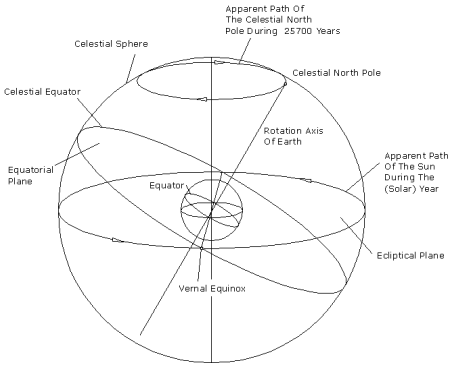
Altitude and **Azimuth** are calculated from the observer's position:
Altitude gives you the "*how above the horizon it is*"; the point straight overhead has an altitude of +90 degrees; straight underneath, an altitude of -90 degrees. Points on the horizon have 0 degree altitudes. An object halfway up in the sky has an altitude of 45 degrees.
Azimuth determines "*which compass direction it can be found in the sky*." An azimuth of zero degrees puts the object in the North. An azimuth of 90 degrees puts the object in the East. An azimuth of 180 degrees puts the object in the South, and one of 270 degrees puts the object in the west. Thus, if Guide tells you that an object is at altitude 30 degrees, azimuth 80 degrees, look a little North of due East, about a third of the way from the horizon to the zenith.
Zenith is the position in the sky directly overhead.
The path in the sky along which the Sun takes is called the **ecliptic**.

The **Celestial Sphere** is the name given to the very large imaginary ***'sphere of sky'*** surrounding the Earth

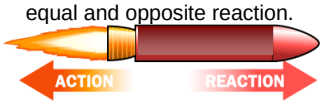


The ***gravitational escape velocity*** has to be achieved (**28,000 km/h**), if humans are to venture into space.

400 B.C	- Archytas used escaping steam to propel a model pigeon along some wires
1st Century	- Chinese used gunpowder to propelled 'flaming arrows'
1700's	- Polish General uses solid fuel rockets in war
Early 1900's	- Konstantin Tsiolkovskii suggested liquid fuel be used for rockets
1920's	- Wernher Von Braun developed the V-2 rocket for war
1926	- Robert Goddard launched the world's first liquid-propellant rocket.
Oct. 4, 1957	- Sputnik was launched by the Russians
Nov, 1957	- Laika (a dog) survived in Earth orbit for 7 days
1961	- Explorer I launched by USA
1962	- Alouette launched by Canada
1969	- First man on the moon
1981	- First launch of the Shuttle

THE SCIENCE OF ROCKETRY

The science of rocketry relies on a basic physics principle: For every action, there is an equal and opposite reaction.



There are three basic parts to a Rocket:

The **structural and mechanical elements** are everything from the rocket itself to engines, storage tanks, and the fins on the outside that help guide the rocket during its flight.

The **fuel** can be any number of materials, including liquid oxygen, gasoline, and liquid hydrogen. The mixture is ignited in a combustion chamber, causing the gases to escape as exhaust out of the nozzle.

The **payload** refers to the materials needed for the flight, including crew, living quarters, food, water, air and equipment for the mission.

Future Space Transport Technology

Ion Drives - engines that use xenon gas instead of chemical fuel. The xenon is electrically charged, accelerated, and then released as exhaust, which provides the thrust for the spacecraft. The thrust is 10 times weaker than traditional engine fuels, but it lasts an extremely long time. The amount of fuel required for space travel is about 1/10 that of conventional crafts.

Solar Sail Spacecraft use the same idea as sailboats. They harness the light of the Sun. The Sun's electromagnetic energy, in the form of photons, hits the carbon fibre solar sails, and is transmitted through the craft to propel it through space. These spacecraft could travel up to 5 times faster than spacecraft today.

Shuttles, Probes and Space Stations

Shuttle

Shuttles transport personnel and equipment to orbiting spacecraft

Mariner 10

Space probes contain instrumentation for carrying out robotic exploration of space

International Space Station

Space Stations are orbiting spacecraft that have living quarters, work areas and support systems to enable personnel to live in space for extended periods

Manned interplanetary space missions, possibly to Mars or Jupiter (one of it's Moons), or the colonization of the moon are the future. Building a remote spacecraft-launching site (on the Moon, or on the International Space Station) is the first step to enable interplanetary flight to become a reality and will reduce the cost dramatically.

Space probes are unmanned satellites or remote-controlled '*landers*' that put equipment on or close to planets where no human has gone before. Probes have done remote sensing on Mercury and Jupiter, taken soil samples on Mars, landed on Venus, and studied Saturn's rings up close. The most recent probes to explore Mars are still there. They are looking for evidence of water to determine if Mars at one time could have sustained life.

The only place that has been explored by humans in space, other than our Earth is the Moon. Apollo 11 was the first landing and there have been many others since. The next step is to establish a base for interplanetary manned missions to Mars.

To go boldly where no human has gone before

Space Hazards

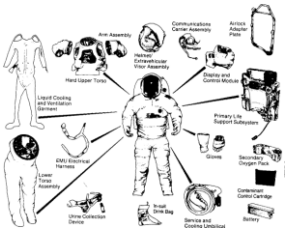
Environmental Hazards - Space is a vacuum with no air or water. Cosmic or solar radiation and meteoroids are the greatest dangers. Because there is no atmosphere, the temperatures in space have both extremes– from extremely hot, to extremely cold. There is also no atmospheric pressure to help regulate the astronaut's heartbeats.

Psychological Challenges - Long trips can present psychological difficulties, as well as claustrophobic feeling of tight living conditions.

Physiological Challenges - microgravity can cause problems because of the effects of weightlessness on the human body. Bones have less pressure on them and so they expand. They also lose calcium and become more brittle. The heart doesn't have to pump as hard to circulate blood. Muscles weaken and shrink. Depth perception is also affected.

The Space Suit

The space suit is a mobile chamber that houses and protects the astronaut from the hostile environment of space. It provides atmosphere for breathing and pressurization, protects from heat, cold, and micrometeoroids, and contains a communications link.



The suit is worn by the astronauts during all critical phases of the mission, during periods when the command module is not pressurized, and during all operations outside the command and lunar modules whether in space, in the International Space Station, or on the moon.