INTERNATIONAL AEROSPACE OLYMPIAD 2020

GROUP A

STUDY MATERIAL

Grade 1ST- 2ND

SPACETRIX AEROSPACE

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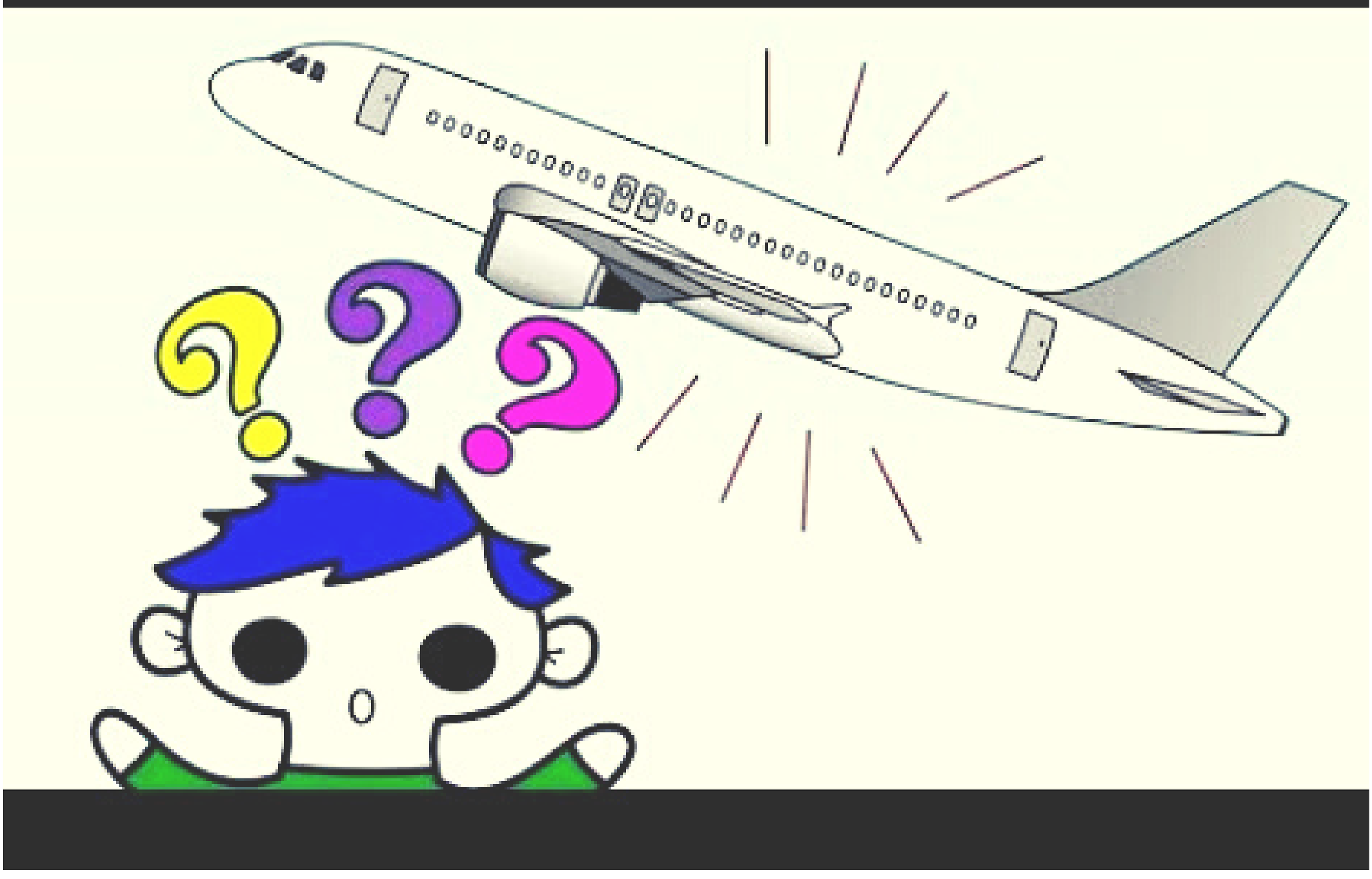
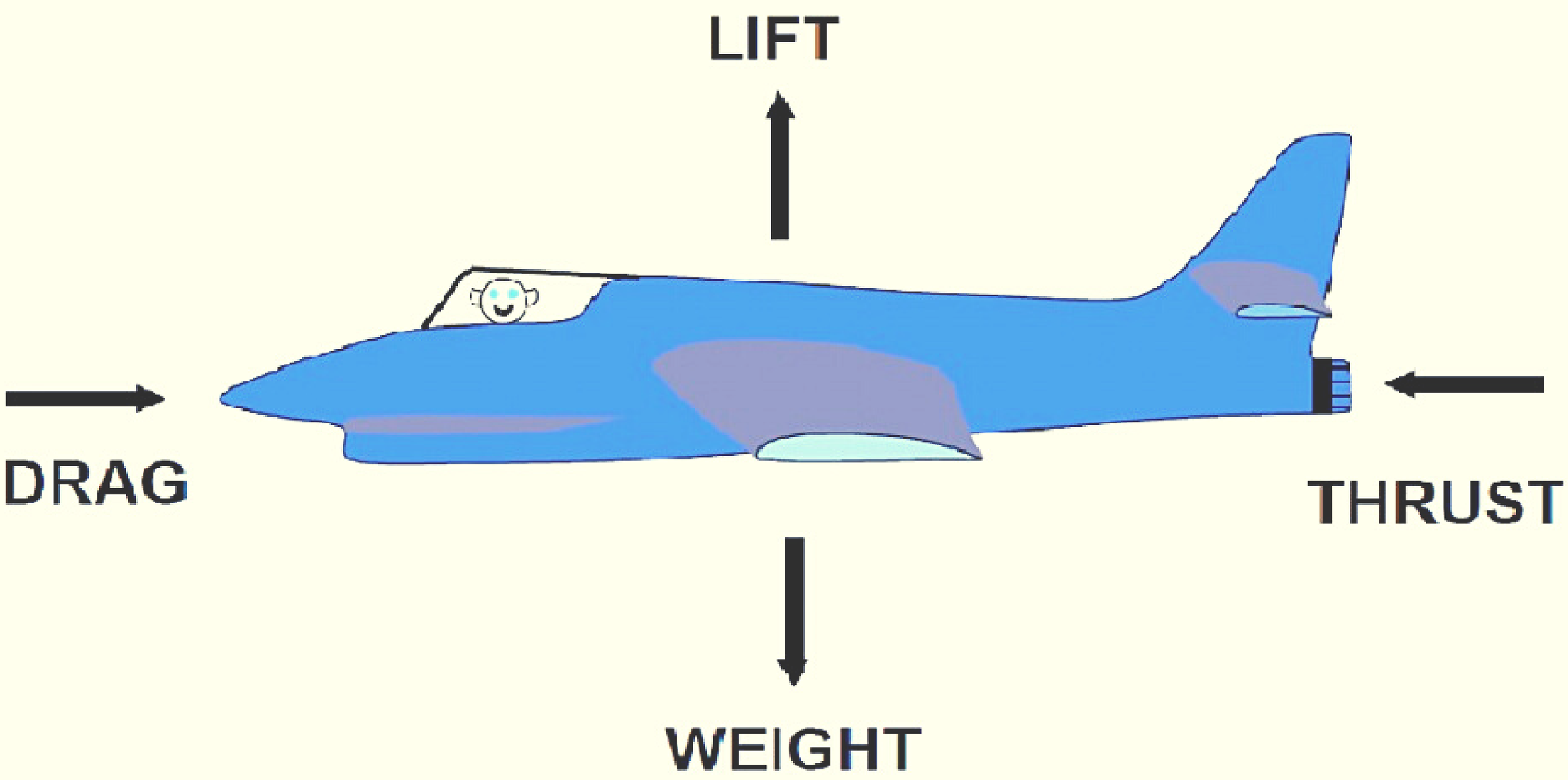


WHAT IS AEROSPACE

AEROSPACE is a term, defined as AERO or the atmosphere surrounding the Earth, and SPACE as the region beyond the Earth's atmosphere or beyond the solar system. From aeronautics to the study of the Earth, to space science and its exploration of objects within the universe, the study of aerospace continues to be a major frontier for discovery.

We have been travelling alone or in crews in vehicles through outer space. Hundreds of unmanned vehicles have also entered regions outside the Earth's atmosphere. A whole new terminology, or system of names, therefore, has been devised to describe the technology and science of all space beyond the Earth's surface. Aerospace is such a word. It describes all the regions beyond the Earth's surface. It includes the atmosphere and the vast expanse of outer space.

The research, design, and production of aeroplanes, missiles, and spacecraft constitute the aerospace industry. Aerospace is a branch of engineering that has two sub-branches. One is aeronautical engineering, and another one is astronautical engineering.



WHAT IS AERONAUTICS

If you ever dreamed of being an astronaut, flying in a fighter jet, working at NASA/ISRO or even completing any kind of physics degree, you've been in some way thinking about aeronautics. Aeronautics is a word with Greek roots that combines the word for air and the word for navigation - so it is literally involved with the navigation of the air. Aeronautics is the study of the science, design, and manufacture of flying vehicles. This includes vehicles that fly only in the air and spacecraft that pass through the air to reach space.

For millennia humans have watched birds and dreamed of being able to fly themselves. Sometimes it was little more than a daydream, but others genuinely tried to make it happen. People have built wings and jumped from tall towers, often crippling or killing themselves in the process. But that goes to show how desperately people wanted to be able to fly.

The Chinese were probably the most successful and used human carrying kites or gliders in ancient China. They also built hot-air balloons, flying toys and lanterns. Balloons were among the earliest flying machines in the West as well.

Roger Bacon was among the first European to come up with the concept for a hot air balloon in the 13th century. Leonardo da Vinci also had multiple designs for possible flying machines, though these weren't discovered until later. It wasn't until the 18th century that these ideas finally came to fruition when the French Montgolfier brothers completed the first manned (tethered) flight. However hot-air balloons weren't perfected until the middle of the 20th century.

Then, humans began to look at planes to make their dreams of flight come true. George Cayley is often considered to be the father of the aeroplane, and his work is considered the start of modern aeronautics. He is particularly famous for following the scientific method in his observations and experiments in flight, and he defined the four forces that affect a flying vehicle: wait, lift thrust, and drag. He also came up with the idea for a fixed-wing aircraft, flew manned and unmanned gliders, and improved human design of parachutes.

It wasn't until 1903 that the Wright brothers completed the first powered and controlled human flight - one of the most famous flights in history.

WHAT IS ASTRONAUTICS

Astronautics is the theory and the practice of travel beyond Earth's atmosphere into outer space. Spaceflight is one of its main applications and space science its overarching field. Astronautics is often referred to as astronomical engineering. It is the science and technology of space flight and is a field of aerospace engineering that deals with machinery designed to work beyond the Earth's atmosphere.

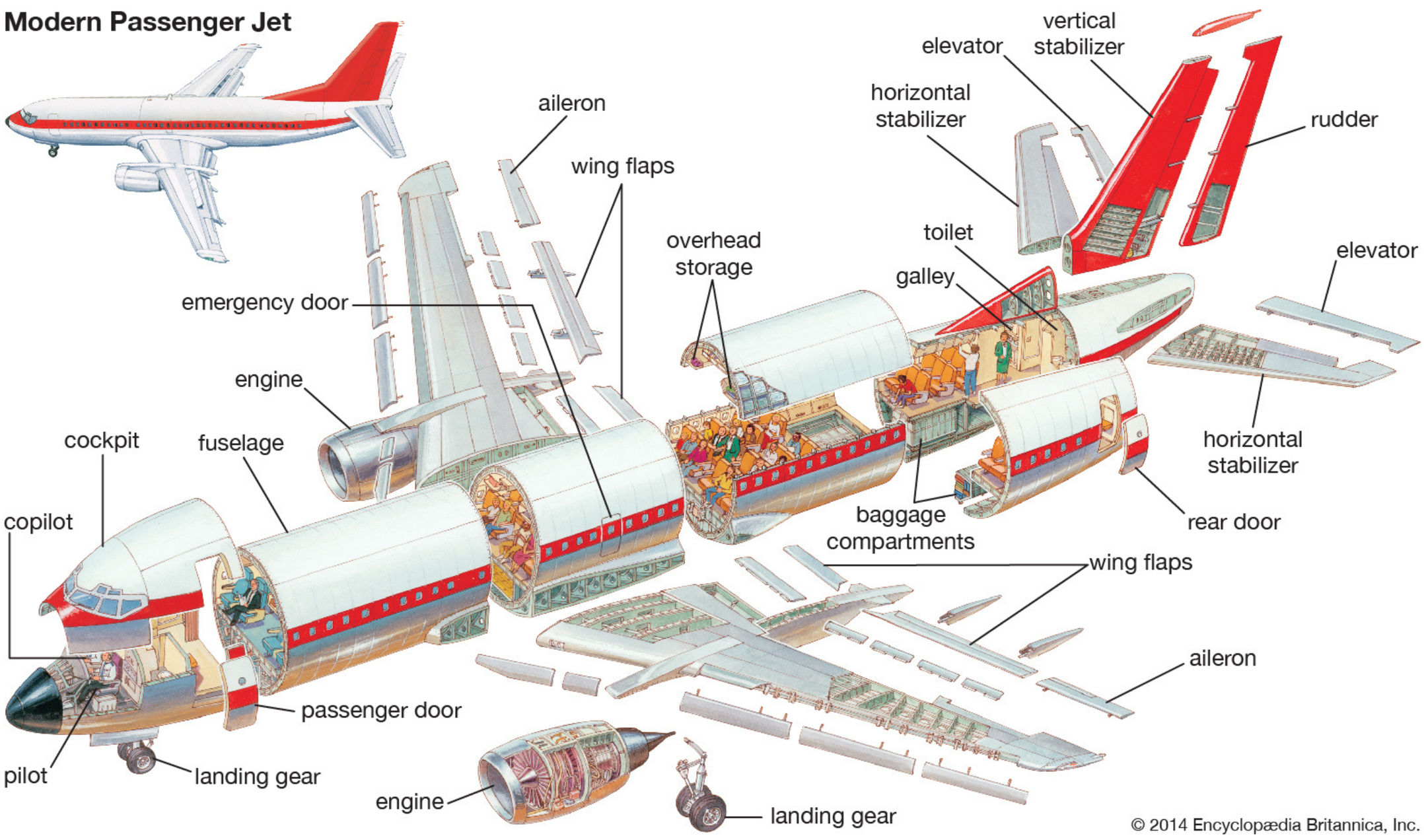
It isn’t uncommon for individuals to confuse astronautics with aeronautics. Although both deal with flight, astronautics has more to do with space vehicles and aeronautics deals with aircraft. When it comes to aircraft, individuals in the field design and construct airframes, engines, and other materials needed for air and space travel. Individuals who work in the field may create space instrumentation, space sensors, and various other space technology devices.

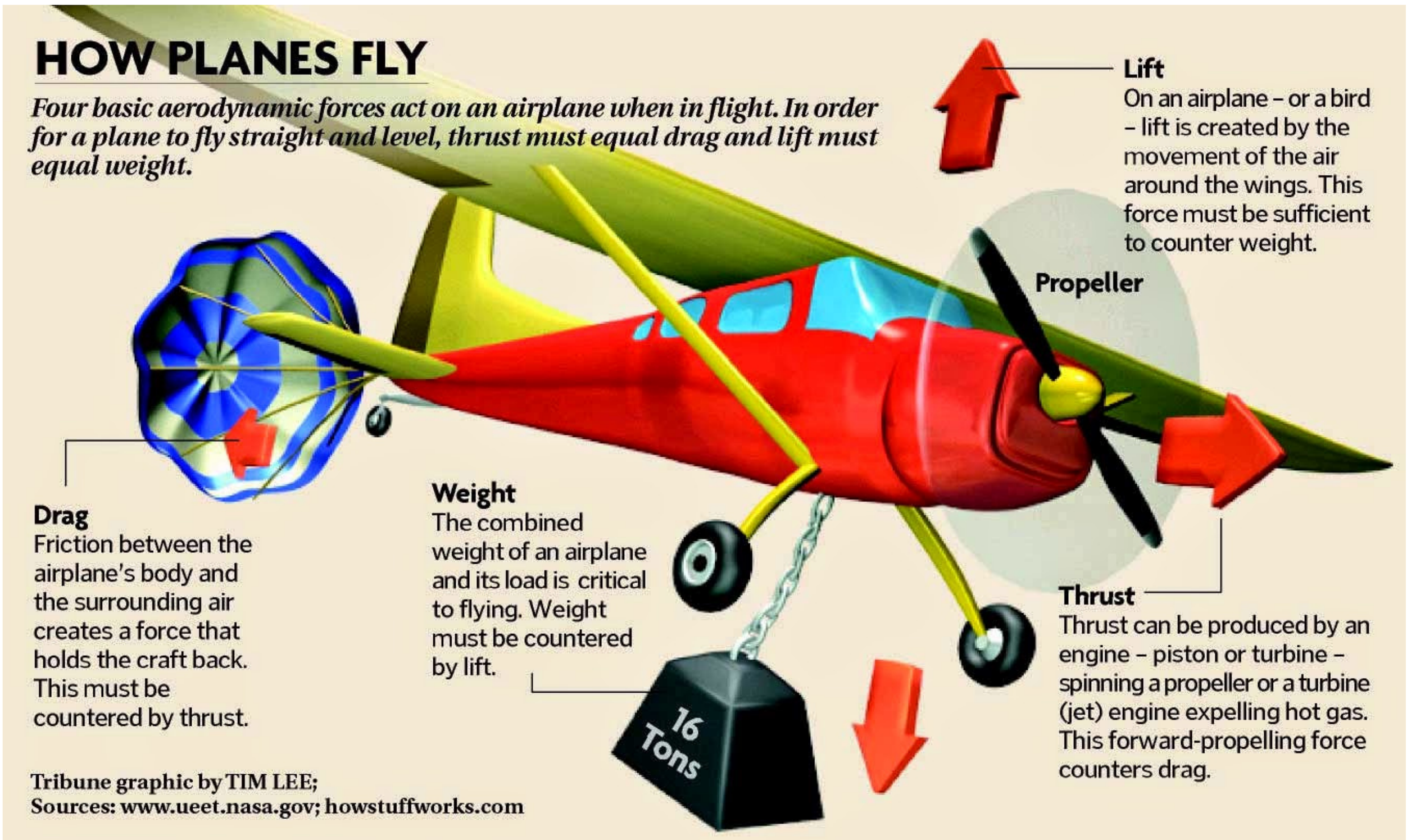
DIFFERENCE BETWEEN AERONAUTICS AND ASTRONAUTICS

When you hear the term aeronautical you should think in terms of flight through the air. Aeronautics and Aeronautical engineering deal with the design of aircraft, aeroplanes, missiles, helicopters – or any similar vehicles that are designed to operate within the confines of the earth's atmosphere.

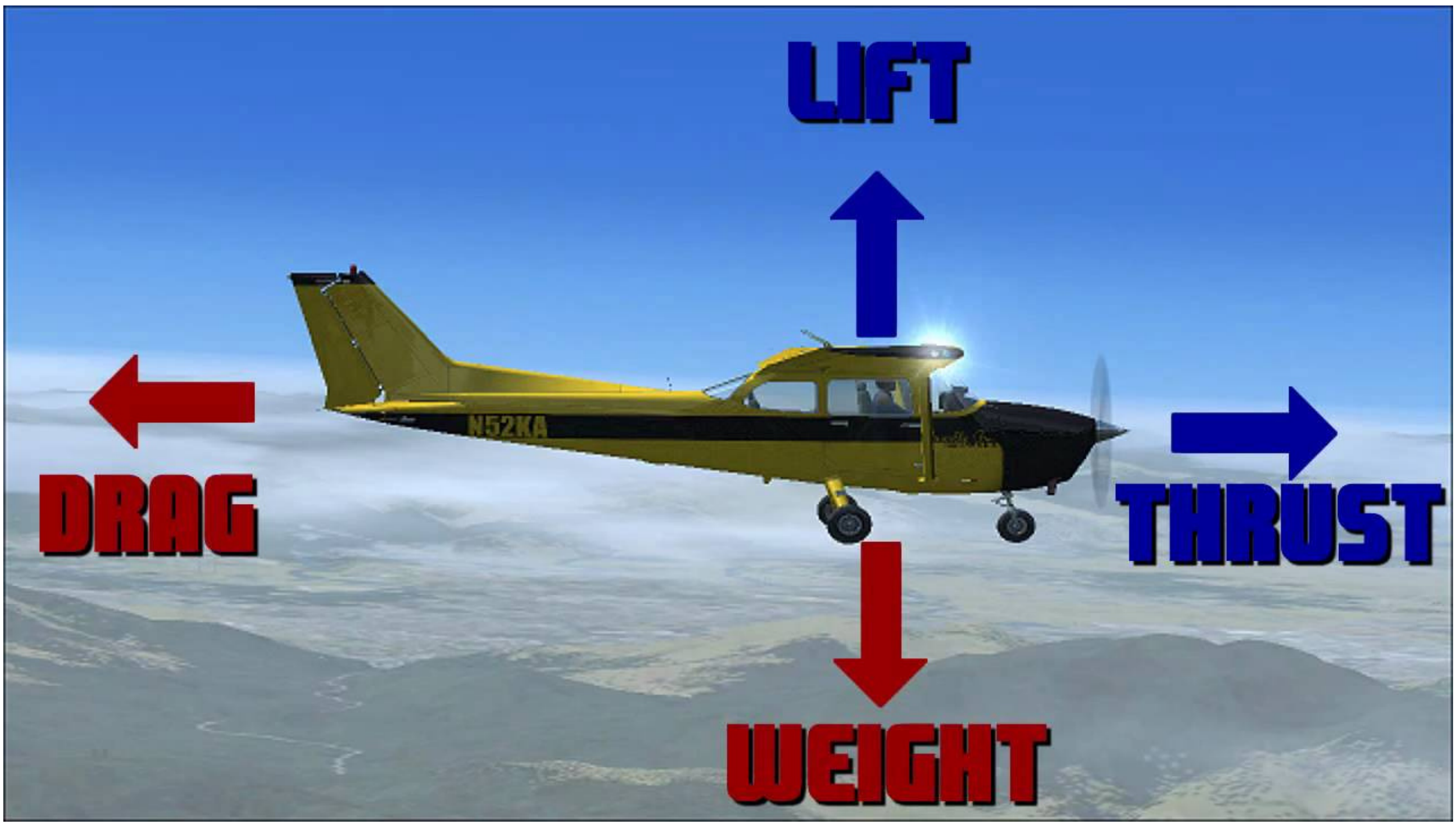
Astronautics deal with travel beyond the confines of the earth's atmosphere. This can involve an interplanetary flight or interstellar flight.

In simple words, aeronautics deals with flight through the air and astronautics deals with operations of vehicles in space i.e. beyond earth's atmosphere.





HOW AEROPLANE FLY? WHAT FORCES ARE ACTING ON THE AEROPLANE?



KALPANA CHAWLA - NASA ASTRONAUT

PERSONAL DATA:
Born in Karnal, India. Died on February 1, 2003 over the southern United States when Space Shuttle Columbia and her crew perished during entry, 16 minutes prior to scheduled landing. She is survived by her husband. Kalpana Chawla enjoyed flying, hiking, back-packing, and reading. She held a Certificated Flight Instructor's license with airplane and glider ratings, Commercial Pilot's licenses for single- and multi-engine land and seaplanes, and Gliders, and instrument rating for airplanes. She enjoyed flying aerobatics and tail-wheel airplanes.

EDUCATION: Graduated from Tagore School, Karnal, India, in 1976. Bachelor of science degree in aeronautical engineering from Punjab Engineering College, India, 1982. Master of science degree in aerospace engineering from University of Texas-Arlington, 1984. Doctorate of philosophy in aerospace engineering from University of Colorado, 1988.

EXPERIENCE:
In 1988, Kalpana Chawla started work at NASA Ames Research Center in the area of powered-lift computational fluid dynamics. Her research concentrated on simulation of complex air flows encountered around aircraft such as the Harrier in "ground-effect." Following completion of this project she supported research in mapping of flow solvers to parallel computers, and testing of these solvers by carrying out powered lift computations. In 1993 Kalpana Chawla joined Overset Methods Inc., Los Altos, California, as Vice President and Research Scientist to form a team with other researchers specializing in simulation of moving multiple body problems. She was responsible for development and implementation of efficient techniques to perform aerodynamic optimization. Results of various projects that Kalpana Chawla participated in are documented in technical conference papers and journals.

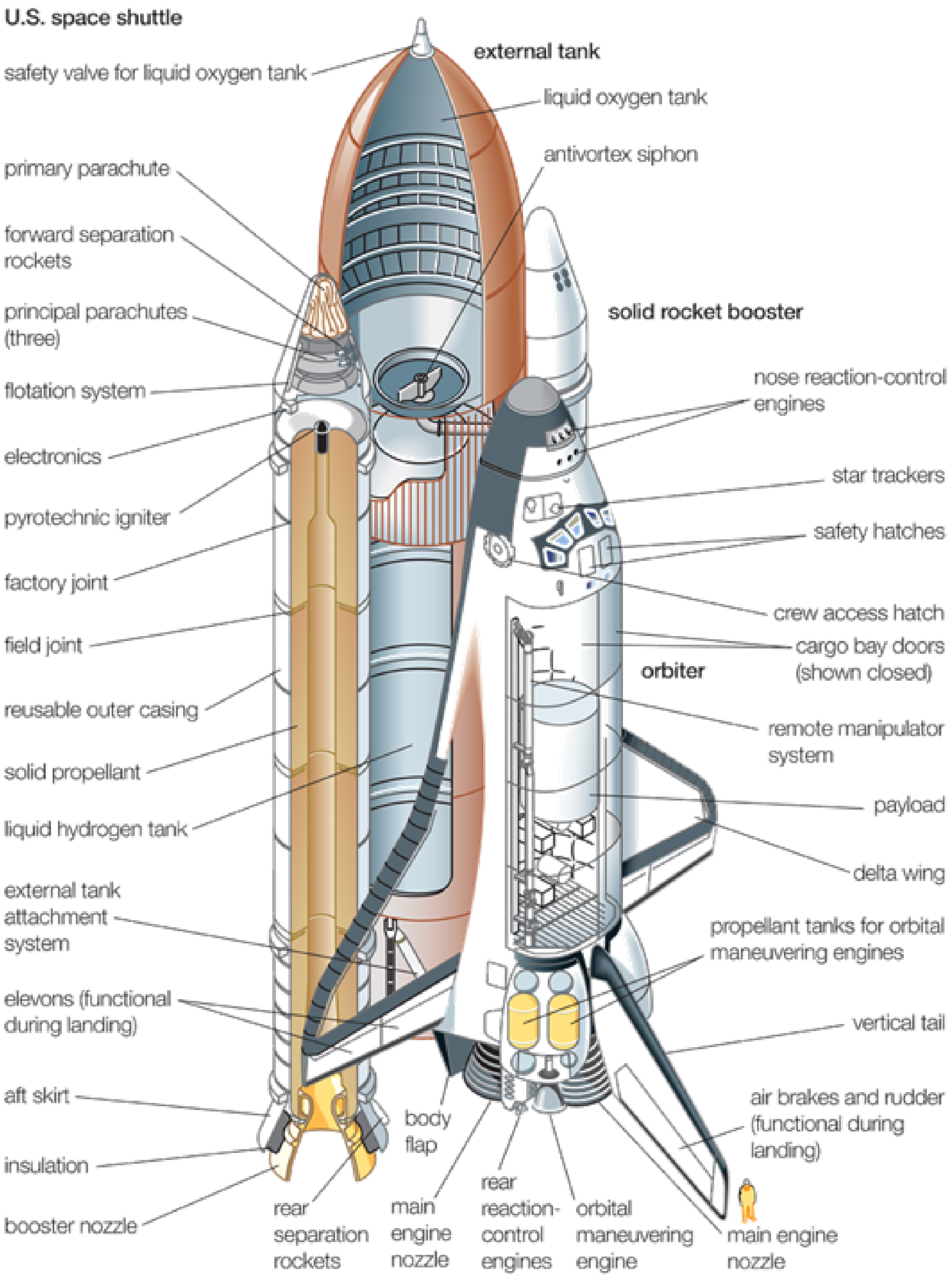
NASA EXPERIENCE: Selected by NASA in December 1994, Kalpana Chawla reported to the Johnson Space Center in March 1995 as an astronaut candidate in the 15th Group of Astronauts. After completing a year of training and evaluation, she was assigned as crew representative to work technical issues for the Astronaut Office EVA/Robotics and Computer Branches. Her assignments included work on development of Robotic Situational Awareness Displays and testing space shuttle control software in the Shuttle Avionics Integration Laboratory. In November, 1996, Kalpana Chawla was assigned as mission specialist and prime robotic arm operator on STS-87. In January 1998, she was assigned as crew representative for shuttle and station flight crew equipment, and subsequently served as lead for Astronaut Office's Crew Systems and Habitability section. She flew on STS-87 (1997) and STS-107 (2003) and has logged 30 days, 14 hours and 54 minutes in space.

SPACE FLIGHT EXPERIENCE: STS-87 Columbia (November 19 to December 5, 1997). STS-87 was the fourth U.S Microgravity Payload flight and focused on experiments designed to study how the weightless environment of space affects various physical processes, and on observations of the Sun's outer atmospheric layers. Two members of the crew performed an EVA (spacewalk) which featured the manual capture of a Spartan satellite, in addition to testing EVA tools and procedures for future Space Station assembly. STS-87 made 252 orbits of the Earth, traveling 6.5 million miles in in 376 hours and 34 minutes.STS-107 Columbia (January 16 to February 1, 2003). Working 24 hours a day, in two alternating shifts, the crew successfully conducted approximately 80 experiments. The STS-107 mission ended abruptly on February 1, 2003 when Space Shuttle Columbia and her crew perished during entry, 16 minutes prior to scheduled landing

SPACE SHUTTLE

NASA's Space Transportation System used the Space Shuttle, which was a low Earth orbital spacecraft that had several reusable parts. The shuttle was made up of the orbiter, the solid rocket boosters, and the external tank. The orbiter and boosters were reusable, but the external tank was not.

The orbiter resembled the shape of an aeroplane and even landed on a runway just as planes do. Up to 7 astronauts could travel in the shuttle and their science experiments or equipment they were delivering would be stored in the payload bay. NASA has diagrams of the orbiter that show exterior and interior views of the various components and also list dimensions and weight. The ET, or external tank, was a large orange fuel tank that was attached to the underside of the orbiter. The SRBs, or solid rocket boosters, were two tall, thin rockets that launched the shuttle from Earth.



Space Weather

Have you ever heard a weather forecast for “scattered showers”? That means there may be rain in different places around your area during the day. But have you ever heard of meteor showers? Meteors are rocks from space that enter the atmosphere around Earth. We call it a meteor shower when many of those rocks encounter the Earth at the same time. You won’t get wet from this type of shower, but it may seem that you are watching a fireworks display high overhead. The tiny bits of space rocks and dust burn up in the atmosphere and create streaks of light that can be seen as shooting stars crossing the night sky.

While we usually speak of outer space as being empty with no air or anything else in it, this is not completely true. There are gas particles out in space but they are very far apart and one can ignore them when one is figuring out how a spaceship will travel. They do have an effect, though. The gas particles are electrically charged and if there are a lot of them in one place, it can interfere with radios and other electrical systems on a spacecraft.

One effect in the Earth’s atmosphere of the outer-space gas is the Aurora Borealis, or Northern Lights. (A recent Micro Lesson discussed the auroras at greater length.) Even though we see this display at night, it is caused by the sun. When the sun releases a large amount of electrically charged gas, some of the particles reach the Earth’s atmosphere and cause a reaction in the gases there and cause a “solar storm.” The nitrogen and oxygen that make up our atmosphere may glow blue, purple, red, and green.

Weather on the Earth includes sunshine. Weather in space also includes sunshine—and even more strongly than the weather on the Earth. Some of the Sun’s radiation, called “ultraviolet,” can cause sunburn; the Earth’s atmosphere absorbs most of this radiation and protects us from it. (This is why you do not get sunburned if you go outside early in the morning or later in the afternoon: the Sun’s rays have to pass through so much air that all of the harmful rays are absorbed.) The Sun’s rays in space will heat up anything that it is shining on; if something is in the shade, it can get very cold.

The Length of a Day on Different Planets

As the Earth turns on its axis, any point on its surface will come around to where it is lit by the Sun. Somebody standing there will see this as the Sun rising. As the Earth continues to turn, the person will see the Sun moving across the sky from east to west. Sometime later, as the point on the Earth's surface moves around to the dark side away from the Sun, the person will see the Sun setting.

If you have a globe and a lamp, you may want to illustrate this concretely by putting a paper doll on the globe and rotating the globe around on its axis. Other planets in the Solar System also rotate on their axes and thus have sunrise, daytime, sunset, and nighttime. There are many variations on this, however; they do not all have sunrise and sunset the way Earth does. For example, the planet Venus rotates in the opposite direction; it takes a little longer to make a full rotation on its axis than it does to move around the Sun once.

Thus on Venus, the Sun rises in the west a little less than twice a Venusian year, or once every 2802 hours, or 116 (Earth) days and 18 hours. (Venus is shrouded by thick clouds, though, and so a person standing on its surface would not see the Sun at all.)Mars' period of rotation is almost the same as that of the Earth—about 24 hours and 37 minutes. Jupiter, in spite of being the largest of the planets, also spins the most quickly and has a day that is only 9 hours 55 minutes long. Saturn's day is almost as short, being about 10 hours 33 minutes long.

Time it Takes to Orbit the Sun