UNIT-4 - SPACE TREK

EXPLORING THE SKIES

The Hubble Telescope

1) Where is the Hubble telescope placed?

A) The Hubble Telescope is a space telescope that was launched into low Earth orbit on April 24, 1990, and remains in operation. With a 2.4-meter (7.9 ft) mirror, Hubble's four main instruments observe in the near ultraviolet, visible, and near infrared spectra. The telescope is named after the astronomer Edwin Hubble. It takes pictures of planets, stars & galaxies. Hubble has additional requirements because it is flown into space as spacecraft. Therefore several spacecraft systems encircle the body of the telescope. Hubble is one of NASA's most successful and long-lasting science missions. It has beamed hundreds of thousands of images back to Earth, shedding light on many of the great mysteries of astronomy.

2) How do the astronomers communicate with the telescope?

A) The communications antennae allows for communication between Hubble and astronomers and technicians here on Earth. They are essential because they are the primary means in which astronomers can instruct and command the telescope. There are four antennas which receive and send information between the telescope and the Flight Operations Team at Goddard Space Flight Centre in Greenbolt, Maryland. Scientists communicate with the telescope through Tracking Data Relay Satellite (TDRS) which are five in number.

Hubble's Computers and Automation

There are two main computers on Hubble. One talks to the rest of the instruments, receives their data, sends data off and sends commands and timing information to the other instruments. The other computer controls the gyroscopes, the pointing control subsystem, as well as other functions. Smaller computers control minute functions such as: open and close exposure shutters, maintain temperature of the instruments, collect data and report back to the main computers.

3) How is the Hubble able to operate without power from the sun?

A) The telescope has two thin solar arrays consisting of solar cell "blanket" which allow for the conversion of sunlight into electricity. This electricity becomes necessary in order to operate the telescope's scientific instruments, computers, and radio transmitters. Hubble is able to operate without power from the sun as the energy is stored in onboard batteries so that the telescope can operate while it is in Earth's shadow.

4) What are the conditions under which the Hubble has to operate?

A) The following are the conditions under which Hubble has to operate: Zero gravity and temperature extremes-fluctuations of more than 100 degrees Fahrenheit during each trip around the earth.

5) How is the telescope protected in these conditions?

A) The telescope is protected from temperature extremes by a 'skin' or blanket of multilayered insulation. During Servicing Mission 4 in 2009, astronauts also added panels of insulation called New Outer Blanket Layers (NOBLs), which replaced sections of blanket that had broken down due to harsh conditions of space.

6) How are the optical system and science instruments protected?

A) During Servicing Mission 4 in 2009, astronauts added panels of insulation called New Outer Blanket Layers (NOBLs), which replaced sections of blanket that had broken down due to harsh conditions of space. The lightweight aluminum shell beneath the Hubble's insulation provides an external structure to the spacecraft and houses its optical system and science instruments.

Hubble's optical system is held together by a truss measuring 210 inches in length and 115 inches in diameter which is made of graphite epoxy that is used in golf clubs, tennis racquets and bicycles. Graphite epoxy is a stiff, strong and lightweight material that resists expanding and contracting in extremes of temperature.

GENESIS OF ISRO

Introduction

The **Indian Space Research Organization** (**ISRO**) is the space agency of the Indian government headquartered in the city of Bengaluru. Its vision is to "harness space technology for national development, while pursuing space science research and planetary exploration". Formed in 1969, ISRO superseded the erstwhile Indian National Committee for Space Research (INCOSPAR), which was established in 1962 by the efforts of independent India's first Prime Minister Jawaharlal Nehru, and his close aide and scientist Vikram Sarabhai. The establishment of ISRO thus institutionalized space activities in India. It is managed by the Department of Space, which reports to the Prime Minister of India.

The milestones achieved by ISRO are:

"Milestones are important events in the development or history of something or in someone's life."

→ISRO built India's first satellite, Aryabhata, which was launched by the Soviet Union on 19 April in 1975.

→Bhaskara-I, an experimental satellite for earth observations was launched on June 7, 1979.

→In 1980, Rohini became the first satellite to be placed in orbit by an Indian-made launch vehicle, SLV-3.

→APPLE, an experimental geostationary communication satellite successfully launched on June 19, 1981.I

→NSAT-1A was launched on April 10; 1982.

→ISRO subsequently developed two other rockets: the Polar Satellite Launch Vehicle (PSLV) for launching satellites into polar orbits and the Geosynchronous Satellite Launch Vehicle (GSLV) for placing satellites into geostationary orbits. These rockets have launched numerous communications satellites and earth observation satellites. Satellite navigation systems like GAGAN and IRNSS have been deployed.

→In January 2014, ISRO successfully used an indigenous cryogenic engine in a GSLV-D5 launch of the GSAT-14.

→ISRO sent one lunar orbiter, Chandrayaan-1, on 22 October 2008 and one Mars orbiter, Mars Orbiter Mission, which successfully entered Mars orbit on 24 September 2014, making India the first nation to succeed on its first attempt, and ISRO the fourth space agency in the world as well as the first space agency in Asia to successfully reach Mars orbit.

The benefits of the Indian space program:

India has developed a sophisticated space technology system over the past few decades that play a significant role in sectors ranging from agriculture to medicine.

Agriculture & Rural Development

→The infrared images taken by imaging satellites of ISRO are used to measure reflectivity of plant covered surfaces through which we can distinguish the crop whether rice or wheat ,well watered or not and also can predict whether the crop will be failed or not.

→Topographic and hydrological maps produced from satellite images help rural communities locate areas most likely to yield underground water so that bore wells can be drilled which can solve the problem of drinking water.

→By building dams where the rain water can be captured which makes dry land for agriculture use.

Disaster management:

India's Space Program in disaster management has played the fore most important role. It is and has become the eye of disaster management department. Some of the important contributions are:

Pre-disaster

1. Warning and prior information of development of a storm, its sheer size, intensity and origin
2.Warning of the likely course to be taken and areas to be hit.
3. In case of drought, prior image of rivers likely to be dried and necessary steps taken.
4. The crops and regions likely to face heat waves.

During Disaster
1. Live monitoring of direction and intensity of storm or cyclone.
2. Impact area by excess rainfall in monsoon.

Post-Disaster
1. Images through satellites (IRS and INSAT) can be taken to check the damage area and its intensity.
2. Periodic marking of prone areas and development of infrastructure accordingly.
3.Planning or Govt. assistance by evaluation of such damages.
4. Measures to be taken for mitigating future damages.

Telemedicine
Telemedicine is the remote diagnosis and treatment of patients by means of telecommunications technology. ISRO has applied its technology to "telemedicine", directly connecting patients in rural areas to medical professionals in urban locations via satellites. Since high-quality healthcare is not universally available in some of the remote areas of India, the patients in remote areas are diagnosed and analyzed by doctors in urban centers in real time via video conferencing. The patient is then advised medicine and treatment. The patient is then treated by the staff at one of the 'super-specialty hospitals' under instructions from the doctor. Mobile telemedicine vans are also deployed to visit locations in far-flung areas and provide diagnosis and support to patients.

OCEANSAT was launched in 1999, monitors the chlorophyll content and the sea surface temperature which identifies the areas of concentrations of fish.

EDUSAT: It is world’s first satellite which is completely dedicated for education purposes.

CHANDRAYAN

Chandrayaan-1 was India's first lunar probe. It was launched by the Indian Space Research Organization in October 2008, and operated until August 2009. It was weighed 34 kg at the time of its on-board launch and carried a video imaging system, a radar altimeter, and a mass spectrometer. The video imaging system was designed to take pictures of the Moon's surface. Whereas, the radar altimeter measured the rate of descent of the probe while the mass spectrometer made a detailed study of the extremely thin lunar atmosphere. Chandrayan finds water on Moon.

Chandrayaan-2 is India's second lunar exploration mission after Chandrayaan-1. Developed by the Indian Space Research Organization (ISRO), the mission is planned to be launched to the Moon by a Geosynchronous Satellite Launch Vehicle (GSLV), includes a lunar orbiter, a lander and a lunar rover, all developed by India. India is planning to launch Chandrayaan-2 by the end of 2017 or beginning of 2018.It weighs about 2650 kg at lift-off,of which the orbiter weight is about 1400 kg and lander weight is about 1250 kg.

According to ISRO, this mission will use and test various new technologies and conduct new experiments. The wheeled rover ,weigh between 30 kg and 100kg ,will move on the lunar surface and will pick up soil or rock samples for on-site chemical analysis. The data will be relayed to Earth through the Chandrayaan-2 orbiter. It will have an operating life span of a month. The lander will also carry a seismograph and reflector.

A Home in the Sky

The **International Space Station** (**ISS**) is a space station, or a habitable artificial satellite, in low Earth orbit. Its first component launched into orbit in 1998, and the ISS is now the largest artificial body in orbit and can often be seen with the naked eye from Earth.The ISS consists of pressurized modules, external trusses, solar arrays and other components. ISS components have been launched by Russian Proton and Soyuz rockets as well as American Space Shuttles.It serves as a home where crews of astronauts and cosmonauts live. The space station is also a unique science laboratory. Several nations worked together to build and use the space station. On Earth, the space station would weigh almost a million pounds. Measured from the edges of its solar arrays, the station covers the area of a football field including the end zones. It includes laboratory modules from the United States, Russia, Japan and Europe.

Life in Space

FOOD: They can eat meals just like we do on Earth. At the beginning of the 1960's, space food was bite-sized or placed in aluminum tubes. The food was prepared this way so that they wouldn't be too heavy or take up too much space. From the 1970's, during the Apollo period, the number of space food items began to increase. Currently, there are about 150 different types of food. The meals are very similar to the meals we eat on Earth.

CLOTHES: The astronauts wear the same types of clothes that we usually wear on Earth. Inside the Space Shuttle, the air pressure is kept at 1 atmosphere, which is the same level as on earth. The temperature and humidity are controlled, so those, the astronauts can live comfortably. Therefore, except for the orange flight suits that are worn during launch and reentry, the astronauts do not need any special clothes. The astronauts dress in the same manner that we on Earth do. When the astronauts venture outside the space shuttle to work in space, they wear spacesuits.

BATH: The astronauts wipe their body clean by using a wet towel, and wash their hair by using waterless shampoo. Since water does not flow in a zero-gravity environment, the astronauts cannot wash their hands under a faucet as you do on Earth. So, there are no sinks or showers inside the space shuttle.

SLEEP: The astronauts sleep in small sleeping compartments by using sleeping bags. They strap their bodies loosely so that their bodies will not float around.In the zero-gravity world, there are no "ups" or "downs". The astronauts can sleep anywhere facing any direction. But it's not good to be floating away somewhere while sleeping. So the astronauts use small sleeping compartments and sleeping bags. They will strap their bodies loosely so that their bodies will not float around while they sleep in the Space Shuttle.

EXERCISE: Astronauts need the proper amount of exercise in order to keep their bones and muscles strong. The treadmill is a machine on which, the astronauts do running exercises with their bodies strapped to it. The Ergometer is a machine similar to a bicycle without wheels. The amount of exercise can be adjusted by changing the pedal's pressure.

CLEANING: The astronauts do some cleaning between their duties. As people live there, it becomes messy after meals and there's also garbage to be disposed of. Between their duties, the astronauts clean the meal area, change the air purification system's filters, collect the garbage, and clean the walls and floors. They use liquid detergent, disposable plastic gloves, multi-purpose wiping cloths and a vacuum cleaner for cleaning.

SICKNESS: The astronaut in charge of medical treatments will take care of the sick.Each astronaut in the Space Shuttle has a specific assigned role, and as such, each has received intensive training required for that specialized task. For medical emergencies, the Crew Medical Officer is the person in charge.

ENTERTAINMENT: The astronauts spend their leisure time by reading their favorite books, listening to music, and looking at the Earth.

Q & A

1) Why is the arrival of new faces a cause of celebration in ISS?

A) The arrival of new faces is a cause of celebration in ISS because the crew members are only six and naturally they enjoy seeing the new faces.

2) What was the experience of a shuttle pilot?

A) The experience of a shuttle pilot is moving from one room to another in space station and feel sitting in the mid air. While using a computer he has to use only a toe to catch something under a wall strap to anchor themselves. With a flick of the hand they will float up to another computer and carry on typing there. The subtle pilot in moving from one place to another feels no sense of up and down.

3) What happens when one tries to sleep?

A) People dozing in orbit see streaks of light caused by cosmic rays falling into their retinas. Fans and air filters also add to the disturbance. Therefore, falling asleep requires getting used to the orbit. They can feel as though they fallen off a ten story building while waking up.

4) How long does day light last? What effect does this have on the astronauts?

A) For an astronaut it takes one and half hours to fly around the planet (Earth). So, he makes 16 complete rounds a day. The day light lasts for 45 minutes. The astronaut is put to havoc by the onslaught of the apparent days and nights.