Blue Canyon Technologies

Satellite Explorers: Exploring Satellites and Space Careers

Today we embark on an exciting journey into the realm of satellites and space, thanks to the generous support of Blue Canyon Technologies (BCT). Throughout this program Girl Scout Juniors, Cadettes, Seniors, and Ambassadors will explore the fascinating world of satellite technology and the diverse careers that make it all possible. Courtesy of BCT, Girl Scouts will earn an exclusive Satellite Explorers patch upon program completion. To request your patch please complete this form.

Blue Canyon Technologies
Satellite Explorers

Supplies for all lessons:

- Computer or Tablet
- Internet
- Supplies:
- Styrofoam or cardboard for the satellite body
- Aluminum foil or metallic paper for the solar panels
- Small craft wire
- Utility knife or scissors
- Hot glue gun or craft glue
- Markers or crayons
- Paper and pens

Steps:

1. Learn about small satellites and what makes BCT's technologies unique.
2. Build a small satellite.
3. Learn about how small satellites orbit.
4. Learn about aerospace careers.

Blue Canyon Technologies:
Pioneering Small Satellite Solutions

BCT is at the forefront of developing innovative small satellite solutions. These small satellites, CubeSats and M-Lines, are cost-effective, highly integrated, and produced with high-volume manufacturing, ensuring a shorter production timeline. They are equipped with advanced technologies that enable a wide range of scientific and practical applications. By specializing in small satellites, BCT enhances the accessibility and versatility of space, driving ongoing exploration and discovery.

Introduction: The Importance of Small Satellites in Aerospace

Space science is one of the most exciting and impactful fields of study today. It encompasses everything from understanding the origins of our universe to exploring distant planets and protecting our own planet. But why is space science so important and how do small satellites play a crucial role in this field?

Why space matters:

1. Expanding our knowledge: Space science helps us answer fundamental questions about the nature of our universe, the formation of stars and galaxies, and the potential for life beyond Earth. It expands our knowledge and fuels our curiosity about the cosmos.
2. Technological advancements: Many technologies we use daily, such as GPS, weather forecasting, and even advancements in medical imaging, have roots in space science. Research and development in this field drive innovation across various industries.
3. Environmental monitoring and protection: Space science provides critical tools for monitoring Earth's environment. By studying climate patterns, tracking natural disasters, and observing changes in land use, we can make more informed decisions to protect our planet.
4. Inspiring the next generation: Space exploration and discoveries inspire young minds to pursue careers in science, technology, engineering, and mathematics (STEM). This inspiration is vital for fostering the next generation of innovators and problem solvers.

Activity 1

What is a satellite and why are Blue Canyon Technologies' satellites unique?

Total Time: 45 minutes

Supplies:

- Computer or Tablet
- Internet
- Projector (optional)
- Glossary (at end of this guide)

Background:

Have you ever looked up at night and seen a flashing object "flying" across the sky? No, it is not a U.F.O, it is a satellite! Satellites are used to perform a variety of tasks to receive and send data back to Earth. In this activity, Girl Scouts will learn more about how satellites are built, what functions they perform, who works on these satellites, and the different types of satellites produced by Blue Canyon Technologies (BCT).

Start by watching Blue Canyon Technologies' video for an introduction to satellites.

Rockets vs. Satellites: Understanding the Difference

To understand the role of satellites, it's essential to distinguish them from rockets. Both are crucial to space science, but serve different purposes:

1. Rockets: Rockets are vehicles designed to launch payloads into space. They provide the necessary thrust to overcome Earth's gravity and transport satellites, spacecraft, and other instruments beyond our atmosphere. Think of rockets as the transportation system that delivers satellites to their destinations.
2. Satellites (or Artificial Satellites): Satellites are objects placed in orbit around celestial bodies like Earth. They perform various functions, such as communication, Earth observation, navigation, and scientific research. Once launched by rockets, satellites remain in space to carry out their missions, continuously orbiting the Earth or other celestial bodies.
    a. Natural Satellites: Natural Satellites are any celestial body in space that orbits around a larger body. For example, moons are called natural satellites because they orbit around plants.

As you complete this program, you will gain a deeper understanding of how important it is to study space and how satellites play a crucial role in not only the study of space, but also many modern conveniences you likely use every day.

Activity 1

What is a satellite and why are Blue Canyon Technologies' satellites unique?

What functions do satellites perform and why are they important?

Satellites are incredibly versatile tools that perform a wide range of functions essential to our modern world. Here are some of the key functions of satellites and why they matter to you:

1. **Earth observation:**
   - Environmental monitoring: Satellites help track changes in our environment, such as deforestation, ocean health, and pollution levels. This information is crucial to fighting climate change and protecting our planet's future. Think about how this affects the air you breathe, the water you drink, and the nature you enjoy.
     - Example BCT Satellite: MethaneSat, a M-Line for MethaneSAT, LLC whose goal is to provide global, high-resolution quantification of methane emissions from oil and gas facilities and measure surface-level methane emissions from other sources of human-triggered methane emissions. Learn more about MethaneSat here: MethaneSAT | Solving a crucial climate challenge
     - Disaster Response: When natural disasters like hurricanes, earthquakes, or wildfires strike, satellites provide real-time data to help with emergency response and recovery efforts. This means faster help for people in need and better preparation for future events.
     - Example BCT Satellite: Incus, a M-Line for Colorado State University and Jet Propulsion Laboratory whose goal is to provide the first tropics-wide investigation of the evolution of the vertical transport of air and water by convective storms. Learn more about the INCUS Mission here: INCUS (colostate.edu)
2. **Communication:**
   - Internet and connectivity: Satellites make it possible for people in remote areas to access the internet. This connectivity allows students in underserved areas to participate in online learning and access information that might otherwise be out of reach.

- Health and medicine: Satellites are used in experiments that improve medical technology and health services. For instance, they help with telemedicine, enabling doctors to provide care to patients in remote locations.

3. Navigation:

- GPS and mapping: Satellites are crucial for Global Positioning System (GPS) technology, which you probably use daily for navigation. Whether you're using maps to find the fastest route to school, discovering new hiking trails, or meeting up with friends, GPS satellites make it possible.
- Everyday convenience: From finding the nearest coffee shop to tracking your fitness activities, GPS satellites are behind many of the apps and services you use every day.
- Transportation and safety: Satellites help manage air traffic, maritime navigation, and even autonomous vehicles, ensuring safer and more efficient transportation systems.

4. Agriculture:

- Precision farming: Satellites help farmers monitor crops, soil conditions, and weather patterns. This technology leads to better crop yields and sustainable farming practices, ensuring that we have enough food to feed the growing population.

5. National security and defense:

- Surveillance and reconnaissance: Satellites provide critical information for national security, helping to monitor and protect against potential threats. This keeps communities and countries safer.
  - Example BCT Satellite: Blackjack, a M-Line for the Defense Advanced Research Projects Agency (DARPA) whose goal is to demonstrate global persistent coverage through operation of one or more payloads from up to six Department of Defense mission areas in low-Earth orbit. Learn more about Blackjack here: Blackjack (darpa.mil)

Satellites are woven into the fabric of our daily lives, often in ways we don't even realize. They help keep us connected, safe, informed, and entertained.

Discussion: Have Girl Scouts break into small groups to discuss these questions or choose a few from each category to discuss together as a larger group.

- Future innovations: How do you think satellites might be used in the future? Can you imagine any new functions or improvements that could make satellites even more useful?
- Personal impact: Have you ever used a service that relies on satellite technology without realizing it? How does knowing about these satellites change your perception of these services?
- Global impact: How do satellites contribute to global cooperation and communication? Can you think of any international projects or collaborations that rely on satellite technology?

Now that you know a little bit more about what different types of functions satellites complete, let's dig into more about Blue Canyon Technologies' satellites and what makes them special.

How satellites are built at Blue Canyon Technologies:

Building a satellite is like assembling the most complex puzzle you can imagine. It starts with a design phase where engineers use computer models to create the perfect blueprint. Once the design is ready, they gather all of the necessary components. Some of these components include solar panels for power, communication systems to send and receive data, sensors for collecting information, and propulsion systems to maneuver in space (you will be able to learn about these components in depth in the next activity).

BCT then assembles them in a very clean environment to avoid any contamination. After assembly, the satellite undergoes rigorous testing to ensure it can withstand the harsh conditions of space, including thermal tests (to simulate the extreme temperatures of space) and vibration tests (to mimic the launch process). In addition to these tests, BCT has developed a one-of-a-kind shock testing machine that tests the satellite for high-G shock events.

Discussion: Have Girl Scouts break into small groups to discuss these questions or choose a few from each category to discuss together as a larger group.

- Problem solving and engineering challenges: What do you think are the biggest challenges engineers and scientists face when designing, building, and launching satellites, especially in ensuring they can survive the harsh conditions of space? How do you think these challenges are overcome, and how do they compare to challenges in other fields of engineering or technology?
- Clean environment: Why do you think BCT builds their satellites in such a pristine, clean environment? Can you think of any everyday situations where cleanliness is just as crucial? How would even a tiny particle of dust affect the performance of a satellite in space?
- Testing importance: Imagine the satellite you designed and built is about to be launched into space. Why is it so important to test the completed satellite under extreme conditions before launch? How do you think these tests prepare the satellite for its mission? What could happen if these tests were skipped?
- Innovation in testing: BCT uses a one-of-a-kind shock testing machine to simulate high-G shock events. Why do you think innovation in testing technology is important? How can cutting-edge testing equipment improve the reliability of satellites?

Who works on these satellites?

Who works on these satellites?

It takes a diverse team of experts to build a satellite. At BCT, there are:

- Aerospace Engineers: They design the satellite and ensure it can operate in space.
- Mechanical Engineers: They focus on the structural components, making sure everything fits together perfectly.
- Electrical Engineers: They handle the satellite's power systems and communication technology.
- Software Engineers: They write the code that controls the satellite's operations.
- Project Managers: They oversee the entire process, ensuring everything stays on track and within budget.
- Mission Operations: They manage the spacecraft on-orbit including the bus and the interfaces. They also monitor and track the satellites once they are in space.

There are so many other roles that assist with overall operations to ensure that BCT can make the best products possible. You will be able to learn more about BCT employees in Activity 4.

Discussion: Have Girl Scouts break into small groups to discuss these questions or discuss together as a larger group.

- Interdisciplinary connections: Building and testing satellites involves various fields of study, such as engineering, computer science, environmental science, physics, etc. How do you think these disciplines come together during the satellite development and use process, and why is this interdisciplinary approach important? Can you think of any other projects or industries where this kind of interdisciplinary collaboration is necessary?

Types of satellites produced by Blue Canyon Technologies

Now that you know what functions satellites perform, have been given some insight on how they are made and who makes them, we can look deeper into why BCT satellites are unique. Satellites come in a variety of shapes and sizes. Some satellites can be as big as your car, whereas others can be smaller than your microwave. BCT focuses on small satellites to perform the variety of functions that you saw earlier.

These small satellites produced by BCT are:

- CubeSats: These are small, cube-shaped satellites that are affordable and quick to build. They are often used for educational purposes and scientific research. They are about the size of a tissue box or standard toaster. An example of a CubeSat is the Colorado Ultraviolet Transit Experiment (CUTE) for the CU Boulder Laboratory for Atmospheric and Space Physics (LASP). This satellite is observing distant exoplanets by traveling in front of their stars and determined some materials in the atmospheres. CubeSats last more than five years at LEO and more than two years at GEO/Deep Space altitude orbit.
- M-Line of Microsatellites and Minisatellites: Slightly larger than CubeSats, these are used for more complex missions, including Earth observation and communication. A BCT M-Line spacecraft is a compact, energy efficient, affordable, radiation tolerant, resilient bus that includes secure communications. They are about the size of a household oven or dishwasher. An example of a BCT M-Line is Temporal Experiment for Storms and Tropical Systems Technology- Demonstration (TEMPEST-D) for Colorado State University (CSU). This satellite constellation is dedicated to observing time evolution of clouds and better understanding cloud processes as they related to climate change. M-Line satellites last more than five years at LEO and more than two years at GEO/Deep Space altitude orbit. Formerly known as MicroSats.
- Other Products: BCT also produces other high-precision, technically advanced products including a star-tracker-based attitude control system and power components.

Discussion: Have Girl Scouts break into small groups to discuss these questions or choose a few from each category to discuss together as a larger group.

- Importance of size: Why do you think the size of satellites matters so much? Can you give examples of situations where a smaller satellite would be more advantageous than a larger one? How might the size of a satellite impact its mission and performance?
- Advantages of small satellites: What do you think are the key benefits of using small satellites like CubeSats and M-Line over larger ones? Can you think of any real-world scenarios or examples where small satellites have an edge due to their size and capabilities?
- Innovation and flexibility: How do you think the small size of CubeSats and M-Line allows for more innovation and flexibility in their design and deployment? Can you imagine any new applications or missions that would be possible with these smaller satellites?
- Cost and accessibility: How might the affordability and quick build time of small satellites impact who can access and use satellite technology? Do you think this could lead to more opportunities for schools, universities, and smaller organizations to participate in space exploration and research?
- Durability and longevity: Small satellites have specific life spans at different altitudes (LEO and GEO/Deep Space). Why do you think it's important to consider the longevity of these satellites? How does their operational lifespan affect the planning and execution of their missions?

Activity 1

Discussion Questions

Have Girl Scouts break into small groups to discuss these questions or choose a few from each category to discuss together as a larger group.

- Big picture: What are the most surprising or interesting things you've learned about satellites and Blue Canyon Technologies? Why do you think these stood out to you?
- Inspiration and innovation: What aspects of satellite technology inspire you the most? How can young people like you contribute to future innovations in this field?
- Future possibilities: Considering the rapid advancements in satellite technology, what new applications or innovations do you think we might see in the future? How could these developments further impact our world?
- Career aspirations: Has learning about the different aspects of satellite technology and the work done by BCT inspired you to consider a career in this field? What roles or jobs in the satellite industry interest you the most, and why?
- Accessibility and education: Small satellites like CubeSats and M-Line have made space technology more accessible. How do you think this accessibility impacts education and research opportunities for students and smaller organizations?

Activity 2
Build a Satellite

Total Time: 30-45 minutes
Supplies:

- Styrofoam or cardboard for the satellite body
- Aluminum foil or metallic paper for the solar panels
- Small craft wire
- Utility knife or scissors
- Hot glue gun or craft glue
- Markers or crayons
- Optional: small decorative elements (i.e. stickers, glitter, etc.)
- Paper and pens for satellite blueprint
- Sample satellite images at the end of this workbook

Pre-activity:
In this activity Girl Scouts will learn more about satellites and their current uses. Begin by breaking them into small groups to design and build a satellite. Using the various satellite images on the following pages as inspiration and the following steps, learn about what each piece of the satellite does and what jobs help implement or design that component. You may opt to use various recycled materials in this activity.

For more inspiration about different types of satellites, see Blue Canyon Technologies - Spacecraft solutions.

Activity 2

1. Design the satellite: Start by designing the shape and features of your satellite. Consider the different components such as a solar array, antennas, a star tracker, sensors, etc. Refer to the glossary at the beginning of this guide for additional components and assistance on what the role of each component. You can draw a blueprint or sketch to plan the layout.
    - Think about what you want your satellite to do. Some ideas: GPS, satellite radio, your own new invention, etc.
    - At the end of this packet are a few satellite example diagrams to help your Girl Scout(s) in the design process.
    - From the careers you have already learned about, who do you think takes the lead on designing the satellite? What roles are involved in this process?
        - Groups may decide to assign roles to each other to work on the specific pieces of the satellite.
2. Build the satellite body: Use Styrofoam or cardboard to create the main body of the satellite. Cut out the shapes according to your design using a utility knife or scissors.
    - While designing and building the body of the satellite talk to Girl Scouts about Engineers and Technicians who design and build these portions of a satellite. Refer back to Activity One if needed.
    - Who do you think are involved in the building of the satellite body? Are they all engineers?
    - Why might the bodies of each satellite vary a bit from mission to mission?

3. Attach solar array: Cut out pieces of aluminum foil or metallic paper to represent the solar array. Attach these to the satellite body using glue. You can also use markers/crayons to add details to the solar array.

- Why is it important for your satellite to have a solar array?
- When electrical engineers design and build solar arrays, what factors do they take into consideration?

4. Add antennas and sensors: Use small pieces of wire or other materials to create antennas and sensors on the satellite. These can be attached to the body using glue. Be creative with the design but try to make it realistic.

- Think back to your original design and the goal you are trying to accomplish with your satellite. Why did you choose to place your antennas and sensors like this?
- The data your satellite will send back to Earth will be communicated through these antennas and sensors back to Mission Operations. What would happen if the antennas malfunction? Based on what you have learned so far, who do you think will fix them?

5. Optional: Present your satellite - Girl Scout groups can present their satellites to each other, explain what their intended outcomes for the satellites are. Have the group(s) highlight any modifications they made and why they made them.

- Were there any challenges the group had to overcome as they built their satellite? What compromises were made, if any.
- If the group assigned roles, explain why they did so and which roles were used. Did anyone discover anything additional about the role they were assigned?
- If you were to create a new satellite, what modifications would you make to your current model?

Activity 3
Orbiting Earth

Total Time: 30 minutes
Supplies:

- Computer or tablet
- Internet
- Projector or TV-casting (optional)
- Paper (optional)
- Pencil or pen (optional)

In this activity, Girl Scouts will learn about the various altitudes that satellites orbit at and why.

Satellite tracker: Live World Map of Satellite Positions - In-The-Sky.org

- Ask: “Can you name any companies you use and/or know of any companies that use satellites?” Now, using a satellite tracker, Girl Scouts can look to see if there are any satellites above North America and/or Colorado now.
    - If the Girl Scouts were able to name any specific satellites, they can also use this tracker to help locate specific satellites (i.e. Starlink, GPS, etc.). Note: you may need to search for the satellite’s shortened name to search. For example, HST is Hubble Space Telescope and ISS is the International Space Station.
      Topics for discussion:
        - How many satellites did you find over the US/Colorado?
        - Did you recognize any of the satellites that you found?
        - Were you surprised by the number of satellites you found?

- Have the Girl Scouts choose a satellite, you may partner Girl Scouts up if needed. By clicking on a satellite, Girl Scouts are able to see additional information like altitude, current latitude and longitude. Girl Scouts can also click on “More Info” to find out where and when the satellite was launched into space, whether or not it is operational, and who owns the satellite.
    - Have the Girl Scouts make a note of this information and compare it with other satellites. Is there anything they notice?

- Girl Scouts likely noticed that satellites are orbiting the Earth at different altitudes. Why do they think that is?
    - Yes, we don’t want satellites to crash into each other, but there is more science behind the reason. Satellites fly at different altitudes depending on their intended purpose and mission requirements.

Here are a few common altitude ranges and their corresponding uses:

- Low Earth Orbit (LEO): Altitude range: 160 to 2,000 kilometers (100 to 1,200 miles). LEO is used for many Earth observation satellites, as well as some communication satellites, due to its relatively close proximity to Earth. Some examples of LEO satellites are the International Space Station (ISS) and Starlink and OneWeb Satellites that provide global broadband internet coverage.
- Medium Earth Orbit (MEO): Altitude range 2,000 to 35,786 kilometers (1,200 to 22,236 miles). MEO is often used for navigation satellites, such as Global Positioning System (GPS).
- Geostationary Orbit (GEO): Altitude: approximately 35,786 kilometers (22,236 miles). Satellites in GEO orbit at the same speed as the Earth's rotation, allowing them to remain fixed over a specific point on the Earth's surface. GEO is commonly used for weather, communication, and broadcasting satellites.

- But how do these satellites get into space and stay around Earth? This can be best explained by SciShow Space in this four-minute video, "How Do Satellites Get & Stay in Orbit".

- BONUS: Girl Scouts can change their general home location and click on "Passes over <Location Name>" to find out when that satellite is anticipated to pass over. In the evening, Girl Scouts may be able to see their chosen satellites pass through the night sky.

Activity 4

Who works on satellites?

Time: 20-30 minutes

Supplies:

- Careers at Blue Canyon Technologies hand out at the end of this workbook
- Paper and pencil

During this activity, Girl Scouts will read through various jobs and backgrounds of real-life Blue Canyon Technologies' employees. Have your Girl Scout choose a person/career to present to the group. Girl Scouts may be broken into small groups if needed.

Presentation questions:

1. Who is the person you chose and what is their job at Blue Canyon Technologies?
2. Why did you choose this person?
3. Do they work directly on satellites? Why/Why not?
4. What was this person's educational pathway?
5. Was there anything about this person's educational pathway and/or job that surprised you?
6. Is there anything else about this person and/or their job you want to share with the group?

For the larger group after presentations:

1. Did some of the careers you heard about today surprise you?
2. Would any of you consider any of the careers you heard about today?

There are so many different careers in the space industry. It is often stereotyped that only people good at math or science can get a job in this field, but there are so many other careers that are equally as important to this industry. No matter what your skillset is, there is an opportunity to work at companies like Blue Canyon Technologies!

Blue Canyon Technologies

Satellite Explorers: Exploring Satellites and Space Careers

Congratulations on mission completion!

You have successfully completed the Satellite Explorers program and have earned the exclusive Blue Canyon Technologies patch! You have learned a lot about satellite functions, careers in this industry, and Blue Canyon Technologies. Next time you look up at the night sky, remember that there are thousands of satellites up there working tirelessly to improve life here on earth!

To request your free patch please complete this brief survey.

If you are still interested in learning more about Blue Canyon Technologies or satellites, you can reach out to Claire Grieco at Cgrieco@BlueCanyonTech.com to ask questions or schedule your troop for their own tour. Please note that tours may have limited availability and require security procedures that will be explained when you book your visit.

BLUE CANYON TECHNOLOGIES

girl scouts of colorado

Example Satellites

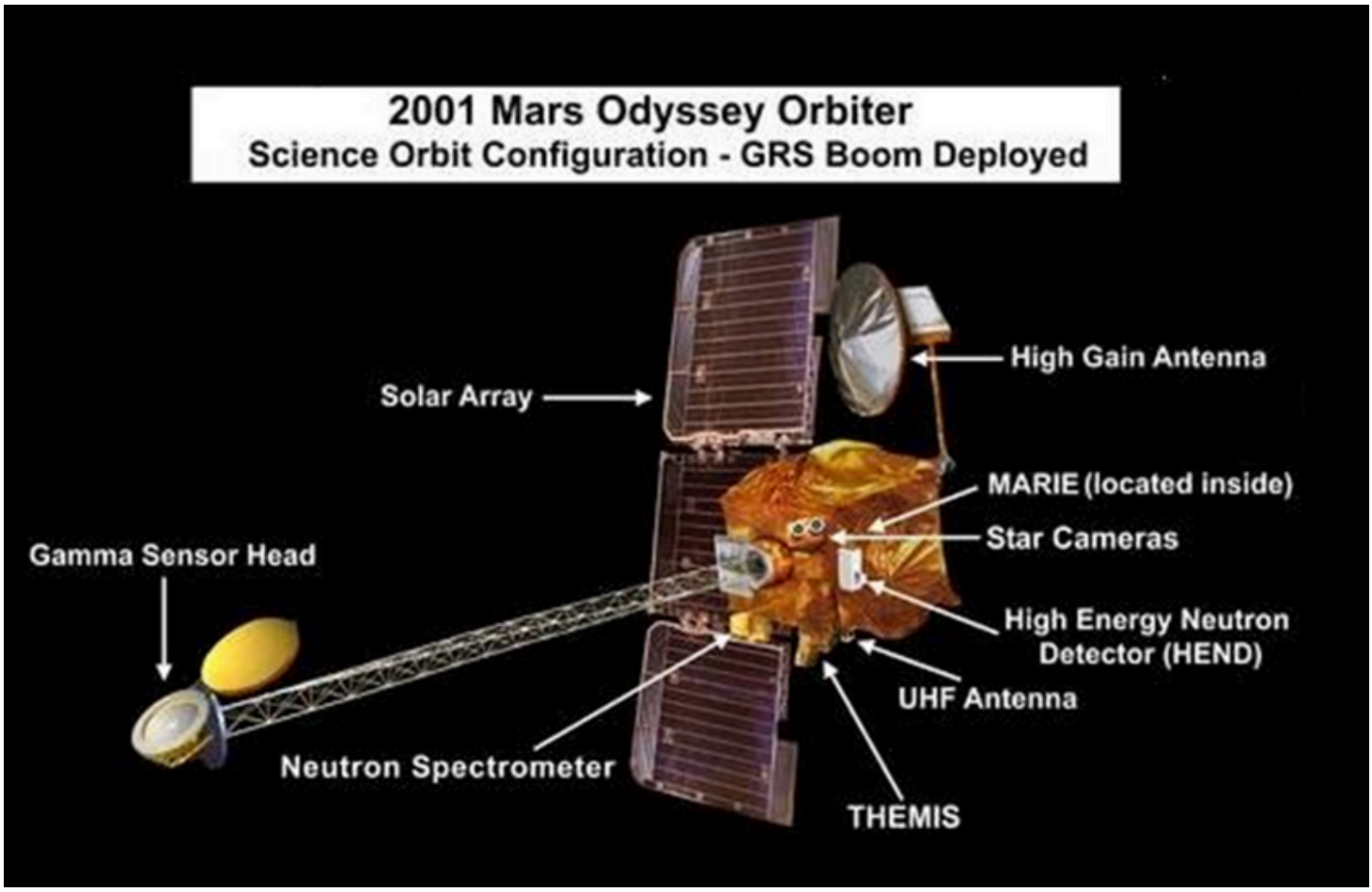

Image credit: odyssey_satellite_diagram.jpg (640×400) (nasa.gov)

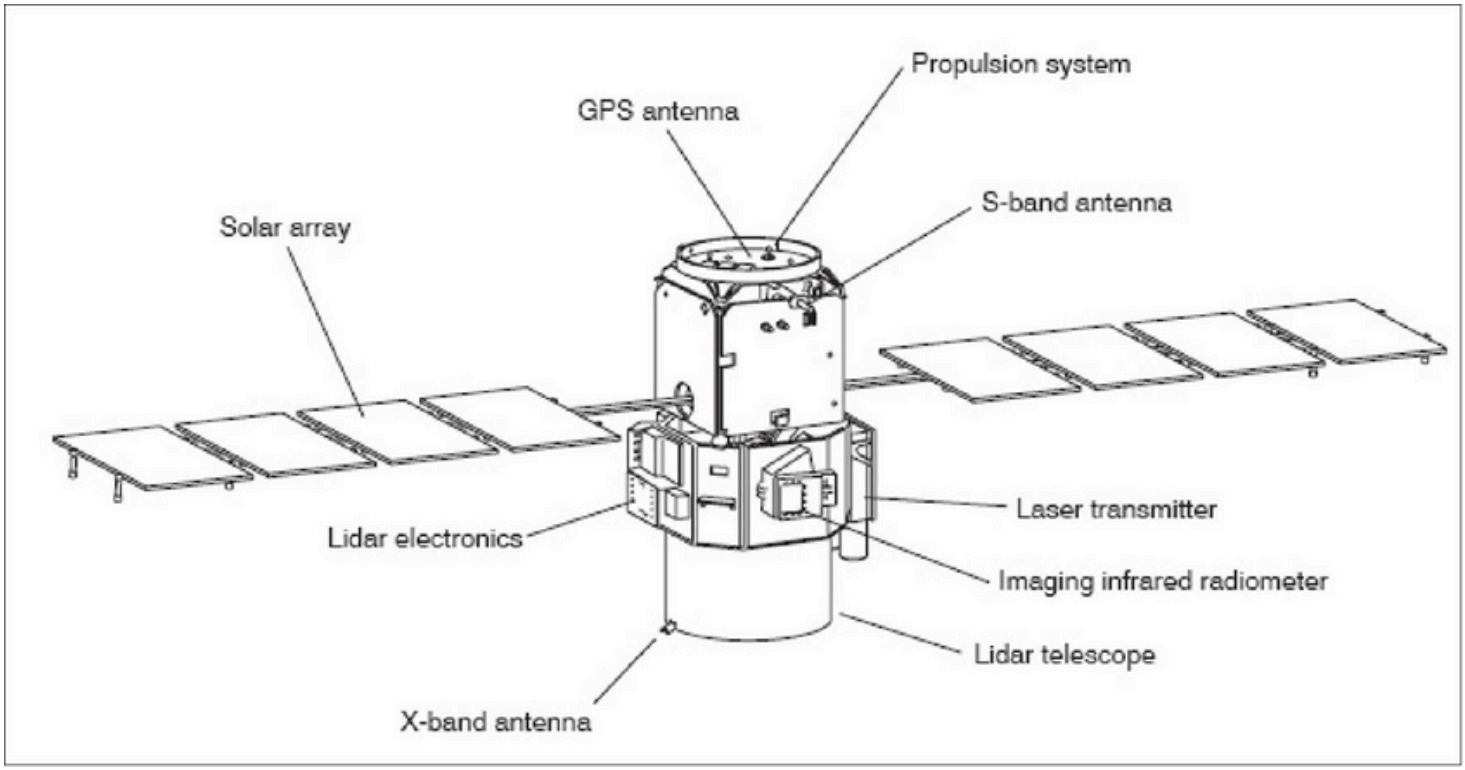

Image credit: CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) - eoPortal

Electrical Engineer

- What they do: This person designs the electrical parts of satellites. They work on the detailed plans that help make sure everything works together properly.
- How they work on satellites: They figure out how to connect all the electrical pieces so the satellite can function in space. They also check and test their designs to make sure they will work in real life.
- Educational pathway: Most electrical engineers study electrical engineering in college and get hands-on experience through internships.

Test Engineer

- What they do: This person makes sure that the satellite works by testing it. They write up instructions on how to test the satellite and then make sure the satellite parts do what they're supposed to.
- How they work on satellites: They look for problems in the satellite parts and fix them before the satellite goes into space. They also keep records of everything they test.
- Educational pathway: Test engineers usually study engineering, physics, or computer science in college. They need to understand how things work and be good at troubleshooting.

Human Resources

- What they do: This person helps Blue Canyon Technologies find, hire, and train employees. They also make sure the company follows employment laws and helps new employees get settled in their jobs.
- How they work on satellites: They don't work directly on satellites, but they help the company find the right people to build and test them.
- Educational pathway: HR professionals usually study human resources, business, or psychology in college. They also need to be good at working with people and following rules.

Planner

- What they do: This person makes sure that the parts needed to build satellites are ready and delivered on time. They track orders and make sure that everything arrives when it should.
- How they work on satellites: They keep everything organized so the engineers and technicians can build and test the satellite without delays.
- Educational pathway: Planners often study business, logistics, or engineering in college. They need to be good at time management and organization.

Satellite Explorers
Glossary

Altitude Control Systems- Systems onboard a satellite that maintain its desired position or orbit altitude by adjusting thrusters or other mechanisms.

Antenna- A device used to transmit or receive radio waves, typically used on satellites for communication purposes.

Satellite Bus- The structural framework or platform of a satellite that houses various subsystems and components.

Aerospace Career- In the context of the satellite industry, this refers to a profession or occupation related to the design, development, operation, or management of satellites or satellite-based systems.

Convective Storms- Storms characterized by vertical motion within the atmosphere, often leading to thunderstorms and other severe weather events. Satellites may study these storms to better understand their behavior and impact.

Engineering Change Order (ECO)- An ECO is a document used when a company needs to change the design of a product. It tells the team exactly what needs to be fixed or improved and how to update the product so everything works better.

Enterprise Resource Planning (ERP)- ERP is a software system that helps businesses keep track of all their important activities, like managing money, orders, supplies, and people. It connects all the different parts of the company to help everything run smoothly and on time.

Glossary

Exoplanets- Planets that orbit stars outside our solar system. Satellites may be used to observe and study these planets to learn more about their composition and characteristics.

GEO(Geostationary Orbit)- An orbit in which a satellite appears to be stationary relative to Earth's surface. Satellites in GEO are often used for communication and weather monitoring.

Gravity Probe- Measures gravity.

High-G Shock- The sudden and extreme acceleration experienced by a satellite during launch or other high-stress events. Satellites must be designed to withstand and minimize the effects of such shocks.

Imaging Infrared Radiometer- An imaging infrared radiometer is an instrument on a satellite that measures the intensity of infrared radiation emitted by objects on Earth or in space. It captures thermal images, allowing scientists to study temperature variations, monitor weather patterns, and analyze heat signatures from various sources, such as land surfaces, oceans, and clouds. This information is crucial for weather forecasting, climate studies, and environmental monitoring.

Launch Vehicle- An object used to launch satellites or other payloads into space.

LEO(Low Earth Orbit)- An orbit close to Earth's surface, typically between 160 and 2,000 kilometers. Satellites in LEO are used for Earth observation, communication, and scientific research.

Glossary

Lidar Telescope (Light Detection and Ranging)- Is a device on a satellite that uses laser light to measure distances to objects on the Earth's surface or in the atmosphere by emitting laser pulses and measuring the time it takes for the light to bounce back after hitting an object. This information is used to create detailed maps of terrain, measure atmospheric components, and study surface features with high precision.

Material Requirements Planning (MRP)- MRP is a system that helps companies figure out what materials they need and when they need them to make products. It makes sure they don't run out of parts or supplies and that everything is ready in time for production.

Neutron Spectrometer- A neutron spectrometer is a scientific instrument on a satellite that measures the number and energy of neutrons. It helps scientists learn about the composition of a planet's surface, search for water, and study radiation in space.

Orbital velocity- The velocity required for an object to maintain a stable orbit around another object, such as a satellite around Earth.

Payload- The part of a satellite that carries instruments, equipment, or other cargo for a specific mission.

Propulsion System- The system onboards a satellite that provides the necessary thrust to change its orbit or orientation.

Radar- A versatile tool that provides critical data for a wide range of scientific, environmental, and defense-related applications.

Reaction Wheels- Devices used on satellites to control their orientation without the need for thrusters, by spinning or stopping the wheels to produce torque.

Glossary

Rocket- A vehicle that uses propulsion to travel through space, often used to launch satellites into orbit.

Satellite- An artificial object placed in orbit around Earth or another celestial body for communication, navigation, remote sensing, or scientific research.

Satellite Constellation- A group of satellites working together in coordinated fashion to achieve a specific purpose, such as global communication coverage or Earth observation.

Sensors- Devices onboard a satellite that collect data about the satellite's surroundings or performance, such as temperature, pressure, or radiation levels.

Solar Array- A set of solar panels on a satellite that convert sunlight into electricity to power the satellite's systems.

Star Tracker- A sensor on a satellite that identifies and tracks stars, used to determine the satellite's orientation in space. It can also be referred to as a Star Camera.

THEMIS (Time History of Events and Macroscale Interactions during Substorms)- A mission consisting of multiple satellites designed to study the Earth's magnetosphere. It aims to understand the processes that cause the sudden releases of energy, known as substorms, which are responsible for the auroras. The mission helps scientists learn more about space weather and its effects on Earth.