Winners of the Space Systems Essay Contest

By Robin Osborne, AIAA GHS Pre-College Outreach Director

The AIAA Space Systems Technical Committee (SSTC) sponsors an annual essay contest for 7th and 8th grade students, and AIAA GHS always encourages students in the Greater Huntsville area to participate by sponsoring a section-level contest.

For this year's contest, the theme provided by SSTC was as follows:

"Choose one aspect of the James Webb Space Telescope, describe how it works, and explain why it leads us to new discoveries and to answer important questions about the universe."

The winners of the 2023 AIAA GHS essay contest are Anna Wallace (7th grade division) and Maia Shadrick (8th grade division). Both are students at Whitesburg Christian Academy. Their teacher sponsor is Mrs. Devin Pond.

Essays were judged by a panel of AIAA GHS members on the criteria of originality of ideas presented, soundness of logic used to develop ideas, realism of ideas presented, quality of composition, and clarity of expression.

This year's winners will each receive $30 and a trophy from AIAA GHS at the section's 69th Annual Awards Dinner on Saturday, May 20 at the Jackson Center. Additionally, the winning essays will be submitted by AIAA GHS to compete for national prizes awarded by the SSTC. Below is some information about these stellar students. Their winning essays are included in the two proceeding pages.

7th grade winner: Anna Wallace

Anna Wallace is a seventh-grade student at Whitesburg Christian Academy who has attended the Academy for eight years. At school, Anna enjoys participating in robotics class and Reading Club. She plays alto saxophone in the Academy Middle School Band and has been a band member for the last three years. Anna has played the piano and taken piano lessons for eight years, and she has recently started playing the guitar. Anna is an active member of the Monte Sano Baptist Church Youth Group and volunteers as a Children's Church helper. In her spare time, she enjoys reading, swimming, fishing, and spending time with family and friends. Anna's family members include her father and mother, Eric and Allison Wallace, as well as her sister Sarah Wallace. In 2022 Anna attended Space Camp at the U.S. Space Rocket Center in Huntsville and for years has demonstrated an interest in aeronautics and astronautics.

8th grade winner: Maia Shadrick

Maia Shadrick is an 8th grade student at Whitesburg Christian Academy. She has been on her school's soccer, volleyball, and track teams. She has also taken ballet and gymnastics lessons for several years. She achieved the rank of Advanced Ninja in Ninja Obstacle training. Maia won the Math Olympics in 3rd and 4th grade. She has served in her school's Student Government Association. Last summer, Maia was selected to attend Tech Trek, a STEM program for future scientists, engineers, mathematicians, and computer specialists, where she studied Cybersecurity. Maia was also a member of her school's Robotics Team, who qualified for the State Competition in their first year. Last year, Maia earned the highest average in all her core classes. Maia has played the trumpet in her school's band since 5th grade and earned "First Chair" this year. Maia qualified for the North Alabama Private School Honor Band, District Honor Band and the Alabama All-State Band. Maia acknowledges her achievements and talents are given from God and is grateful for His love.

The Backbone of the James Webb Space Telescope

By Anna Wallace
7th Grade

The James Webb Space Telescope, also called the JWST, is a telescope designed and built by the National Aeronautics and Space Administration (NASA) that launched on December 25, 2021. The JWST was designed for a special mission, to find out more about the places inside and outside of our solar system. It will search for and discover new things about the galaxies created during the very beginning of the universe, and the formations of other solar systems with planets that could support life, similar to our solar system and planet Earth. Images from the JWST are studied by scientists who are then able to draw conclusions to questions humans have been asking about the universe for hundreds of years. Its journey will last up to a decade from its launch and will be filled with amazing findings, broken barriers, and incredible works thanks to its amazing technology.

The technology of the JWST is filled with innovations and inventions that have helped change the world. From its eighteen-part mirror, infrared detectors, and tennis court-sized sunshield to its ingeniously designed microshutters, the James Webb Space Telescope is filled with some of the world's greatest scientific advancements. However, I think the most important and significant innovation of all is the telescope's backplane. The backplane is made of lightweight graphite connected by fittings made of invar and titanium. It is made up of the secondary mirror support, the BSF (backplane support fixture), and the structure that deploys the telescope off of its spacecraft. The backplane of the JWST is the supporting factor of all its scientific instruments and other components, though its most important role is motionlessly holding the mirrors of the telescope.

The mirrors of the telescope are used to reflect light from deep space onto the infrared detectors, so images can be created and studied. For the mirrors to be able to do this, they must remain completely still. If they move even a small amount, they would not be able to focus on the light coming from deep space causing the images to have inadequate quality. The backplane can be held almost motionless up to thirty-two nanometers which helps the mirrors remain incredibly still. The motionlessness of the backplane ensures the images' supreme quality. The backplane is also the supporter of the entire telescope, holding about 2.5 tons of weight. Without the backplane, the scientific equipment would have almost no support and would not be secure. Also, without it, images made by the telescope would be unfocused and hard to study.

By supporting the entire James Webb Space Telescope, the backplane helps discoveries be made about the universe's galaxies and solar systems since it holds all the cameras, infrared detectors, and mirrors, all essential equipment for images to be created. The JWST is a new and exciting tool that scientists are using to make discoveries and the backplane is a big part of it. As you can see, the backplane is an essential innovation of the James Webb Space Telescope that provides support, ensures supreme image quality, and holds together the telescope's structure, but most importantly, helps lead us to new and exciting discoveries about the universe.

The James Webb Telescope:
Peeking into the Past to Focus on the Future

Maia Shadrick
8th Grade

The James Webb Telescope, which has been in space for almost a year and a half, is the largest and most powerful telescope NASA has ever made. This telescope was built by organizations from Europe, Canada, and the USA. While it orbits our solar system, it uses its powerful components to see beyond our solar system. For example, the James Webb Telescope has found two Super-Earths, or planets unlike any in our solar system. The four main components of the telescope are the Optical Telescope Element (OTE), the sun shield, the spacecraft bus, and the Integrated Science Instrument Module. The Integrated Science Instrument Module, or ISIM, consists of four elements, the Near-Infrared Camera, the Near-Infrared Spectrograph, the Mid-Infrared Instrument, and the Fine Guidance Sensor (FGS)/Near-InfraRed Imager and Slitless Spectrograph (NIRISS).

The FGS and NIRISS work together, but they are separate instruments. The FGS is controlled by the telescope, however, NIRISS is independent. These systems were built as joint projects between companies in Canada and the US. The FGS and NIRISS are used to detect and characterize exoplanets. The instruments have a wavelength range between .6 - 5 micrometers.

The Fine Guidance System focuses on keeping the telescope aimed correctly at the target. The FGS acts as a guide to ensure the James Webb Telescope takes the correct pictures. It also allows scientists to have accurate measurements of the distance between two points. The FGS will use the guide star to send corrections 16 times every second. These corrections will be sent to the James Webb Telescope's attitude control system or ACS. Unlike the other four instruments of ISIM, the Fine Guidance System will be used for every observation the telescope partakes in.

The NIRISS is designed for Near-Infrared Imaging, wide-field slitless spectroscopy, single-object slitless spectroscopy, and aperture masking interferometry. Near-Infrared Imaging is used to assess a solar system for light from early stars, the concentration of stars in a specific area, and the development of young stars. Wide-field slitless spectroscopy is a tool that scatters the light of any object in the telescope's view. This creates a rainbow-like image that will overlap for observation. Single-object slitless spectroscopy produces three rainbow-like pictures of the targets. The aperture masking interferometry ensures the production of a higher-quality image. These parts of NIRISS will work together to create impressive pictures of the universe.

The FGS and NIRISS help to lead us to discoveries because of the high-quality pictures they can take. As aforementioned, the James Webb Telescope is the most powerful telescope made by NASA. While other telescopes may only be able to take blurry pictures of faraway stars, this telescope can capture clear images of unseen stars and solar systems. It has found many new galaxies and will continue to find many more. We can observe the catastrophes which plague other planets to prevent similar events from happening on our planet. We could also observe the formation and life of different stars. Also, it has detected light from the beginning of the universe. The powerful cameras allow the telescope to send images of far-away astronomical bodies while staying in our solar system!

We can now answer important questions about the universe because of these discoveries. For example, we could discover other planets like ours. We could answer the question, "Is there life other than life on Earth?" Also, we could receive a better understanding of how our solar system works, and how long our star will sustain us. This would help us to calculate when our sun will die and prepare for the event of our sun dying. These would all help us to preserve life on Earth. We could answer the fundamental question, "When did our universe begin?" The James Webb Telescope can detect light from the beginning of the universe, which would allow us to calculate the age of the universe.

The James Webb Telescope has been instrumental in many of the recent consequential discoveries of the universe. The FGS/NIRISS is key in providing the images from the telescope. It and all of its components are carefully designed to capture the best possible images. Thanks to the James Webb Telescope, we will continue to make significant discoveries of the many galaxies which surround us from the sanctuary of our solar system.