III. Science & Technology

Update on the Webb Telescope: 'A Gift to Mankind'

by Janet G. West

Where there is no vision, the people perish.
—Proverbs 29:18 KJV

Dec. 30—The successful launch on Christmas Day of the James Webb Space Telescope (JWST) was not only a "gift to the world," but an inauguration of a new era in space exploration. From physicists to astronomers; from world leaders to the man on the street; this mission is being hailed as a magnificent breakthrough for science and engineering by mankind.

At the time of this writing, the JWST has successfully deployed both the forward and aft sunshield pallets called the Unitized Pallet Structures (UPS) and the Deployable Tower Assembly (DTA), and has also begun to transmit temperature data for both sides of its sunshield. It also executed the second of three thruster burns to ensure that its trajectory is on course for its final destination, known as the Earth's Lagrange Point 2 (L2).

The DTA raised the entire mirror assembly about two meters above the "bus" (the housing for the instruments of the spacecraft), allowing it to cool further, and allowing enough space between the mirrors and the bus to enable the five-layer sunshield to unfurl.

The entire assembly is tilted relative to the plane of Earth's orbit, such that the sunshield is always facing toward the Sun; it is already providing some thermal protection. The crucial complete unfurling of the sunshield will have proceeded over the four to five days through the New Year's weekend into the first week of January 2022.

The next steps will be to complete the setting of the five layers of the sunshield to their correct tension, providing space in between each layer for proper insulation and dissipation of heat. This process is expected to be completed by the evening of Jan. 2; the sequence of the steps can be manually controlled from Mission Control at NASA's Goddard Space Flight Center in Greenbelt, Maryland in the event of a need to pause and make assessments.

Once the sunshield is properly deployed, the secondary mirror will move into position, and then the opening of the primary mirror is expected by Jan. 7.

Pat Izzo

A full-size replica of the James Webb Space Telescope on display outside the Maryland Science Center in Baltimore, Oct. 14, 2011.

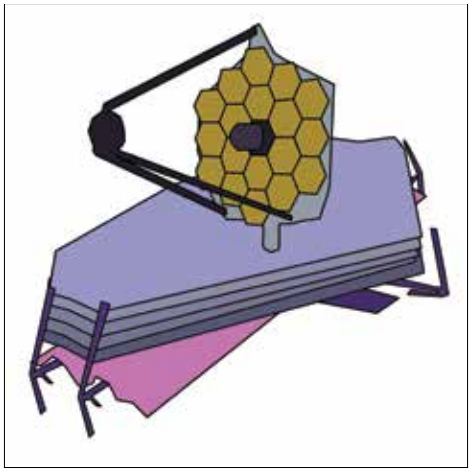
'Keep Cool, Webb!'

The sunshield comprises five layers of a material developed by DuPont called "Kapton®." Each layer is about one one-thousandth of an inch thick and is about 21 by 14 meters (70 by 47 feet) in area. Kapton was chosen due to its remarkable properties, all of which are

crucial for its task in protecting the JWST:

- temperature stability (even in the extremes of outer space)
- electrical insulation—designed to withstand partial electrical discharges
- resistance to chemicals—has a very high resistance to organic solvents, acids and humidity (moisture absorption)
- thermal resistance—highly resistant to fire, and won't conduct heat, but dissipates it
- mechanical resistance—highly resistant to punctures (such as from micrometeors), tears or rips, and mechanical abrasion due to friction
- resistance to radiation—resistant to both X-rays and high-powered gamma rays

FIGURE 1



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Schematic of the James Webb Space Telescope as fully deployed.

Michael McElwain, the Observatory Project Scientist from NASA's Goddard Space Flight Center, explains (see **Figure 1**):

> There are 50 major deployments that transform Webb from its stowed, launch configuration into an operational observatory. The sunshield deployment sequence started with the forward, then aft mechanical release of the UPS from the telescope and motorized lowering into position. The telescope and science instruments, mounted on a deployable tower assembly, were then mechanically released and raised.
>
> There is a momentum flap attached to the end of the aft UPS that is released and positioned, whose function is to balance the solar pressure on the deployed sunshield. The sunshield covers are released via retraction of the 107 membrane release devices and roll out of the way, readying the system for the deployment of the sunshield layers. The telescopic mid-booms sequentially push out from the spacecraft bus perpendicular to the telescope line of sight, pulling the folded stack of sunshield layers out into the final, but still untensioned configuration.
>
> Finally, each sunshield layer is tensioned into position, starting with the Sun-facing layer first and finishing with the telescope-facing layer. The deployed sunshield begins a rapid cooldown of the telescope and the science instruments, but onboard heaters within the science instruments will be used to control their cool-down and prevent contamination.

Lagrange Points: Fun Places to 'Hang Out'

The JWST is, as 2021 ends, edging out to about 45% of the way to its orbit at Lagrange Point 2 (L2). "What's so special about L2, and why should I care?" you ask. Turns out, all of the Lagrange Points are pretty special.

The NASA website explains:

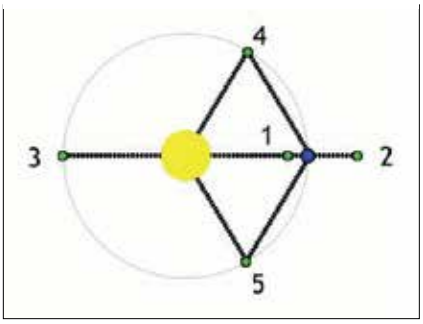
> Joseph-Louis Lagrange was an 18th-Century mathematician who found the solution to what is called the "three-body problem." That problem is: Is there any stable configuration, in which three bodies could orbit each other, yet stay in the same position relative to each other? As it turns out, there are five solutions to this problem—and

NASA/Chris Gunn

After successfully assembling the entire observatory, technicians and engineers fully deployed and tensioned all five layers of its tennis-court-sized sunshield.

they are called the five Lagrange Points, after their discoverer. At Lagrange points, the gravitational pull of two large masses precisely equals the centripetal force required for a small object to move with them. The L1, L2, and L3 points are all in line with each other—and L4 and L5 are at the points of equilateral triangles.

FIGURE 2



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The five Lagrange Points, relative to the Sun-Earth gravitational system.

Johannes Kepler (1571-1630), whose 450th birthday we celebrated on Dec. 27, developed what are called his three planetary laws of motion, which are:

1. Every planet's orbit is an ellipse with the Sun at a focus;

2. An imaginary line joining the Sun and a planet sweeps out equal areas in space in equal times;

3. The square of a planet's orbital period (the time it takes to orbit the Sun) is proportional to the cube of the semi-major axis of its orbit.

Referring to **Figure 2**, you'll note that both L1 and L2 are along a line between the Sun and the Earth. You'd expect that L1 would rotate on its orbit slightly faster than Earth does on its orbit, and L2 slightly slower. But, remarkably, due to a combination of forces (gravitational, centripetal and the apparent centrifugal), these points move in their orbit with the same periodicity as Earth.

This means that the JWST will maintain its alignment with the Earth all the way around the Sun, while also orbiting L2 at right angles to the plane of Earth's orbit, so its motion would appear as a type of epicycle (like a Ferris wheel moving along a track). This allows for a minimum expenditure of fuel to keep it in its orbit; the JWST was designed with a nominal five-year mission, but is expected to endure for at least 10 years, and probably longer. An animation of the orbit is available here.

These Lagrange Points are already being used for some solar observations—L1 is host to ACE (Advanced Composition Explorer), DSCOVR (Deep Space Climate Observatory), SOHO (Solar and Heliospheric Observer), and the 1994 Wind spacecraft; L2 has the satellites Herschel, Planck and WMAP.

The properties of Points L4 and L5 are equally impressive: Both L4 and L5 are strategic and durable gravity wells in which larger missions, such as a large space station or way-station, could be maintained for long periods of time. Since these points are equidistant from Earth, they could be used for long-term spacecraft construction projects, where materials were ferried between Earth (or Moon), and these points of stability (although not for a planet with a lot of asteroids or space debris).

Joel Dejean: 'Kepler and the James Webb Space Telescope'

Joel Dejean, running as a LaRouche Independent candidate for U.S. Congress from Texas' new 38th C.D., released the following statement on the launch and mission of the James Webb Space Telescope.

Dec. 27—Johannes Kepler was born on December 27, 1571, 450 years ago. Using the naked-eye observations of Tycho Brahe, he was able to formulate the laws of planetary motion that are being used to guide the James Webb Space Telescope, launched on Christmas day, to its observation station 1.5 million kilometers from Earth.

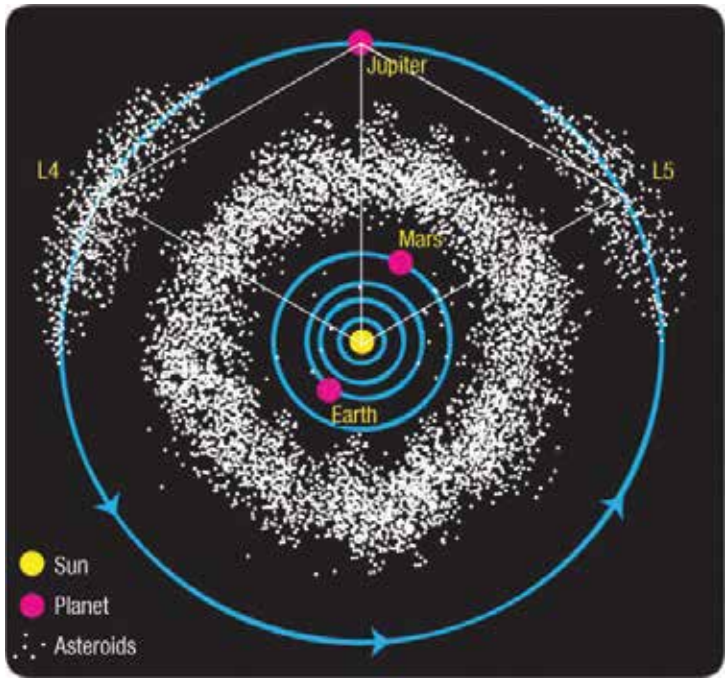
While working on his *Harmony of the World*, Kepler and the rest of Europe were at the beginning of what came to be known as the 30 Years' War, which killed a third of Europe's population. Today, we are in danger of sleep-walking into a thermonuclear war, which would wipe out *all* human civilization. Let us use the example of the James Webb Telescope, where scientists and engineers from 14 nations, working over 25 years, and spending 200 times less than that spent over the last 20 years by the U.S. and NATO to destroy Afghanistan, as an example of what Mankind is capable of, when it puts its mind to a truly human goal.

Think of what Kepler was able to discover about the solar system, using only naked-eye observations. What will a future Kepler be able to discover about the universe, using fantastic instruments like the James Webb?

Lagrange Points exist for any two orbiting masses, so we can look to other planets' orbits, such as Jupiter, and note that asteroids congregate at L4 and L5 (for Jupiter), known as the "Trojans" (60˚ behind Jupiter) and the "Greeks" (60˚ ahead of Jupiter), and ride along with Jupiter in its orbit around the Sun (see **Figure 3**). The NASA mission "Lucy," which launched October 16, 2021, will be visiting eight of these asteroids (one inner-orbit and seven Trojans) to help us learn more about their origins and geology.

The L3 is generally directly opposite the planet, on the other side of the Sun. Earth's L3 is currently not being considered for any space missions, due to the challenge of any possibility of communications.

FIGURE 3



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For the Sun-Jupiter gravitational system, asteroids clustered at L4 (60º in front of Jupiter) in its orbit around the Sun, are known as "Greeks," and those at L5 (60º behind Jupiter) are known as "Trojans."

'Looking Back in Time'

The JWST is not only 100 times more powerful than the Hubble telescope but will be able to "see" in the infrared range as it views stars and galaxies many millions of light-years away from us.

The prevailing theory of how the Universe began is currently the Big Bang Theory. It is important to bear in mind that it is still only a theory. In a nutshell, it states that the Universe began as an infinitely dense and tiny point, comparable to a super-charged black hole—a singularity. The theory hypothesizes that the origin of all matter, energy, space, and time came from an explosion of this singularity (hence, the "Big Bang"), and after billions of years, galaxies, stars, planets, and other astronomical entities came into existence, approximately 13.8 billion years ago. According to various sources, Albert Einstein didn't agree at first with the theory, insisting that the universe had always existed, but later came to accept it (or at least the idea of an expanding universe), since it was consistent with his Theory of General Relativity.

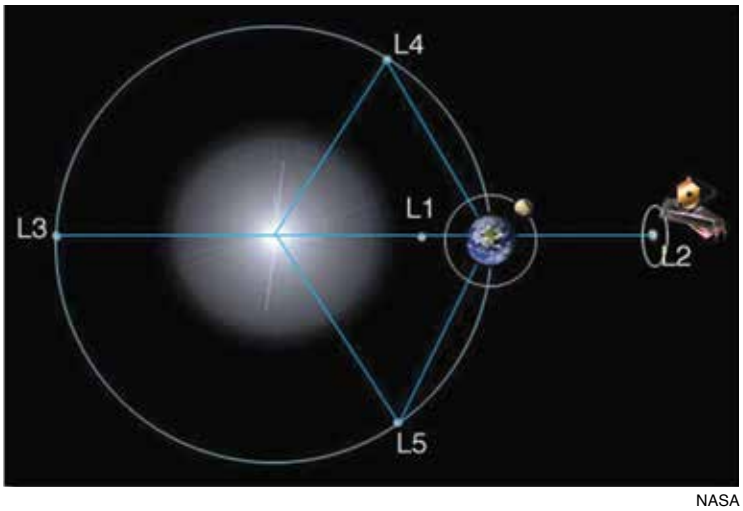
Although it is beyond the scope of this article to explore this in-depth, there are a few key concepts to understand why the infrared range of the electromagnetic spectrum is considered to be so important.

Only a little over a century ago, most scientists and astronomers believed that our universe was contained within our own galaxy, the Milky Way. Edwin Hubble (1880-1953, for whom the Hubble telescope was named) discovered in the 1920s that the Andromeda Galaxy wasn't just a star or an emerging solar system, but an entirely separate galaxy, now estimated to be about 2.5 million light years away from Earth. The world was stunned to learn that there are billions and billions of galaxies in all directions around Earth. The question for the scientists of the day was: What is the nature of this universe? Is it expanding, contracting or stationary?

EarthSky, in a Nov. 20, 2021 posting, "Edward Hubble and the expanding universe," noted what this meant:

> The answer involved the light of galaxies as a whole. Astronomers observed shifts toward the red end of the spectrum in distant galaxies' light. They interpreted this red shift as a sign that the galaxies are moving away from us. Hubble and his colleagues compared the distance estimates to other galaxies with their red shifts. On March 15, 1929 Hubble published his observation that the farthest galaxies are moving away faster than the closest ones.

This is similar in principle to the "Doppler Effect" in sound waves; when a fire engine siren approaches us, the sound waves "bunch up," and the pitch appears to be higher, and then when it passes and is heading away from us, the pitch is apparently lower, because the sound waves stretch out and are further away from each other. But this is only relative to our position and



NASA

The final destination for the James Webb Space Telescope will be at the Sun-Earth Lagrange Point 2, about 1.5 million kilometers from Earth, where it is expected to function beyond its 10-year official mission.

movement in relation to the moving siren; the firemen on board wouldn't hear a change in pitch.

As galaxies appear to be moving away from our own, the light waves are apparently stretching into the infrared range, hence the "red shift"—the light from these remote galaxies is so far away that the original light waves have lengthened into the infrared range. If they were moving towards our galaxy, then the light would move to the opposite end of the spectrum, into ultraviolet (shorter) wavelengths. Some galaxies are so far away that they are no longer detectable in visible light (in which the Hubble telescope operates), and this is why scientists speak in terms of "looking back in time"—what we see through such a telescope is not how the stars and galaxies appear *now*, but billions of years ago when the radiation first started out on its journey toward our galaxy.

From a different point of view, if one were some hypothetical intelligent life form viewing Earth from a far-off galaxy, one would be viewing dinosaurs, not our present civilization.

'A Thought of God'

As we have seen in many other astronomical discoveries, the truth is often far more spectacular than theory. With the JWST, we can inch closer to what may be the most profound discovery of all—how the known Universe was created, and an increased understanding of mankind's role in it. Perhaps, we may discover the truth of Friedrich Schiller's idea, "The universe is a thought of God."

Since the time when prehistoric humans began to walk the Earth, the extraordinary creativity of human beings has enabled us to not only adapt to a changing environment, but to transform Nature, in such a way that we are the only species that can willfully increase our population, and increase the standard of living for an increasing number of people. This is elaborated in Lyndon LaRouche's concept of a rising "potential relative population-density" as the key to a healthy economy. This unique creativity is what sets us apart from, and superior to, mere animals.

With the creation of the first knife, axe or spearhead hewn from carefully selected stone material, its cutting edge was revolutionary in its power and efficiency for slicing meat, chopping wood or hunting animals for food.

Now, the new cutting-edge technology will be in orbit 1.5 million kilometers away from Earth—a work of human hands, labor and creativity—and will extend humanity's reach further into the cosmos than it has ever been before.

Projecting our minds forward to the time when the JWST's scientific tasks are expected to get underway in June 2022, and then looking back to today, let us act now upon the urgent warnings of Helga Zepp-LaRouche and others, that humanity is sleepwalking into thermonuclear war. Let us reflect and change our economic and strategic policies such that when JWST sends its first images of faraway suns, there will be a human race here to welcome them.

Live tracking of JWST's progress is available here.

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