

Is space exploration a necessity or an indulgence?

When I was little, my father shared a secret with me.

He told me that every night, while the world slept, he'd go out to clear the sky for the moon and stars, then paint it blue again before morning, so I'd wake up to a bright blue sky.

Now and then, he said, the oceans would tear apart, and no one would notice. But he'd stay awake and sew them back together, restoring their deep blue color by sunrise.

I believed him.

I remember wanting to wake up at night to help, painting the sky and ocean beside him. I imagined the quiet of those early hours - the world paused and fragile, waiting for restoration by adept hands. In those moments, the universe felt small enough to care for, as if it depended on someone choosing to protect it.

Only years later did I understand the gift. He'd instilled in me a love for the sky above me and the ocean below, not as something impermeable, but something vulnerable. He taught me to look at the world with immense care, as if it were a painting I must restore and always preserve in its original splendor.

But as I came of age, I began to question this secret, this premise. The sky did not clear each night; the ocean did not require brushstrokes by unseen hands. What once felt like magic gave way to something deeper - more profound: it turned into curiosity.

I began to ask the same compelling questions that have haunted humanity for centuries. Why does the universe exist? What is our place in it? Where did we come from and where do we go?

These questions are not contained in childhood. They expand beyond the sky I once believed was painted - into the vastness of the cosmos itself. They transform from quiet wonder into an unwavering search for understanding. From these questions, space exploration begins. It does not start as an indulgence. It ignites as an inevitable response to curiosity.

Thus, could space exploration be rightly deemed an indulgence? Or does humanity rely on scientific discovery?

I found myself caught between two ways of thinking about space exploration. On one hand, I initially construed that pursuits in space could not positively impact the many problems I witnessed around me - notably, poverty, inequality, and environmental change - challenges that felt immediate and urgent. It was easy to determine that exploring far-off planets meant turning away from what was fragile and needy here on Earth. This concern reflects a broader argument: that space exploration diverts billions of dollars and scientific talent away from urgent crises, making it seem like an unjustifiable luxury. The moral weight of this claim is difficult to ignore. Yet, as my assessment advanced, my questions changed. I began to comprehend that innovation,

which prompts progress, emerges from a commitment to ask questions - especially when answers are distant and uncertain.

Indeed, space exploration did not begin with rockets, nor with competition between nations. It began with wonder. It launched with the same impulse that once led a child to believe the sky was carefully prepared well past midnight. The exploration of space is not a luxury we pursue after solving our problems. It is among the ways we learn how to solve them.

It is, fundamentally, a necessity. Not only for survival, but for understanding. I reached a clear conclusion: The aim to understand the universe was cohesive with, and deeply connected to, the responsibility to care for our own world.

One of the most profound contributions of space exploration is not what it enables us to reach, but what it enables us to see. When Voyager 1 turned its camera back toward Earth from billions of kilometers away, it captured an image that would transform human perspective. Carl Sagan poetically described it as a mote of dust suspended in a sunbeam. In that now-famed image, later defined as the Pale Blue Dot, every ocean, every city, every human life was reduced to a fraction of a pixel.

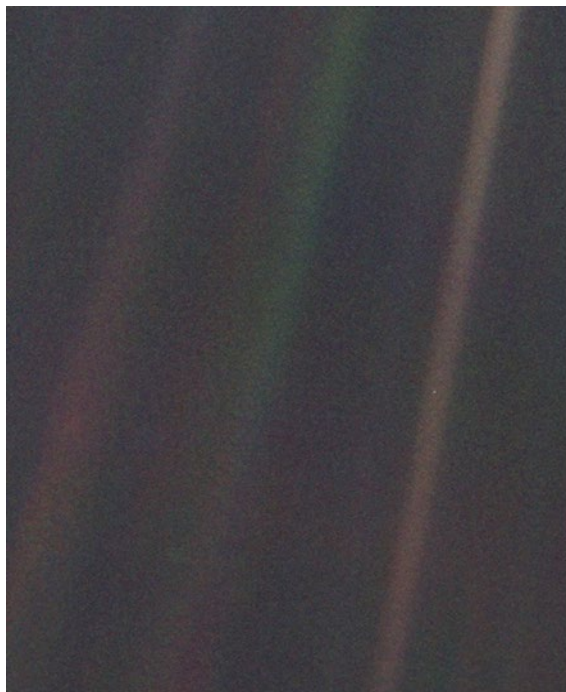


Figure 1: Pale Blue Dot image captured by Voyager 1.

From that far distance, the world no longer appears so vast, so dominant. It reveals fragility, vulnerability. The belief that someone might be quietly maintaining it no longer seems viable. Instead, the image reveals something far more valuable. There is no one else responsible for it ... only us. I am taken back to the inky nights I imagined someone quietly caring for the vast sky. Now, I realize that the responsibility I once placed in those narratives always belonged to us.

In a universe now estimated to contain trillions of galaxies, this realization becomes even more profound. Our planet is not the center of existence: It is one small part of a much larger system. Yet, it also is the only place we know where life exists. Space exploration does not diminish Earth. It reveals its significance.

More importantly, it reshapes how we think about knowledge itself. Without observing our planet from outside it, we'd remain confined to a limited perspective, unable to fully understand the systems that sustain life. The act of looking outward becomes a method of looking inward. It allows us to study Earth not as lone inhabitants, but as observers capable of recognizing our shared destiny within and beyond it.

The same curiosity that once led humankind to imagine stories about the sky now drives us to study it with precision. Astronomers have discovered thousands of planets orbiting distant stars, many within regions where liquid water might exist. These discoveries suggest that the conditions for life may not be unique to Earth, and also highlight how rare and delicate such conditions can be.

At the same time, scientific research reveals that the elements that comprise our bodies were formed in the interiors of ancient stars. The atoms of oxygen, carbon, and iron within us were once part of stellar processes that occurred billions of years ago. In a very real sense, we are not separate from the universe we study. We are a product of it.

This realization changes the question itself. Space exploration is not simply about traveling outward. It is about understanding origins. It is about tracing the processes that led to the formation of planets, stars, and eventually life. Without this knowledge, our understanding of existence remains incomplete, incomprehensible.

Space exploration is also deeply connected to life on Earth in practical and immediate ways. Satellites orbiting our planet form an invisible infrastructure that supports modern civilization. They enable us to forecast weather, monitor environmental changes, guide transportation systems, and maintain global communication. But more than that, they have fundamentally changed how humanity responds to challenges. This shift did not simply improve technology. It changed how humanity relates to uncertainty itself.

We are no longer a species that reacts only after events occur. Through satellite observation, we have become capable of anticipating patterns before they unfold. We can track the development of storms, monitor the spread of wildfires, and observe long-term environmental changes with increasing precision.

Far from being detached from earthly concerns, space exploration has become one of the primary tools through which we manage them. It permits us to see patterns that cannot be observed from the ground and make decisions based on global understanding that transcends terrestrial limits.

It is seeing the same fragile world through a new lens - finally understanding what is truly at stake.



Figure 2. The Blue Marble (Apollo 17 Earth Image)

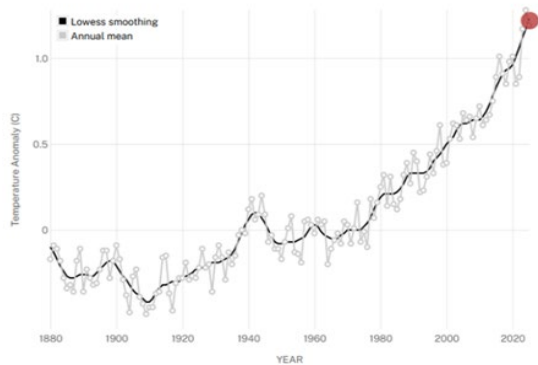


Figure 3. Land Ocean Temperature

The lesson I once learned as a child, that the world around me was something to be cared for, takes on a new meaning when seen from space. Images of Earth reveal no borders, no divisions, no separate systems. They portray a single, interconnected planet in delicate balance.

From orbit, scientists measure rising sea levels, changing atmospheric conditions, and shifting ecosystems. These observations have transformed environmental science - enabling humanity to recognize not only the existence of climate change, but its scale and urgency.

Space exploration, in this sense, does not pull us away from Earth. It brings us closer to it. It gives us the ability to understand the very painting I once believed someone was carefully maintaining.

But there is no one quietly repairing the damage. The idea that someone might be painting the sky - bringing it back into place, no longer feels comforting, but it does make the responsibility we carry impossible to ignore.

The responsibility is ours.

To explore the cosmos while ignoring our own planet would indeed be an indulgence. Yet, to use that exploration to better understand, protect, and preserve Earth transforms it into something entirely different. It becomes a necessity grounded in responsibility.

There is also a deeper reason why space exploration cannot be dismissed as optional. It fosters the long-term survival of humanity. Earth is our only home, and it is not guaranteed to remain safe indefinitely. History reminds us that planetary-scale events, such as asteroid impacts, have shaped the course of life before. Scientific research suggests that future risks, whether sudden or gradual, are possible.

A species confined to a single planet is inherently vulnerable. Exploring space, studying other worlds, and developing the ability to exist beyond Earth are not acts of fantasy. They are acts of self-preservation.

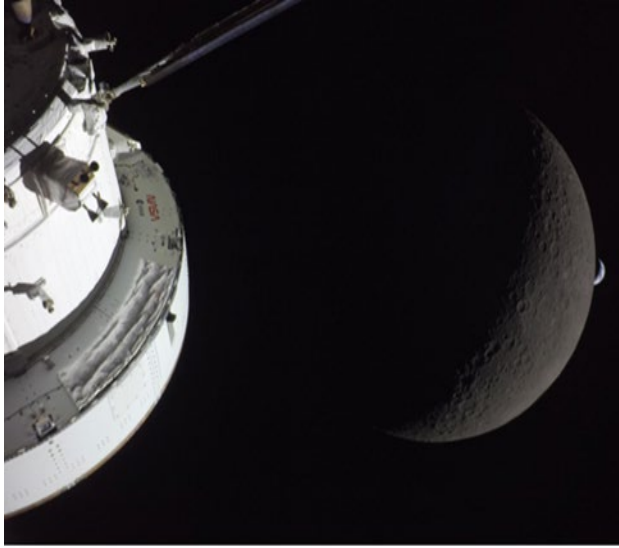


Figure 4: View from NASA's Orion spacecraft during the Artemis II mission, showing the Moon and Earth in the distance

At the same time, the future of space exploration is not about abandoning Earth in search of something better. It is about understanding our place more fully. As we look beyond our planet, we are no longer only observers of the universe. We become participants in its unfolding story.

There is a compelling paradox at the center of this pursuit. The farther we look into space, the more we learn about ourselves.

Observations of distant galaxies reveal the origins of matter. Studies of planetary atmospheres help us understand our own climate. Even the search for life elsewhere prompts us to define what life is here.

Space exploration is the only form of exploration in which distance does not create separation, but connection. The more we explore, the more we see that Earth is not isolated, but part of a continuous cosmic process.

Missions to Mars, the search for habitable environments, and the study of distant planetary systems represent more than technological achievement. They reflect a fundamental aspect of human nature - a longing to extend our understanding beyond the limits of what is immediately visible.

And in doing so, we gain perspective. We begin to see Earth not as the center of everything, but as part of something much larger. This perspective does not reduce its importance. It magnifies it.

I no longer believe that someone wakes in the middle of the night to clear the sky or paint the oceans blue. The stars do not need to be revealed by careful hands, and the sea does not wait to be stitched back together before dawn. Now, I understand why I once believed it. It was my way of making sense of a world too vast to comprehend.

Today, we no longer rely on stories, myth, and folklore to explain the sky. We explore it.

We build telescopes that look billions of years into the past. We send spacecraft beyond the boundaries of our solar system. We analyze distant worlds in search of patterns that might reveal the presence of life.

We pursue these things not because we have solved all problems on Earth, but because we have not exhausted our questions.

Space exploration is neither a luxury nor an escape from reality. It is the continuation of pursuits determined as deeply human. At its core, it reflects a deep human desire to understand where we come from, where we are headed, and what our place is within the vastness around us.

And perhaps the most important lesson it offers is this.

The night sky was never waiting to be painted.

It was waiting to be understood.

And understanding it is the only way to learn how to protect this world we call home.