

Technology Trends

Space

Center for Learning in Retirement

CLR Fall 2020

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Week 10

Public Service Announcement

- We are currently asking members who are currently enrolled in a Fall II and/or Fall term course(s) to please submit an anonymous evaluation for each course.
- The deadline to submit a Fall II and/or Fall Term CLR Course Evaluation form is Friday, December 4 by Noon (ET). [Fall II & Fall Term CLR Course Evaluation Form](#)

Thank you!

The What

- ~~Artificial Intelligence & Machine Learning~~
- ~~Robots & Drones~~
- ~~Autonomous Transportation Systems~~
- ~~Surveillance~~
- ~~(Cyber) Crime, Security & Warfare~~
- ~~Medical Tech~~
- ~~Media~~
- ~~(Virtual) Money & Blockchain~~
- ~~Communication~~
- Space
- Earth & Sky

Crew 1 Mission (takeoff 11/15/2020)



1st CCtCap (Commercial Crew Transportation Capability) mission

Commander:

- NASA astronaut Mike Hopkins

Pilot:

- NASA astronaut Victor Glover

Mission Specialist:

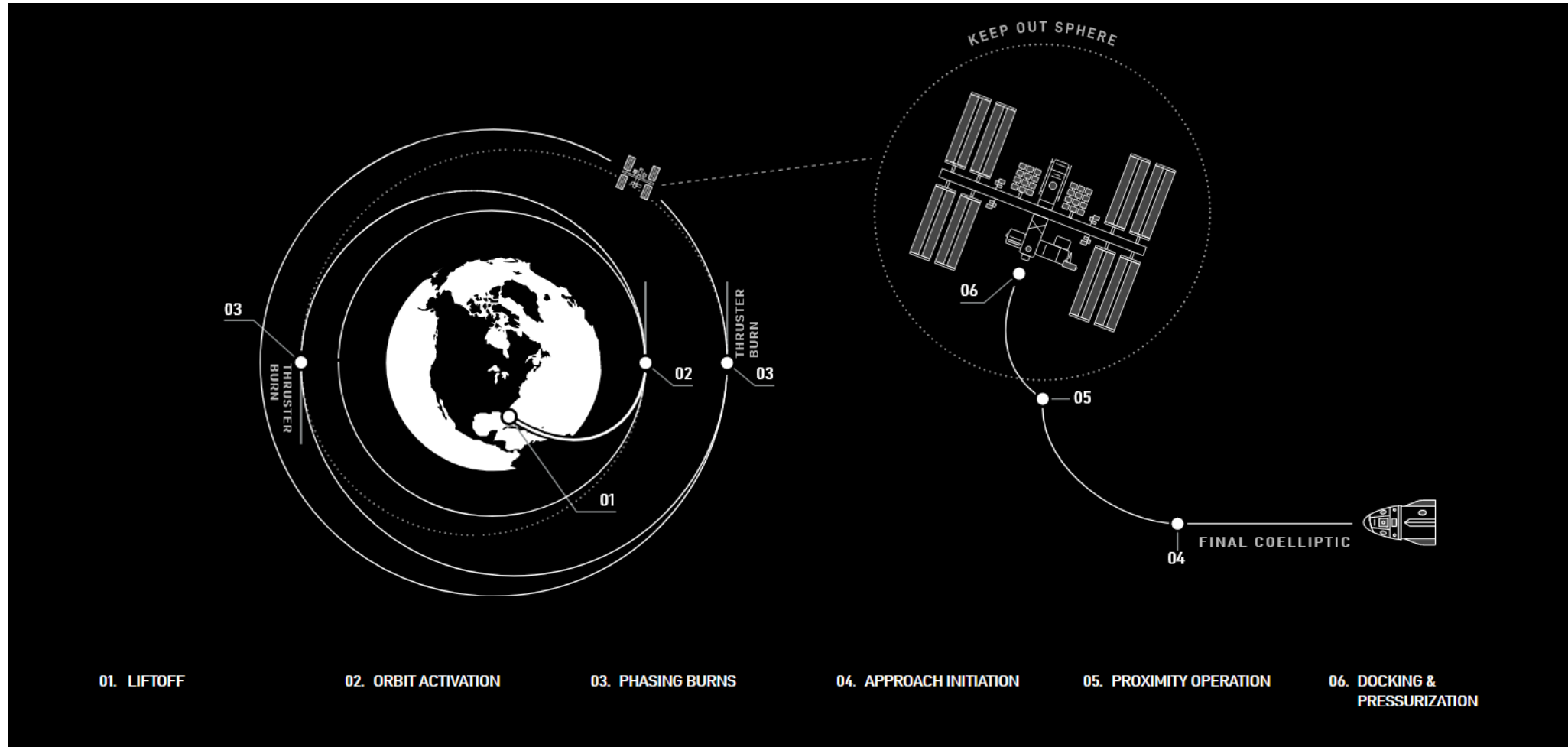
- NASA astronaut Shannon Walker

Mission Specialist:

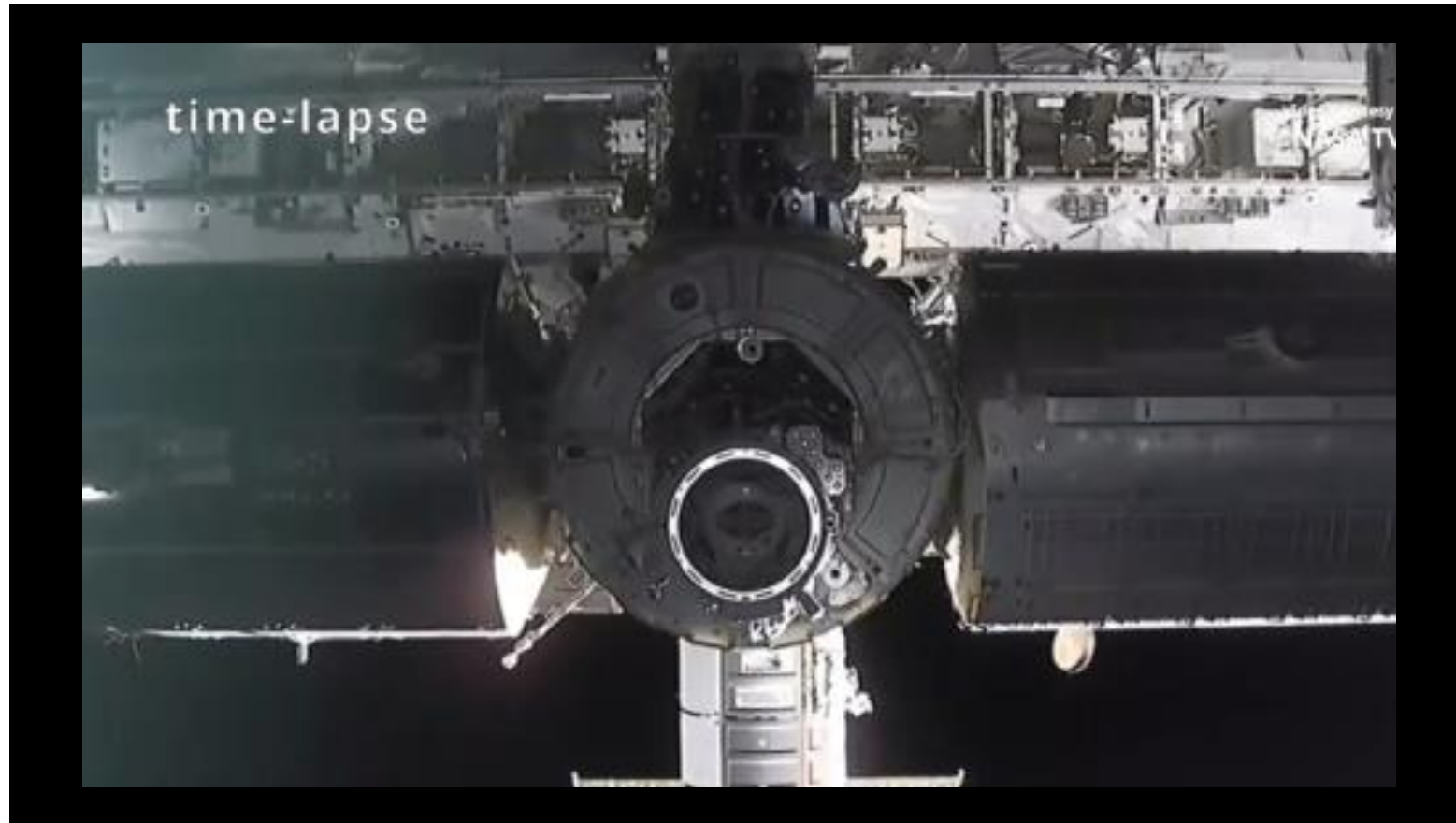
- JAXA astronaut Soichi Noguchi



Crew 1: Flight plan schematics



Crew 1: Docking w/ ISS ([source](#))



Space: What is it? ([source](#))

- From the perspective of an Earthling, outer space is a zone that occurs about 100 kilometers (60 miles) above the planet, where there is no appreciable air to breathe or to scatter light. In that area, blue gives way to black because oxygen molecules are not in enough abundance to make the sky blue.
- Further, space is a vacuum, meaning that sound cannot carry because molecules are not close enough together to transmit sound between them. That's not to say that space is empty, however. Gas, dust and other bits of matter float around "emptier" areas of the universe, while more crowded regions can host planets, stars and galaxies.

How big is it? (source)

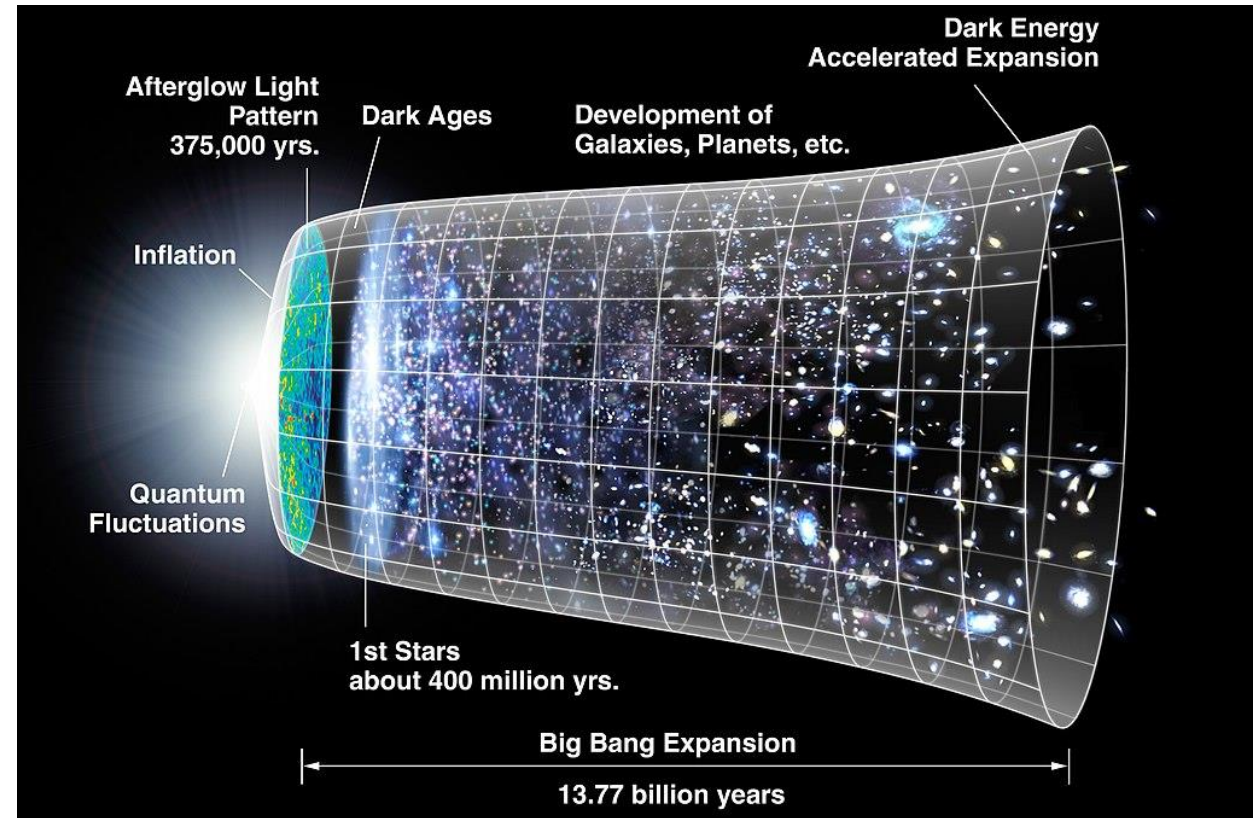
- No one knows exactly how big space is. The difficulty arises because of what we can see in our detectors. We measure long distances in space in "light-years," representing the distance it takes for light to travel in a year (roughly 5.8 trillion miles, or 9.3 trillion kilometers).
- From light that is visible in our telescopes, we have charted galaxies reaching as far back as 13.7 billion years ago. This means we can "see" into space at a distance of almost 13.7 billion light-years. However, astronomers are not sure if our universe is the only universe that exists. This means that space could be a lot bigger than it appears to us.

Where are we in it? ([source](#))

- Earth is located in the universe in the [Virgo Supercluster](#) of galaxies. A supercluster is a group of galaxies held together by gravity. Within this supercluster we are in a smaller group of galaxies called the Local Group. Earth is in the second largest galaxy of the Local Group - a galaxy called the Milky Way. The Milky Way is a large spiral galaxy.
- Earth is located in one of the spiral arms of the Milky Way (called the Orion Arm) which lies about two-thirds of the way out from the center of the Galaxy. Here we are part of the Solar System - a group of eight planets, as well as numerous comets and asteroids and dwarf planets which orbit the Sun. We are the third planet from the Sun in the Solar System.

Timeline (according to the [Big Bang](#))

- The **chronology of the universe** describes the history and [future of the universe](#) according to [Big Bang](#) cosmology.
- The earliest stages of the universe's existence are estimated as taking place 13.8 [billion years](#) ago, with an [uncertainty](#) of around 21 million years at the 68% confidence level.^[1]



How many galaxies are there? ([source](#))

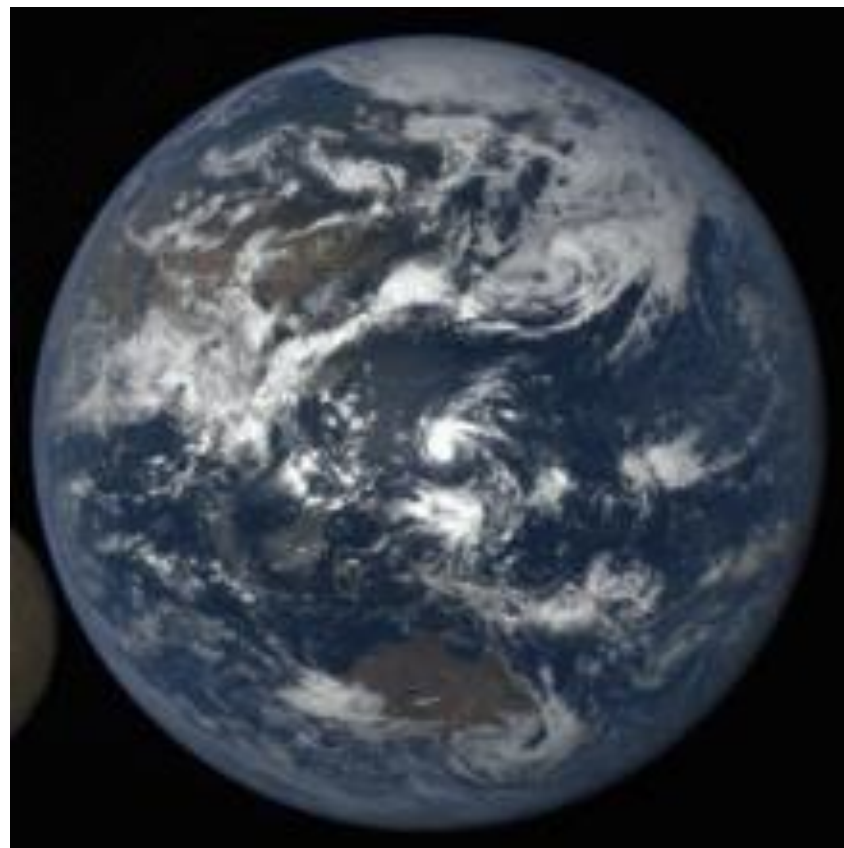
- One of the most fundamental questions in astronomy is that of just how many galaxies the universe contains. The landmark Hubble Deep Field, taken in the mid-1990s, gave the first real insight into the universe's galaxy population. Subsequent sensitive observations such as Hubble's Ultra Deep Field revealed a myriad of faint galaxies. This led to an estimate that the [observable universe](#) contained about 200 billion galaxies*.
- The new research shows that this estimate is at least 10 times too low. Using new mathematical models, which allowed them to infer the existence of galaxies that the current generation of telescopes cannot observe. This led to the surprising conclusion that in order for the numbers of galaxies we now see and their masses to add up, there must be a further 90 percent of galaxies in the observable universe that are too faint and too far away to be seen with present-day telescopes.

How many stars are there then?

- **Our galaxy, the Milky Way, has approximately 100 billion stars in it.**
- **And the observable universe contains about 2 trillion galaxies (the most recent estimate)**
- My estimate: a really big number, so for simplicity, let's just say **'infinity'!**

“There are 10 times more stars in the night sky than grains of sand in the world's deserts and beaches, scientists say.”

Time to come back down to earth



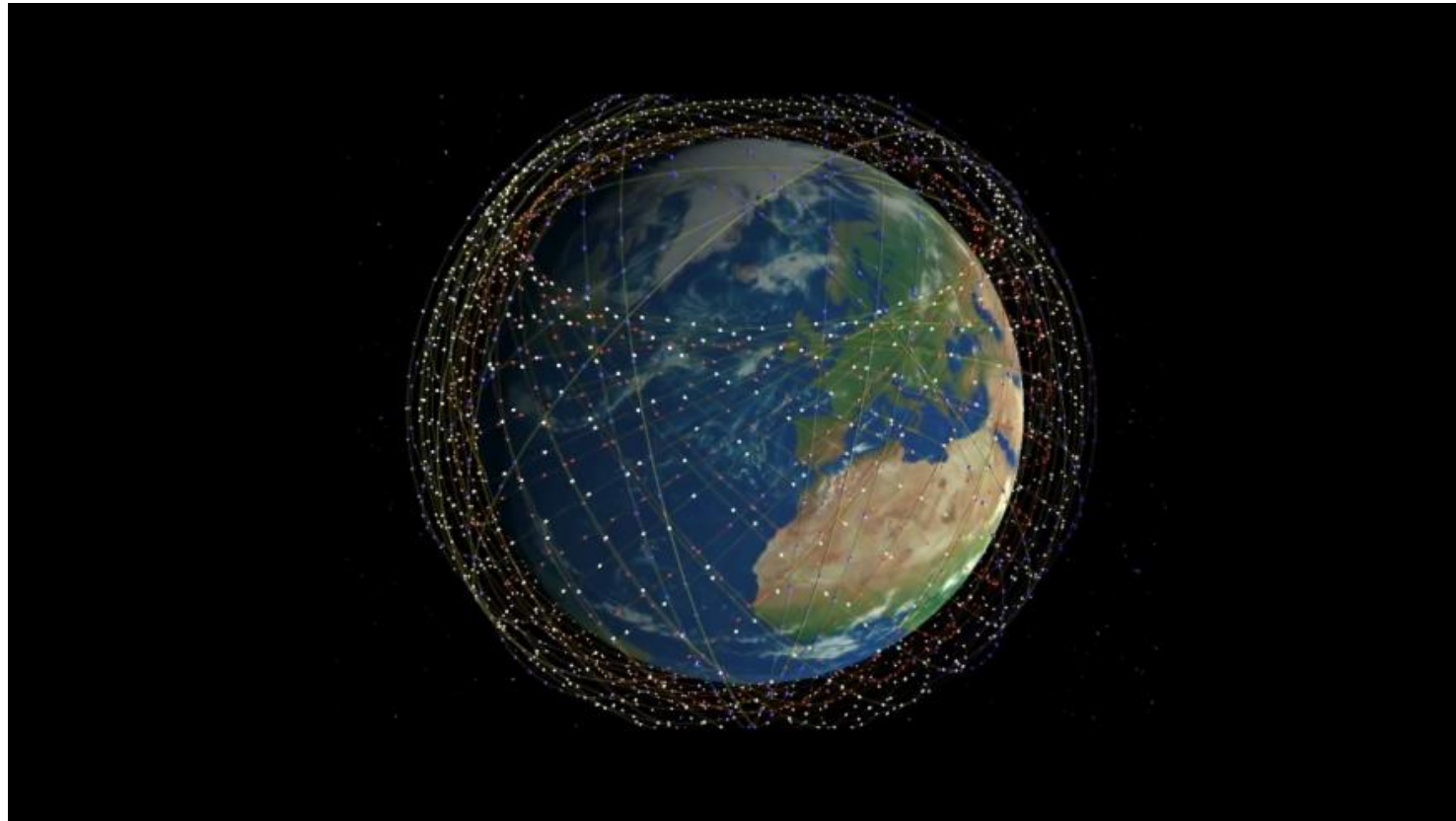
Satellites ([source](#))

- [What is a Satellite? - The History and Technology ... - Space.com](#)
- [What Is a Satellite? | NASA](#)
- [LIVE REAL TIME SATELLITE TRACKING AND PREDICTIONS](#)
- [Autonomous Tech Will Transform What We Can Do in Space](#)
- Video: [In Orbit: How Satellites Rule Our World - BBC Two](#)

Satellite Communications ([source](#))

MIKE LINDSAY

More On StarLink ([source](#))



The Truth About Space Debris ([source](#))



Space telescopes ([source](#))

- [Major Space Telescopes | Space](#)
- [Have Telescopes Changed Our View of the Universe? - NASA](#)
- [From telescopes to satellites, space exploration and the ...](#)
- [List of space telescopes - Wikipedia](#)
- [Why Do We Put Telescopes in Space? - Scientific American](#)
- Video: [James Webb Space Telescope: Earth's Favorite New Telescope](#)

Once There Was [Hubble](#) (1990)



James Webb Space Telescope: Earth's Favorite New Telescope (31 October 2021)

