

NATION



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NASA's Nancy Grace Roman Space Telescope is being assembled at the Goddard Space Flight Center in Greenbelt, Md.

A RARE LOOK AT NASA'S NEXT SHARP-EYED SPACE TELESCOPE

Assembly ramped up this fall with 600 workers aiming to get everything tested by late 2026

By Joel Achenbach
WASHINGTON POST

The next great space telescope will study distant galaxies and faraway planets from an orbital outpost about a million miles from Earth. But first it has to be put together, piece by piece, in a cavernous chamber at the NASA Goddard Space Flight Center in Greenbelt, Maryland.

The place is known as the Clean Room, or sometimes the High Bay. It is 125 feet long, 100 feet wide, 90 feet high, with almost as much volume as the Capitol Rotunda. NASA boasts that in the Clean Room you could put nearly 30 tractor-trailers side by side on the floor and stack them 10 high.

"This is the largest clean room in the free world," Mike Drury, a 40-year veteran of Goddard, said as he led visitors into the busy chamber on a recent Friday. "It is a privilege to work here."

About two dozen workers clustered around towering pieces of hardware, some twice or three times the height of a typical person. When stacked and integrated, these components will form the Nancy Grace Roman Space Telescope.

The assembly of the telescope ramped up this fall, with 600 workers aiming to get everything integrated and tested by late 2026. NASA has committed to launching the telescope no later than May 2027.

The telescope will be roughly the size of the Hubble Space Telescope, but not quite as long (a "stubby Hubble," some call it). What the astronomy community and the general public will receive in exchange for the considerable taxpayer investment of nearly \$4 billion is an instrument that can do what other telescopes can't.

It will have a sprawling field of view, about 100 times that of the Hubble or Webb space telescopes. And it will be able to pivot quickly across the night sky to new targets and down-



A worker in a clean suit labors on the assembly of the Roman Telescope.

load tremendous amounts of data that will be instantly available to the researchers.

A primary goal of the Roman is to understand "dark energy," the mysterious driver of the accelerating expansion of space. But it will also attempt to study the atmospheres of exoplanets – worlds orbiting distant stars.

Anyone who might think two-and-a-half years is a leisurely timeline for assembling a telescope and getting it to the launchpad is unfamiliar with the delicacy of such endeavors and the engineering requirements for state-of-the-art astronomy. The standard everyone is aiming for is perfection.

In the Clean Room the workers are pretty much indistinguishable. Everyone wears white gowns, white hoods, white booties, white surgical masks and, adding a dash of color to the scene, blue surgical gloves. The goal is to keep hardware from being contaminated by humans. No dust allowed. No stray hairs. One wall is entirely covered by HEPA filters.

The Clean Room is full of fascinating stuff, but a visitor knows it would be unwise to pick up an object and ask, "So what does this thing do?"

The main element, informally referred to as "the telescope" but officially called the "optical telescope assembly," showed up this fall. It was originally built as a spy satellite for the National Reconnaissance Office.

That's right: It was built

to look down at Earth, rather than at the rest of the universe. The NRO decided more than a decade ago that it didn't need it, and gave it, along with another, identical spy satellite, to NASA.

Roman's wide-angle view of deep space, its maneuverability and ability to download massive amounts of data makes it optimized as a dark energy telescope. And it will also study the effects of dark matter, which comprises about 25% of the universe but remains a ghostly presence.

"Roman won't be able to detect dark matter directly, but will help understand its role in shaping the structure of the universe," NASA astrophysicist Joshua Schlieder, part of the Roman science team, said as he and Webb senior project scientist Jane Rigby prepared to enter the Clean Room.

"Whatever dark matter is, it's got to be strange," Rigby said. "Dark matter can't be in the periodic table. It's got to be weirder than that."

Golden age of astronomy

The Roman is named for NASA's first chief of astronomy, Nancy Grace Roman, a pioneer in her field. "I was told from the beginning that women could not be scientists," she often said, according to a NASA biography.

Roman joined the agency when it was just getting started, in 1959, and retired two decades later, having lobbied for the creation of a space telescope. She died

at the age of 93 in 2018, and 15 months later NASA honored her by renaming a telescope that had originally been called WFIRST, for Wide-Field Infrared Survey Telescope.

The Roman is the latest in what is turning into a golden age of astronomy. In Chile, the Vera C. Rubin Telescope, named after another pioneering female astronomer and funded by the National Science Foundation and the Department of Energy, is a wide-field telescope scheduled to begin inaugural observations – first light – this year.

And NASA is avidly working up plans for a space telescope called the Habitable Worlds Observatory, which will try to make good on its name and see distant planets with signs of atmospheres suitable for life as we know it.

The question for American policymakers is whether they will provide the funds necessary to build ever-larger or more sensitive telescopes in a period in which astronomy is a competitive global enterprise. There is a race to build huge ground-based observatories and the United States is poised to be sitting on the sidelines while European Southern Observatory completes what is called the Extremely Large Telescope on a mountain-top in Chile, with first light expected in 2028.

Astronomy leaders in the United States want to build two huge telescopes, the Giant Magellan Telescope and the Thirty Meter Telescope, the first covering the south-

ern sky from Chile and the second covering the northern, probably from Hawaii. Both have institutional and scientific support, but they are effectively competing against one another for the blessing, and funding, of the National Science Foundation.

There doesn't appear to be nearly enough NSF money for both, and funding even one would be challenging for NSF unless Congress decides to boost the agency's budget.

The night sky does not belong to anyone. Light can travel the breadth of the universe carrying cosmic information for whomever has the wherewithal to look in the right direction with the right instrument.

Probing cosmic darkness

Built in Rochester, New York, by L3Harris, the Roman was flown in a military cargo plane to Joint Base Andrews, then trucked slowly and gently in the middle of the night along the Beltway to Goddard.

(When NASA a few years back had to drive the extraordinarily delicate James Webb Space Telescope from Goddard to Andrews, a person walked in front of the truck with a flashlight, looking for potholes, according to Rigby.)

The Roman – sorry, the optical telescope assembly – was parked in a corner of the Clean Room, unattended, looking a little bit ignored even, as workers attended to other hardware across the chamber. The central feature of the

telescope is an exquisitely polished, concave primary mirror, 7.9 feet in diameter.

The primary mirror sits beneath a smaller, secondary mirror that, connected by struts, sits at the peak of the telescope. When starlight hits the primary mirror (the "light bucket" as some call it), it will be reflected to the secondary mirror and then reflected again to a hole in the center of the primary mirror, down into a chamber with seven more mirrors and two astronomical instruments.

One of them is a coronagraph. It will block the blinding glare from a star in a manner that potentially allows it to capture reflected light from an orbiting planet. This is dubbed a "technology demonstration." Seeing "exoplanets" (which orbit stars other than our own) has long been a challenge. One goal of the Roman is to come up with a census – an estimate – of planets in our galaxy.

The second and most important instrument, the wide-field camera, which is about the height of a small car, hadn't yet been installed on that Friday. It sat on the floor just a few steps away.

In another corner of the room loomed the sun shade (or "deployable aperture cover"), which will ensure the telescope can probe the cosmic darkness without getting the sun in its eyes. It was scheduled to be attached to what's called the outer barrel assembly, described by NASA as "the telescope's exoskeleton."

The telescope will eventually be integrated with what's called the "spacecraft bus," a bulky, cylindrical structure that holds electronics and communications hardware for the mission. Then the hardware will undergo vibration tests and then be heated and cooled in outer-space-like conditions in a vacuum chamber.

An essential feature of the Roman is that, just like the Webb, it is not designed to be repaired by astronauts if something goes wrong in space. That's because, unlike the Hubble, it will not be in low Earth orbit. It'll be where the Webb is, in a stable solar orbit called Lagrange point 2, or L2, roughly a million miles from home and never straying too far away.

So it needs to be put together correctly – perfectly shipshape, immaculately clean – before it gets flung into deep space.