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We are scientists and engineers testing NASA's James Webb Space Telescope, which is the scientific successor to the Hubble, AMA!

NASAWebbTelescope [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Hello! We are scientists and engineers working at NASA Goddard, and leading the current testing on the James Webb Space Telescope in NASA Johnson's historic Chamber A. Why is this testing notable? Chamber A is a giant thermal vacuum chamber, and our telescope is undergoing a ~100 day, end-to-end test at extremely cold temperatures, in a space-like vacuum inside of it. We'll answer questions about why Webb has to perform in extreme cold, why NASA built a giant, infrared telescope, and what cryogenic testing is all about. We'll be online for an hour or so on Thursday October 19th, at 1pm ET for questions, and we will be checking back in periodically after the Q&A for other questions. NASA's James Webb Space Telescope (Webb) is the world's premier space telescope of the next decade. It will delve deeper into our solar system, look beyond to distant worlds around other stars, and help us to learn more about the universe and our place in it. Webb is an international collaboration among NASA, the European Space Agency (ESA), and the Canadian Space Agency (CSA). Answering your questions: Mark Voyton: Optical Telescope Element and Integrated Science Instrument Module Manager Juli Lander: Deputy Optical Telescope Element and Integrated Science Instrument Module Manager Randy Kimble: Integration & Test Project Scientist Lee Feinberg: Optical Telescope Element Manager & Optical Telescope Element and Integrated Science Instrument Module Technical Lead. ETA: We are about done for today - but we'll check back in tomorrow. Thanks so much for all the excellent questions, we had a great time!

the WINNOWER

REDDIT

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NASAWEBBTELESCOPE R/SCIENCE

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Answering your questions:
Mark Voyton: Optical Telescope Element and Integrated Science Instrument Module Manager
Juli Lander: Deputy Optical Telescope Element and Integrated Science Instrument Module Manager
Randy Kimble: Integration & Test Project Scientist
Lee Feinberg: Optical Telescope Element Manager & Optical Telescope Element and Integrated Science Instrument Module Technical Lead.
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When will we see the first images taken from this telescope?

Jolurawa

Hi - it won't be for some months after launch. The short answer is that the telescope needs to get out to where it will orbit the Sun, and then it needs to cool down to operating temperature, and we'll need to align the mirrors and calibrate the instruments. Routine science operations will start ~6 months after launch - the first light images will be out prior to that. The longer answer is here: https://jwst.nasa.gov/faq.html#howdeploy

--Maggie for the Webb team

What could the Webb telescope tell us about the 7 Earth-like planets in the TRAPPIST-1 system there was so much fuss over earlier this year?

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recentfish

The TRAPPIST-1 planets are very exciting targets for JWST. They "transit" in front of their star as viewed from Earth (pass between us and the star), such that they periodically block out a small fraction of the star's light. As you would expect, the solid body of a such a planet blocks out the same fraction of the light at all wavelengths -- but when such a planet has an atmosphere, then at wavelengths where the atmosphere absorbs, the planet will block a tiny bit more of the star's light. With JWST's infrared coverage, we will be able to search for interesting atmospheric constituents like water, or even biologically significant molecules like methane and ozone. More detail can be found at https://www.nasa.gov/feature/goddard/2017/probing-seven-worlds-with-nasas-james-webb-space-telescope

Randy K.

Firstly, I have to say that I'm incredibly excited for your mission and look forward to a successful launch and deployment.

For my question: How have the recent advancements in LIGO changed your mission from your guys' perspective, if at all?

cuddlefucker

This opens up a new opportunity to study dramatic events such as the neutron star collision that occurred last week. While Webb can't search large areas of sky for optical counterparts, when wider-field telescopes discover an event, JWST will have unmatched sensitivity for looking at the details of the explosion that resulted from the collision.

Randy K.

What improvements does the new telescope have over the Hubble?

useful_person

Webb really picks up where Hubble's sensitivity isn't very good which is right at the near-infrared wavelength of 1.7um's. Webb goes all the way up to 28um's which is in the Mid-Infrared. This means Webb can see further back in time due to the red shifting of light into the infrared and also can detect molecular species around Exoplanets that Hubble cannot using the Transit methods - including methane, Co2 etc!! Lee

All missions from NASA I read about are one monumental effort where no expense is spared to make sure that nothing ever goes wrong because there's just one shot for getting it right. From a distance this looks like a positive feedback loop. Nothing may ever go wrong because the mission is so expensive, so we make the mission even more expensive to make sure that nothing goes wrong (a bit like the rocket equation but for costs).

Has anyone at NASA ever considered building and launching 10 telescopes without all the redundant systems and all that expensive testing and if 70% of them fail, screw it, we still have three left? Stagger the launches a few months apart and if a bug gets discovered it can be fixed between launches. Or is there some static fundamental cost (my first guess would be launch and mirror and maybe the PR cost) that makes this a bad idea?

hegbork

Yes, and that works well for small missions that fit on Cubesats and small satellites. That's hard to do on large missions like Webb with complex instruments....though we do build spares :) Lee

What's a cool little known feature the telescope has and what is that feature's purpose?

Any Easter eggs / "Joe was here" type of stuff in the design ?

kenef

How about a 2 dimensional array of little tiny shutters that are as small as .2mm on each side that can be programmed? We will use these when we look at the deep fields to allow us to get spectra on each of the galaxies of the deep field. This is a "MEMS" technology developed at the Goddard Space Flight Center and it operates at 50 Kelvin!! Is that cool or what? Lee

ETA: read more about the microshutters here: http://jwst.nasa.gov/microshutters.html

Compared to Hubble, 10 years seems a small lifetime for an expensive telescope like this, why wasn't it designed to last more time (and what is expected to happen once it becomes unable to keep its L2 orbit)? Also, does NASA have plans for a successor?

EnUnLugarDeLaMancha

YES! Next up is WFIRST and then we are studying a few different options for the next really big telescope. It could be LUVOIR which would be similar to Webb but 10-15 meters and would be tailored for looking for Earth-like Exoplanets and searching for life as well as blowing Hubble away in the UV and optical wavelengths. How cool does that sound? Lee

Hi

1) Are there any specific things/phenonena that you look forward to observing with the new space telescope?

2) What are the major problems that Hubble faced which you have planned to solve using James Webb Space Telescope?

MasterAgent47

Hubble's big problem was the primary mirror was ground wrong. We've checked this one multiple ways plus it is an active mirror that could actually correct the Hubble error using the actuators on the segments themselves to shape the mirror. Lee

During the design process do you have to factor in physical changes caused by the extreme cold? For instance do you have make seals etc oversized knowing they are going to contract?

AdolfJongUn

All areas of the design that operate under the cold of space conditions require a thorough understanding of the basic properties of the materials involved. And yes, you have to design the system knowing what it will do when it achieves it's cold operational temperature. Each component that operates at Cryo temperatures is modeled and tested to confirm that the behavior at extremely cold temperatures is well understood. The performance of the materials, components assemblies, and fully

integrated elements are also tested at extremely cold temperatures to prove the design meets its requirements when operating in space. Mark

I heard your crew had to spend a few nights at the chamber in Johnson during Harvey, even having to helicopter in liquid nitrogen to keep the test going. Is there anything else that Harvey has done for operations at Johnson and what were your contingencies if the test had been disrupted?

jediwashington

We did sleep there on air mattresses!! We did not helicopter in liquid nitrogen but were grateful for the amazing work of the team to get our liquid nitrogen resupplied! We were incredibly prepared for a Hurricane but Harvey had unique challenges because of the duration that the team handled with amazing teamwork and dedication. Lee

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jediwashington

Additionally to Lee's answer, we worked on a Hurricane plan for 2 years with the JSC facility and operations team, and had several contingencies planned out. We also had several team members take FEMA training so they would know what to do during the storm to keep personnel and hardware safe. - Juli

How have the launch delays affected your work? Is it a hinderance, or does it give you more time to test and quality assure the telescope?

descendantofstars

The launch delay did not impact our work. Our plans to complete the optical portion of the telescope can be executed without requiring the additional time.

Mark

I was really worried for the telescope during the hurricane flooding. Did the flooding get close to where the telescope was held?

if it had flooded would the telescope have been recoverable or would you have had to start again from scratch?

Shardless2

Johnson Space Center was amazingly not hit real hard except for a few parking lots so the telescope was never at risk. The hardest problem was probably getting our team back and forth to the facility over the 5 days of Harvey. It took a little creativity (think Pickup Truck convoys and careful attention to weather maps), but the team came through! The team had an amazing "can do" attitude which kept the telescope and team safe.... Lee

Good morning! Thanks for taking the time out answer some questions.

1. Why has it taken so long to build and deploy the James Webb Telescope? Have there been any major issues that delayed the deployment?
2. How did you get in to building giant state of the art space telescopes? What did you do that lead you to this?

drgngd

2) I studied optics in part because i am blind in one eye, moved to DC and thought "hey, NASA is down here and that would be a cool place to work". So I found a job working on teh ground system for Hubble and then when Hubble had it's flamed flaw, I got job working on the optical fix which was incredibly exciting. Then when Webb started, I had about a decade of experience working on Hubble and lucked into my job.
Lee

I just want to say how excited I am that this project is being done. I honestly cannot wait for what new discoveries that will come from it.

With that said, What is the one thing above all else you want to see come from this project?

And what about this project excites you the most?

Thank you all for doing this!

Salael

The one thing I want to see is that Webb is not the last big telescope our great nation builds. We have learned how to build a segmented, deployed telescope and now know how to do it faster and cheaper and can build even bigger ones that can find signatures of life on earth like exoplanets. And what excites me most is getting those first images down. Lee

Hey team, thanks for doing the AMA!

What are your thoughts about developing a piece of technology (like the James Webb Space Telescope) with such a long development time in today's fast-changing technology landscape? Is it frustrating to develop a module only to see it fall out of date by the end of the project? How do you know when to stop iterating on a concept and accept it for all it's strengths and flaws?

sethkid

It's true that there is a bit of lag in some technologies in a long development program like this. So, for example, infrared detectors with more pixels will be available when Webb launches than what we have in our cameras. But the detectors that we have are still very high performance (high sensitivity, low noise), just smaller than will be available in the future. And Webb really pushed the envelope, developing a number of new technologies to give it its great capabilities. But one critical thing -- the advantages of space are so great, the telescope will immediately be at the forefront of scientific capability. The main space advantages are: the sky is thousands of times darker than it is from even a high mountaintop, there is no atmosphere to absorb the wavelengths of light we want to view, and there is no atmosphere to distort the images with turbulence, so you can make sharper images.

Randy K.

Hi! Thank you for having this AMA. I have a few questions.

1. How will Webb get into orbit in the L2 point?
2. How do you prevent the telescope from absorbing the heat of space?
3. How will you prevent the telescope mirrors from getting scratched by dust particles?
4. If the telescope malfunctioned and only half of its mirrors unfolded, could it still take some measurements with its equipment?
5. Could the telescope take direct pictures of hot, young planets?
6. Will the telescope be able to make infrared observations of earth and monitor global warming?
7. How will you stop the mirrors from expanding and contracting when being exposed to the extreme temperatures of space?

Seas-of-Europa

1. Ariane Rocket
2. Rolling it during and then deploying sunshield
3. Not much dust to worry about where we are going (l2)
4. Hard to say but that won't happen :)
5. I don't know...
6. No, Webb doesn't look at earth. There are other satellites NASA builds to do this (check out the OCO and JPSS)
7. We plan for them to contract as it cools and compensate for that in the design and construction. Lee

Hi! Thank you for having this AMA. I have a few questions.

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Seas-of-Europa

We do have a coronograph, so we can image planets - BUT they would just be like dots. If you imagine just how far away these exoplanets are and how small they are, you can see why it'd be difficult to get grand panoramas of alien landscapes. We didn't even know what Pluto really looked like until New Horizons flew right up to it, and Pluto is much closer to us. Ideal candidates for us are planets orbiting M-type stars (those smaller and redder than our Sun), and that transit right in front of the planet. https://jwst.nasa.gov/origins.html

Also - Earth is way too bright for our telescope - we can see objects in the solar system, but they have to be from Mars on out. Anything between the telescope and the Sun is too bright and would swamp our really sensitive telescope. But NASA has lots of Earth-facing satellites observing Earth, fortunately!

-Maggie for the Webb team

Hi Webb Telescope! My question is: when the JWT goes operational on space, how are the mirrors protected against micrometeorites and other cosmic debris? If by chance one of the segmented mirrors gets struck, would it disable the entire observational capabilities of the telescope? Thank you so much.

ali3nbabble

One mirror would not impact the other mirrors. If we do have a problem with a mirror, we can defocus it so it doesn't impact the other ones in a significant way. And we tested mirror samples for the effects of micrometeoroids on the ground and found they leave very, very small pits that don't impact the performance. Great questions! Lee

Will there be a program in which the public can see every single image taken from the Webb? I'd love to follow our gaze into the stars!

2Skies

Hi! We haven't launched yet, so no images at this time - but you can definitely expect to see Webb's images online, much like we release Hubble images for the public now. There will definitely be a site archiving those for people to browse. Also, for professional astronomers looking for Webb data, there will be a data archive in the same place where Hubble data is archived: https://archive.stsci.edu/

-- Maggie Masetti for the Webb team.

Earlier this week we learned about the first optical detection of a neutron star merger and resulting kilonova involving thousands of astronomers across the planet. Once deployed, will the James Webb Space Telescope be capable of imaging such phenomena? How does re-positioning such an in-demand piece of equipment work?

shiruken

As more gravitational wave detectors come on line, the position of the detections improves. Then telescopes on the ground with wide sky coverage may be able to (and in last week's case did) localize the galaxy where the event occurred, by seeing an optical counterpart. While JWST observations will be in great demand, and normally scheduled well in advance, there will be a capability to rapidly replan the observing schedule for particularly exciting "targets of opportunity". Events like this are perfect candidates for disrupting the schedule to take a look.

Randy K.

HOLY HELL!!! IVE BEEN FOLLOWING THIS FOR YEARS!! YOU GUYS JUST GOT DONE TESTING IT IN THOSE GIANT CHAMBERS AT WILD TEMPERATURES!! DO WE HAVE A ROUGH ESTIMATE FOR NEXT YEAR?! ALSO WHAT KIND OF PICTURES CAN WE EXPECT LIKE DOES IT TRULY GO TO THE END OF OUR UNIVERSE?! WE WILL FOREVER CHANGE SPACE AFTER THIS 😭 OHHH MA GAAAAAD IM SO EXCITED !!!!!

gildmeurcatnotgold

How about pictures of some of the first galaxies and stars and how they evolved? Or how about Spectra from the Trappist Planets? Or how about pictures of planets and comets and galaxies and Supernova and planet forming regions? We're all super excited JUST LIKE YOU!! Lee

First and foremost, thank you for your work. Second, can we expect to see more photos or movies of the neutron star collision in the near future?

IsUserNameIsntTaken

Thank you to everyone who is thanking us for our work. Some of us worked just an incredible number of hours this past year and thanks like this is actually this biggest reward we get...I too hope we will get pictures of future gravitational wave events using Webb just like was done with HST. I'm sure it is possible! Lee

Has it been decided what the James Webb Space Telescope will look at first? If so, what?

Drbreakfast

The very first science target has not yet been decided yet - but there is a list out of some of the observations Webb will make during its first year of observations. It's a bit technical, but you can see that here: https://jwst-docs.stsci.edu/display/JSP/JWST+GTO+Observation+Specifications

--Maggie for the Webb team

It's my layman understanding thay this telescope will allow us to 'see' some of the earliest light of the universe however there is a point before that where the universe was in this haze (?) and that because of that haze we can not 'view' the birth of the universe. Do you see a day where we might find a work around to that unanswered question?

CornellCage

Hi - good question, mostly because what/when our mission will see is often confused. There are missions that have seen earlier light than we will see - microwave missions like WMAP and COBE saw the universe ~380,000 years after the Big Bang. We are going to see quite a bit later than that - around ~200-300 *million* years after the Big Bang. That's the approximate time period in the early universe during which the first stars and galaxies first started forming. It's not a period of the universe's history we have been able to explore yet because we haven't had a telescope optimized to see it.

You are right that there is a point past which we can't see - because the "particle soup" that existed did not allow photons of light to travel freely. If light can't travel outside of this particle soup, then we can't detect that light. I don't know that there is a workaround for that - it just is what it is. More on that here: https://jwst.nasa.gov/firstlight.html

We did this Q&A recently with our senior project scientist, Dr. John Mather, who won a Nobel Prize for his work on COBE and studying the Big Bang - it might help answer your further questions: https://www.nasa.gov/feature/goddard/2017/nasa-s-james-webb-space-telescope-and-the-big-bang-a-short-qa-with-nobel-laureate-dr-john

--Maggie for the Webb team

During one of the videos released by Elon Musk, there was an image depicting a 9 meter (4.5meter radius) single object launched by BFR.

What kind of (single, preassembled mirror) or (assembled in space) mirror could you achieve with that kind of launch vehicle? How would that compare to Hubble or JWST?

asdlkf

There's a future telescope study called LUVOIR which recently showed a 15.1 meter diameter can fit in the 8.4m SLS rocket with a JWST-like folding architecture (but more than 2 wings). Some of us from

Webb are helping to studying lots of future possible telescopes like this are rooting for the human program to provide us rockets capable of fitting these! lee

What's the biggest challenge with getting all those mirrors and delicate large foldable bits into space via controlled explosion?

Sayfog

We run a series of Vibration tests, which simulates the motion/shaking the hardware will see during launch, and then through Acoustics testing, which simulates the sound of the rocket launch which can cause different issues. At the Spacecraft level, there is also a Shock test, which mimics the forces associated with separation from the rocket. The test criteria are determined by extensive modeling of the hardware, that then is used to design the test plans. - Juli

Will the JWST actually be able to capture images of exoplanets or will it only be detecting RF data?

phoenixgeek

We have a coronograph and can image exoplanets - but they will only be dots. Not grand panoramas like you might see from a mission that is able to travel right next to a planet, Voyager-style. Consider that Pluto is (astronomically speaking) not that far away from us, and we didn't know what it really looked like until New Horizons did a fly-by! Exoplanets are very very far away and comparatively extremely tiny. But even an image of a dot can be use to analyze the light we are seeing and tell us lots of stuff about that planet and its atmosphere.

-Maggie for the Webb team

Is there a particular reason this telescope sees the specific wavelengths that it does? I have always wondered why there are so few visual spectrum telescopes, is there a reason for this? I've always wondered what the deep cosmos look like in true color as if I was looking at it myself instead of the false color emission spectra they currently use.

ehalepagneaux

Yes! Webb was specifically built to see infrared light because there are things/eras of the universe that we have not studied yet, because you need a powerful infrared telescope to see them. These include things like stars & planets being born inside clouds of dust and gas, the first stars & galaxies forming in the early universe, as well as the signatures of organic chemicals in the atmospheres of planets around other stars. Read more: http://jwst.nasa.gov/science.html

As far as your other question - here's how Hubble images are colorized (they aren't captured in color like your phone would capture a digital photo). http://hubble.stsci.edu/gallery/behind_the_pictures/

-Maggie for the Webb team

Super excited for the next generation of deep-space observation!

The Hubble was greatly lauded for its ability to be upgraded and repaired by space shuttle missions. Does the Webb Space Telescope have a similar capability? If so, what's the plan to upgrade/repair it without shuttles?

isotope-12

Webb was not designed to be serviced in part because it will be really far away at the L2 Lagrange point. However, I like to remind people we fixed things on Hubble that we didn't originally intend to service and robotics has come a long ways so never say never! Lee

The one thing I've always wanted to know is why is the telescope named the James Webb and what kind of research equipment is installed on it to further research on distant star systems we already know about?

BloodyVengeance

Here's an answer to the first part of your question. We named this space-based observatory after James E. Webb (1906- 1992), NASA's second administrator. He was best known for leading Apollo, a series of lunar exploration programs that landed the first humans on the Moon. However, he also initiated a vigorous space science program that was responsible for more than 75 launches during his tenure, including America's first interplanetary explorers.

Laura Betz from the Webb team

Do you expect to find signs of life in the cosmos with this new telescope?

DS_9

Personally, I don't think Webb is likely to find life because it can't quite characterize earth size planets around sun like stars. But the next generation telescope could and we are working on enabling that!! But who knows, maybe life is really, really abundant and, if so, Webb could find it!!!!!!! Lee

1. From what I know, in the Columbia disaster the problem was overheating of sealant between the tiles - is extreme cold a risk as well, and if so, how are you overcoming it?
2. Is the entirety of the telescope in the testing chamber at once, or do you test each part separately? Are full system tests a thing?

Thanks for doing the AMA!

bowiz2

The fact that JWST needs to be very cold to make its sensitive infrared observations is indeed challenging -- there are many design aspects that are affected by the need to operate so cold. Right now we do have the entire telescope and its science instruments in the testing chamber, though not with the sunshield and warm spacecraft. But you don't do that right away -- integration and testing takes place at ever higher levels of assembly. First you test small subsystems on their own, then you build those up into larger units for higher level tests. For example, detectors were tested on their own, then full instrument level tests occurred, then tests of the integrated suite of instruments, and now our test of the telescope plus instruments. The spacecraft and sunshield will soon be undergoing its own thermal-vacuum test. Then those two main parts of the observatory will be integrated together -- from that point, it will only get testing in air.

Randy K.

Today I was learning about one of Jupiter's moons (Europa) in which NASA is planning to launch a trip to sometime around the mid 2020's. I was wondering if this telescope would be used to help with this space mission in anyway? The moon is covered in a large layer of ice multiple kilometers deep. Would this telescope be able to provide information about the moon that hasn't already been provided by the Hubble telescope?

Maximillion645

We will be able to observe Europa, actually - you can read more about that here: https://www.nasa.gov/feature/goddard/2017/nasa-s-webb-telescope-will-study-our-solar-system-s-ocean-worlds

-Maggie for the Webb team

I would like to know the advantages or improvements using this telescope would offer when compared with its predecessor, Hubble telescope in the overall study of cosmos.

apoorvx

Hubble was incredibly great but can't see at wavelengths beyond 1.7um's because it is a warm telescope and literally the heat from the mirrors create infrared light above that wavelength that swamp its detectors. By cooling Webb to 40 Kelvin, we can see out to 28um's and see this huge wavelength range Hubble can't see. Light from the early universe is stretched into the infrared due to the expansion of the universe, so if you want to see back to the earliest stars and galaxies, you need to look at infrared wavelengths that Webb is designed to see!! So hold onto your time machine seatbelts, Webb is going to uncover the early universe in all of its infrared glory! Lee

I would like to know the advantages or improvements using this telescope would offer when compared with its predecessor, Hubble telescope in the overall study of cosmos.

apoorvx

The principal advantages are 1) sensitivity -- the ability to see fainter objects than Hubble, mostly because of its larger mirror, and 2) wavelength coverage -- much more coverage into longer infrared wavelengths, which will allow Webb to better observe highly redshifted objects from the distant, early universe, and to observe star and planet formation in condensing interstellar clouds of gas and dust.

Randy K.

Awesome! The last few days I've been reading up on the telescopes, so this truly is perfect timing. I am extremely excited for the years to come and the things you guys will discover with the Webb.

What kind of things are you hoping/expecting to learn about the formation of our universe? Will it give us insights into the Big Bang and the immediate aftermath?

itsgonnabeanofromme

Thank you! We are excited too, to be honest!

We actually won't be looking at the very beginnings of the Universe - that actually isn't something observable. We will be looking at a period a few hundred million years after the Big Bang, when the first stars and galaxies started forming. That's not a period we know much about because we haven't had the right equipment with which to observe it.

Here's a Q&A we did about the Big Bang and what Webb will or won't see, with Nobel Laureate John Mather, who is also our senior project scientist. Hope this helps! https://www.nasa.gov/feature/goddard/2017/nasa-s-james-webb-space-telescope-and-the-big-bang-a-short-qa-with-nobel-laureate-dr-john

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itsgonnabeanofromme

I'm not a scientist, but I know scientists are really excited to understand how the early universe formed and evolved, including when stars and galaxies first formed. Lee

What will be the most crucial/dangerous situation during the project ? The start? The travel ? ..

homboo

All facets of the buildup, launch and commissioning offer various challenges that all get evaluated for risk and testing to lower risks. Even something as "simple" as just lifting the telescope from one stand to another location requires tons of coordination and planning by a large team. Launch is always high risk, but that's why we run so many simulation tests. And all of the deployments to open up the telescope and sunshield from their folded, launch configuration takes years of planning and testing. Almost all Spacecrafts have some deployables, but on JWST, there are many more critical deployments, so those probably worry me the most- Juli

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homboo

Launch is always a big concern so that probably comes to mind.

Lee

What will be the most crucial/dangerous situation during the project ? The start? The travel ? ..

homboo

Also, the Ariane 5 rocket has an excellent safety record. Between April 2003 and September 2017, Ariane 5 has flown 81 consecutive missions without failure.

-Maggie

Hi and thanks for joining us today!

Telescope related: does interplanetary dust accumulate on the mirrors of space telescopes? Are they cleaned?

Launch related: why French Guinea?

Space related: why does Mercury not have a 1:1 spin-orbit resonance?

PHealthy

Fortunately, space is really a very good vacuum. The density of interplanetary dust is very low, so it is not necessary to clean the telescope. Hubble has been in orbit for 27 years now (where there is debris from satellites and launch vehicles and such as well as the natural background of material!), and the throughput of the telescope has not changed detectably.

The launch will be on an Ariane V rocket, made by the French company Arianespace. The rocket is being provided by the European Space Agency, one of the major international collaborators on the JWST project. Arianespace's launch facility is in French Guiana. Like in Florida, this location provides a fairly equatorial launch position where you can launch eastward (over ocean, which is safer), taking advantage of the earth's rotation.

Randy K.

Do you already have a significant amount of time booked on it? And if so, what are the first few things you plan on looking at with it? I assume that a lot of that might depend on what you see at first, but there must a few things on deck, I would imagine.

Akoustyk

Scientist wishing for time on our telescope will propose for it - this is actually how other NASA telescopes (like Hubble, Swift, Fermi, etc) work. Scientists submit a proposal detailing what observation they want to make, how much time they are asking for, etc. Those proposals are reviewed by a panel of peer scientists and time is awarded.

There was an early cycle of proposals and you can see those that were awarded time (which will be in the first year of mission operations) here - it's a bit technical but tells you what some of the early mission targets will be: https://jwst-docs.stsci.edu/display/JSP/JWST+GTO+Observation+Specifications

--Maggie for the Webb team

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Akoustyk

I'm an engineer and have no time booked it. I will help get it deployed and aligned and make sure it does everything right optically and then I will move on to the next bigger telescope.....which I'm already helping to think about.... Lee

Is this thing going to launch before I die of old age?

GoBay33

We sure hope so!! We are literally working 24/7 to get this done and to make sure it will work. We are leaving no stone unturned to make sure it will work but also working incredibly hard ... just ask my wife! Lee

I wish you all the success with this mission. I'd also want to thank each of you for your years of dedication.

My question:

After the initial launch and first light, what two events will have you sitting on the edge of your seats waiting for confirmation all went well?

onegunzo

When we have a really good image of a star with all of the needed sensitivity, I will relax... Lee

Can it be pointed at, and used for capturing data of nearby celestial bodies? If so, what kind of results could it yield, or would that be useful?

Akoustyk

JWST will be able to observe all of the bodies in the solar system from Mars on out. We can't look inward toward Mercury or Venus (or the Earth itself) because the telescope stays carefully shadowed behind its large sunshield, which is what allows the telescope to get cold enough to have such fantastic infrared sensitivity. But we have the capability of tracking moving targets, so there is a lot of excitement in the planetary community about Webb's capabilities for observing the atmospheres of the outer planets. Infrared wavelengths are particularly valuable for such atmospheric observations.

Randy K.

I don't actually have a question about the telescope, though I think it's incredibly cool. Instead, I wou like to ask you about the career path that led you to NASA. Specifically, how one would go about getting on that path. I'm an engineer just a couple of years out of college, and it's always been my dream to work at NASA, so can you tell me a little about how you got the job? Is there specific qualifications or work experience NASA looks for? Any tips you can give to someone who wants to work there eventually?

The_God_King

I personally took the Taoist path. I came down to DC to get away from the cold of Rochester where I studied optics. I started with a management consultant, then went to Ford Aerospace to work on the ground system for Hubble (I was good at optics software) and then Hubble had a major optics flaw and I got hired to help with the repair. After leaving Hubble and working at a startup for a year and developing telescope and instrument technology, I started working on Webb and have been the Telescope Manager at Goddard for over 16 years. My advice is to do something you are passionate about and don't stress that you have to find the perfect first job. If you are good at what you do, the cream will rise to the top and NASA will find you (if Elon Musk doesn't first ;) Lee

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The_God_King

I graduated with an Aerospace degree but there were not any engineering jobs to be had. So I applied for a technician job with a contractor in the DC area. When I had my interview, I was told the job was actually at Goddard Space Flight Center (GSFC). Once I had my foot in the door, I moved from job to job at GSFC by building a good resume and working hard. My recommendation is to apply for any opportunity to get your foot in the door and then the sky is the limit! - Juli

I'm assuming the telescope will orbit earth? Or will it be sent to a certain planet to take better quality images and improve our understanding

NugThePug

The telescope actually will be orbiting the sun, about a million miles farther away from the sun than the Earth is. That location is called the L2 Lagrange point -- the combination of the sun's gravity and the Earth's gravity is such that the telescope will also orbit the sun in one year, so that it will stay roughly in line with the Sun-Earth and not drift away. Such an orbit is not perfectly stable, so it takes a little bit of fuel to stay in that vicinity. But this is a great location for Webb -- it allows us to deploy our sunshield and shadow the telescope from the Sun, Earth, and Moon, allowing the telescope to cool to the temperatures needed to make its sensitive infrared observations.

Randy K.

What are the first images you plan on taking with the JWST? Any plans to take a picture of Hubble's famed Deep Field and make a side by side comparison?

RussellG2000

A very early program will combine the power of the main near infrared science camera and the main near infrared spectrometer together to look at a Deep Field. The lead scientist for the camera told a few of us that the moment we get the first images, they can write a paper. And note we will spend weeks looking at that so it is going to be just incredible to see back farther in time than Hubble at the Deep Field and this was a key observation we targeted when Webb was designed! Lee

Thanks again for doing this, exciting stuff! What sort of lifespan are you predicting for the Webb telescope, how many years are you hoping to get out of the telescope?

guitarshredda

What type of music do you play on that guitar you shred? I'm a Metheny, Hendrix and Duane Allman fan myself. Lee

Anyway, the requirement was 5 years, goal was 10, and it could last decades.

What do you hope to see with this new telescope?

Pitiedowl

Good question! Here's our mission goals: -Search for the first galaxies or luminous objects formed after the Big Bang. -Determine how galaxies evolved from their formation until now -Observe the formation of stars from the first stages to the formation of planetary systems -Measure the physical and chemical properties of planetary systems, including our own Solar System, and investigate the potential for life in those systems

ETA: You can read more here: http://jwst.nasa.gov/science.html

Lee

When is the next We Are Scientists album coming?

WelshElf

I don't know, but I play in a few bands and one is called Outta Scope ... started by a bunch of us on Webb. I'm an avid piano player, composer, and even improvise jazz when I have time to practice!

Lee

I understand yall took a beating during the hurricane. How did you save the experiment from getting destroyed?

blablabliam

It was a long week for a lot of reasons but the experiment was never in danger. One of the hardest parts was keeping the people safe who were needed to keep the telescope safe. And of course there were plenty of unique challenges like getting in the expendables but we were well prepared and everyone stepped up with incredible teamwork. If any of the folks who were there are reading this, THANK YOU, YOU ROCK! Lee

Thanks for the AMA, How will this be useful in finding about Gravitational waves and do you have any plans and specific structures for it to be operated in Space.

etimejumper

We at the Goddard Space Flight Center are working on ways to directly detect gravitational waves ranging from the LISA mission to future more sensitive systems employing technologies like Atomic Interferometry. Webb will not detect gravitational waves but maybe can see the infrared emission from events that create gravitational waves. Lee

After reaching the Lagrange point, about how long would you expect to elapse until the first micrometeorite hits JWST? Did you simulate this by shooting BBs at the telescope while it was in deep freeze?

osxpert

Hey! We actually do expect to get pinged with little micrometeroids frequently while we are out there, maybe even on the way out. No BBs, but we tested mirror samples for the effects of micrometeoroids on the ground and found they leave very, very small pits that don't impact the performance. Lee via

Maggie

What is the most critical point for JWST to fail? (launch, deployment, travelling to L2, achieving a stable orbit, operation of scientific instruments, communication to earth,...)

BHvsNS

Yes.

Seriously, we design and test and evaluate and analyze everyone of these in detail. Failure is not an option :)

Lee

Hello ! I wonder if there is a plan to point the JWST to the part of the sky where Hubble captured the deep field image ? I wonder what JWST will find in that region :) I understand that teams have to probably submit proposals to get time on the JWST to point it to something they would like to study ? If true, I hope someone is planning on doing this.

Thanks for doing this AMA.

maverick_dallas

I am absolutely certain there will be observations of the Hubble Deep Fields with JWST. JWST will be able to see galaxies that are even fainter and farther away and will resolve more detail in the galaxies that Hubble has already seen. But it's very useful to build on the existing observations, as many other observational tools (telescopes observing in the X-ray or sub-mm for example) have been brought to bear on those fields -- so adding Webb's fantastic data to this compilation will deepen our understanding of the universe.

Randy K.

(And yes, teams will submit proposals to use the telescope; in addition, the teams that built the instruments have some guaranteed observing time as a reward for their efforts.)

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Thanks for doing this AMA.

maverick_dallas

Yes! We'll definitely be doing follow-ups to the Deep Fields that Hubble captured. Here's a feature: https://www.nasa.gov/feature/goddard/2017/nasa-s-webb-telescope-to-witness-galactic-infancy

--Maggie for the Webb team

Thanks for taking the time to answer these questions, it must be a busy time for you all!

Is there anything in particular that you are particularly excited at being able to detect/find that you

weren't previously able to?

Have there been any major setbacks during the project?

Of course my mind is blank now I have the chance to ask, but I'm excited to read responses to all the great questions here.

ghostno36

I'm especially excited to get the spectra of Trappist and other Exoplanets to see what they are made of and see if we can learn things about Exoplanets that might pertain to how we think about our own planet.
Lee

How far are the first stars?

Lilpuncher

Hi - we don't know precisely, which is one reason we are building this telescope! There are varying theories that put the first stars forming anywhere from ~100 million years to ~300 million years after the Big Bang. (Making them over 13.7 billion light years away from us.) Webb will seek to give us more precise answers.

--Maggie for the Webb team

Hey, I wanted to know to what detail exactly are you capable of viewing planets with the James Webb in terms of its surface and where in the galaxy is the most likely area other life forms might exist?

JWood_99

We do have a coronograph, so we can image planets - BUT they would just be like dots. If you imagine just how far away these exoplanets are and how small they are, you can see why it'd be difficult to get grand panoramas of alien landscapes. We didn't even know what Pluto really looked like until New Horizons flew right up to it, and Pluto is much closer to us. That said, we can learn a lot about a planet's atmosphere and what it is composed of, even from just a dot of light.

-Maggie

When I was young - in the 70's and 80's - we were still taught that the universe was infinite.

I remember standing outside one freezing night, looking up at the stars and trying to comprehend infinity, resulting in a moment of terror, followed by a moment of euphoria, and ending with being a changed person.

Thanks to the work that you and others have done, and are continuing to do, we now know that the universe is not infinite. Soon we will see its beginning as well as its end.

In your opinion, does infinity still play a role in the nature of being - whatever that is..., or is it an entirely imaginary concept?

cicerothedog

The big bang is a singularity that is a point of infinity and now there are new universes being created at the edges of black holes so my opinion is infinity is definitely playing a role in the nature of being -

whether religious or scientific. Lee

Hi. Is there any chance JWST's short wavelength performance will slightly exceed the specifications. I mean will it really be diffraction limited only to 2 microns or could it go to 1.8... It may seem like a dull question but small improvements in the PSF lead to big improvements in crowded photometry for things like Cephids. Thanks.

ThickTarget

It could well be better. And the beauty of active telescopes is you can actually optimize way better over a smaller fields if you really, really wanted to...we do have sensitivity into the visible...and a few filters that go down there. lee