good afternoon and welcome to the

science portion of today's briefings

about NASA's new mission to said study

the sky of our nearest celestial

neighbor the moon the mission is called

the lunar atmosphere and dust

environment Explorer or ladee I'm Rachel

Hoover and the public affairs office at

NASA's Ames Research Center in Moffett

Field California where the mission was

designed tested integrated and will be

managed after launch earlier today we

heard from laddie team members about the

spacecraft design its ride into space
and the conditions leading up to tomorrow night's launch at 11:27 p.m.

eastern right here from NASA's Wallops Flight Facility in Virginia now we'll turn our attention to the science goals of the mission and a lunar laser communications demonstration on board before I turn our attention to the panel I'd like to make a take a moment to point out that you can learn more about the mission by visiting us online at WWD.gov / lady or by following us on social media including Twitter at NASA laddie in a moment we'll hear brief
presentations from our panel and then

we'll open it up to questions here at

NASA Wallops from NASA field centers and

participants joining us from the phone

it is now my pleasure to introduce

today's panel joining us today is Sarah
	noble laddie program scientist from NASA

headquarters Rick Elphick laddie project

scientist at NASA Ames Research Center

and Don Cornwell the lunar laser communications demonstration mission

manager from NASA's Goddard Space Flight Center in Greenbelt Maryland and with

that I'd like to pass it over to our
thanks Rachel I'd like to give you guys a quick overview of the science of laddie laddie has two major science goals to understand the lunar atmosphere as well as the dust environment around the moon I think sometimes we get a little surprising when we start talking about a lunar atmosphere because most of us were taught in school that the moon doesn't actually have an atmosphere it does but it's very very thin it's so thin that the individual molecules that make up the atmosphere never see each other they don't interact they
don't collide this is something we call an exosphere and if I can get the first slide up yes the earth actually has a Nexus sphere as well but in fact you have to go out past where the International Space Station orbits before you get to this condition where the molecules are so far apart they don't collide on the moon that actually happens right at the surface so the term we use for this class of atmosphere is a surface boundary exosphere and in fact the moon is not the only example we have mercury a lot of the moons of outer
planets as well as some of the larger asteroids in our solar system all have surface boundary exit spheres it turns out to be the most common class of atmosphere we have and yet it's one that we don't really know very much about so laddie is a really great opportunity to go to learn not only about the moon but about a mini many of the bodies in our solar system it's also a really good time for us to go and be run working this mission the moon because the exosphere the moon is so thin and so delicate it's easily disturbed by things
like spacecraft landing and then the moon has been pretty quiet lately in terms of landings we have landed anything there for a few decades but that's going to change there are a number of countries and even some private companies who are looking to land things on the moon in India upcoming years and so now is a really good time while the moon's atmosphere is still sort of pristine in its natural state for us to go and learn about it before we go in and impact it the DNA lynn late stands for dust our other our
other major science goals to understand

00:03:41,639 --> 00:03:45,359
the dust environment if I can get the

00:03:42,780 --> 00:03:47,579
second visual we've actually had

00:03:45,359 --> 00:03:50,909
questions about the dust environment on

00:03:47,579 --> 00:03:52,889
the moon since even before Apollo on the

00:03:50,909 --> 00:03:55,439
on the left here you can see some images

00:03:52,889 --> 00:03:57,180
from the surveyor spacecraft which saw

00:03:55,439 --> 00:03:58,579
the strange thing on the horizon just

00:03:57,180 --> 00:04:00,650
before sunrise this sort of go

00:03:58,580 --> 00:04:02,510
whoa and we think that actually

00:04:00,650 --> 00:04:04,180
might be due to dust getting lofted into

00:04:02,509 --> 00:04:07,399
the atmosphere and reflecting the light

00:04:04,180 --> 00:04:09,290
the Apollo astronauts also saw saw this

00:04:07,400 --> 00:04:12,319
horizon glow on the lot on the right

00:04:09,289 --> 00:04:14,239
there is a is a sketch from gene
Cernan's notebook Apollo 17 astronaut who not only saw that horizon glow he saw these things that he called streamers going up high into the atmosphere tens of kilometers which we also think is due to the dust so we have three instruments on my day if i can get my third visual we have three instruments on laddie in which to look at our to science goals there is a lunar dust experiment designed and built by the university of colorado which will look at individual dust grains institute there's a neutral mass spectrometer nms
designed and built at NASA Goddard Space Flight Center which will look at the atmosphere and finally there's a UV spectrometer not the first spectrometer we've sent to the moon we've sent many spectrometers there but generally when you send a spectrometer it's looking down at the surface to look at the the minerals that make up the moon itself will actually be looking sideways through the atmosphere in the dust to understand what's going on just above the surface so that's a quick look at our science payload I'm going to turn it
over to Rick now so he can give you a
more in-depth view well sarah just told
you the ladee mission is about it's
a tale of two mysteries the first being
the thin tenuous very exotic lunar
atmosphere utterly unlike our own and
the second being this mysterious lofted
substance purportedly dust that the
Apollo astronauts saw above the surface
and so in the first video that I'll show
you it kind of illustrates the second
mystery there's laddie in orbit around
the moon and the Sun going down over the
horizon and you can see this glow behind
the spacecraft and that's meant to

158
00:05:51,829 --> 00:05:55,668
represent this possible dust cloud that

159
00:05:54,199 --> 00:05:57,399
exists around the moon near the

160
00:05:55,668 --> 00:06:00,139
Terminator of the moon near the dark

161
00:05:57,399 --> 00:06:03,168
sunlit portion so those are the things

162
00:06:00,139 --> 00:06:06,110
that laddie is equipped to look at and

163
00:06:03,168 --> 00:06:09,288
try to explain and this next video shows

164
00:06:06,110 --> 00:06:10,610
you laddie pure wedding in space and I

165
00:06:09,288 --> 00:06:11,789
want to use this video to kind of

166
00:06:10,610 --> 00:06:14,400
illustrate the different

167
00:06:11,790 --> 00:06:16,800
and their locations on the spacecraft so

168
00:06:14,399 --> 00:06:19,500
coming up actually is done Cornell's

169
00:06:16,800 --> 00:06:21,780
instrument the lasercom instrument on

170
00:06:19,500 --> 00:06:24,720
the side but if you look at the very top

171
00:06:21,779 --> 00:06:25,949
of the spacecraft the small tube looking
outward is the ultraviolet visible spectrometer the neutral mass spectrometer is down on the mid-deck side of the spacecraft and the lunar dust experiment is at the top above the neutral mass spectrometer it's the sort of coffee cans sized thing that you saw at the top there so those are the three instruments that are meant to address these two mysterious questions and I'd like to tell you a little bit about how one of those instruments is actually going to operate so the next video illustrates how the lunar dust
experiment actually captures dust and analyzes it on its path around the moon. Basically it will intersect and analyze any particles that are in its way as LADDEE moves at 1.6 kilometers per second around the moon. These particles come in and create little charges that they're then registered on a detector and the size of those charges actually corresponds to the sizes of the grains that are being impacted. The neutral mass spectrometer operates in a very similar fashion but it has a smaller aperture and it's really aimed...
at looking for the gas particles the

atoms and the molecules in the tenuous

lunar atmosphere and it identifies those

molecules on the basis of their mass so

you can identify things like calcium and
titanium and iron that may be and

present in the lunar atmosphere but we

haven't measured them yet we don't know

if they're really there or not the final

video I wanted to show you focuses

actually takes us back to 2009 and the L

crossed mission so this mission involved
taking a empty center space sorry launch
Pole of the moon into a location of permanent shadow and ultra ultra cold in places like that where there's no sunlight it gets so cold that ice if you can put it there will last for billions of years without going away and L cross was meant to check out whether or not that actually occurs we had hits from lunar prospector but it wasn't until L cross actually impacted the surface that we could actually see ice locked it up into sunlight and the ultimate the infrared spectrometer aboard el cross actually measured the features of the ice that was present
there so now we know there's ice there

but how did it get there that's the

question and so you can imagine a number

of scenarios that would deliver ice to

the cold regions of the moon one might

be a cometary impact but there's another

possibility that slowly over the

millennia molecule by molecule water

molecules have migrated hopping across

the surface of the moon and finally some

of them get cold trapped in these

locations where there's no sunlight at

all and it's ultra ultra cold and

they're stuck for basically forever
laddle is in a perfect position to look

at those at the possibility of water and

hydroxyl o-h in the lunar atmosphere and

so we'll be able to check that pathway

that water cycle if you will that takes

up the possible water from the

mid-latitudes up into the cold traps and

the fourth instrument on the

spacecraft is the lunar laser

communications system a whole new way of

doing business in terms of

communications from deep space and Don

Cornell will tell you about that next

thank you Rick I'd also like to take
this time to thank the NASA science Mission Directorate and the ladee project for the ride to the moon that we're going to have for our technology demonstration as Rick said we're not actually a science instrument but we are the lunar laser communications demonstration we're going to demonstrate the first high-speed to a laser communications really for NASA and from the moon back to the earth and just as a point of reference we are six times the bandwidth the amount of data that we can send back in a certain amount of time as
compared to the most

272
00:10:03,179 --> 00:10:07,019
state-of-the-art radio system that was

273
00:10:05,009 --> 00:10:09,629
sent to the moon on the Lunar

274
00:10:07,019 --> 00:10:11,190
Reconnaissance Orbiter in 2009 and at

275
00:10:09,629 --> 00:10:13,500
the same time we use half the weight and

276
00:10:11,190 --> 00:10:16,910
twenty-five percent less power so we're

277
00:10:13,500 --> 00:10:19,589
more efficient my first slide actually

278
00:10:16,909 --> 00:10:20,698
is an excellent illustration of the

279
00:10:19,589 --> 00:10:21,930
mission concept it's very

280
00:10:20,698 --> 00:10:23,729
straightforward when you look at it

281
00:10:21,929 --> 00:10:26,399
there's our optical terminal on the side

282
00:10:23,730 --> 00:10:28,170
of late and we're exchanging laser

283
00:10:26,399 --> 00:10:29,970
beams between the Earth and the moon and

284
00:10:28,169 --> 00:10:33,120
there's data and parted on each of those

285
00:10:29,970 --> 00:10:35,629
laser beams in the form of hundreds of
millions of little pulses every second

so the next slide please so why are we

interested in laser communications so

over the last 50 years radio has served

NASA very well for for providing space

communications but like everyone

everyone else nASA has needs for faster

download speeds and to bring back our

earth data video and images high speed

high resolution images and 3d

high-definition video from satellites

that orbit the earth and probes going to

the moon and beyond so light waves are

much shorter and wavelength in radio
waves which means that we can pack more bits of data into every second on a light beam. We can also use smaller transmitters and receivers. If you can play the animation, please do so. For example, the antenna on the left is a radio antenna which is many many tens of feet across. The antenna on the right that you saw in the animation became smaller. That's our new optical communications ground terminal, which will be based in White Sands. It again leverages the fact that light waves are shorter, allowing us to keep packing more data into every second.
the beams more collimated more focused

and deliver more energy at a distant point so we can get more bandwidth with

optical communications using a smaller size and less power next slide please so

we have an animation here that actually shows how our system will work we have

time stations one is at NASA JPL it's actually a site that they have in

California the European Space Agency has a site and MIT has a site so the ground

beam from one of the sites will scan for

ladie around the moon and when ladie sees that it sends a pulse back I'm a
little bit behind on this and then that

00:12:22,480 --> 00:12:26,779
causes the ground station to then

00:12:24,740 --> 00:12:28,310
locks beam to the uplink v2 the

00:12:26,779 --> 00:12:31,129
downlink beam and then we start

00:12:28,309 --> 00:12:33,109
communicating and we can send up to 220

00:12:31,129 --> 00:12:34,879
megabits per second of data on the

00:12:33,110 --> 00:12:38,509
uplink from the earth to the moon and

00:12:34,879 --> 00:12:41,779
then as much as 622 megabits per second

00:12:38,509 --> 00:12:43,970
from the moon down to the earth and I'd

00:12:41,779 --> 00:12:46,159
like to again point out that MIT Lincoln

00:12:43,970 --> 00:12:48,050
Laboratory design built tested and

00:12:46,159 --> 00:12:48,699
delivered at both our flight terminal

00:12:48,049 --> 00:12:50,019
and our

00:12:48,700 --> 00:12:52,240
first ground terminal and that we are

00:12:50,019 --> 00:12:54,399
partnering partnering with NASA JPL and
the European Space Agency for are the

two ground terminals and with that I

returned the stage to Rachel Thank You

panel will now open it up for questions

here in the audience at nasa wallops if

you have a question please raise your

hand wait for mics and state your name

and affiliation yes I have a question

about the laser communication system can

if you increase the wattage does it make

it better or is it just you only need

that minimum Wantage to make it at peak

efficiency I mean is it like with

regular radio the bigger the antenna the
more the wattage the better the signal

so that's a good question this is a certain design point so we worked with the resources that that we had available to us and and and one of our you know we have some limits and power we're at the moon and we're on a small spacecraft and so this is a design point that was chosen for the transmitter power if the transmitter power were larger you could in theory send a higher data rate there are more bits per second because or over a longer distance as well that's right thanks for the help on the question yes
our next question also comes here from NASA Wallops if you could please state your name and your affiliation i Ken Kramer Universe Today have two questions please first for Don can you tell us I think you're the length of your experiment is is restricted to 30 days or so after you get to orbit can you talk about why that is and I'm believe also the spacecraft is going into an elliptical orbit why why is it elliptical nup polar thanks ok so 30 days is what we believe is sufficient to do our demonstration and we are along
for the ride it is a science mission and
00:14:41,379 --> 00:14:45,399
we can't deprive our science team here

00:14:43,480 --> 00:14:48,070
of answering their very important

00:14:45,399 --> 00:14:49,209
questions as well so we think we can do

00:14:48,070 --> 00:14:51,220
everything we need to do within the

00:14:49,210 --> 00:14:53,620
30-day period and we have a follow-on

00:14:51,220 --> 00:14:54,879
mission called the laser communications

00:14:53,620 --> 00:14:56,860
relay demonstration that will be

00:14:54,879 --> 00:15:00,309
launched in 2017 it's a funded mission

00:15:00,309 --> 00:15:04,009
again based on MIT technology but will

00:15:02,049 --> 00:15:05,490
be built at NASA Goddard and that

00:15:04,000 --> 00:15:09,009
well will be a duration of two to five

00:15:05,490 --> 00:15:10,149
years where we hope to really

00:15:09,009 --> 00:15:13,419
demonstrate long-term performance and I

00:15:09,009 --> 00:15:13,419
can take the question about the
elliptical orbit even if you start off with a circular orbit at low altitudes where we want to operate it very very quickly gets perturbed into an eccentric orbit and so it's just a question of managing those perturbations which are induced by the gravity field of the moon which is very irregular compared to that of Earth's as we know from Grail now so it's that which perturbs the orbit and that changed orbit is something we need to adjust periodically so every week or so we perform a burn to attempt to basically
really sort of circularize the orbit and maintain periapsis the point of closest approach high enough so that frankly we don't crash into the surface of the moon it's the gravity won't be gravity field that causes our orbit to perturb the science drives the low point the science drives getting as low as we can safely get with the spacecraft lower is better for ladee lowers better be good because we've got two instruments that make in-situ measurements one's going for the dust the other is going for actual in institute gas species and
so the lower you go the more there are

the better your signal the more you

learn but will be wandering around in

altitudes as the orbit gets perturbed by

the gravity field in the moon will

always try to get back to the low

altitudes again I hope it helps you

pappalardo with popular mechanics I'm

just wondering if there's any of you

could describe some of the differences

between the light and dark side to the

moon in terms of the exes exosphere oh

sure actually we've got a resident

expert in the audience who made
measurements of that very thing back on

Apollo Apollo 17 de coches is in the

audience and and I hope I do justice to

what what I found out certain of the

can basically freeze out on the

surface as you as the the night side as

you probably know of the moon since it's

not in sunlight and there's very little

atmosphere to conduct heat or to convict

heat it gets very very cold it gets

below 100 kelvins

on the night side just before dawn

that's cold enough so that when an atom

or a molecule comes down and interacts

with the surface grain it basically
chills down too and so its residence
time that molecules residence time on
that grain can become very very long
before it hops off again and when it
does hop off it doesn't go nearly as
high so the atmosphere kind of collapses
or parts of the atmosphere can actually
collapse at night whereas on the day
side it gets warm enough that these guys
are hopping around I think someone
described it as like bunnies across the
surface that's a picture I won't be able
to get out of my head and very soon but
that's basically what the molecules of
the exosphere are doing they're hopping
around with the they're sticking time
the residence time on surface grains
it's strongly controlled by the
temperature and therefore there's a day
to night strong day to night asymmetry
hi just a question about the given that
it's a highly rarefied exosphere what
rate of detection are you expecting for
the for the dust and for the for the elements I expect to be a fairly
continuous or just once every few
seconds or what that's a that's a really
good question the density of the dust
that we are we have in our requirements

for measurement at about 50 kilometers

altitude is a pretty small number it's

like only 100 or so dust particles per

cubic meter that's not much I mean

that's way less than in my house for

instance something so running through

that however at 1.6 km 1600 meters per

second you can imagine smacking into

those things with with the aperture of L

decks fairly frequently and so if the

dust is there in that density will see

at a few counts per minute possibly even

higher rates just how much is there and

higher rates just how much is there and
if we don't see anything that says

pretty much we can place a very

stringent lower upper limit on on how

much dust is actually there but we'll

know right away as soon as we drop down

to those low altitudes

as far and the other instruments for

dust detection the ultraviolet and

visible spectrometer can look at a

distance and integrate over a fairly

large column at whatever dust is there

the challenge that they have is for some

of their measurements they're looking

against the coronal and zodiacal light

of the Sun if you're looking back across
the limb of the moon you'll see not just the dust that's scattering light toward you but also the zodiacal light and the inner solar system plus the coronal structure as well so it's a challenge but they've shown they can do it so we're looking forward to that so this is more of a practical question with the laser communication what's the cost difference between a radio and laser comm system well we did a lot of development here to to solve a lot of the issues that are you know part of doing this the complicated mission so
Initially it's expensive but as we build more and more copies we expect that cost to go down just like for any system so there's a lot of non-recurring engineering that happened for this project. Perhaps we can talk offline yeah all right Matthew front oh is it on Matthew Frances popular science question two questions one is how much dispersion is there in the laser beam between moon and Earth I know in lunar ranging missions there's a fair amount of dispersion how big is the does the station need to be
to reliably pick up the laser on the earth end and vice versa okay so when you say dispersion I think you mean actually the spread of the beam that's right so to speak yeah so it starts out at at four inches in diameter from the spacecraft telescope and by the time it gets to the earth it's about three and a half miles in diameter six kilometers so it's still large but at the same time it's a very small point when seen from the moon and one of the big challenges we have is keeping that pointed accurately over the entire time
you're trying to communicate the second

00:21:54,420 --> 00:22:00,000
question was about the dust detection

00:21:57,660 --> 00:22:03,120
device and I'm not sure which of the two

00:22:00,000 --> 00:22:06,210
of you it should be directed to but you

00:22:03,119 --> 00:22:08,399
mentioned that the size of the grain was

00:22:06,210 --> 00:22:14,069
correlated with the electric charge on

00:22:08,400 --> 00:22:15,450
it so is that you want me to tell you a

00:22:14,069 --> 00:22:18,389
little more about yes if you would

00:22:15,450 --> 00:22:21,960
please I'm looking actually at when the

00:22:18,390 --> 00:22:23,580
grains come in they they impact that

00:22:21,960 --> 00:22:24,779
witness plate at the back end of the

00:22:23,579 --> 00:22:27,089
instrument and they create a little

00:22:24,779 --> 00:22:29,069
plasma cloud and the amount of charge

00:22:27,089 --> 00:22:31,529
that's created by that is controlled by

00:22:29,069 --> 00:22:33,569
two mostly by two really important
factors one is mass and the other is the
velocity at which it comes in your
various formulae that relate those two
things but we know what the velocity of
the spacecraft is so that particular
issue is taken care of in that way that
way you can look at the charge and
relate it directly to the mass of the
particle that's coming in
hi John Pritchard NASA social
participant with the lady science with
the study of the exosphere and the
scientific results that come out of that
I think we're looking at evolution of
the earth-moon system and then getting

into some earth science so what can we

point to an earth science that we could

learn about in future from this work for

example is it possible to learn

something about Earth's magnetic field

hmm okay I'm not sure I follow where

you're going with that question we've

measured the terrestrial magnetic field

multiple times with very very high

precision okay well okay but the earth

and the moon have evolved down to very

very different paths since their birth

together you know roughly
four-and-a-half billion years ago the earth is retained and accumulated more volatile hence oceans and things like that and that is that along with it's very very active geologic processes have really sculpted and changed the surface of the earth we've got continents that drift around because the mantle is convecting there's an interior dynamo that gives rise to the magnetic field that constantly changed the surface of the earth the moon on the other hand has one geologic process going on today and one only and that's impact asteroids
come in and they smack into the surface

614  
00:24:20,659 --> 00:24:25,129  
of the Moon and they create craters so

615  
00:24:22,608 --> 00:24:27,739  
material is excavated and redistributed

616  
00:24:25,128 --> 00:24:29,898  
around but you know they're they're

617  
00:24:27,739 --> 00:24:32,358  
really different worlds fortunately for

618  
00:24:29,898 --> 00:24:34,939  
us unfortunately for the Russians uh you

619  
00:24:32,358 --> 00:24:37,460  
know the the impacts don't occur very

620  
00:24:34,940 --> 00:24:39,798  
often on the earth they're happening all

621  
00:24:37,460 --> 00:24:41,720  
the time on the moon now that said

622  
00:24:39,798 --> 00:24:43,970  
there's one other aspect of this that's

623  
00:24:41,720 --> 00:24:45,950  
kind of interesting if the moon has

624  
00:24:43,970 --> 00:24:47,808  
maintained this that's low obliquity

625  
00:24:45,950 --> 00:24:49,639  
this very low inclination the Earth's

626  
00:24:47,808 --> 00:24:51,168  
inclination is 23 and a half degrees

627  
00:24:49,638 --> 00:24:52,819  
that's why we have seasons the moon
NASA - Talking LADEE Science

doesn't have seasons it's a very stable system that means the locations at the boat at the North Pole and the South Pole some of those locations are impermanent shadow that also means that stuff that has been delivered to those location from the earliest times of the solar system is still there that stuff that was delivered to the earth in the earliest times of the solar system too but it's been lost the stuff that was delivered in the very earliest times has been lost by the same geologic processes.
I was just talking about the geology covers it up it's gone I can't recover it anymore the moon is still there it's still sequestered so if we go there to the poles of the moon and start digging this stuff up we might be looking at the prebiotic materials that gave rise to life on Earth the same ones thank you we have time for a few more questions I have a real quick question and it involves what what do we know about the moon's outgassing and how does that tell us about the interior and it's state of evolution so fair for Jim Green to ask
questions that we do know that argon-40 is outgassing from the interior of the moon that was the experiment that was one of the experimental results that dick Hodges over there sitting in the audience got back in the 70s on Apollo 17 argon-40 is comes from radiogenic decay of potassium-40 of which there is a fair amount on the moon we see it actually in distinct locations on the moon and that's really strongly related to the crustal history of the moon and the interior history of the moon another thing we observed that may some of which
may be coming out of the Interior and

should be expected as helium but it

looks like based on LRO results that the

helium that is seen in the lunar atmosphere mostly derives from the solar wind so that's something that's coming from the outside in now more about the interior of the moon there may be other things that are leaking out argon-40 gets out because it's a noble gas and it doesn't chemically react with anything other substances such as water may not be so lucky there may be juvenile water still in the interior of the moon in fact mineral samples have revealed the
presence of water in those earliest minerals appetite grains and I'm getting way deep into the science of that but the water probably would have a hard time getting out because it's so reactive so anything we see near this nearer on the surface either was excavated delivered or migrated from low latitudes and got cold trap thank you we have time for one more question from social media or media here in the audience at nasa wallops if Jim Green is an answer askim I guess I I can't 20 of course the Apollo astronauts
left lunar corner cubes reflectors on the surface of the Moon and we've been paying them with lazers for years to measure the earth-moon distance. The laser common principle also is a range. In instrument how much more accurate now of course laddies in orbit how much more accurate will the laser come give us a measurement of distance to at least laddie then then the lunar reflectors. Well we're really good at measuring relative changes in the distance along the path and we're working with some of the science folks at NASA to see if.
we can turn that into absolute range
measurements but we know we can measure
relative changes down to the centimeters
and with a lot of averaging the variations and maybe microns per second
even it's what's bens discussed so there are a lot of variables when you're actually doing the ranging you have to account for the atmosphere and what that does because sometimes the path light changes there and so but as I said we're working with them to see what we can back out to be able to get absolute range measurements but centimeters is
the answer we have time for one more

00:28:50,308 --> 00:28:54,418
question from a member of the social

00:28:52,349 --> 00:29:01,048
media team regarding red good news media

00:28:54,419 --> 00:29:03,840
der in the audience hi I'm Miriam

00:29:01,048 --> 00:29:07,648
Kramer and with space com and I was just

00:29:03,839 --> 00:29:09,269
wondering uh are there engineering

00:29:07,648 --> 00:29:11,969
implications that could potentially come

00:29:09,269 --> 00:29:13,589
from the science of this mission for

00:29:11,970 --> 00:29:17,519
instance I something having to do with a

00:29:13,589 --> 00:29:23,089
lander or even probes to various

00:29:17,519 --> 00:29:23,089
asteroids or mercury yeah

00:29:23,779 --> 00:29:30,480
okay Hillier been talking a lot but if

00:29:28,740 --> 00:29:32,970
you're asking about what the science

00:29:30,480 --> 00:29:35,099
instruments can bring to future

00:29:32,970 --> 00:29:37,350
exploration well there are similar
problems at other bodies we'd love to know whether lofted dust occurs at larger asteroids whether lofted dust occurs leaks expect that if it happens that the moon it happens elsewhere as well so sending similar instruments to those bodies will confirm and further inform us of that physical process as exotic as it is so you can make second use of anything that you develop for Space Flight but I was wondering if you were going in a different direction with maybe the reuse of the ladee common buzz the modular bus design okay all right
okay I'll stop there then thank you

piano that concludes today's science

briefing about the ladee mission you can

learn more about the mission by visiting

us online at nasa.gov/laddie or by

following the mission on our social

media including Twitter at NASA laddie

and tune in tomorrow at nine-thirty p.m.

Eastern when nasa TV begins its live

mission broadcast and launch is

scheduled for 11:27 p.m. eastern i hope

you'll tune in and thank you for joining

us

you
you