good afternoon my name is Dwane Brown

and welcome to NASA headquarters today's briefing will discuss the upcoming March 12th launch of NASA's magnetospheric multiscale or MMS mission that will study magnetic reconnection around the earth now that's a lot to swallow but remember these two words magnetic reconnection what is it why is it important to study today you will get those answers all of the information you were here today and any updates will be on the website at www.nasa.gov/station science coming from this mission Twitter
Facebook and other social media platforms will have brief presentations from our participants and then we're opening up for questions starting here in the NASA TV studio our phone lines and the questions from the public viewing this program on social media first let me introduce you to today's participants first you hear from Jeff Newmark interim director heliophysics division NASA headquarters in Washington birch principal investigator MMS instrument suite science team Southwest
Research Institute San Antonio Texas

Greg Dulli MMS project manager and NASA's Goddard Space Flight Center in Greenbelt Maryland and Paul Casick associate professor West Virginia

we'll start with Jeff Thank You Duane and good afternoon everyone I'm really thrilled to be here today to introduce MMS to you all before we talk about MMS in detail I wanna step back a little bit and talk about how it fits in with with the important work that NASA is doing on heliophysics physics it's kind of a
strange horror trip to many of you but

it deals with some of the most

fundamental parts that we know starting

with the Sun we all recognize the Sun

and what we're doing is looking at the

Sun and its extended atmosphere that we

call the heliosphere and how it

interacts with the planets the space

environment around the earth the space

environment on all the planets out to

the edges of our interstellar space this

Sun is actually variable many of you

think of the Sun as a constant but if

you look at this first movie I have here

you'll see what we actually when we look
at national look at the Sun that you see

it's these activity zones you see large

eruptions of the Sun we call solar

storms these storms travel throughout

interests planetary space and at times

the storms interact with the earth and

that interaction can cause what we call

space weather what's what starts these

storms what causes the space weather

around the earth this is a phenomenon

that's wayne already mentioned magnetic

reconnection magnetic reconnection

actually occurs throughout the universe

not just on the sun not just around the
earth but on other planets at the edges of our solar system and in fact around black holes large other galaxies this is a fundamental process that occurs and MMS is going to revolutionize our standing of it if you in that movie we saw as a very large-scale system looking from the Sun all the way through space the earth how do we study that system the next graphic you see here shows you the our Healy physics system observatory the fleet of spacecraft that nASA uses to look at this connected system we're studying the Sun how the solar storms
erupt from the Sun how they travel through space how they interact with the Earth's magnetic environment and so we need this whole system together MMS is going to fill a key part of this new system you look at the my next view you'll start to see introduce you to MMS what does MMS doing it's going to actually fly in the Earth's magnetosphere this protective magnetic environment around the earth and you can see here the observatories we're using this environment around the earth as a natural laboratory we've actually rather
than building one on earth we're going to wear these magnetic reconnection actually occurs in space so we can understand it you'll see here as you see we have four spacecraft which gives us a three-dimensional understanding and in fact a four dimensional understanding you'll hear about the instruments that revolutionize our ability to make measurements in time as well as in space to tell you some of the details about it I want to introduce dr. Jim birch thank you Jeff sunlight in starlight ionized as thin gases that fill the solar system and
galaxies and this so-called plasma state
electric and magnetic forces are stronger than gravity and many dynamic phenomena occur the most energetic of these is magnetic reconnection it occurs when magnetic fields and adjacent regions of space interconnect and the process magnetic energy is destroyed and heat and kinetic energy are released because of its explosive nature magnetic reconnection is often described as a magnetic explosion in space reconnection is important to us as the engine that drives space weather and a main dish
that is frustrating our attempts to harness nuclear fusion with magnetic containment devices the MMS mission will conduct a definitive experiment in space that will finally allow us to understand how magnetic reconnection works let's look at a video magnetic fields exist throughout the universe and energy is often released by magnetic reconnection in the outer parts of our galaxy or at the centre of our galaxy there's a black hole and these are x-ray flares that have been observed recently caused by reconnection in the sun's superheated
corona magnetic fields create spectacular loops and arcades the energy stored in these structures can release creating explosive solar flares and coronal mass ejections intense fluxes of energetic particles and giant clouds of ionized gas and magnetic fields are ejected from the Sun and traveled throughout the solar system when these clouds impact other magnetic fields such as the Earth's similar reconnection events occur and these caused intense magnetic activity and the Aurora lights at the same time they accelerate charged
particles to high energies creating a
hazard to space travelers in spacecraft

and even disrupting ground-based power

in laboratory devices and this is a
major magnetic storm at the earth
producing the aurora in the laboratory
devices that are designed to harness
nuclear fusion by heating up the plasma
confined by magnetic fields events
called sawtooth crashes have thwarted
efforts to permanently solve the energy

our next slide shows a simplified
picture of reconnection a fundamental
question is why and how does magnetic
reconnection take place the answer is in

one sense simple but in another sense

complex and mysterious the simple part

is that adjacent magnetic fields

pointing in opposite directions tend to

annihilate each other releasing their

magnetic energy and heating the charged

particles in the surrounding environment

and this process magnetic reconnection

the May

kinetic fields are torn apart and

reattached to their neighbors the

mysterious part is what goes in on

inside the box labeled effusion region
with MMS we will be able to probe the diffusion region for the first time with measurements down to the smallest scale of the plasma the electrons scale to solve this mystery

the next animation is going to show reconnection of simulations this is the magnetosphere solar wind coming in from the left there are two boxes these are our targets on the day side and one in the tail on the right inside these boxes reconnection is going on and this video shows how this animation shows one of the latest and most sophisticated
computer simulations of the diffusion

region we know what goes on outside of

this box from some previous missions but

what goes on inside the box is a mystery

even with the simulations because they

cannot simulate everything computers are

not big enough and so we have to fly

spacecraft in that box and we have to

put four spacecraft in there and make

particle measurements a hundred times

faster that have been attempted in

previous missions now this is our

orbital strategy the videos showing the

launch of the satellites the four
spacecraft in a pyramid configuration

00:09:32.909 --> 00:09:39.299
lost on the night side we spend six

00:09:35.159 --> 00:09:41.279
months getting the instruments ready and

00:09:39.299 --> 00:09:43.199
then we scan through the day side along

00:09:41.279 --> 00:09:45.839
the magnetopause where reconnection is

00:09:43.200 --> 00:09:48.240
occurring adjusting the spacing between

00:09:45.840 --> 00:09:50.490
the spacecraft down to a minimum of 10

00:09:48.240 --> 00:09:53.220
kilometers and we make two scans to the

00:09:50.490 --> 00:09:56.370
day side at this point we raise the

00:09:53.220 --> 00:09:59.160
Apogee 225 Earth radii and make one scan

00:09:56.370 --> 00:10:02.129
through the magnetotail also adjusting

00:09:59.159 --> 00:10:03.929
the spacing between the spacecraft now

00:10:02.129 --> 00:10:06.809
to tell us how we accomplish this with

00:10:03.929 --> 00:10:09.929
the spacecraft is Greg Dulli project

00:10:06.809 --> 00:10:12.059
manager good afternoon I'm going to talk
just a little bit about these incredible machines that we've built and how we're going to fly them to create this institute flying laboratory that the gentlemen have just described in my first photograph which you can see you'll see the four MMS observatories in there in the cleanroom at Goddard Space Flight Center and EDA God Space Flight Center where we designed and built and tested these observatories the instruments and there are a hundred of them were led and brought to goddard by the Southwest Research Institute
where we then integrated them with these four observatories and you can see in the picture the red covers show you some examples of the instruments and such and there are covers on the solar arrays now in the next photograph we could bring the next time you see you see the stack where you can actually see the solar arrays and the instruments on the top edge of that octagonal perimeter and we're flanked there by the two halves of the Atlas fairing the four meter fairing each of those MMS spacecraft weighs just shy of 3,000 pounds about 900 pounds of
that is fuel we carry and they measure
each about four feet tall by about
twelve feet across that octagonal
cross-section a couple things that are very special about MMS and indeed some of the challenges we faced in building them and some of the reason that we built them ourselves at NASA is in order to make the measurements that were described these very precise a magnetic field electric field and particle measurements our own spacecraft has to be very very clean meaning they can't have very much a significant electric
field or magnetic moment of their own we

don't want to see our own noise so we've

built spacecraft in this case that are

more than a lot more than a hundred

times lower residual magnetism and more

than a thousand times lower than what is

typical for spacecraft to have in terms

of electric charge so every aspect of

these spacecraft was designed to be very

clean so we can make these precision

measurements the other aspect of these

is these are spinning spacecraft as was

mentioned so they have to be precisely

balanced even as we deplete the fuel

they have to be balanced because we need
to keep an in this little model of MMS

we have to keep these very precisely

oriented with respect to the ecliptic

north of our solar system all the while

while spinning now lastly this is a

fairly large stack and when we stack it

up when you saw it that's about 16 feet

tall but the in this picture what you

can't see is when we when we deploy

these we then extend sensor booms

each one of these we deploy 16 feet of

magnetometer booms you'll see those

unfolding a video in a moment we then

also extend 50 feet of booms out that
along the spin axis this way and then we finally on four sides put out almost 200 feet of wire booms with sensors on the end all of these booms then enable us to measure in three dimensions the electric fields in the magnetic fields we do all this with spinning spacecraft that we're flying in a formation as close as 10 kilometers to give you some sense of scale once we've deployed these booms an MMS footprint is about the size of a full baseball field so we end up flying for baseball fields kind of in a distance that ends up being about the
size of Washington DC separation when we're 10 kilometres apart in the video

we'll show next and we can bring it up and I'll narrate it I'll describe a little bit about what are what are only a few weeks from now it's going to look like that's the Atlas rocket on the pad of course that's our launch vehicle in some aspects of this video are sped up otherwise this must come to be very long and I'll comment on that when you see them but there's our launch on the Atlas 5 we then here you'll see the booster separate in the Centaur upper stage will
carry us on our initial orbit that Jim

00:14:02,870 --> 00:14:07,730 showed you the fairing separates which

00:14:05,690 --> 00:14:09,680 we detect and there's our stack of four

00:14:07,730 --> 00:14:11,899 MMS spacecrafts already spun up by the

00:14:09,679 --> 00:14:14,839 Atlas centaur now you'll see them start

00:14:11,899 --> 00:14:16,549 to separate from the top down in in

00:14:14,840 --> 00:14:18,620 actually it's about five minutes

00:14:16,549 --> 00:14:20,329 between the separation events as we get

00:14:18,620 --> 00:14:22,039 a the separation distance we want

00:14:20,330 --> 00:14:25,840 initially we sped it up here to show you

00:14:22,039 --> 00:14:27,889 and here you'll see that first 16-foot

00:14:25,840 --> 00:14:29,389 magnetometer pair of booms deploy

00:14:27,889 --> 00:14:34,210 outward on the bottom side of the

00:14:29,389 --> 00:14:37,009 spacecraft and then shortly we will see

00:14:34,210 --> 00:14:40,280 the example where we start releasing
those 200-foot wire booms out the side

all the while while spinning all the

wobble keeping this thing very very

stable and then finally in this in this

in this video you'll see those both spin

axis or axial booms deployed up where

they uncoil their folded coil booms

leaving us with with these very large

spacecraft in a formation that forms

this laboratory and as this video rolls

on with another Liberty with the video

as you can begin to see other MMS in the

picture I don't think you'd see them

quite this well at ten kilometres but
you get the idea we are flying these

four spinning very large once deployed

spacecraft in formation we maintain that

formation to an accuracy of a hundred

meters so I'm flying ten kilometres

apart using the GPS on the that is

actually below us a GPS system we built

we keep track and maneuver this

formation to the within a hundred

meters now to talk a little bit more

about the bigger picture of what we're doing with MMS and how it fits in the

bigger picture of heliophysics I'll I'll

turn it over to Paul Thank You Craig so
I'm really excited to talk to you today about why scientists are waiting with bated breath for MMS to be launched and why everyone should also be excited about what we're going to be able to learn so the first M in MMS stands for my neato spheric the earth has a magnetic field that sticks out into space and a part of space where the magnetic field is dominant is called the magnetosphere outside the magnetosphere you have particles from the Sun being spewed out that's called the solar wind and those particles that would normally
run into Earth instead they run into the

Earth's magnetic field so the Earth's

magnetic field is very important in

protecting us from the particles from

the Sun so shown here in my first

graphic is a sketch of the Earth's

magnetosphere which comes from a

computer simulation the earth is the

ball in the middle and the

strange-looking yellow lines represent

the magnetic field the lines connecting

to the earth in the center are in our

the magnetosphere and on the left you

see a magnetic field line and that one

is being pushed in away from the Sun by
the solar wind towards the earth so as

we've heard from the other panelists the

MMS mission is designed to study

magnetic reconnection using the

magnetosphere as a laboratory it occurs

when oppositely directed magnetic fields

point in opposite directions and they

come together and effectively break

so we will see this in motion in a

moment magnetic fields from the solar

wind in this animation will come in from

the left side and when they reach the

magnetosphere they will break and that's

what magnetic reconnection is so let's
go ahead and roll the animation so you can see the field lines coming in from the left and breaking when they reach the magnetosphere and that's a magnetic reconnection but the process doesn't end there you see these magnetic fields being dragged away from the Sun and when they get to the the far side of the earth the field lines are oppositely directed again and they break again that's again the process of magnetic reconnection and you can see what happens is the magnetic field lines shoot back towards Earth and that's
where it gets interesting for us so the magnetic fields snap back like rubber bands and blast these hot particles back towards the earth so as we saw in Jim's animation some of these particles harmlessly run into the atmosphere at earth and when they do they excite the gas up there and they the gas ends up giving off light and that's what we on earth see as the northern and southern lights also known as aurora as pictured here however as we've also heard from the other panelists the particles can cause problems too so there's a number
of satellites in space that we use for

very important things like cell phone

communication and GPS so if these

particles run into the satellites they

can short out the circuits and can knock

out the satellites and that would cause

problems for cell phone reception the

moving magnetic fields can also drive

electric currents on the earth and that

can overload transformers and lead to

power outages which has happened in

Canada and the United States and parts

of Europe so all of these are aspects of

what are known as what's known as space

we can see that magnetic
reconnection plays a very important part in space weather and that's why it's important for us to study the fundamental science of magnetic reconnection in order to understand it so that's just one reason that MMS is important to all of us so why is MMS so important to science scientists so going back to the name MMS ii M and the F stand for multi scale this signifies that reconnection happens at a very small region in space as we saw in the animation but it impacts a huge region of space of the whole
magnetosphere which is a million miles long this makes it extremely difficult to study so like a cosmic version of finding a needle in a haystack the best we've been able to measure magnetic reconnection in the magnetosphere has been with a mission with four satellites in a pyramid and they were separated by 600 kilometres or more so 600 kilometres is the distance from Washington DC to Boston but as we've heard from Craig the four spacecraft for MMS will be separated by only 10 kilometers which is about the size of Washington DC so much
closer than we've ever been able to see

before in addition as we've heard we'll

going the data much faster than we have in

the past a hundred times faster than

previous missions so to get a feel for

what this is like picture watching a

football game and you can watch for a

minute at a time but you have to wait an

hour in between times that you can watch

it would be really hard to figure out

what's going on in the football game so

these are the problems that have been

plaguing researchers studying magnetic

reconnection is that we can't see the

these are the problems that have been

plaguing researchers studying magnetic
smaller scales and we can't process the

data fast enough to really understand

what happens right at the place where

magnetic reconnection happens so this

makes it difficult to see for example

how particles get accelerated and heated

during magnetic reconnection events so

you can see NASA's MMS mission is really

going to give scientists an

unprecedented opportunity to study

reconnection go back to tween thank you

Paul and in folks okay so let's see if

we can go ahead and go take questions

we're start with we're here in the NASA

TV studio with the question here and
then we'll go to the phone lines and

then we'll go to social media if you can

wait for the microphone say your name in

you know affiliation please Adam interim

until news service and actually a

question for Greg you mentioned the four

different

shuttles that are being used can you

explain why specifically there needed to

be for and whether kind of these four

shuttles flying so close together is a

norm and something that typically is

done but their spacecraft or

observatories but I wouldn't I wouldn't
call them shuttles I mean we have we

have for MMS spacecraft we there's a

model of them there but the reason we

have four is as we've talked about we

want to measure this phenomenon we want

to capture it in three dimensions and so

if you just kind of imagine if I've got

three things no matter how I put them

down they'll define a plane I can only

get two dimensions with three objects so

in order to have four measurements

simultaneously of whatever's going on I

really need to have at least four points

in space and that's what we talked about
making a pyramid there's three of them

and another one here so now we have a

three dimensional shall we say sensor

made up of four satellites so we can

know what's going on in 3d and we also

know what's going on very fast in time

studies in the future know that this

mission is this mission is is dedicated

and indeed we we anticipate it will

largely solve the mystery of magnetic

reconnection but it's it's a mission

dedicated to that they'll fly for two

years possibly more if we if we decide

to extend the mission but they're Persol
purposes is to probe and really understand and solve the mysteries of magnetic reconnection. Okay, we're gonna kind of switch gears here. We're gonna go to social media and Karen Fox, who's on the board there. What's going on in the community? Of course, since they're coming up, some questions for you at Bobby Drake has asked us. She's been studying SMAP, a recent NASA mission in her high school Global Studies class. She's wondering whether MMS will be related to that and then the question is how will MMS data be connected to some of the other missions that we have. So, this is Jeff.
DeMarco I'll take that.

SMAP is an earth science mission looking at soil moisture and this mission is not really related to that it really is looking at a very different phenomenon no it's really looking at the environment our near space environment where SMAP is looking down at the soil so in the soil throughout the over the earth in terms of how the data works together again where I showed you earlier in the video we have today spacecraft that look at the Sun look at the initiation of those
solar storms we watch those storms
go travel through interplanetary space
go towards the earth and then we
don't really know what happens as they
interact with the Earth's magnetic field
so we use the other spacecraft to set up
the contacts and that allows MMS to then
study the details of what's going on in
that magnetic reconnection zone that you
heard so much about you have any other
questions can but take two more from
social media and we go to the phone line
and we'll come back another question
from at beastmode I wanted to follow up
on the GPS that Craig Tooley mentioned

600

00:25:00,220 --> 00:25:06,610
can you describe how mms uses GPS and

601

00:25:03,009 --> 00:25:08,170
relies on it please sure our GPS system

602

00:25:06,609 --> 00:25:10,799
and and it's actually got a name it's

603

00:25:08,170 --> 00:25:13,810
called navigator which is quite fitting

604

00:25:10,799 --> 00:25:15,849
the way the way it works is what I mean

605

00:25:13,809 --> 00:25:17,109
much as we use GPS on the ground as you

606

00:25:15,849 --> 00:25:19,089
would use in your handheld or in your

607

00:25:17,109 --> 00:25:21,189
car or on your phone we use it to

608

00:25:19,089 --> 00:25:22,899
determine our location of each

609

00:25:21,190 --> 00:25:25,509
Observatory which is very important

610

00:25:22,900 --> 00:25:27,850
because that's that's how we you know we

611

00:25:25,509 --> 00:25:29,500
we begin to understand where we are in

612

00:25:27,849 --> 00:25:32,399
these orbits because essentially MMS

613

00:25:29,500 --> 00:25:34,450
flies for very similar but not identical

orbits all the time in order to maintain

that formation you can imagine for over

the lines that are very close so we need

to know precisely where each one is in

relation to the earth now the thing it

is very very novel and actually

interesting about MMS is GPS system is

the GPS constellation is far below us

you know we are much higher than that

constellation of GPS satellites and so

our system is able to actually pick up

very very weak signals from the side

you know from of those GPS
satellites and from that it can triangulate and determine where each of our MMS satellites is. It also gets very precise timing of when we're there and then we that is continually we send that to the ground we use that end to to design and plan the maneuvers that actually adjust the formation to maintain not too far apart not too close together and the right shape and instantly as we do that we get feedback from the science team it's it's not something we've known in advance some of the interesting things about the mission.
is will be fine-tuning that that separation in order to optimize as we see the data they'll be looking at this data real-time throughout the mission and we'll be tuning that that laboratories to collect the data one more Karen and then we'll go to the phone lines alright another question from at galaxy galius the question is what to expect to be the lifespan of MMS and do we think that the sun's radiation could have an effect either on the mission or on the data the MMS mission is actually nominally planned for two
years of science gathering it's preceded

by six months as dr. Burch described

as we wait for our orbit actually to get

around into that region of interest in

the magnetopause in front well we'll

swing through that may need to pause

twice and then we will double our orbit

size our apogee our farthest point and

we'll swing through the tail and that's

the second year so this is

essentially a two-year science campaign

we carry fuel so if it makes sense

and there's and still something to

be done we could potentially do some
more work afterwards if NASA decides

00:27:43,359 --> 00:27:47,199
that's warranted so we won't run out of

00:27:45,099 --> 00:27:51,039
feel quite that soon in terms of the

00:27:47,200 --> 00:27:52,990
radiation it the although magnetic

00:27:51,039 --> 00:27:54,609
reconnection sounds very explosive and

00:27:52,990 --> 00:27:56,769
it is from the standpoint of the

00:27:54,609 --> 00:27:59,259
electronics and such we have built on

00:27:56,769 --> 00:28:01,599
the spacecraft these orbits this region

00:27:59,259 --> 00:28:04,000
in space is fairly typical of what we

00:28:01,599 --> 00:28:06,369
see for satellites it's in fact some of

00:28:04,000 --> 00:28:08,380
the time it's less severe than what

00:28:06,369 --> 00:28:10,449
geostationary satellites see as we pass

00:28:08,380 --> 00:28:13,390
in and out of the radiation belts so in

00:28:10,450 --> 00:28:15,309
terms of radiation this is a typical

00:28:13,390 --> 00:28:17,170
kind of environment for us to build
science satellites in

okay if you've just joined us again

we're here NASA headquarters learning

about the upcoming NASA mission to study

magnetic reconnection around Earth and

it is the first I believe dedicated

project to do this very extraordinary

science so we're going to go to the

phone lines on to our media and I

believe we have Ken Kramer from Universe

Today Kim hi thanks for taking my

question I wonder if you could talk a

little bit about studying would it be

worth studying the magnetosphere
anywhere else in the solar system and any other planets and how it does do the other planets compared to the earth thanks question in fact we are studying reconnection and other planets Cassini at Saturn for example and then Jupiter also reconnection is going on but the mode is different because these planets are dominated more by rotation of the planet and so the solar wind has an influence and reconnection as an influence but is not as strong as it is at the earth and so it's a different type of circulation that is set up in
these planets but people like myself we

work on reconnection we do that as

Saturn as well there are other missions

have observed and we've learned about

REM and recondition other regions of our

magnetosphere although we haven't flown

into it they asked about other regions

on the earth

oh yeah well here we have two missions

that have been up a while seven to ten

years is the European cluster mission

and the NASA Themis mission and those

are still operating and they be

operating in different parts of the
magnetosphere and this is where we'd be able to do a global study of what reconnection causes as Paul mentioned reconnection happens in this small region but it affects the entire magnetosphere and by comparing our data to the thymus and cluster data we'll have a very powerful thing that we call the Heliospheric Observatory or this will be a major part of the Heliospheric Observatory it's Paul cassock just to add also the messenger satellite mission is measuring reconnection at mercury and mercury is a lot like Earth except it's smaller and so everything that we just
described happens

about 10 times faster okay yeah there's

a lot of buzz in the associate media

atmosphere we're gonna go back to Karen

Fox again if you have any questions send

in to hashtag a snåsa and I can't Fox

what do we got going on coming in now we

have a question from @m monitored who

wants to know how does the spinning of

the spacecraft interact with the sensors

how do you control the data given that

everything is spinning

yes thank you for that question most of

our measurements are independent of the
spin and this is how we make these very fast particle measurements because we're not tied to the spin of the spacecraft like just about all previous magnetospheric missions have been so we have a lot of instruments and we don't care what the spin rate is for our particles a low-energy particles some of our measurements are do rely on the spin these long wire booms that Craig talked about need to spin for a certificate force because otherwise these wires wouldn't be stretched out like that so we need to the booms to deploy our
antennas the spin of the spacecraft it's
a pretty slow spin rate compared to most
magnetospheric missions I don't know if
that answered the question completely I
think we're back to me we have some fun
questions that are going a couple other
directions but I'm going to throw them out to you all one of the questions from
the raisin to 222 is is there a chance of the magnetosphere around Earth is
connected to them a magnetosphere around a black hole at the center of our galaxy
I would say that the they're not connected in terms of being touching
each other I think where we hope the

00:32:28,009 --> 00:32:33,620
connection is is that if we understand

00:32:30,019 --> 00:32:36,259
the physics of reconnection here near

00:32:33,619 --> 00:32:39,558
Earth and the magnetosphere then we can

00:32:36,259 --> 00:32:41,089
apply what we've learned here in the

00:32:39,558 --> 00:32:43,339
magnetosphere to other places that

00:32:41,089 --> 00:32:44,389
reconnection happens such as in solar

00:32:43,390 --> 00:32:52,270
the movies of other planets and even in

00:32:48,500 --> 00:32:54,319
you know black holes and neutron stars

00:32:52,269 --> 00:32:55,220
we'll take one more from social media

00:32:54,319 --> 00:32:58,789
great Karen

00:32:55,220 --> 00:33:00,769
great at bill Waldman 8:08 asks whether

00:33:00,769 --> 00:33:08,599
this mission is going to provide a model

00:33:08,599 --> 00:33:09,900
that can be used to predict space
weather events in the future this is a
research mission and what we learned
from it will be an important part of
models that will eventually be able to
predict space weather we won't be predicting it from this mission but we will be coming up with theories and we'll be proving theories that then can be used in the end models to make them better in fact I think it's crucial that we understand magnetic reconnection because as I said earlier a reconnection is the engine that drives space weather so if you're going to predict what's
happening you got to understand the

engine not a comment to follow that up

just more generalized people think about

centuries ago as we as

we became a seafaring species it became

increasingly important that we figured

out how to understand it predict the

weather

that's crucial you're gonna navigate the

globe and you can see as a species as

we're gonna move out into our own solar

system indeed that we need to understand

what drives all of that weather is

equally important okay what we're gonna
do here we're gonna go ahead and close

out and before I do any final comments

here I want to turn it over to Jeff

Newmark for some final comments thanks

well I hope we gave you a little bit of

a taste of how exciting MMS is going to

be the complexity of developing this

mission is just really unprecedented for

spacecraft 100 instruments each 100 times better than we've done before

really enabling us to revolutionize our

understanding looking at this area that

Jim shows you that of magnetic

reconnection that we've never been able


to sample before using our magnetosphere

00:34:52,550 --> 00:34:58,220
as a natural environment Ori to study

00:34:55,128 --> 00:35:00,650
this we're just we're just very excited

00:34:58,219 --> 00:35:03,709
and I hope you continue watching us on

00:35:00,650 --> 00:35:05,510
this journey and I want to thank our

00:35:03,710 --> 00:35:07,849
panelists I want to thank the folks

00:35:05,510 --> 00:35:10,250
joining us on the phones here and

00:35:07,849 --> 00:35:14,359
particularly social media join the

00:35:10,250 --> 00:35:16,070
conversation on Twitter Facebook and go

00:35:14,358 --> 00:35:17,179
to the website you'll be seeing a lot of

00:35:16,070 --> 00:35:18,559
updates and a lot of additional

00:35:17,179 --> 00:35:24,429
information as we get closer to launch

00:35:18,559 --> 00:35:27,829
down in Florida at WWDC Golf / MMS

00:35:24,429 --> 00:35:29,899
magnetic reconnection I like to call

00:35:27,829 --> 00:35:32,059
this class 101 the advanced classes will
be down in Florida

it's phenomenal science with a

phenomenal team we will see you down in

Florida

thanks to contractor team and the in the

launch team we're ready we'll see you in

Florida March 12th thanks for joining us

from NASA headquarters good bye

you

you

you

you