good afternoon everyone I want to welcome all of you to the National Air and Space Museum my name is Jennifer Levasseur and this is our astronaut program today it is my honor and pleasure to get to introduce astronaut Kevin Ford who's here to talk to us about his experience in space Kevin is a retired US Air Force colonel and he joined NASA in 2000 he flew a was the pilot of space shuttle flight sts-128 which occurred in 2009 happened to be the pilot of our own discovery out at the udvar-hazy center he also flew to
the International Space Station in October of 2012 and was commander of the
space station from November through March of 2013 so he's only been back on earth for just a few months Colonel Ford has over 4,000 hours of flying experience and 157 days in space he's a native of Indiana and comes from the University of Notre Dame with a Bachelor Science degree he has Master of Science degrees from Troy State University and the University of Florida and has a PhD from the Air Force Institute of Technology welcome
all to all of you and let's welcome

Colonel Kevin Ford all right Thank You

Jennifer and thank you for not seeing

anything negative about Notre Dame I

know you're a Michigan grad and that

took some restraint I know I appreciate

the introduction it's great to be here

and our nation's Air and Space Museum

and my my spaceship discovery is now

here at the space the Space Museum as

well and I haven't had a chance to see

it myself yet but I can't wait to get

over and see that I did have a the great

opportunity and good fortune of flying
space shuttle discovery to the

International Space Station in late 2009

and then having the opportunity to

return again on a Soyuz spacecraft a

Russian Soyuz to spend five almost five

months on the space station just

just late last fall through the spring

so I did just return just tell but two

months ago

yeah that's he and out here a little bit

just you know my Mike I think it's

cutting out a little bit and had a had a

group its living aboard is very

different than then visiting on a space

shuttle mission should I just turn this
off okay I think I'm gonna go to the handheld mics and so it was kind of just a little bit there for our audience outside the building the the living in space is a completely different thing than visiting on a space shuttle sortie the short the shuttle sortie of about two weeks is very choreographed orchestrated planned ahead of time checklists are written out and we do everything deliver the cargo we get in and we get out of there we try not to disturb the resident crew and being there is a resident crew doing science
living on board and spending months and

months there is a very different

experience so I'm going to share today

with you the information more about the

expedition but at the end of the session

about a half an hour we're going to take

some questions and if anybody has any

questions about discovery itself or the

Soyuz operations and how they are

similar in different please feel free to

ask if we could go to the first slide I

came up on a Soyuz called Soyuz 32 s

because it was the 32nd Soyuz to visit

the International Space Station the
program history Soyuz have flown many hundreds and hundreds of sorties safely but this was the 32nd one to the space station the international space station they also flew to Mir and before that to solute and so forth so there's a there's our international space station on the screen and also the rocket that I flew up on that rocket the Soyuz rocket is about the size of a space shuttle solid rocket booster so quite a bit smaller than the space shuttle is itself its sole purpose is just to carry the three people up there deliver them and
then serve as a lifeboat while you're
onboard the space station and come home

again there's a beautiful model in this

in this area right here that you can

have a look at before you leave to I'm

gonna spend some time admiring it it's

it really gives you a nice feel of the

dimensional nature of the space station

if you'll give me the next slide I put

this this photo and to show you it was

taken at the end of sts-132 as the Space

Shuttle was departing and it's almost

completely and its glory there you can

see a Soyuz docked to the top port there

with those little bitty solar arrays up
in the middle and that is where when I arrived back in October we parked our Soyuz on a module called Poe esc' which means search kind of is in search for knowledge that's where we parked and we left our Soyuz there for the for the five months we were on board next slide this just gives you a feel for the size it's really hard for people to imagine how big the International Space Station is I can tell you when you see it out the windows as you're approaching it looks absolutely huge there's a football
00:05:09,779 --> 00:05:14,669
field underneath it we're the NASA

00:05:11,639 --> 00:05:17,339
football team plays and you can see how

00:05:14,670 --> 00:05:19,620
big and how much acreage it covers the

00:05:17,339 --> 00:05:22,019
interior volume is about the interior of

00:05:19,620 --> 00:05:23,850
what would be a 747 aircraft if you

00:05:22,019 --> 00:05:26,669
emptied out this gives us a lot of room

00:05:23,850 --> 00:05:28,710
to live and to do science and

00:05:26,670 --> 00:05:30,600
maintenance and stow things that you

00:05:28,709 --> 00:05:31,289
might need during the course of the

00:05:30,600 --> 00:05:35,250
expedition

00:05:31,290 --> 00:05:36,660
next slide please we leave now to and

00:05:35,250 --> 00:05:40,439
from the space station at the current

00:05:36,660 --> 00:05:41,850
time on a Soyuz rocket that again just

00:05:40,439 --> 00:05:43,709
carries three crew members the
The spacecraft itself is tiny and fits underneath the nose of the fairing on the front of the rocket and that rocket booster takes us to space in about nine minutes and this is what it looks like in Kazakhstan you can see we don't have quite the crowd in Kazakhstan that we would have in Florida next slide there's after you get into space and the rocket has done its job and delivered you there the solar arrays pop out and you'll see you'll get to see a little video in the movie I'm going to show in a second where you can see those arrays
extending and this is what the

158  
00:06:13,560 --> 00:06:17,339
spacecraft looks like that spacecraft is

159  
00:06:15,389 --> 00:06:19,439
actually made up of that bulb on the

160  
00:06:17,339 --> 00:06:21,959
front that's the habitation module if

161  
00:06:19,439 --> 00:06:24,810
you can see that that's not accessible

162  
00:06:21,959 --> 00:06:27,389
during launch it's closed off and that's

163  
00:06:24,810 --> 00:06:28,740
where we live during the two-day transit

164  
00:06:27,389 --> 00:06:30,569
to the International Space Station

165  
00:06:28,740 --> 00:06:32,790
because it takes us as a routine about

166  
00:06:30,569 --> 00:06:34,800
50 hours to get there the middle section

167  
00:06:32,790 --> 00:06:36,960
of that piece right there looks like a

168  
00:06:34,800 --> 00:06:39,270
little gun drop shape and that is the

169  
00:06:36,959 --> 00:06:41,189
descent module and that's the piece that

170  
00:06:39,269 --> 00:06:41,609
we end up coming all the way to the

171  
00:06:41,189 --> 00:06:42,959
ground
that's the only part of this spacecraft that survives re-entry all the way to the ground and it's got the parachutes in it it's got a main and a spare and that's how we get home safely and then the bottom section is the electrical you can see the arrays and the solar well the solar arrays in the propulsion system on the back and lots of antennas and this is where the main engine is as well that allows us to increase our and do our rendezvous with the altitude and space station and then when it's time to come home
to fly away from space station safely

and then do our slow down burn we have
to burn an engine for about well almost
five minutes now from the 250 miles of
altitude and that's slowing down is what
allows us to fall back to the earth and
out of orbit we'd now if once we've
slowed down we don't have the speed to
stay in orbit anymore we fall back we
catch the atmosphere and we essentially
re-enter just like a meteor would so
that's the way we come home and then a
parachute to a hard landing on the
ground in that Kazakhstan next slide
please

this is just a really cool space shot

of my buddies that join me in the middle

of the expedition of my time on

board coming in the moon in the

background and the Soyuz pointing at us

in the black of space it's really it's

really amazing set of machines but when

you get into space and you look at the

beauty of it it seems so simple against

the blackness of the cosmos next slide

these are the crews I was there as part

of expedition 33 and then expedition 34

so you usually split your time you're a

so you usually split your time you're a
three-person crew that goes up and you

00:08:15,240 --> 00:08:18,240
join a three-person crew that's already

00:08:16,680 --> 00:08:20,158
been there so they're the senior crew if

00:08:18,240 --> 00:08:21,870
you will and then we're the junior crew

00:08:20,158 --> 00:08:24,449
for a while they teach us all about the

00:08:21,870 --> 00:08:27,209
station base station get us all set up

00:08:24,449 --> 00:08:29,610
hand it over and then they leave and a

00:08:27,209 --> 00:08:31,709
new crew comes up so that's my first six

00:08:29,610 --> 00:08:34,050
six person expedition the top left and

00:08:31,709 --> 00:08:36,088
the final compliment we had on board on

00:08:34,049 --> 00:08:37,620
the bottom right three members of the

00:08:36,089 --> 00:08:41,099
crew on the bottom right picture there

00:08:37,620 --> 00:08:43,709
are in the dark blue seats Romanenko

00:08:41,099 --> 00:08:46,470
Hadfield Marshburn just landed last

00:08:43,708 --> 00:08:48,629
night in Kazakhstan and are on their way
back to their homes as we speak I know

Hadfield and Marshburn or in an airplane

somewhere over the Atlantic headed to

Houston at this very second thanks like

this is the last slide I'm gonna show

before I start a little bit of a crew

movie and I wanted to show you this one

because in the movie you're gonna see

testbed things that we do on Space

these two guys flying these two little

bowling ball-sized satellites are called

spheres it's just one of the engineering

satellites can fly around they have
their own propulsion system and their own brains and I wanted to show you this because in the movie you can't tell it very well but the one on the left there the red guy actually has his own brain than his own eyes you can see the the lens caps there on the glasses and he can find the blue satellite fly over to it fly in and look at it from a certain angle which is all very useful someday in space if you want to send your robot out to go look for an ammonia leak you could just put it out the hatch it could go out go find the leak take pictures of
it and send it back inside to you we

wouldn't have to go out and do a

spacewalk and invest all those resources

a few three or four days of resources to

go find problems like that so if you

could now we'll take it to the through

the movie and I'll be just narrating

most of the movie there is some sound as

well so all quiet down a little bit when

there's something to be heard so these

are Clips really both of expedition 33

and 34 again we launched on the 23rd of

October out of Kazakhstan and on the on

the days prior to the two arriving in

Kazakhstan they roll the rocket out they

00:10:18,360 --> 00:10:23,070
take it out of its hanger on a train

00:10:20,220 --> 00:10:24,389
track and early morning the prime crew

00:10:23,070 --> 00:10:25,950
doesn't ever get to see the rocket

00:10:24,389 --> 00:10:27,659
before launch but the backup crew gets

00:10:25,950 --> 00:10:29,370
to go see you can see it's got a

00:10:27,659 --> 00:10:31,110
strap-on boosters on the back and a

00:10:29,370 --> 00:10:33,029
middle section it's got kerosene and

00:10:31,110 --> 00:10:34,350
liquid oxygen is propellant and then the

00:10:33,029 --> 00:10:36,329
spacecraft is underneath the white

00:10:34,350 --> 00:10:38,129
section on the front what you'll see in

00:10:36,330 --> 00:10:39,629
just a minute it never hurts to get a

00:10:38,129 --> 00:10:41,669
little blessing before you go fly in

00:10:39,629 --> 00:10:43,409
space we are very happy to get that

00:10:41,669 --> 00:10:45,209
nobody ever turns that down as far as I
know we'll take all the luck we can get

and all the help we can get

so walk out to the bus usually some of

the family members get to come and join

are quarantined so it's very carefully

controlled those are doctors walking

behind us to make sure we don't touch

any of the wrong people we're allowed to

touch the big shots but we're not

allowed to touch any of the wrong people

so we get suited up we do wear pressure

suits on ass

and entry as well and you climb in
through that opening right there and
then they tie it up with rubber bands
twice they fold it over and they stick
it in and you zip it up tight and it
actually holds pressure just fine so we
do we do get the suits put on by
professionals we do everything way too
early so there's a lot of sitting around
and waiting a lot of times before launch
this is a chance to get in the
specialist make sure the suit is get
them a teaching that's actually airtight
and it can hold pressure and we make
sure that if for some reason on a scent
the spacecraft depressurizes because of some kind of problem or we have to re-enter immediately and we have some kind of depressurization then we will be safe inside these suits all pressured up it is like being inside a really really tight beach ball though it doesn't give you much mobility it's a little tight and uncomfortable to work in but it's better than the alternative if you were to depressurize to vacuum so all the formalities a lot of NASA management came to join us and see us off which is very heartwarming to see a lot of your
friends there all the way in Kazakhstan

00:12:12,000 --> 00:12:17,339
Lech appreciated the chief of Roscosmos

00:12:14,100 --> 00:12:19,830
here saying final goodbyes and telling

00:12:17,339 --> 00:12:22,020
us not to mess up up the ladder we go we

00:12:19,830 --> 00:12:24,028
get into a very small elevator and crawl

00:12:22,019 --> 00:12:25,860
up and then spend about Oh 45 minutes

00:12:24,028 --> 00:12:27,360
getting into our seats the first time

00:12:25,860 --> 00:12:29,070
you ever actually make the entry into

00:12:27,360 --> 00:12:32,190
the spacecraft and take your perch

00:12:29,070 --> 00:12:33,750
inside the Soyuz is launch day you get

00:12:32,190 --> 00:12:35,670
in there one set one other time but not

00:12:33,750 --> 00:12:37,350
in the same way you do this day so

00:12:35,669 --> 00:12:38,610
here's a little launch sequence I'll

00:12:37,350 --> 00:12:43,050
just kind of let the video or the audio

00:12:38,610 --> 00:12:46,200
player lift off lift off of Kevin Ford
Evgeny tarelkin and Oleg novitskiy as they head on two dates refer to the International Space Station a little bit of high clouds but didn't really get in our way as we punch up through the rocket launch is just a big push in the back lots of vibration lots of string left and right and up and down as the rocket steers itself and then big booms and bangs is like you can see the strap-on boosters coming up and off right here they last about two minutes then they separate and fly off and every
time one of these pyrotechnic events

happens there's a big bang inside and

you kind of okay that was supposed to be

there right yeah that was supposed to be

there and then you're happy we have

usually have a little toy hanging inside

so that we can see when we're in zero-g

and kind of what the G level is you can

see that thing swinging it kind of a

high frequency doesn't quite look normal

like it would swing if you had it

hanging at home and that's because and

under the high G's it swings in a little

bit of a stiffer fashion we've at this
point just shut down the engines just

things happen fast here if you look in

the window in the top top of the screen

you can see the solar array through the

glass there that's deployed it's all

deployed automatically and after we get

off the rocket we're kicked off again

with like a pyro explosion and then for

the next door but we just tumble we just

tumble outside and you can see our toy

as is telling us it's floating and if we

weren't strapped in our seats we'd be

doing the same thing but we stay

strapped in nice and tight for quite a
while because after we get off we fire

386
00:14:18,578 --> 00:14:22,899
up all the spacecraft systems and turn

387
00:14:20,980 --> 00:14:25,180
on the jets and we do some maneuvering

388
00:14:22,899 --> 00:14:26,589
and we do some burns we actually call

389
00:14:25,179 --> 00:14:29,169
them burns when we light our rocket

390
00:14:26,589 --> 00:14:31,990
gine and add some altitude to our

391
00:14:29,169 --> 00:14:34,269
orbit at just the right time so that two

392
00:14:31,990 --> 00:14:36,190
days further down the line we'll be in a

393
00:14:34,269 --> 00:14:39,189
position to fly up to the International

394
00:14:36,190 --> 00:14:40,810
Space Station and rendezvous with it so

395
00:14:39,190 --> 00:14:42,279
this is all like my Soyuz commander and

396
00:14:40,809 --> 00:14:44,708
you have Guinea there's out my window a

397
00:14:42,278 --> 00:14:49,929
little bit of jets firing and so forth

398
00:14:44,708 --> 00:14:51,939
and this is taken out my my right window

399
00:14:49,929 --> 00:14:53,588
that's the Nile River Valley right there
during our orbits during the first couple days really spectacular to be up there the two cosmonauts I flew with we're both first-time Soyuz fliers I don't call them rookies because they're super experienced but they they are first-time fliers and of course it was my first time in a Soyuz as well so this is a new experience to most of us that little spin right there on that toy that's the toy Soyuz inside a real Soyuz and that's the kind of spin we do for a couple days as we're waiting to catch up and phase up to the International Space
Station we do that to stabilize our attitude so that we can keep our solar arrays pointed at the Sun and this is what it looks like out the window as we make this solar spin it's about two and a half degrees per second and it just keeps us in a nice inertial orientation with the Sun always perpendicular to our solar arrays so we rendezvous again after 50 hours so it's an amazing time to be in a tiny little spacecraft the spacecraft would fit on this stage and flying through space but then ultimately the job is to
get up to the space station and get to work that's why NASA takes care of getting our seats for us with the Russians and gets us up there to do the research this is right after we arrived on board we popped inside said hello to our new crew five days after I got there there was a spacewalk to do so I suited Sonny Williams an ocular see today up and they went outside to fix a little problem with an ammonia leak outside on the space station they did take care of the problem then that problem has recurred a little bit sense and we just
had another spacewalk about four or five
days ago in which those guys went out

and did a little bit more work out there

they were only with us for about three

weeks just a little bit of regular but

we didn't have too much handover time

with Sonny and Aki there I am alone

looking out through the cupola windows

and taken taken some opportunities when

I was there on weekends to get some

photography of the ground and getting

familiar with the earth outside it's

really spectacular when I flew in the

shuttle I had very little time for that

but when I flew on the on the space
station for 144 days I had a lot more time this is actually the ground in this area right here if you watched you shortly on the left side that's Patuxent River Maryland right there that base and I'm showing this because this is if you look at the ground this is how fast we're moving we're doing five miles every single second in the space station going around the earth every 90 minutes and I always thought it'd really be neat to have a space station right down at ground level flying by and you could watch it fly by can you imagine
00:17:14,740 --> 00:17:19,058
ten miles away five miles away over you

00:17:17,230 --> 00:17:21,068
five miles away and ten miles away I

00:17:19,058 --> 00:17:23,318
mean it's just an incredible rate of

00:17:21,068 --> 00:17:24,639
speed but because we're up out of the

00:17:23,318 --> 00:17:28,209
atmosphere we don't have to worry about

00:17:24,640 --> 00:17:29,590
aerodynamics and all is safe so we get

00:17:28,209 --> 00:17:31,210
in the windows when we can when we go

00:17:29,589 --> 00:17:32,829
away we close them up make sure they

00:17:31,210 --> 00:17:34,990
don't get struck by any micro meteorites

00:17:32,829 --> 00:17:36,699
or anything while we're up there some

00:17:34,990 --> 00:17:38,920
interesting things happen one of them is

00:17:36,700 --> 00:17:40,319
we had this really high beta period

00:17:38,920 --> 00:17:43,029
where the Sun is out to the

00:17:40,319 --> 00:17:44,889
perpendicular to orbit plane so as we
fly around the earth we always in the sunlight it just stays over to the side and goes around in circles for days on end and then slowly it comes back around and starts to be in your plane again and go as around you over your head and back end of the earth and then you get nighttime again a daytime again but in the high beta periods it's always out to the side so that's really difficult thing for the thermal guys to deal with during that just before Christmas time we got a new crew this is the the crew of what we call 33s the guys who just
came home last night as a matter of fact

00:18:13,750 --> 00:18:17,049 and this is some video I took of them

00:18:15,549 --> 00:18:18,730 docking on docking day just before

00:18:17,049 --> 00:18:20,259 Christmas some a little if you watch

00:18:18,730 --> 00:18:22,450 closely at the end you'll see thrusters

00:18:20,259 --> 00:18:24,220 firing on the soyuz as it comes and it

00:18:22,450 --> 00:18:25,660 bumps into the proper place you're

00:18:24,220 --> 00:18:27,519 allowed to bump into the space station

00:18:25,660 --> 00:18:29,259 but only in the place that the engineers

00:18:27,519 --> 00:18:32,019 have decided it's okay to bump into it

00:18:29,259 --> 00:18:36,910 and it catches on to you you can open

00:18:32,019 --> 00:18:38,980 some hatches and come one in so we had

00:18:36,910 --> 00:18:40,720 Christmas day off and we called the

00:18:38,980 --> 00:18:42,400 ground and sang some Christmas carols to

00:18:40,720 --> 00:18:44,500 them had a little bit of fun and
merriment usually it's very hard work up there but some days in space are just made to be made to be leisure and we had a lot of fun that day had some Santa came to see us and it was a day of playing just like hopefully you had on earth I had to cry uncle finally say no no so Christmas day this is how we weigh ourselves so of course after Christmas few say you have to get weighed and this works on an engineering principle where the frequency the frequency you have
depends on your mass so you can tell exactly what your mass is we do a lot of science we drop a lot of things things go flying away in space this is me getting to a freezer that's minus 95 degrees Celsius so it keeps things frozen very cold that's some urine samples that I've taken earlier in the day and I'm putting them away in the freezer and they'll come home for science they can tell by looking at that urine samples and blood samples how much bone we are losing and how much gain were how much were gaining back by the
types of food we're eating I showed you

that slide of these two satellites in

that one then my right hand there is the

one that has the goggles and it's

actually looking at the other one and we

turn them loose and then these guys can

fly relative to each other for 15

minutes and engineers on the ground can

work on the algorithms they need to

figure out how to maneuver these things

to make them autonomous how to program

em up to go out and do a job this is

running a little bit faster than real

time but you can see that the blue guy


they're the closest one to us is doing a

00:20:17,919 --> 00:20:22,700
little work on the other guy doing a

00:20:19,450 --> 00:20:26,830
little inspection and this add this

00:20:22,269 --> 00:20:28,509
experiment is called spheres very fun to

00:20:26,829 --> 00:20:30,069
do on board to set these up and watch

00:20:28,509 --> 00:20:31,150
them fly around I might just something

00:20:30,069 --> 00:20:34,418
you might do for three hours on an

00:20:31,150 --> 00:20:35,620
afternoon this is a picture of some fish

00:20:34,419 --> 00:20:37,929
that we had on board while we were up

00:20:35,619 --> 00:20:39,969
there called medaka they have bones that

00:20:37,929 --> 00:20:41,620
are just like mammals and we can look at

00:20:39,970 --> 00:20:44,079
how their bone is created and destroyed

00:20:41,619 --> 00:20:46,719
and look at the what they call the

00:20:44,079 --> 00:20:49,899
osteoclast and the osteoblast formation

00:20:46,720 --> 00:20:51,069
and japanese investigators think that
there's some really good chance that they'll make a very big impact someday on osteoporosis and what a legacy just that alone would be for the space station if the world's population someday had some kind of cure or prevention for osteoporosis so it makes such a big difference this is just a piece of equipment that Tom and I worked on for three days there that's Tom Marshburn and I and we're just getting ready to put it back and reassemble it it's a carbon dioxide scrubber but
it kind of shows you how massive things just float in space and and how interesting it is to work there some science is as more for spacecraft this is something they're looking at how to control fluids and fuel tanks if you think about your car at home you never have to worry about where the gasoline is you know it's on the bottom of the tank and right where the engineers designed the outlet but in a rocket that fuel could be anywhere it migrates to in zero gravity so they're looking at how to control where the fluids go where the
bubbles go and that's applicable to pumps on the ground also and things like syringes I'm sure some of you have seen maybe with the nurse or something when you're gonna get a shot there's bubbles in the end and they're there using gravity and flicking them to try to get the bubbles away from the end and someday we'll understand how to do that by building the mechanism perfectly and not have to worry about flicking it or getting a bubble into one weekend I did some stuff for some kids that had Legos involved and this is a Lego device
here built built just to demonstrate

00:22:13,808 --> 00:22:18,220
some things that kids were interested in

00:22:16,358 --> 00:22:20,589
investigating so we do a lot of projects

00:22:18,220 --> 00:22:22,629
for kids too that kids actually can come

00:22:20,589 --> 00:22:24,398
up with some fantastic ideas for space

00:22:22,628 --> 00:22:26,618
e exploration and we'll do some

00:22:24,398 --> 00:22:28,508
demonstrations for them and show show

00:22:26,618 --> 00:22:30,668
how things work because it's really hard

00:22:28,509 --> 00:22:32,618
to get there and we're happy to be the

00:22:30,669 --> 00:22:34,028
hands in orbit for any kinds of ideas

00:22:32,618 --> 00:22:36,128
that you might have so there are

00:22:34,028 --> 00:22:38,079
programs to do that this is actually

00:22:36,128 --> 00:22:39,728
just the blob of water I squeezed out of

00:22:38,079 --> 00:22:42,579
a water bag and I threw some orange tic

00:22:39,729 --> 00:22:44,109
tacs into and it just made a nice orange
color there and I'm just spinning around

playing using a piece of dental floss to make that water spin around so a lot of fun hey Derek this is our dragon spacecraft came up to see us and this is the birthing process actually you can tell it's running fast a little orbit on orbit and a half here ground actually did this birthing for us after we captured it with the arm I'll talk about that more in just a second and put it on the spacecraft that freed us up so that we could actually do some work inside well the ground controllers did that
birthing so it's a it's a development

again over the last six or seven years

they've perfected that and now it's just an advancement in space exploration that

that frees up the crew this is a time to say goodbye in this this movie is just about come to an end here this is what it looks like on our screen as we're undocking and flying away and then this is what a landing looks like and it's on it's in the plane Kazakhstan there's not supposed to be any trees or big rocks around or any Lakes or anything like
that and we land out there that wasn't

my landing you saw this is my landing we

grew into a bunch of clouds and we were

never seen again until they finally

stumbled onto us out there it was really

foggy and snowy on the ground and it

took them a while to get to us so they

don't have any great video of us hitting

the ground unfortunately but I'm here to

testify that we did hit the ground I

remember it well crawling out then with

a little help from the crew after being

in zero-gravity it's very difficult to

really pull yourself out of that capsule
you you just even though you're strong

671
00:24:18,250 --> 00:24:22,359
you still feel like you weigh a ton and

672
00:24:20,140 --> 00:24:24,580
it's really really hard to get to get

673
00:24:22,359 --> 00:24:26,559
moving they carry you away that's all

674
00:24:24,579 --> 00:24:30,490
it's all really fun and pleasant to be

675
00:24:26,559 --> 00:24:32,679
honest I took a little bit of a drug

676
00:24:30,490 --> 00:24:35,500
just to help me out no side effects just

677
00:24:32,680 --> 00:24:37,539
made me happy and they were able to get

678
00:24:35,500 --> 00:24:39,970
me the helicopter and get me back to the

679
00:24:37,539 --> 00:24:43,029
NASA plane so NASA could fly me home

680
00:24:39,970 --> 00:24:45,100
again so a lot of Russians there we're

681
00:24:43,029 --> 00:24:46,990
very familiar and friendly with these

682
00:24:45,099 --> 00:24:49,809
people by the time we end up coming back

683
00:24:46,990 --> 00:24:51,910
to Earth and they also take a helicopter

684
00:24:49,809 --> 00:24:53,919
pick up our spacecraft that's all that's
left of that whole rocket that we launched at the beginning just that little capsule that little gumdrop at the at the end there and this is getting off the plane back in Houston after being really gone from Houston for about almost like six and a half or seven months total because the flight the flight itself was about five and there's a lot of training at the beginning in other locations so that's that's some video coverage of the flight I got a few more slides I want to talk to you about a couple more things that
are so the science one board that isn't
in the video and one of them is I
understand they have the original
Robonaut here in the Air and Space
Museum so I hope you get a chance to see
that
Robonaut was delivered up by a space
shuttle and we got this guy out of his
out of his bunk if you will
pulled him out set him up and he
operated maybe six or seven times
my expedition up there and he can he's
learning to work switches and grab
handles he can pick up a 70 pound bar
and hold it up over his head for an hour

and I can't do that and I don't think

most of you could either but that's what

you can do with somebody that's robotic

and the reason it's nice that they're in

human form is because so many of the

things we interface are made to be

interfaced with with our hands and with

our eyes above our hands and all that so

this last crew actually so that they

could see what Robonaut is seeing

through his visor and also they could

move his hands so it's when you're

wearing it it's just like you can look
out and see robot's hands in front of

00:26:22,150 --> 00:26:25,210
you and you can move your hand like this

00:26:23,319 --> 00:26:26,950
and reach out and grab something in fact

00:26:25,210 --> 00:26:28,360
you can reach out toward yourself if you

00:26:26,950 --> 00:26:30,700
want to it's really kind of a strange

00:26:28,359 --> 00:26:33,099
strange thing but it's really fun to do

00:26:30,700 --> 00:26:35,110
and next slide if your show I've got one

00:26:33,099 --> 00:26:37,209
here there's there's me just set and

00:26:35,109 --> 00:26:39,099
Robonaut up and the visor and if you

00:26:37,210 --> 00:26:40,930
would the next two in a row will show

00:26:39,099 --> 00:26:42,490
Robonaut flipping that switch and

00:26:40,930 --> 00:26:44,860
turning it off if you saw that he can

00:26:42,490 --> 00:26:47,140
just reach out there with his binocular

00:26:44,859 --> 00:26:49,059
vision and turn that off so it's going

00:26:47,140 --> 00:26:51,070
to be a fantastic capability for getting
lots of different kinds of chores done
on board someday and even maybe outside
the space station so a great a great
development and a great kind of if you
wee technology testbed for robotics next
slide in just a second I’m going to run
this this is a little video as well the
sphere in the middle is fuel that's been
introduced by those two little needles
that come in from the top and the bottom
so they inject some fuel in there that
can burn and then the two little loops
and the top left and bottom right are
actually igniters they don't have to
touch the fuel to ignite it they just
glow red-hot and it'll light this ball
of fuel this is all done inside the
space station and a shelf on a rack that
we can't see at the time but we do get
in there and change these needles and
work with these igniters I changed the
igniters out while I was there and that
and we just maintain it as well so what
happens here in this video is as soon as
it start the lights go out so you can
see the fuel burn and better you'll see
the igniter is ignite the ball the
needles pull away and then the ball
burns and free space and so burning in

zero-g is very different than burning in

an 1g if you light a candle on earth you can

burnin and the air comes in from the bottom because of gravity and convection

but that can't happen in space so it's very interesting for the scientists next

slide this is a column of water that looks like a jar of glass but it's just really it's water between two plates

with some particles inside and scientists are studying a phenomenon called Marangoni flow if you'll go ahead
and start the little video there you can

00:28:21,279 --> 00:28:24,339
tell it to water because of the way it's

00:28:22,509 --> 00:28:25,900
oscillating this is real time again if

00:28:24,339 --> 00:28:26,980
you were to go up and walk up to that

00:28:25,900 --> 00:28:28,269
and push it with your hand you would

00:28:26,980 --> 00:28:29,710
just be able to knock that water right

00:28:28,269 --> 00:28:32,918
away or if you shook it enough that

00:28:29,710 --> 00:28:34,750
water would fly away but we we are very

00:28:32,919 --> 00:28:36,429
careful not to disturb it on board it

00:28:34,750 --> 00:28:38,109
can only work this thing can only work

00:28:36,429 --> 00:28:40,090
in zero gravity you could never do this

00:28:38,109 --> 00:28:42,129
on the earth and they can study them the

00:28:40,089 --> 00:28:43,808
flow of these particles inside if they

00:28:42,130 --> 00:28:46,000
heat and cool the plates on both ends so

00:28:43,808 --> 00:28:49,178
Marangoni Marangoni flow it's called in
the experiment - next slide and we're just about two questions so those of you have the questions go ahead and be thinking about them and be ready to ask me and we'll keep the show going

this way one new phenomenon that we're seeing a lot more in space is called noctilucent clouds and they they seem to be more prominent than they used to be

and if you go through these slides

that's the typical atmosphere there if you go through to the next slide you'll see up high some clouds start to appear as we fly around the earth these clouds
are about 80 kilometers high so like 50 miles well up out of the air so way out in the atmosphere and it's still very interesting to earth scientists and stuff what causes them and and what their impact might be on earth so you can see how thick they can become and that's just below the altitude where we'd normally fly the shuttle in the first couple of orbits so it's really pretty high altitude for clouds next slide and next slide one of the things we did while we
were up there this a new thing when
space station is delivery of cargo and
perhaps crew in three or four or five
years by commercial companies this
spacecraft right here was built by SpaceX corporation out in Hawthorne
California and it's called the dragon
and in early March one of these was
launched by the company and flew up to
us flew up underneath the space station
in a place close enough so that we could
take our robotic arm and reach out and
put the the in defector what we call the
defector it's the hand if you will
above it and grab it and put it pull it

in and birth it to our space station and

get all the cargo out of it so a very

exciting thing to see it's a beautiful

thing in space to see another spacecraft

come up and approach you and and and

just watch the whole dance and watch all

the spacecraft and of course see the

earth below your next slide so that's

what it looks like flying up this is

what it looks like after after the

grapple out my window and we just again

we were able with hand controllers to

fly that big long arm out there and grab

a hold of it next slide and that's after
a happy job we have it grappled we can
turn the arm off inside the space
station and then as I mentioned we
handed it off to ground control we went
and did other work on the space station
while they birthed it someplace where we
could open hatches and get the cargo out
next one please one little story here
and a couple minutes over this is a one
one day in space just a human human
this is a bottle bottle of shampoo
that's just about empty and you can see
that the shampoo is not just in the bottom of the bottle but it's on the sides of the bottle and in the top of the bottle and I hadn't used this Russian shampoo before on orbit so I went over and I thought well you know what I'll do is I'll just I've been using the American shampoo maybe I'd like a little change I'll pop this bottle open and all I'll see what this smells like see if I want to use it I put it under my nose pop the cap and gave a little squeeze and underneath that cap was hiding a nice big glob of
shampoo and zero gravity it wasn't all in the bottom like it would be on earth

and I learned a lesson there about making sure you shake that shampoo out of the cap before you before you squeeze it in your nose good recommendation for when you go to space next slide

also one of the things that was really really touched me while I was up there was a chance to talk to children we used the ham radio and some other means to do outreach to school kids and two adults and and all kinds of venues really but these this is a chance for
kids of all ages to get to talk directly

to us on the space station and we use

the ham radio

do that and and here's here's one day

when I was really enjoyed doing that

from Columbus next slide some

photography - I thought I'd bring a

little picture along of Washington you

guys probably recommend or recognize

that if you've been walking them all

around here lately

so that was taken on the Sunday before

an auger ation day and next and since

it's so hard to tell cities apart from

two hundred and fifty miles away I was
just snapping whatever cities I could find and I also happened to get Baltimore so for those of you who are from the Baltimore area you're gonna recognize that one too and that wasn't too long before the Superbowl I think about a week before so a lot of a lot of fun to shoot our targets next once in a while ground will call us and say hey you're gonna have an excellent pass over a volcano perhaps over some maybe some icebergs have broken off or maybe you have a storm and this was typhoon Bopha back in November
and a great pass by typhoon Bopha boy

down when you look out the window and you get

there with the camera there's no

question about what's a typhoon and

what's just a bunch of clouds and I

looked at that and I thought there's no

way I'd ever stay you know stay

someplace where a typhoon or a

Hurricanes head in my way if I could

help it because it just really looks

powerful and awesome from the space

perspective next slide when you come

home you do come home and the spacecraft

most of it burns up you burn but you
don't burn up let's let's put it that way so there is a lot of heat associated with entry and as you look out the window it's um it's uncanny because you're just looking at a lot of fire out there and a lot of stuff around you but this the engineering that has taken us to a place where we know how to safely get home in our spacecraft and the very bottom color the very bottom flame when that picture is the crew that was the crew of actually the before me and I took this photo as they were coming home and they're surviving inside that little
fireball the rest of their spacecraft

breaking into pieces and and will well

burn out before getting to the surface

next slide and back on the planet Earth

and that's why I'm back here safely and

eight weeks ago that's what I was doing

but now I'm here to answer questions

I loved the flight I loved telling about

the flight of you

Space Flight is my life and I'm just as

passionate about it now as I was before

I got into the business and I'd like to

educate as many people as I can about

all the aspects of what we're doing out

there and and bringing you bring you all
on board I think space is definitely in our future it's here to stay and you're gonna see a lot of cool things happen in the next decade so for anybody who's got questions I think that's my cue to start taking a few and we got a mic over here I know that it's not as much fun when you have to walk over to the mic I guess any questions yep so what are the common pathways to actually become an astronaut great question we have astronauts who are medical doctors engineers scientists pilots is pretty common in my class we had a
submarine officer an oceanographer just all kinds of a geophysicist in my astronaut class really any kind of science is qualifying to be an astronaut you have to have at least a bachelor's degree to apply of course more advanced degrees and the more you know about different subjects is really great they really like to see of course you know you're not always doing science when you're strapping into a tiny spacecraft and and you know zipping up your your spacesuit and that sort of thing a lot of its really operationally
intensive and they you know they like to

think that you're gonna love the

operations too because of course that's

a that's a big part of the job so

qualifications of a really great science

background plus some really broad

operational experiences what they're

looking for the most kind of battery of

like mental testing and group testing

you go through it's not too extensive

you take as you apply you take some some

tests just just just kind of things

maybe maybe like an SAT or something

like that but for the most part let me


just tell you you know the astronauts

are accomplished people but not

necessarily they're not getting 800s on

the SATs necessarily it's just there

looking for some some good general

knowledge and the ability to learn I

would say is is the big thing that

they're looking for thank you yeah thank

you my name is Julianna and I'm from and

I'm from Maryland Maryland what does it

feel like to be in zero gravity what

does it feel like to be in zero gravity

that's a that's a fantastic question and

is imagine when you go swimming if you
could float anywhere you wanted close

your eyes not have to worry about

breathing in water and you could just

breathe the air and you were in kind of

warm water so you didn't really feel

cold or anything then that's that's what

it feels like nothing touching you and

just floating very light touch

everywhere so it's really really a

unique experience what what makes it

extra fun is that you can just turn

upside down though or turn sideways

anytime you want to and float in any

orientation you don't have to worry
about the ceiling or the floor and if

you wanted to you could just fly up to

that corner of the room up there just

give a little push and fly it but don't

go too fast because when you get there

you have to stop how do you stop there

better be something to grab a hold of and

it shouldn't be a light or something

like that because you might rip it off

you have to be really careful with the

equipment and and make sure you have it

kind of under control we do practice

flying faster and faster and there are

some handrails that you can always grab
ahold of so you always kind of shoot for

a handrail so that you know you can get

yourself stopped it's a great question

thank you

my name is Breanna I'm from Nashville my

question is what majors do you have to

do to become an astronaut what majors

you can major it really just needs to be

something where you can get some

technical education but we have teachers

people who are education majors but have

a lot of also science science in their

education too and medical doctors

engineers scientists physicists chemists


any of those kinds of things they the

the mathematics is is kind of important

so the more mathematics you can learn

the better off and then the technical

disciplines you kind of really need to

know those to understand a lot of the

science and a lot of the operations we

have to do so those are those are the

best majors and if you're interested for

people who are interested in knowing

because it looks like it's about time

for you to apply you can look on the

NASA website and they'll tell you what

the qualifying majors are so that's

that's a great question to know if
you're interested in the career field

before you head off and pick

a major what college did you go to

I went to Notre Dame we have a lot of

people that went to really all schools

that they can offer technical education

so a lot of Academy graduates - that are

astronauts and certainly all the

universities across the nation are

qualifying universities yeah thank you

how do you fall asleep oh that's a great

question because one of the worries

astronauts have before they go up there

is am I going to be able to get any
sleep and what's it gonna feel like and

I was I'm very lucky because I did sleep

very well on Space Station some people

have to change body positions and that

sort of thing at night some people like

a little support that we have a small

cabin that's it's maybe about the size

of a big refrigerator or something we

sleep in but it's well lit and padded

it's got really good ventilation and

lighting and some people will put their

feet on the wall with their back against

the other wall and that gives them a

little bit of a feeling of being on
earth so it helps them to sleep a little

but we have sleeping bags and

they you tie them to the wall so you

don't have to worry about floating away

and they're very nice you can just kind

of slow yourself in to them

zip yourself up and then put your arms

inside if you'd like to and if you can

sleep floating then you can just easily

fall asleep it's not too hard I would

like put my feet up on a little handrail

that I had put it mounted on the floor

it was just a little rail across the

floor and Bend myself a little bit put
my arms inside and no problem falling

1127
00:41:14,059 --> 00:41:21,049
asleep it's a great question thank you

1128
00:41:17,650 --> 00:41:22,610
hi my name is love me Nashville

1129
00:41:21,050 --> 00:41:25,550
Tennessee

1130
00:41:22,610 --> 00:41:27,890
how do you like work out at the space

1131
00:41:25,550 --> 00:41:29,690
station yeah thank you for asking that

1132
00:41:27,889 --> 00:41:32,029
question work out like as an exercise

1133
00:41:29,690 --> 00:41:34,730
right how do we work out we have three

1134
00:41:32,030 --> 00:41:37,460
excellent exercise machines on the space

1135
00:41:34,730 --> 00:41:39,159
station now one of them has been there

1136
00:41:39,159 --> 00:41:42,110
for a long time as an exercise bicycle

1137
00:41:39,159 --> 00:41:43,879
that the ground the ground team can

1138
00:41:42,110 --> 00:41:46,550
program with various loads and you can

1139
00:41:43,880 --> 00:41:47,869
get on it you just wear shoes with clips

1140
00:41:46,550 --> 00:41:51,140
on them you put your feet on the pedals
and you just can pedal for 45 minutes of various loads and really work up a nice sweat and you can always see your heart rate so you know you're getting a good aerobic workout we also have a treadmill that we can run on the treadmill itself requires special bungee cords and a special harness on the space station to hold you down against it so otherwise when you took a step and ran it would just push you away from it you wouldn't be able to keep your feet on the track developed by NASA and you can adjust it.
to different different weights and then

you can run for hours on end with that

with that bungee system on you and then

we have one more thing that's kind of an

aerobic exercise as well but I really

like that one the other thing we have

for an aerobic exercise to make sure our

bones and muscles stay strong is called

the a red it's a resistive advanced

resistive exercise device and we can't

lift weights up there because everything

is weightless as you know but we can

with this machine dial in a certain kind

of resistance in the bar and there's a
Platform we stand on and we can pick up this bar we can lay on a bench and push this bar up like we're doing a bench press and shoulder presses over our heads and we can really work our legs out all the way up to 600 pounds of low if we want to and it's all based on a couple big tubes that are a vacuum and you're really pushing against the pressure of the air in the cabin with a lever arm that makes it all work out so that you can get a really good workout and we exercise two and a half hours every day the whole time you're up there
and that's important to keep your bones

in good shape and to keep your muscle tone fantastic question thank you

yes my name is Rosalind Ellis Hyde I'm from Baltimore Maryland I'm extremely interested in the psychological and artistic aspects of space travel I write poetry about space travel and I know that some of the astronauts in the Apollo program were very interested in this particular subject Jim Irwin being one of them and the other I believe his name was Charles Duke and they did a number of psychological experiments and I was wondering if this has ever
factored into your flight plans well we
do we as well we look at a lot of
different things with the way our brain
behaves we take some tests regularly
called winds cat to make sure our
cognitive processing to see how that's
changing with time a lot of the the
scientific individual human science we
do might be looking and interpreting
images and stuff on on a display while
we're free-floating and comparing the
way we interpreted them on the ground so
what we see in space and then there are
there are some other things where will
they last us to do some things and maybe

maybe listen to at some tones or

something like that and then make

estimates on how we're feeling so you

know as a pilot I kind of don't

understand that whole thing but I do

feel it and I felt some things in space

that surprised me and just just the kind

of the way I felt about looking at the

earth I I found after I'd been there for

a few months I had a different feeling

about it there was it was kind of emotional and so some of those things

are very interesting to me and I wrote
them down and and they you know me when

I wouldn't the pace slows down a little

bit think a little bit more about those

things please read the book called to

rule the night by Jim Irwin to rule the

night yes he was Apollo fifth

he was the I don't know not the

commander but the second-in-command and

he had some absolutely amazing

experiences and it's called to rule the

night and I'm sure you can get it in the

NASA library Thank You fantastic ok

thank you very much this is a great

question

question
thank you so much colonel for coming to

00:45:40,219 --> 00:45:44,088
speak with us today happy here I'm when

00:45:42,440 --> 00:45:45,048
fairly I'm from Santa Barbara California

00:45:44,088 --> 00:45:47,028
huh

00:45:45,048 --> 00:45:50,119
you said you weigh a ton when you get

00:45:47,028 --> 00:45:51,829
down on the ground that was an

00:45:50,119 --> 00:45:54,019
interesting statement the longer you in

00:45:51,829 --> 00:45:56,240
space do you feel heavier when you

00:45:54,018 --> 00:45:58,189
arrive back on earth how long does it

00:45:56,239 --> 00:46:00,258
take to recover a feeling of just

00:45:58,190 --> 00:46:01,970
normalcy in your human body here on

00:46:00,259 --> 00:46:05,329
earth what do you do to get that feeling

00:46:01,969 --> 00:46:07,759
that's that's a fantastic question and

00:46:05,329 --> 00:46:09,230
one of the things that I found the most

00:46:07,759 --> 00:46:13,068
confusing when I came back from my
shuttle flight was how weak I felt but how strong I was on the other hand

normally normally we when we pull in something if you were to do a pull-up

for example on earth you might you might feel like it's very hard but you might be strong enough to do more than than you thought there's a sensory perception as well as the real strength that you have when I came back from Space Station because of this advanced resistive exercise device this weightlifting machine we had I was actually stronger about 20% stronger my upper body than
before when I left and if you would ask

me when you hung me from the bar and they said see how many pull-ups

you can do I would have said I can't

even do one but in truth I could do even more than before I left so that's a very interesting phenomena I think that sensory perception it's the same thing with picking things up because because for 144 days in space I never used any kind of hand pressure on anything even that really big device you saw us moving through the laboratory even though it might be 300 pounds of
mass it just you just touch it gently

and you move everything so gently that

and I hope for a hundred and some days a

long time you just don't put any kind of

pressure or anything and you probably

heard stories about astronauts dropping

things when they come home because

you'll pick up

cup and you what you've done before is

you just just feather touch it to

keep it in position but now with gravity

it's gonna be pulled free from your

hands crash to the floor and we all

learn that lesson I did it again after
this flight even though I said I wasn't

00:47:46,760 --> 00:47:52,040
going to write on my kitchen floor so

00:47:49,269 --> 00:47:54,800
anyway those those things are really

00:47:52,039 --> 00:47:57,019
interesting and and unique and there's a

00:47:54,800 --> 00:47:58,850
lot of study going on about getting past

00:47:57,019 --> 00:48:01,369
those one of the things we do is we work

00:47:58,849 --> 00:48:03,889
with rehabilitation guys directly I mean

00:48:01,369 --> 00:48:07,279
the day we get home we start doing stuff

00:48:03,889 --> 00:48:09,529
you know walking standing on one leg for

00:48:07,280 --> 00:48:11,030
a while and hiking across the gym floor

00:48:09,530 --> 00:48:12,500
and back and that sort of thing and

00:48:11,030 --> 00:48:14,510
they're they're really building us back

00:48:12,500 --> 00:48:16,460
to normalcy and it takes it takes about

00:48:14,510 --> 00:48:18,800
six weeks before you're close to 100%

00:48:16,460 --> 00:48:23,059
and about three weeks two and a half
weeks before you're not dangerous and no

more snorting Russian shampoo that's

exactly so it's a sensory perception

mm-hmm yes that you're weaker than you

really are

yes yes question I noticed in one of the

last shots you had a really hilarious

piece of Astroturf that looked like

grass underneath your seats why did you

put astroturf inside Thanks well of

course we get pulled out of the capsule

and we're pretty much all we're doing is

looking at sky and you know breathing

the fresh air I guess they put it out
there so that we people could stand

there and not slip around that's all I'm

guessing I did see it when I came out of

the capsule and of course it was

snow-covered Kazakhstan at that point it

was actually about that deep with a big

crust on top so they had a hard time

carrying us around and I guess they mash

the area down and put that grass down

just just so they wouldn't slip around

perhaps very funny thanks again

fascinating nice you noticed that thank

you hi my name is Eric Phantom from

Jacksonville North Carolina uh-huh first
of all I had the honor of making the

clevis joints and the radiators for the

space shuttle and you know it feels good

for me but are you guys training or you

they got the dragon they're going to

have a man thing are you guys training

already for that

particular space no not training not

training for it yet in a manned role I

think the development we have some

astronauts in the office that are part

of the development and they actually

can't even tell us stuff one of the

brought you know with the commercial

brought you know with the commercial
thing one of the things they have to be

1355
00:50:00,929 --> 00:50:05,669
careful about in development is this

1356
00:50:03,449 --> 00:50:07,199
proprietary rights and that sort of

1357
00:50:05,670 --> 00:50:08,760
thing but we do have astronauts that are

1358
00:50:07,199 --> 00:50:10,710
out there and in tune with the people

1359
00:50:08,760 --> 00:50:13,020
who are making the designs to make sure

1360
00:50:10,710 --> 00:50:15,059
that you know our concerns are satisfied

1361
00:50:13,019 --> 00:50:17,039
at the same time when we finally have a

1362
00:50:15,059 --> 00:50:18,389
man rated dragon we don't want to say

1363
00:50:17,039 --> 00:50:20,190
you have to go back to the drawing board

1364
00:50:18,389 --> 00:50:22,230
we want to say hey we're happy with it

1365
00:50:20,190 --> 00:50:24,599
when it finally arrives at our doorstep

1366
00:50:22,230 --> 00:50:25,380
and of course it will happen sometime

1367
00:50:24,599 --> 00:50:27,869
down the road

1368
00:50:25,380 --> 00:50:31,619
dragon is was a beautiful vehicle on
board and right now it needs a lot of enhancements obviously to fly people including you know emergency escape provisions and environmental control so it's got a it's got a ways to go but I think it's capable the only reason why I asked that question is is because to me help building that beautiful machine over there they retired it too early you know because we went from 100% almost a zero percent and now we're dependent on somebody else and the space shuttle also lifted up the space station to because
it's falling yeah what lifts it up now

well we can we can still use propellant

from the space station we can take

propellant up one progress and also the

the ATV the automated Transfer Vehicle

the ISA vehicle and take propellant up

and they could use the propellant from

the back end of the space station or

they can use the vehicle while it's

docked there itself

to give it a little bit of extra boost

and that's done regularly what work more

often than once a month almost to go

ahead and add a little bit of of energy
to the space station to keep its orbit

up where it needs to be so

that's what we do and that's of course

we did do that with with a space shuttle

so and we did we absolutely did hate to

say goodbye to our space shuttle say I

agree with you I thank you for your time

yeah thank you for your service

all right a few more I'm Shania from

Nashville uh-huh

I wanted to know what's a benefit for

you to go to school longer then Lester

crying I'm sorry one more time I said I

wanted to know what's a benefit for you
to go to school longer than what's required what's the benefit for me to go to school alone go to school longer is that what she said good school longer well you know I've kind of been like a student my whole life even even when you're all done with school and you're done with University and and you're training for a flight you're a student and we even take exams and we take all kinds of tests sometimes before committees and that sort of thing and of course the ultimate test is can we can we do the job on the space station so school yeah school is kind of learnt
teaching you how to learn I always

looked at school most as well maybe I

won't use this material directly but

learning how to assimilate this material

in case I do need it as kind of the most

important thing so a lot of a lot of

school and learning to become a good

student is really good for any

career field I think you should always

study and keep up with your career field

regardless of what it is and in my

business we we even keep having exams

right up until the launch pad and if you

if you think about it the launch
itself as an exam of sorts so just getting it just getting in tune with staying with that education as important

thing thank you hi my name is Aziza Carolina I was a flight sergeant in the United States Air Force so I’m very much interested in the space flight I was stationed that bill where they had the sr-71 so we were always interested in what blood changes happened in your body when you’re in space yeah like do you lose a lot of calcium and vitamin D you

how do you recover it how do you recover

well you’re right they have recognized
that's a problem up there certainly
during the MIR program long-duration
flights people were losing a lot of bone
mass and also struck
and you can rebuild it back on the
ground but sometimes it's a very
different structure on the ground when
you rebuild it back so we are really
trying hard to maintain our bone our
bone mass and we take vitamin D
supplements every day onboard to help
with that and then the nutrition and
experts are can continue to refine what
they what they feed us and what we eat
the changes in our body are kind of

remarkable one of the things that seems
to be true for spaceflight is that you
can eat as much as you want to and you
won't gain weight I don't really know

why but your metabolism and the zero

gravity is just confused enough that

there's some subtle changes to it so we

we see a lot of things up there very

interesting and those those flight docks

they look at us once a week they talk to

us and they look at everything we're

doing and they've found a way to keep us

in shape and now nowadays keep our bones

where they're supposed to be and our
muscle tissues too so one of the great

benefits of the ISS I think for the

I'm getting I'm getting the

word here it's time to wrap it up or do

we have time for one more thank you you

great great room to be in

I have a chance to look over the space

station model and it's just been a

fantastic experience with all of you

today great to be here and if you have

any questions maybe I can take a few
even afterwards so thank you all for coming you